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UNIVERSITY OF THE
WITWATERSRAND,
JOHANNESBURG

Developing an advanced reactor model for complex, non-ideal reactors

Prepared by

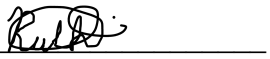
Ruth Stephenson Elfick

A thesis submitted to the Faculty of Engineering and the Built Environment, University of the Witwatersrand, in fulfilment of the requirements for the degree of Doctor of Philosophy.

Johannesburg 2022

Declaration

I declare that this thesis is my own unaided work. It is being submitted for the degree of Doctor of Philosophy to the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination to any other University.



Ruth Jane Stephenson

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Summary

Constructed wetlands are a low cost and low maintenance technology which can be used for treating wastewater of various types, and in a water scarce country, such as South Africa, have the potential to be used in a variety of contexts. However, to use this technology as an effective form of wastewater treatment, accurate modelling of both the kinetic and hydraulic behaviour is required. Work has been done to improve the kinetic modelling of constructed wetlands. Kinetic modelling techniques rely on reaction time, but reaction time is a function of the hydraulic behaviour of the system. If the reaction time is quantified incorrectly, a kinetic model will not produce accurate results, regardless of how detailed and comprehensive it may be. It cannot be said that reaction time relies only on the hydraulic behaviour of the system and the importance of mixing and local concentration must not be forgotten.Accordingly, this study investigated the development and use of two novel hydraulic modelling techniques for use in quantifying the flow behaviour of constructed wetlands. The aim was to combine the residence time distribution techniques with an existing biokinetic model. In this study, two techniques were developed which were based on limitations found in existing techniques, and hydraulic tracer studies were conducted to assess the applicability of the techniques for use in constructed wetlands.

The first technique was based on the method-of-moments technique, used in chemical engineering for reactor design, and in this technique, it was assumed that the flow through a system could be divided into sections. By determining the hydraulic parameters of each of the sections, the hydraulic behaviour could be investigated in more detail and the data obtained from the study could be used with an existing biokinetic model. Impulse-response tracer tests were conducted on two systems, vertical flow columns and a horizontal sub-surface flow constructed wetland. It was found that the data from these studies could be used in investigating the hydraulic behaviour of the system and could be combined with first-order rate kinetics.

The second technique aimed to address the environmental impact of tracer studies on water bodies. Tracer studies require the use of a conservative tracer, but the conservative nature of the tracer means that it persists in the environment long after the studies are complete. In this study the use of a non-conservative tracer was investigated. Step-change tracer studies were conducted on a horizontal sub-surface flow constructed wetland using a conservative tracer (uranine) and a non-conservative tracer (benzoate). The response curves of the two tracers were compared and the advective-dispersive solute transport equation, along with a non-linear least-

squares analysis, was used to determine the hydrodynamic dispersion, retardation factor and decay of each tracer. These transport parameters were used to determine if it was possible to relate the non-conservative tracer response curve with the conservative tracer response curve in such a way that the hydraulic parameters, which quantify flow behaviour, were the same. This technique was found to be most accurate for mean residence time.

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Table of Nomenclature

Symbol	Description	Unit
b_A	Rate constant for X_A lysis	1/d
b_{AMB}	Rate constant for X_{AMB} lysis	1/d
b_{ASRB}	Rate constant for X_{ASRB} lysis	1/d
b_{FB}	Rate constant for X_{FB} lysis	1/d
b_H	Rate constant for X_H lysis	1/d
b_{SOB}	Rate constant for X_{SOB} lysis	1/d
C	Concentration in wetland	g/m^3
C_A	Concentration of component 'A'	g/m^3
$C_{initial}$	Initial concentration	g/m^3
C_{inlet}	Inlet concentration	g/m^3
$C_{i,in}$	Inlet concentration of component 'i'	g/m^3
$C_{i,out}$	Outlet concentration of component 'i'	g/m^3
C_{out}	Outlet concentration	g/m^3
D	Hydrodynamic dispersion	m^2/hour
$D_{benzoate}$	Hydrodynamic dispersion of benzoate	m^2/hour
$D_{uranine}$	Hydrodynamic dispersion of uranine	m^2/hour
D_m	Molecular diffusion coefficient	m^2/hour
$D_{m,benzoate}$	Molecular diffusion coefficient of benzoate	m^2/hour
$D_{m,uranine}$	Molecular diffusion coefficient of uranine	m^2/hour
E(t)	Residence time distribution function	(-)
e	Effective volume utilisation ratio	(-)
erfc	Error function	(-)
F(t)	Cumulative distribution function	(-)
$f_{BM,SF}$	Fraction of SF generated in biomass lysis	g COD_{SF}/g COD_{BM}
$f_{BM,XI}$	Fraction of XI generated in biomass lysis	g COD_{XI}/g COD_{BM}
$f_{Hyd,SI}$	Production of SI in hydrolysis	g CODSI/g CODXS
f_{om}	Fraction of organic matter in the sub-surface media	(-)
K_d	Distribution coefficient	(-)
K_{om}	Organic matter-water partition coefficient	(-)
K_{ow}	Octanol-water partition coefficient	(-)
K_{H2SA}	saturation/inhibition coefficient for S_{H2S}	mgS/L
K_{H2SAMB}	saturation/inhibition coefficient for S_{H2S}	mgS/L
$K_{H2SASRB}$	saturation/inhibition coefficient for S_{H2S}	mgS/L
K_{H2SFB}	saturation/inhibition coefficient for S_{H2S}	mgS/L
K_{H2SH}	saturation/inhibition coefficient for S_{H2S}	mgS/L
K_{NHA}	saturation/inhibition coefficient for S_{NH}	mgN/L
K_{NHAMB}	saturation/inhibition coefficient for S_{NH}	mgN/L
K_{NHASRB}	saturation/inhibition coefficient for S_{NH}	mgN/L
K_{NHFB}	saturation/inhibition coefficient for S_{NH}	mgN/L
K_{NHH}	saturation/inhibition coefficient for S_{NH}	mgN/L
K_{NHSOB}	saturation/inhibition coefficient for S_{NH}	mgN/L
K_{NOAMB}	saturation/inhibition coefficient for S_{NO}	mgN/L

K_{NOASRB}	saturation/inhibition coefficient for S_{NO}	mgN/L
K_{NOFB}	saturation/inhibition coefficient for S_{NO}	mgN/L
K_{NOH}	saturation/inhibition coefficient for S_{NO}	mgN/L
K_{NOSOB}	saturation/inhibition coefficient for S_{NO}	mgN/L
K_{OA}	saturation/inhibition coefficient for S_O	mg O_2/L
K_{OAMB}	saturation/inhibition coefficient for S_O	mg O_2/L
K_{OASRB}	saturation/inhibition coefficient for S_O	mg O_2/L
K_{OFB}	saturation/inhibition coefficient for S_O	mg O_2/L
K_{OH}	saturation/inhibition coefficient for S_O	mg O_2/L
K_{OSOB}	saturation/inhibition coefficient for S_O	mg O_2/L
K_{SA}	saturation/inhibition coefficient for S_A	mg $CODS_A$/L
K_{SASRB}	saturation/inhibition coefficient for S_A	mg $CODS_A$/L
K_{SAMB}	saturation/inhibition coefficient for S_A	mg $CODS_A$/L
K_{SF}	saturation/inhibition coefficient for SF	mg CODSF/L
K_{SFB}	saturation/inhibition coefficient for SF	mg CODSF/L
K_{SSOB}	saturation/inhibition coefficient for SHsS	mgS/L
K_X	saturation/inhibition coefficient for hydrolysis	g CODSF/g CODBM
k_h	hydrolysis rate constant	1/d
N	Number of continuously stirred tank reactors in series	(-)
Ni	Moles of component ‘i’	
Pe	Peclet number	(-)
R	Retardation factor	(-)
ri	Reaction rate of component ‘i’	
S_O	Dissolved Oxygen	
S_F	Fermentable, readily biodegradable COD	
S_A	Fermentation products as acetate	
S_I	Inert, soluble COD	
S_{NH}	Ammonium and ammonia nitrogen (NH_4^+-N and NH_3-N)	
S_{NO}	Nitrate and Nitrite nitrogen (NO_3^--N and NO_2^-N)	
S_{SO4}	Sulphate sulphur	
S_{H2S}	Dihydrogensulphide sulphur	
t	Time	hour
t_m	Mean residence time	hour
T_j	Limit of a portion under the impulse response tracer test	
τ	Nominal residence time	hour
u	Fluid velocity	m/hour
V	Volume of system	m^3
$\dot{v}$	Volumetric flow rate	m^3/hour
x	Distance along reactor	
X_A	Autotrophic nitrifying bacteria	
X_{AMB}	Acetotrophic methanogenic bacteria	
X_{ASRB}	Acetotrophic sulphate reducing bacteria	
X_{FB}	Fermenting bacteria	
X_H	Heterotrophic bacteria	
X_I	Inert particulate COD	
X_S	Slowly biodegradable particulate COD	

X_{SOB}	Sulphide oxidising bacteria	
Y_A	Yield coefficient for autotrophic bacteria	g COD_{BM}/g N
Y_{AMB}	Yield coefficient for acetotrophic methanogenic bacteria	g COD_{BM}/g COD_{SA}
Y_{ASRB}	Yield coefficient for acetotrophic sulphur reducing bacteria	g COD_{BM}/g COD_{SA}
Y_{FB}	Yield coefficient for fermenting bacteria	g COD_{BM}/g COD_{SF}
Y_H	Yield coefficient for heterotrophic bacteria	g COD_{BM}/g COD_{SF}
Y_{SOB}	Yield coefficient for sulphide oxidizing bacteria	g COD_{BM}/g S
α_l	Mechanical dispersion in the longitudinal direction	m
$\alpha_{l,benzoate}$	Mechanical dispersion of benzoate in the longitudinal direction	m
$\alpha_{l,uranine}$	Mechanical dispersion of uranine in the longitudinal direction	m
α_t	Mechanical dispersion in the transversal direction	m
$\alpha_{t,benzoate}$	Mechanical dispersion of benzoate in the transversal direction	m
$\alpha_{t,uranine}$	Mechanical dispersion of benzoate in the transversal direction	m
σ^2	Variance	$hour^2$
μ	First-order decay coefficient	1/hour
μ_A	maximum aerobic growth rate on SNH	1/d
μ_{AMB}	maximum aerobic growth rate for XAMB	1/d
μ_h	maximum aerobic growth rate on CR	1/d
η_h	Correction factor for hydrolysis by fermenting bacteria	(-)
φ	Zero-order production constant	(-)
γ	Fraction of area under the Impulse-response curve	(-)
λ	Hydraulic efficiency	(-)
ρ_b	Bulk density as SG	(-)
ε	Void fraction	(-)
θ_w	Water content	(-)
θ_r	Residual water content	(-)
θ_s	Saturated water content	(-)

Chapter 1: Introduction

South Africa is a water-scarce country which means that there is not enough of this precious resource to support the needs of both humans and the ecosystem (Bond *et al.*, 2019). Even though water is a renewable resource, there are challenges that relate to both the supply and quality of water (Hedden and Cilliers, 2014). In theory, South Africa treats about 60% of its wastewater, but with a significant number of the existing treatment facilities in poor condition, the actual number could be much lower (Donnefield, 2019). A multi-pronged approach which includes improvements in current wastewater treatment systems, the development of new solutions, and the reduction of water use, is required to remedy the situation.

Developing infrastructure which allows for easy and reliable access to clean water in rural communities is one of the challenges in the South African context (Majuru, Jagals and Hunter, 2012). Constructed wetlands are a treatment technology which have the potential to reduce the contamination instances posed by sewage which will assist towards addressing this issue. These systems are low cost and low maintenance when compared to conventional wastewater treatment technologies (Wu *et al.*, 2015). Constructed wetlands can handle varying loads, promote water reuse and recycling, and have minimal energy requirements (Gu *et al.*, 2017). For these reasons their applicability is being explored in South Africa (Ochieng, Seanego and Nkwonta, 2010).

To make use of constructed wetlands as an effective form of wastewater treatment, design and modelling are required to ensure optimal construction and implementation. The original constructed wetland models developed were considered 'black-box' models which relied on empirical correlations between inlet and outlet concentrations (J. L G Kumar and Zhao, 2011), but recently modelling has advanced to mechanistic and process-based models (Meyer *et al.*, 2015). Of utmost importance in the modelling of constructed wetlands is the accurate modelling of the hydraulic behaviour of the system (Zahraeifard and Deng, 2011).

The hydraulic behaviour of constructed wetlands has been simplified to plug flow by many researchers (Werner and Kadlec, 2000). Ideal plug flow implies that all fluid particles spend the same amount of time in the system. However, there are multiple features of a constructed wetland that prevent ideal plug flow. The heterogeneous nature of the sub-surface media of constructed wetlands, changing root structure of macrophytes, biofilm growth, and clogging due to suspended solids, all contribute to a variation in flow resistance in the constructed

wetland. This variation in resistance leads to a variation in the flow velocity profiles and as a result, fluid particles do not all spend the same amount of time in the system. This leads to non-ideal plug flow behaviour and a distribution of residence times within the constructed wetland.

To gain an understanding of the hydraulic behaviour of a constructed wetland, residence time distribution (RTD) studies are conducted (Kadlec, 2007). The data from these studies are used to determine hydraulic parameters such as the mean residence time. The mean residence time is the average amount of time that the fluid particles have spent in the system and is supposed to represent the non-ideal hydraulic behaviour resulting from the residence time distribution (Fogler, 2006). All kinetic models require some representation of the hydraulic behaviour of a constructed wetland and it is common for the mean residence time from a tracer study to be used (Kadlec, 2007). However, a single value is not enough to accurately represent the non-ideal hydraulic nature of constructed wetlands and this can lead to the under-sizing and inaccurate design of the systems (Fontes Lima and Zaiat, 2012).

There are still limitations in the understanding and modelling of the hydraulic behaviour of constructed wetlands. In this thesis, two techniques are presented which aim to address some of these limitations. The first technique presented is an adapted method-of-moments technique which makes assumptions about the multiple flow paths and velocities in a constructed wetland, and the extent of pollutant degradation in each of these flow paths. Effort is made to combine this technique which an existing and established multi-component biokinetic model, the Constructed Wetlands Model No.1 (CWM1).

The second technique which is described in this thesis has been developed to use the data from tracer studies conducted with non-conservative tracers, such as benzoate. The aim of this technique is to address the limitations of conservative tracers when conducting tracer studies on constructed wetlands. Tracer studies require the use of a soluble and conservative tracer to be injected into the constructed wetland (Chazarenc, Merlin and Gonthier, 2003). The conservative nature of the tracer implies that it is not degraded or retained in the system either through adsorption, photodegradation or biodegradation, to name a few mechanisms (Cucco and Umgiesser, 2006). The long-term effects of the tracers on living organisms in constructed wetlands are still relatively unknown, and disposal of tracer (if possible) can be costly. The use of biodegradable chemicals, such as benzoate, to be used as a tracer has not been investigated previously. A biodegradable chemical would reduce the negative impact of the tracer studies

on the environment in which the study is being conducted, as it would not remain there permanently.

1.1 Research Objectives

a) To develop an advanced, novel residence time distribution technique in order to improve the accuracy of the measurement of constructed wetland hydraulics.

b) To apply the technique to the International Water Association's constructed wetland model No.1 (CWM1) to improve the accuracy of the predicted output concentrations.

c) To modify the matrices of stochiometric coefficients and rate laws given in CWM1 to include a residence time distribution function.

d) To calibrate the model on a small-scale indoor reactor.

e) To validate the model on an established large-scale outdoor wetland.

1.2 Problem Statement

Various biokinetic models have been developed to predict the output concentrations of a constructed wetland, but these models do not necessarily account for the non-ideal plug flow behaviour and residence time distribution of the wetland. Attempts to combine hydraulic reactor modelling and biokinetic modelling have either assumed reactor types with deviations or require highly advanced numerical modelling skills and technologies.

1.3 Thesis Structure

This thesis has been divided into 8 chapters. An introduction and analysis of literature make up the first two chapters. The next four chapters each addresses a specific research objective.

In Chapter 3, the methods and materials used in the development of two residence time distribution techniques are detailed.

In Chapter 4, two residence time distribution techniques are presented. The first is based on the method-of-moments technique and the second is based on the advective-dispersive transport equation.

In Chapter 5, a combination of the two residence time distribution techniques with an existing and established biokinetic model, the Constructed Wetlands Model N°1, is presented.

In Chapter 6, the methods used to linearise the reaction rates of the Constructed Wetlands Model N°1, to be used with the adapted method-of-moments technique, are presented.

In Chapter 7, the validation of the technique based on the advective-dispersive transport equation on a small-scale constructed wetland is presented. The validation of the adapted method-of-moments technique on gravel filled columns and a small-scale constructed wetland is also given.

In Chapter 8, the work is discussed, potential ramifications for constructed wetland design are presented, and concluding remarks are made.

Chapter 2: Literature review

Contents of this chapter have been published in The Journal of Water Process Engineering (Stephenson, R. and Sheridan, C. (2021) 'Review of experimental procedures and modelling techniques for flow behaviour and their relation to residence time in constructed wetlands', *Journal of Water Process Engineering*. Elsevier Ltd, 41(February), p. 102044. doi: 10.1016/j.jwpe.2021.102044)

2.1 The Historical Context and Use of Constructed Wetlands

Constructed wetlands (CWs) are systems which make use of the same process as natural wetlands and have been designed and placed specifically for wastewater treatment (Brix, 1994). Various physical, biological, and chemical processes take place simultaneously and these all influence one another. It is the combination of these processes that leads to a reduction in contaminant load of wastewater. CWs consist of 3 main components, the packing medium (such as soil or gravel), macrophytes, and a multitude of microorganisms.

For as long as humans have been discharging wastewater, wetlands have played a role in the treatment of this wastewater. The first documented use of CWs was in 1904 in a report to the Hornsby Literary Institute in NSW, Australia (Brix, 1994). Not much further happened until the 1950s, when, in Germany, K. Seidel was the first to investigate the use of CWs to treat wastewater (Seidel, 1961). Seidel continued investigations into the 1960s into the treatment of different waste streams including phenol, dairy, and livestock waste streams (Kadlec and Wallace, 2009). Throughout the 1970s and 1980s CWs were adopted around Europe, including Denmark, France, the United Kingdom, and the Netherlands. During this time CWs were used almost exclusively for domestic and municipal water treatment but from the 1990s these systems were used for a much wider range of wastewater treatment (Vymazal, 2005). By this time, CWs had become the preferred method of wastewater treatment for decentralised systems such as small villages. It was during the 1970s that the use of CWs began to emerge in the USA, treating streams such as wildlife habitat discharge (1973), industrial waters (1975), and process waters (1975). The use of surface flow CWs was more commonly adopted in the USA while sub-surface flow CWs were the predominantly used CW in Europe (Vymazal, 2010). The use of CWs was adapted on the African continent during the late 1980s and 1990s with the applications including agricultural, mining, industrial, and domestic wastewater treatment (Kadlec and Wallace, 2009).

2.2 Advantages and Disadvantages of Constructed Wetlands

Some of the advantages of CWs are that they can provide on-site treatment, they are pleasing to the eye, and provide a habitat for amphibians, birds, and plants. CWs are low-cost systems that require minimal operation and maintenance (Wu *et al.*, 2015). These systems can handle varying loads, promote water reuse and recycling, and have minimal energy requirements (Gu *et al.*, 2017). This makes CWs an attractive option in water scarce, rural areas, as these systems are able to address the need for clean water without incurring a large capital cost or requiring large amounts of energy and an expert to run them.

However, there are some disadvantages of these systems. The perception of low maintenance means that it many cases no maintenance is done and as a result, in the long term, the system can fail. They are also potentially a habitat for insects, such as mosquitos, which can bring other problems and diseases including malaria and yellow fever (Bondurant, 2010). Owing to the need for microbial communities to be established, CWs may also have a lengthy start-up time. Nitrogen removal is another limitation of these systems, as different redox and aeration conditions are required to remove the different forms of nitrogen, and so only complex CW configurations achieve adequate nitrogen removal (Vymazal, 2013). Some wetland plants are sensitive to high COD levels and clogging is a major operational problem of CWs. They are also land intensive and have a larger foot print than more elevated systems (Wu *et al.*, 2014).

One of the biggest barriers to CWs being widely used as a form of wastewater treatment is the lack of proper design protocols. Many different configurations and recommendations exists, but because of the lack of detailed understanding of the combination of microbial processes that break down wastewater contaminants, the interrelatedness of these processes with other physical and chemical processes, and the changing and complex hydraulic nature of CWs, setting design protocols has not yet been achieved (Sheridan, 2012; Wu *et al.*, 2015).

2.3 Classification of Constructed Wetlands

CWs can be classified according to various characteristics. One of the most common characterisations is based on the fluid flow of the wetland. Flow can be characterised as being below the surface or on the surface. Free water surface flow CWs are primarily horizontal flow while sub-surface flow wetlands can either have horizontal flow, vertical flow, or both. The other characteristic used as a basis for classification of CWs is the type of macrophyte used in

the system: submerged, emergent, or free floating. The different configurations have their advantages and disadvantages, and the choice of wetland should be guided by the treatment and design requirements. Figure 2.1 gives a breakdown of the classification of CWs.

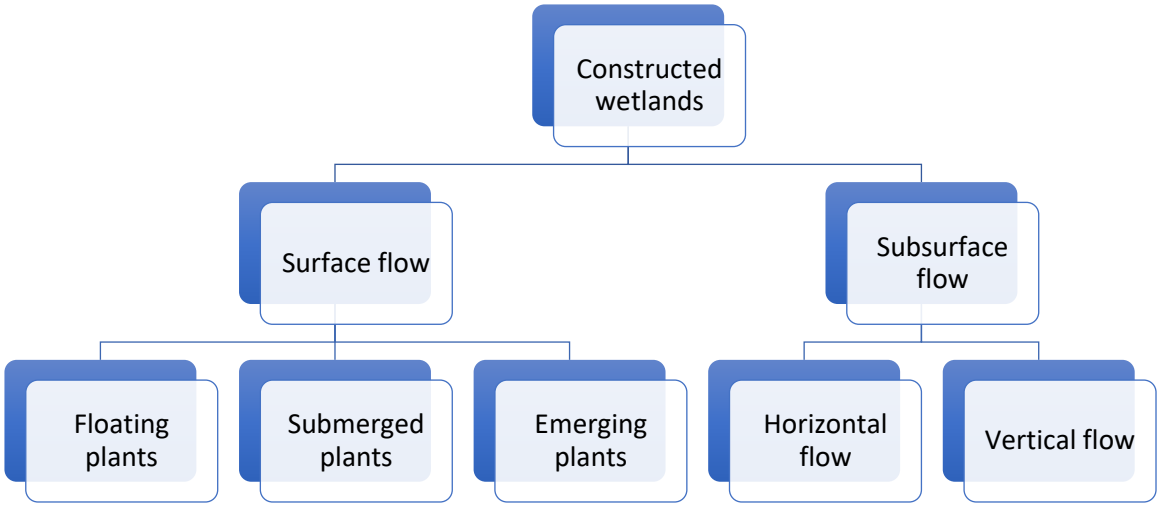

***Figure 2.1**: Breakdown of the classification of CWs ,adapted from (Kadlec and Wallace, 2009)*

2.3.1 Free Water Surface Wetlands

Free water surface (FWS) wetlands consist of areas of open water with emergent and floating plants, and commonly have a water level of 0.4 m (Langergraber, 2008). This configuration tends to look very similar to a natural wetland although liners, dikes and berms can be used to control the flow through the system (Kadlec and Wallace, 2009). Apart from water treatment, FWS wetlands have additional benefits, such as a habitat for amphibious and bird wildlife (Kadlec, 2009). When treating urban, agricultural, and industrial stormwaters, FWS wetlands are the most common choice among the configurations owing to their ability to deal with pulse flow and changing water levels. They are also often used for mine water treatment, groundwater remediation, and leachate treatment. Figure 2.2 is an example of a FWS CW.

One of the disadvantages of FWS wetlands is that the exposed water surface, and typically low flow rates, make these systems susceptible to insect infestations and the release of odours from the polluted water, which are difficult to control due to lack of covering (Bondurant, 2010; Leverenz *et al.*, 2010). Because of the exposed water surface, water tends to flow over the bed

and therefore there is limited contact with the dense microbial matrix, resulting in lower degradation potentials. Other disadvantages of FWS wetlands relate to the systems' response to temperature: these systems are prone to excessive evapotranspiration in summer because of the lack of covering (Kivaisi, 2001); Kadlec *et al.*, 2009). Note that during the winter months there is a decrease in nitrogen removal efficiency because the majority of the removal is dependent on biological activity, which requires warmer temperatures (Kadlec, 2009). FWS CWs can be used as stand-alone systems or as part of a multi-step process. If part of a multi-step process, then the FWS CW is typically a tertiary treatment step after sedimentation and biological treatment processes (Wallace and Knight, 2006).

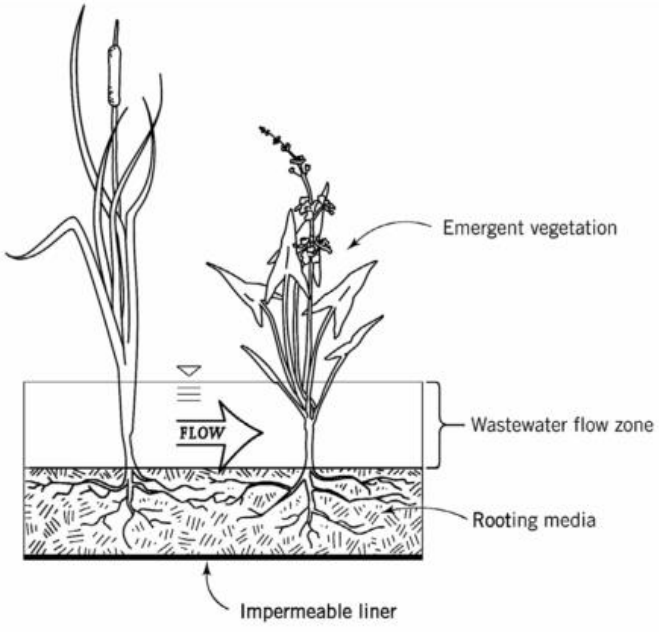

***Figure 2.2**: Free water surface constructed wetland (Kadlec and Wallace, 2009)*

2.3.2 Horizontal Sub-surface Flow Constructed Wetlands

Horizontal sub-surface flow (HSSF) wetlands consist of beds of a packing material, commonly soil or gravel, planted with vegetation. Water flows below the surface of the bed and comes into contact with biofilms, plant roots, and rhizomes which facilitates pollutant removal (Vymazal, 2009; García *et al.*, 2010). Typically, a HSSF wetland consists of inlet and outlet piping, a liner, berms, and emerging vegetation (Kadlec and Wallace, 2009). Water enters through a single inlet or inlet distribution network and flows horizontally along the length of the wetlands to the outlet (Rios *et al.*, 2009). Bed depth is typically between 0.6 m and 1.0 m and the bottom of the bed is sloped downwards to prevent water from flowing across the surface of the system (Haberl *et al.*, 2003). Due to the low exposure of the treatment water to the open

air, compacted soil, and macrophyte covering, there is limited oxygen transfer in HSSF wetlands and so oxidation of ammonia as well as other aerobic processes is minimal (Camacho *et al.*, 2007). Figure 2.3 displays the various components of a HSSF CW.

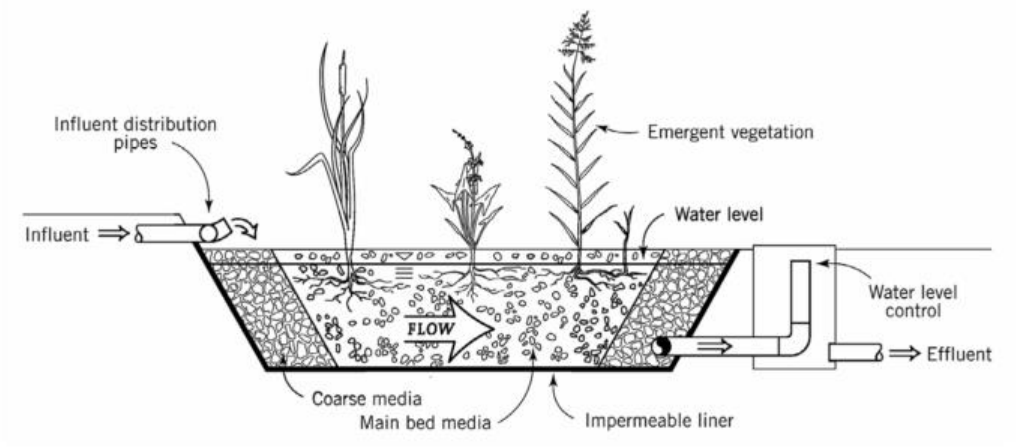

***Figure 2.3**: Horizontal sub-surface flow constructed wetland (Kadlec and Wallace, 2009)*

2.3.3 Vertical Flow Sub-surface Flow Constructed Wetlands

In vertical flow (VF) wetlands, water is distributed along the surface of the bed and percolates vertically downward through the porous medium and plant roots to a drainage network (Lavrova and Koumanova, 2010). These systems are an attractive alternative which require less surface area than horizontal sub-surface flow CWs (Kadlec and Wallace, 2009). The intermittent loading means that air is sucked into the CW as water levels drop between loading cycles and is then displaced by water once the CW is loaded again. Because of this, aerobic processes are more dominant in VF wetlands than HSSF wetlands (Langergraber, 2008). The consequence is that VF wetlands cycle between aerobic and anaerobic processes. The gravitation effect of the flow in vertical flow CWs promotes settling and sedimentation, this combined with aerobic conditions enhances high rates of biological degradation (Saeed and Sun, 2012). VF wetlands are used to treat landfill leachates and food processing wastewater, both of which have a high ammonia content. Biosolids dewatering is also a common use of VF wetlands (Kadlec and Wallace, 2009). One of the drawbacks of the VF CWs is the inability to remove phosphorus from wastewater due to insufficient binding capacity of the available granular media (Brix and Arias, 2005; Prochaska and Zouboulis, 2006). Figure 2.4 displays a schematic of a VF CW.

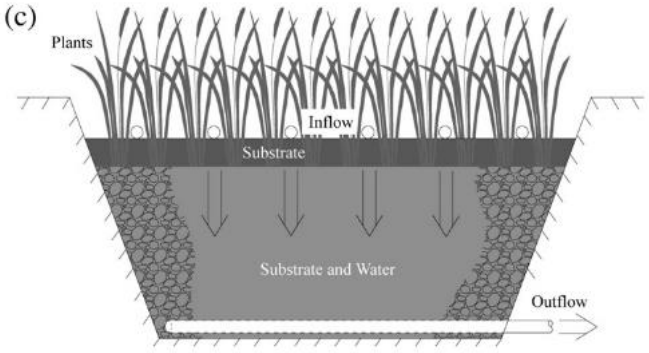

***Figure 2.4**: Vertical sub-surface flow constructed wetland (Li et al., 2014)*

2.3.4 Hybrid Systems

It is also possible to create a hybrid CW system by combining two or more wetlands of different types in order to make use of the advantages of the different systems. Many combinations of hybrid CWs exist but the most common one is a VF-HF hybrid system (Vymazal, 2013). Hybrid CWs are mostly used to enhance total nitrogen removal because different types of CWs provide different redox conditions which are suitable for nitrification and denitrification (Vymazal, 2011a). Hybrid wetlands have mainly been used for sewage treatment (Vymazal, 2013) but other types of wastewater treated include landfill leachate (Bulc, 2006), domestic wastewater (Jehawi *et al.*, 2020), secondary effluent (Bang *et al.*, 2019), swine wastewater (Ren, Wang and Zhao, 2020), winery effluent (Serrano *et al.*, 2011), and cooling tower water (Wagner *et al.*, 2020).

2.3.5 Classification by Plant type

Plants are a vital component in CWs as they aid the removal of contaminants from wastewater in various ways (Brix, 1987; Wu *et al.*, 2011). There are 3 categories in the classification of CW macrophytes: free-floating, submerged, and emergent (Dhote and Dixit, 2009; Bakker *et al.*, 2013). Free-floating macrophytes float on the surface of the water, with only their roots submerged (Van De Moortel *et al.*, 2010; Headley and Tanner, 2012). The two most commonly used free-floating macrophytes in CWs are *Eichhornia crassipes* (water hyacinth) and *Pistia stratiotes* (water lettuce) (Marchand *et al.*, 2010; Mufarrege, Hadad and Maine, 2010). In Figure 2.5 an illustration of a free-floating macrophyte CW can be found. Submerged macrophytes have their entire structure below the water surface and so the whole plant plays a role in wastewater treatment (Dhote and Dixit, 2009). *Potamogeton crispus* and *Littorella uniflora* are two of the most regularly used submerged macrophytes in CWs (Dordio and

Carvalho, 2013; Zhao *et al.*, 2014). An illustration of submerged macrophytes in a CW can be found in Figure 2.6. Emergent macrophytes have their roots in the soil but emerge above the surface of the water to different heights. The most commonly emerged macrophyte used on CWs is *Phragmites australis* (Common reed) (Vymazal, 2011b) while *Typha latiofolia* and *Phragmites carka* are also regularly used (Li *et al.*, 2013). An illustration of an emergent macrophyte CW can be found in Figure 2.7. While all three plant-classified types of wetlands are possible for surface flow CWs, sub-surface flow CWs have only emergent macrophytes, as the surface of the water is covered by the wetland medium, such as gravel.

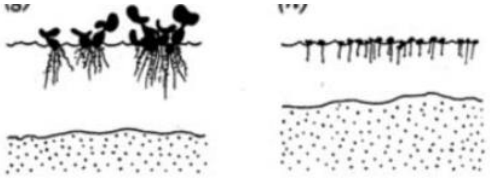

Figure 2.5*: Examples of free-floating macrophytes used in constructed wetlands adapted from (Headley and Tanner, 2012)*

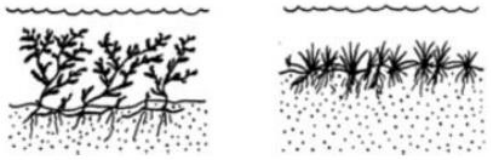

***Figure 2.6**: Examples of submerged macrophytes used in constructed wetlands adapted from (Headley and Tanner, 2012)*

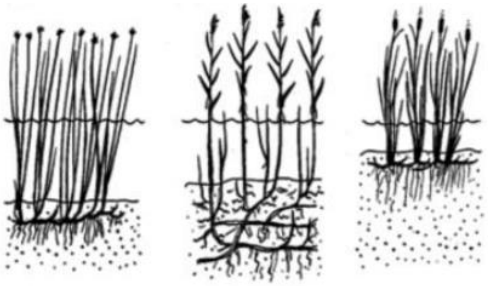

***Figure 2.7**: Examples of emergent macrophytes used in constructed wetland adapted from (Headley and Tanner, 2012)*

2.4 Waste Streams Treated by Constructed Wetlands

Early uses of CWs were mainly for the treatment of domestic and industrial wastewater on a small scale and this area of application continues to grow. The range of treatment applications has increased to include agricultural, industrial, and stormwater runoff (Vymazal, 2009). In the treatment of municipal wastewater, wetlands are used as secondary treatment for small communities or as add-ons for existing treatment units (Wallace and Knight, 2006). Examples of the different types of wastewater treated by CWs include landfill leachate (Nivala *et al.*, 2007; Wojciechowska, 2017; Yi *et al.*, 2017; Bakhshoodeh *et al.*, 2020), petroleum refinery waste (Aslam *et al.*, 2007; Jain *et al.*, 2020), dairy wastewater (Pelissari *et al.*, 2014; Adhikari, Harrigan and Reinhold, 2015; Schierano *et al.*, 2020), winery effluent (Serrano *et al.*, 2011; Sheridan, Glasser and Hildebrandt, 2014; Rozema, Rozema and Zheng, 2016; Flores *et al.*, 2019), and acid mine drainage (Pat-Espadas *et al.*, 2018; Singh and Chakraborty, 2020).

2.5 Mechanisms for Contaminant Removal in Constructed Wetlands

2.5.1 Mechanisms for Organic Matter Removal

Organic matter (OM) in wastewater typically takes two forms, particulate organic matter and dissolved organic matter. The breakdown of the two forms occurs via different processes and

the pathways for both of these are discussed here. Organic matter present in wetlands has two sources, an external source and an internal source. The external source is from the influent wastewater, while the internal source is from the macrophytes in the system called root exudates (Headley and Tanner, 2012).

Particulate organic matter

CWs are often a secondary step in the wastewater treatment process and so a large portion of the total suspended solids (TSS) (a category into which particulate OM falls) have already been removed (Vymazal, 2011a). Influent particulate OM is removed by the physical processes of sedimentation and filtration (Vymazal and Kröpfelová, 2008). This particulate OM then either accumulates or disintegrates and undergoes hydrolysis. This process generates dissolved OM which is degraded through a variety of other pathways. The build-up of particulate organic matter contributes significantly to clogging, which is the most common operational problem of CWs and is known to decrease the residence time (Knowles *et al.*, 2011). The removal rates of influent TSS in SSF CWs are usually very high (>90%) (García *et al.*, 2010).

Dissolved organic matter

The decomposition of dissolved OM can take place under aerobic, anoxic and anaerobic conditions(Saeed and Sun, 2012). Under aerobic conditions oxygen is the final electron acceptor. Oxygen can enter the system through three pathways: with the influent water, through surface reaeration, and through plant root release. In horizontal sub-surface flow CWs, the oxygen entering the wetland from these three processes is not considered enough to maintain aerobic conditions. Vertical flow CWs experience more aerobic conditions because they are typically operated under intermittent loading and resting periods, which promotes the physical reaeration of intergranular spaces (Langergraber and Simunek, 2005). Aerobic degradation of organic matter is given in Equation 2.1 and is performed by heterotrophic bacteria (Vymazal and Kröpfelová, 2008).

$$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + 12e^- + energy \quad (2.1)$$

Under anoxic conditions, OM is degraded by bacteria which use nitrate or nitrite as the final electron acceptor, as well as oxygen. In cases where the dissolved oxygen is depleted, anaerobic degradation takes place. Anaerobic conditions allow for the development of many different bacterial groups, intermediate steps, and alternative pathways (García *et al.*, 2010). There are

multiple steps in the process of anaerobic digestion, starting with the conversion of complex soluble polymers into monomers and amino acids. From there the amino acids are fermented to produce fatty acids, alcohols, hydrogen, methane, and carbon dioxide. The fatty acids are subsequently converted into carbon dioxide, water, and hydrogen sulfide by sulfate-reducing bacteria. This process follows the reaction given in Equation 2.2 (Gujer and Zehnder, 1983):

$$CH_3COOH + {SO_4}^{2-} \rightarrow 2CO_2 + 2H_2O + S^{2-} \quad (2.2)$$

Methanogenic bacteria also convert fatty acids, carbon dioxide, and hydrogen into methane by the two reaction steps given in Equation 2.3 and Equation 2.4 (Vymazal and Kröpfelová, 2008).

$$CH_3COOH + 4H_2 \rightarrow 2CH_4 + 2H_2O \quad (2.3)$$

$$4H_2 + CO_2 \rightarrow 2CH_4 + 2H_2O \quad (2.4)$$

2.5.2 Mechanisms for Nitrogen Cycling

Inorganic nitrogen present in wastewater can take the form of ammonia, nitrite, nitrate, nitrous oxide and elemental nitrogen or nitrogen gas (Deblonde, Cossu-Leguille and Hartemann, 2011). Organic nitrogen pollutants include aromatics and amino acids (Rosal *et al.*, 2010). CWs were proposed as a tool for the removal of nitrogen from agricultural wastewater in the 1990s, with surface flow constricted wetlands being the most commonly used type of wetland for this use (Mitsch, 1992; Vymazal *et al.*, 2020). Nitrogen transformation occurs through a variety of processes which are discussed below.

Ammonia volatilisation

Ammonia volatilisation is an equilibrium reaction between ammonium and ammonia and this reaction is pH dependent. At a pH of 9.3 or higher, the removal of nitrogen via ammonia volatilisation is effective, while at less than a pH of 8 this effect is not significant (Reddy, Patrick and Broadbent, 1984). The equilibrium reaction is given below in Equation 2.5.

$$NH_3 + H_2O \rightleftarrows {NH_4}^{+} + OH^{-} \quad (2.5)$$

Ammonia volatilisation rates are typically between 0.27 and 0.5 g N m-2 day-1, and constitute a small portion of the total nitrogen removal in HSSF CWs (Poach, M. *et al.*, 2002).

Ammonification

Ammonification in the process in which organic nitrogen (peptides, proteins and nucleic acids) are transformed into ammonium (Vymazal, 2007; Saeed and Sun, 2012). The rate at which this process takes place is a function of temperature, pH, soil conditions and the carbon : nitrogen ratio in the wetland (Reddy, Patrick and Broadbent, 1984). The optimal pH range for ammonification is between 6.5 and 8.5, while the optimal temperature lies in the range of between 40 ºC and 60 ºC (Vymazal, 1995). This conversion happens via a series of oxidative and reductive deamination reactions (Vymazal, 2007). The oxidative scheme is provided in Equation 2.6 (Savant and De Datta, 1982) and the reductive scheme is provided in Equation 2.7 (Rose, 1976). The oxidative conversion process proceeds much faster than the reductive conversion process (Vymazal, 2007). In HSSF CWs the rate of ammonification is typically higher near the surface of the wetland, where there are higher levels of dissolved oxygen.

$$\text{Amino acids} \rightarrow \text{Imino acids} \rightarrow \text{Keto acids} \rightarrow NH_3 \tag{2.6}$$

$$\text{Amino acids} \rightarrow \text{saturated acids} \rightarrow NH_3 \tag{2.7}$$

Nitrification

Nitrification is defined as the biological oxidation of ammonia to nitrate with nitrite as an intermediate product (Vymazal, 2007). The first step is the conversion of ammonia to nitrite by aerobic bacteria (Equation 2.8) and in the second step, nitrite oxidising bacteria convert the nitrite to nitrate (Equation 2.9) (Vymazal, 2007). The nitrifying bacteria derive energy from the oxidation of ammonia and CO_2 is usually the carbon source (Paul and Clark, 1996).

$$NH_4^+ + 1.5O_2 \rightarrow NO_2^- + 2H^+ + H_2O \tag{2.8}$$

$$NO_2^- + 0.5O_2 \rightarrow NO_3^- \tag{2.9}$$

The rate of nitrification is dependent on temperature, pH value, alkalinity of the water, inorganic C source, moisture, microbial population, and concentrations of ammonium and dissolved oxygen (Vymazal, 1995). Nitrification rates in wetlands were reported to be in the range of 0.01–2.15 g N m^{-2} d^{-1} with the mean value of 0.048 g N m^{-2} d^{-1} (Reddy and D'Angelo, 1997).

Denitrification

Denitrification is most commonly defined as the process in which nitrate is converted into dinitrogen via intermediates nitrite, nitric oxide, and nitrous oxide (Paul and Clark, 1996). The equations for this irreversible reaction can be seen in Equation 2.10 (Hauck, 1984). This process takes place under anaerobic conditions with organic compounds being used by bacteria as a carbon source (Wen *et al.*, 2010) and nitrogen being used as an electron acceptor instead of oxygen (Vymazal, 2007). Denitrification is usually the first process to take place after oxygen has been depleted in the system.

$$6(CH_2O) + 4NO_3^- \rightarrow 6CO_2 + 2N_2 + 6H_2O \qquad (2.10)$$

Factors which influence the rate of denitrification are oxygen concentration, redox potential, presence of denitrifiers, organic matter, nitrate concentration, pH and temperature (Vymazal, 1995, 2007). The optimum pH range lies between 6 and 8, with the process being slow but significant at a pH of 5 and insignificant below a pH of 4 (Paul and Clark, 1996). Rates of denitrification are at a maximum in the temperature range 60°C to 75°C and then they decline rapidly after that (Vymazal, 2007).

Annamox ©

The anaerobic oxidation of ammonium is also possible and understanding of this process is more recent that nitrification. This process takes place via the following reaction (Equation 2.11)

$$NH_4^+ + 1.32NO_2^- + 1.066HCO_3^- + 0.13H^+ \rightarrow$$

$$1.02N_2 + 0.26NO_3^- + 0.066CH_2O_5N_{0.15} + 2.03H_2O \qquad (2.11)$$

Research conducted by Coban et al. (2015) revealed that annamox activity is low in HSSF CWs and as such, does not play a large role in the overall nitrogen transformation process (Coban *et al.*, 2015).

Plant uptake

Two forms of nitrogen are taken up by plants: ammonia and nitrate. This assimilation takes place at its fastest rate during plant growth. Nitrogen uptake by plants is reliant on the plant growth rate and the concentration of nitrogen in the water (García *et al.*, 2010). In order for

this to be a long-term form of nitrogen removal, harvesting of the biomass is required, which can be costly and so this is not considered an extensive process of nitrogen removal (Vymazal, 2007).

Adsorption

Adsorption of ammonium ions onto the surface of the wetland medium is able to remove some nitrogen, but this process is not considered a long-term sink. The amount adsorbed onto the surface is dependent on the concentration of ammonium in the water, the type, nature, and amount of soil organic matter, and the presence of vegetation (Savant and De Datta, 1982; Vymazal, 2007).

2.5.3 Mechanisms for Phosphorus Removal

Phosphorus removal in CWs is achieved mainly through sorption, precipitation, plant uptake (requiring subsequent harvest), and peat/soil accretion. The sorption of phosphorus is limited by the adsorption capacity of the wetland medium, and this capacity increases with clay and mineral content (Prochaska and Zouboulis, 2006). Precipitation takes place when phosphorus reacts with metallic cations such as Fe, Al, Ca or Mg, forming amorphous or poorly crystalline solids (Reddy and D'Angelo, 1997). The removal of phosphorus by plant uptake is fastest during the first phase of plant growth, but thereafter is limited. In order for this removal mechanism to be effective, the plants must be harvested so that the phosphorus is not released back into the system as the plants decay. All three of these mechanisms are saturable (Vymazal, 2007) which means there comes a point when the removal is not dependent on phosphorus concentration. Soil accretion of phosphorus is the dominant long-term sink in CWs. This removal mechanism is only effective in systems with a high generation of biomass and water overlying the sediment. Because of this, it is only FWS CWs with emergent vegetation that are really able to achieved long-term phosphorus removal (Vymazal, 2007).

2.5.4 Mechanisms for Sulphur Removal

Sulfur is an important component in biochemical processes in CWs. There is high sulfur oxidation and reduction in CWs (Baldwin and Mitchell, 2012; Chen *et al.*, 2016). Sulfide is considered the main product of sulfur reduction and has the potential to reduce the treatment efficiencies of CWs as it inhibits ammonium/carbon removal and plant photosynthesis (Chen *et al.*, 2016). Two main pathways are considered for the removal of sulfide: precipitation with

heavy metals, and oxidation (Stein *et al.*, 2007; Wiessner *et al.*, 2010). Both chemical and microbial oxidation of sulfur take place in CWs (Wu *et al.*, 2013).

2.5.5 Mechanisms for Metal Removal

Metal removal in CWs can occur via multiple pathways including sedimentation, filtration, chemical precipitation, adsorption, through interactions with the microbial matrix, and through interactions with the vegetation (Hafeznezami, Kim and Redman, 2012). Multiple factors including pH, plant growth and transpiration rates, redox conditions, and the presence of aerobic and anaerobic bacteria, affect the ability of a CW to remove metals (Hadad, Maine and Bonetto, 2006). Vegetation and sub-surface media facilitate the sedimentation of metals by decreasing water flow rates (Lee and Scholz, 2007). Absorption by plants is also possible for metals such as iron, manganese, zinc, copper, cadmium, and chromium. However, the contribution of plant accumulation to the overall metal removal rate in HSSF CWs is limited (García *et al.*, 2010). Metals such as iron, aluminium, and manganese precipitate out of the water and are deposited in the wetland in the form of oxides or hydroxides (Woulds and Ngwenya, 2004). Adsorption of metal ions onto the substrate surface is an important mechanism for removing metals from wastewater in CWs (Marchand *et al.*, 2010). This step is limited by the adsorption capacity of the wetland substrate and can become saturated. Potassium is a nutrient for plants and is rapidly taken up during plant growth (Bustamante *et al.*, 2011).

2.6 The Design of Constructed Wetlands

CWs are complex systems and thus their design must be carefully considered. There are various factors that need to be investigated in the design of a CW, starting with the type of wastewater to be treated as well as the inlet concentration of contaminants and the required outlet concentrations. The second consideration is the type of CW. As discussed in Section 2.2, the dominant treatment processes that take place in a CW are dependent on the type chosen. Then the site on which the wetland is to be built must be investigated. This will determine many of the physical and biochemical conditions of the wetland. Factors such as climate, geography, soil conditions and potential for run-off water out of the CW are affected by the site and will have an impact on the treatment capacity of the CW. Then there are other considerations to be made, such as the water depth which determines the volume of water to be treated and the effectiveness of the system. The macrophytes used in a CW play a significant role in the

treatment processes. Transpiration, flow resistance, and particulate trapping are all physical processes that take place as a result of the presence of plant life in a wetland. Therefore, the plant type as well as density must be considered. The location and density of plants affects the extent of mixing in the wetland (Guo *et al.*, 2019). The type of matrix is also an important factor. In the original use of CWs, soil with a high clay content was used. This, however, led to recurring clogging problems. In the 1980's, in the United Kingdom, the use of clay was changed to washed gravel, thereby alleviating the clogging problems (Vymazal, 2005). The type of porous material used can include soil, gravel, sand, and slag, to name a few (Kadlec and Wallace, 2009). The inlet and outlet configurations affect the effective volume usage and mixing in the system, with a distributed inlet considered optimum for hydraulic behaviour (Sabokrouhiyeh *et al.*, 2017). Wetland configuration and aspect ratio are also necessary factors to consider in the wetland design. The larger the length to width ratio, the more the system has ideal plug flow behaviour, but resistance to flow increases along the length of the wetland, which can lead to overflow, and larger length to width ratios have higher capital costs (Knight, 1987; Reed, Crites and Middlebrooks, 1995; Persson, 2000).

2.7 The Need for Modelling of Constructed Wetlands

To use CWs as an effective form of wastewater treatment, accurate design and modelling is required. This need has become increasingly evident in the last three decades, as many models have been developed, with varying levels of complexity. The challenge with CW modelling is that the inherent complexity of the CW itself means that the model may require more time or computational power than is available or necessary under the circumstances (Meyer *et al.*, 2015). For the design of CWs, the models developed tend to be simpler and require less computational power than those developed for scientific research, but they may not be as accurate (Meyer *et al.*, 2015). Complex physical, chemical, and biological processes take place simultaneously, and this is layered with the complexity of modelling diffusive flow in wetlands, making it more difficult to model than conventional wastewater treatment processes (Marsili-Libelli and Checchi, 2005).

Meyer et al., (2015) described the following needs for modelling of CWs:

- Describing the phenomena ongoing in a CW (e.g., water flow, adsorption, O_2 transfer).
- Using models as a tool to compare 2 similar systems and their behaviour under different conditions (e.g., effect of loading characteristics, effect of plant species, effect of season, etc.).
- Predicting the performances of a given system (e.g., developing design recommendations).
- Answering "what if?" questions (e.g., over or under loads, etc.).
- Performing system control (especially in case of system intensification like the use of artificial aeration, recycling etc.).

The original CW models developed were considered 'black-box' models which relied on empirical correlations between inlet and outlet concentrations (J. L G Kumar and Zhao, 2011). These techniques relied on a qualitative understanding of what takes place in a CW but limited quantitative estimation of the role that the various processes play in the treatment of wastewater (Rizzo and Langergraber, 2016). Correlations based on surface area, regression, and first-order models were used but these models could only be used for similar systems where the wastewater type, plant type, climate, and porous material are all the same. Inherent in 'black-box' models is an assumption about the flow, typically that there is ideal plug flow in the CW. Given the complexity of these systems and based on research conducted in recent years, it can be said that this assumption does not hold and that these empirical correlation-based models are not adequate to model CWs (J. L G Kumar and Zhao, 2011; Stephenson and Sheridan, 2021). Subsequently, modelling has advanced to mechanistic and process-based models. These models can be divided into two general categories:

1. Models which describe the hydraulic behaviour of the CW in detail but assume simple kinetics or focus on the reactive transport of a single contaminant
2. Models which describe the detailed reactive transport of a single (or multiple) contaminant(s), but assumes simplified or ideal hydraulic behaviour

In both cases some simplifying assumptions have been made, either with regards to reaction kinetics or hydraulic behaviour. In recent years, models have been developed which combine detailed modelling of both hydraulic behaviour and reaction kinetics. These models typically

require extensive computational power, a specific software, and a detailed understanding of numerical modelling.

2.8 Kinetic Modelling of Constructed Wetlands

The rate at which chemical components are converted is referred to as the 'kinetics' of the process (Fogler, 2006). The kinetics of a process are required for the design and sizing of equipment such as reactors (Levenspiel, 1999). The kinetics of processes in CWs are not simple owing to the interrelatedness of individual components and specific reactions. Initial kinetic modelling of CWs was based on quantitative correlations between inlet and outlet concentrations. This was a good starting point but in time proved to be insufficient to describe wetland process and so kinetic models have become more advanced.

2.8.1 Reaction Rate

The reaction rate of a specific component is defined in Equation 2.12. This is the conversion of a specific component with respect to time and is dependent on properties of the reacting materials or micro-organisms. First order rates are linear and have a rate that is proportional to the concentration. These are typically the most commonly found, especially in unsaturated biologically reacting systems. An example of this, for component A, is given in Equation 2.13 Reaction rates can also be an algebraic function, and proportional to concentration to some power of 'n'. Equation 2.14 gives an example of this for component A.

$$r_i = \frac{1}{V}\frac{dN_i}{dt} \tag{2.12}$$

$$-r_A = kC_A \tag{2.13}$$

$$-r_A = k{C_A}^n \tag{2.14}$$

The Monod Equation is a special case of the Michaelis-Menton kinetics and allows the rate equation to change from first to zero order if there is saturation of a substrate within a biological reaction (Equation 2.15). This saturation occurs because the bacteria reach their maximum metabolic rate and so the reaction rate is no longer dependent on concentration. The Monod Equation has been used as the basis for reaction rates in many models for CWs (Rajabzadeh, Legge and Weber, 2015; Deng *et al.*, 2016; Gargallo *et al.*, 2017; García *et al.*, 2020).

$$-r_A = V_{max} \frac{C_A}{k_m + C_A} \quad (2.15)$$

2.8.2 The CWM1

The International Water Association (IWA) CW Model No1 (CWM1) is a biokinetic model developed by Langergraber et al (2009) which describes the transformation and degradation processes of organic matter and nitrogen through microbial processes to predict the effluent concentrations of components in a sub-surface flow CW (Langergraber, Rousseau, *et al.*, 2009). Aerobic, anaerobic, and anoxic processes are modelled which allows CMW1 to be used for both HSSF and VF CWs. All microorganisms are considered particulate matter and referred to as bacteria only (Langergraber, Rousseau, *et al.*, 2009). The microorganisms are separated into bacterial groups, based on their function in treating wastewater. In the CWM1 model reaction rates are given for 17 biological processes and 16 contaminant groups are modelled. Particulate components are denoted X_i and soluble components are denoted S_i. A list of all components, their symbols and assumptions are included in Table 2.1. The components modelled in the CWM1 are organic matter, nitrogen species, sulfur species, and various bacterial groups. It is important to note that there is a difference between a reaction rate and the rate at which an individual component is degraded or consumed. Reaction rates refer to the rate at which one process involving multiple components takes place, while the rate at which a specific component is degraded or produced is based on the rate of the reactions in the component participates. In CWM1, the processes whose reaction rates are modelled include hydrolysis, growth of multiple bacterial groups, and lysis of these same groups. The reaction rates are given in a 17x1 matrix called the reaction rate matrix. Further details of these processes can be found in Table 2.2. The reaction rates given for growth of bacteria are based on Monod kinetics and, as a result, are not linear.

A second matrix of dimension 17x16, is included in the model and links the reaction rates with the rates at which the various components are produced and consumed according to each individual process. This is called the coefficient matrix. Each coefficient is denoted $\alpha_{li,}$ relating process 'l' and component 'i'. The table of coefficients can be found in Table 2.3. In most cases the components are involved in more than one reaction and these component rates become quite intricate, consisting of more than one term. Blank fields in the coefficient matrix indicate that the specific component, 'i' does not take place in process 'j' and therefore is not influenced

by the reaction rate of process ‘j’. The dot product of the coefficient matrix and the reaction rate matrix gives a matrix of component production or degradation rates, of dimensions 16x1.

Gaseous emissions are not predicted in this model and so methane was not considered a model component (Langergraber, Rousseau, *et al.*, 2009). CWM1 is merely a biokinetic model and therefore does not account for the hydraulics of a CW, the influence of planes, transport of suspended solids, or clogging. For a fully predictive model these processes must also be investigated.

***Table 2.1**: A list of all components modelled in the CWM1, their symbols, descriptions and units. Adapted from (Langergraber, Rousseau, et al., 2009)*

Component number	Type	Symbol	Description	Units	Soluble/ particulate
1	Dissolved Oxygen	S_O	Dissolved oxygen can be directly measured and is subject to gas exchange.	$M(O_2)\ L^{-3}$	Soluble
2	Fermentable, readily biodegradable COD	S_F	This fraction of the COD is directly available for biodegradation by heterotrophic and fermenting bacteria and is produced by hydrolysis.	$M(COD)\ L^{-3}$	Soluble
3	Fermentation products as acetate	S_A	All fermentation products are assumed to be acetate only. Removal of S_A occurs by aerobic and anoxic growth of heterotrophic bacteria and is produced from hydrolysis.	$M(COD)\ L^{-3}$	Soluble
4	Inert, soluble COD	S_I	S_I cannot be further degraded in the treatment plant and is assumed to be part of the influent organic matter and can be produced from hydrolysis	$M(COD)\ L^{-3}$	Soluble
5	Ammonium and ammonia nitrogen (NH_4^+-N and NH_3-N)	S_{NH}	S_{NH} is assumed to include all NH_4^+-N. As organic nitrogen is modelled as a fraction of the COD, S_{NH} is produced by degradation of organic matter. S_{NH} is degraded by nitrification and by incorporation during biomass growth.	$M(N)\ L^{-3}$	Soluble
6	Nitrate and Nitrite nitrogen (NO_3^--N and NO_2^-N)	S_{NO}	S_{NO} is assumed to include all nitrate and nitrite nitrogen since nitrite is not included as a separate model component. For stoichiometric equations S_{NO} is assumed to be NO_3^--N only. S_{NO} is produced from nitrification and consumed by denitrification and anoxic sulphide oxidation.	$M(N)\ L^{-3}$	Soluble
7	Sulphate sulphur	S_{SO4}	S_{SO4} is expressed as sulphur. Sulphate reducing bacteria uses S_{SO4} as an electron acceptor for oxidation of S_A. S_{SO4} is produced from aerobic and anoxic sulphide oxidation.	$M(S)\ L^{-3}$	Soluble
8	Dihydrogensulphide sulphur	S_{H2S}	S_{H2S} is produced by reduction of S_{SO4} whereas S_{H2S} is converted to S_{SO4} by sulphide oxidisers such as *Thiobacillus*	$M(S)\ L^{-3}$	Soluble
9	Slowly biodegradable particulate COD	X_S	X_S represents organic substances which have to undergo cell external hydrolysis before they are available for degradation. When bacteria die, the biodegradable parts of their cells are added to the amount of X_S. X_S loses occur through hydrolysis by heterotrophic bacteria.	$M(COD)\ L^{-3}$	Particulate
10	Inert particulate COD	X_I	This part of the particulate organic matter is not degraded in the system of interest. X_I is assumed to stay in the pore space unless higher flow rates exert enough shear stress to drag along solids.	$M(COD)\ L^{-3}$	Particulate
11	Heterotrophic bacteria	X_H	These organisms are assumed to be the 'allrounder' heterotrophic being responsible for hydrolysis, mineralization of organic matter (aerobic growth) and denitrification (anoxic growth).	$M(COD)\ L^{-3}$	Particulate
12	Autotrophic nitrifying bacteria	X_A	Nitrifying organisms are responsible for nitrification. It is assumed that S_{NH} is nitrified to S_N. Nitrite, as an intermediate product of nitrification, is not considered.	$M(COD)\ L^{-3}$	Particulate
13	Fermenting bacteria	X_{FB}	Under anaerobic conditions fermenting bacteria consume fermentable, readily biodegradable COD (S_F) and produce acetate (S_A).	$M(COD)\ L^{-3}$	Particulate
14	Acetotrophic methanogenic bacteria	X_{AMB}	Anaerobically growing acetotrophic methanogenic bacteria consume acetate (S_A) and produce methane (which is not considered as a model component).	$M(COD)\ L^{-3}$	Particulate
15	Acetotrophic sulphate reducing bacteria	X_{ASRB}	Sulphate reducing bacteria use S_{SO4} as an electron acceptor for oxidation of acetate (S_A) and produce S_{H2S}.	$M(COD)\ L^{-3}$	Particulate
16	Sulphide oxidising bacteria	X_{SOB}	Sulphur oxidising bacteria are chemautotrophic organisms that use oxygen S_O or nitrate S_{NO} to oxidise sulphide (S_{H2S}) to sulphate (S_{SO4}).	$M(COD)\ L^{-3}$	Particulate

***Table 2.2**: A list of all the process modelled in the CWM1 and the rates at which they proceed. Adapted from (Langergraber, Rousseau, et al., 2009)*

Process number	Process	Process rate ρ_j
1	Hydrolysis	$k_h * \left[\frac{\frac{X_s}{X_H + X_{FB}}}{K_X + \frac{X_s}{X_H + X_{FB}}}\right] * (X_H + \eta_h * X_{FB})$
2	Aerobic growth of heterotrophic bacteria on fermentable, readily biodegradable COD	$\mu_H * \left[\frac{S_F}{K_{SF} + S_F}\right] * \left[\frac{S_F}{S_F + S_A}\right] * \left[\frac{S_O}{K_{OH} + S_O}\right] * \left[\frac{S_{NH}}{K_{NHH} + S_{NH}}\right] * \left[\frac{K_{H2SH}}{K_{H2SH} + S_{H2S^*}}\right] * X_H$
3	Aerobic growth of heterotrophic bacteria on fermentation products as acetate	$n_g * \mu_H * \left[\frac{S_F}{K_{SF} + S_F}\right] * \left[\frac{S_F}{S_F + S_A}\right] * \left[\frac{K_{OH}}{K_{OH} + S_O}\right] * \left[\frac{S_{NO}}{K_{NOH} + S_{NO}}\right] * \left[\frac{S_{NH}}{K_{NHH} + S_{NH}}\right] * \left[\frac{K_{H2SH}}{K_{H2SH} + S_{H2S^*}}\right] * X_H$
4	Anoxic growth of heterotrophic bacteria on fermentable, readily biodegradable COD	$\mu_H * \left[\frac{S_A}{K_{SA} + S_A}\right] * \left[\frac{S_A}{S_F + S_A}\right] * \left[\frac{S_O}{K_{OH} + S_O}\right] * \left[\frac{S_{NH}}{K_{NHH} + S_{NH}}\right] * \left[\frac{K_{H2SH}}{K_{H2SH} + S_{H2S^*}}\right] * X_H$
5	Anoxic growth of heterotrophic bacteria on fermentation products as acetate	$n_g * \mu_H * \left[\frac{S_A}{K_{SA} + S_A}\right] * \left[\frac{S_A}{S_F + S_A}\right] * \left[\frac{K_{OH}}{K_{OH} + S_O}\right] * \left[\frac{S_{NO}}{K_{NOH} + S_{NO}}\right] * \left[\frac{S_{NH}}{K_{NHH} + S_{NH}}\right] * \left[\frac{K_{H2SH}}{K_{H2SH} + S_{H2S^*}}\right] * X_H$
6	Lysis if heterotrophic bacteria	$b_H * X_H$
7	Growth of autotrophic nitrifying bacteria on ammonium and ammonia nitrogen	$\mu_A * \left[\frac{S_{NH}}{K_{NHA} + S_{NH}}\right] * \left[\frac{S_O}{K_{OA} + S_O}\right] * \left[\frac{K_{H2SA}}{K_{H2SA} + S_{H2S^*}}\right] * X_A$
8	Lysis of autotrophic nitrifying bacteria	$b_A * X_A$
9	Growth of fermenting bacteria	$\mu_{FB} * \left[\frac{S_F}{K_{SFB} + S_F}\right] * \left[\frac{K_{H2SFB}}{K_{H2SFB} + S_{H2S^*}}\right] * \left[\frac{K_{OFB}}{K_{OFB} + S_O}\right] * \left[\frac{K_{NOFB}}{K_{NOFB} + S_{NO}}\right] * \left[\frac{S_{NH}}{K_{NHFB} + S_{NH}}\right] * X_{FB}$
10	Lysis of fermenting bacteria	cc
11	Growth of acetotrophic, methanogenic bacteria	$\mu_{AMB} * \left[\frac{S_A}{K_{SAMB} + S_A}\right] * \left[\frac{K_{H2SAMB}}{K_{H2SAMB} + S_{H2S^*}}\right] * \left[\frac{K_{OAMB}}{K_{OAMB} + S_O}\right] * \left[\frac{K_{NOAMB}}{K_{NOAMB} + S_{NO}}\right] * \left[\frac{S_{NH}}{K_{NHAMB} + S_{NH}}\right] * X_{AMB}$
12	Lysis of acetotrophic, methanogenic bacteria	$b_{AMB} * X_{AMB}$
13	Growth of acetotrophic sulphate reducing bacteria.	$\mu_{ASRB} * \left[\frac{S_A}{K_{SASRB} + S_A}\right] * \left[\frac{S_{SO4}}{K_{SOASRB} + S_{SO4}}\right] * \left[\frac{K_{H2SASRB}}{K_{H2SASRB} + S_{H2S^*}}\right] * \left[\frac{K_{OASRB}}{K_{OASRB} + S_O}\right] * \left[\frac{K_{NOASRB}}{K_{NOASRB} + S_{NO}}\right] * \left[\frac{S_{NH}}{K_{NHASRB} + S_{NH}}\right] * X_{ASRB}$
14	Lysis of acetotrophic sulphate reducing bacteria.	$b_{ASRB} * X_{ASRB}$
15	Aerobic growth of sulphide oxidising bacteria on dihydrogen sulphide	$\mu_{SOB} * \left[\frac{S_{H2S}}{K_{SSOB} + S_{H2S}}\right] * \left[\frac{S_O}{K_{OSOB} + S_O}\right] * \left[\frac{S_{NH}}{K_{NHSOB} + S_{NH}}\right] * X_{SOB}$
16	Anoxic growth of sulphide oxidising bacteria on dihydrogen sulphide	$\mu_{SOB} * \eta_{SOB} * \left[\frac{S_{H2S}}{K_{SSOB} + S_{H2S}}\right] * \left[\frac{S_{NO}}{K_{NOSOB} + S_{NO}}\right] * \left[\frac{K_{OSOB}}{K_{OSOB} + S_O}\right] * \left[\frac{S_{NH}}{K_{NHSOB} + S_{NH}}\right] * X_{SOB}$
17	Lysis of sulphide oxidising bacteria	$b_{SOB} * X_{SOB}$

***Table 2.3**: Coefficient matrix of processes and components in CWM1. Adapted from (Langergraber, Rousseau, et al., 2009)*

j	process	I	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
		Component	S_O	S_F	S_A	S_I	S_{NH}	S_{NO}	S_{SO4}	S_{H2S}	X_S	X_I	X_H	X_A	X_{FB}	X_{AMB}	X_{ASRB}	X_{SOB}
		Expressed as	O_2	COD	COD	COD	N	N	S	S	COD	COD	COD	COD	COD	COD	COD	COD
1	Hydrolysis			1-$f_{Hyd,SI}$		$f_{Hyd,SI}$	$v_{5,1}$				-1		1					
2	Aerobic growth of X_H on S_F		$1-\frac{1}{Y_H}$	$-\frac{1}{Y_H}$			$v_{5,2}$						1					
3	Aerobic growth of X_H on S_A			$-\frac{1}{Y_H}$			$v_{5,3}$	$-\frac{1-Y_H}{2.86*Y_H}$					1					
4	Anoxic growth X_H on S_F		$1-\frac{1}{Y_H}$		$-\frac{1}{Y_H}$		$v_{5,4}$						1					
5	Anoxic growth of X_H on S_A				$-\frac{1}{Y_H}$		$v_{5,5}$	$-\frac{1-Y_H}{2.86*Y_H}$					1					
6	Lysis if X_H			$f_{BM,SF}$			$v_{5,6}$				$v_{9,Lysis}$	$f_{BM,XI}$	-1					
7	Growth of X_A on S_{NH}		$-\frac{4.57-Y_A}{Y_A}$				$-i_{N,BM}-\frac{1}{Y_A}$	$\frac{1}{Y_A}$						1				
8	Lysis of X_A			$f_{BM,SF}$			$v_{5,8}$				$v_{9,Lysis}$	$f_{BM,XI}$		-1				
9	Growth of X_{FB}			$-\frac{1}{Y_{FB}}$	$\frac{1-Y_{FB}}{Y_{FB}}$		$v_{5,9}$								1			
10	Lysis of X_{FB}			$f_{BM,SF}$			$v_{5,10}$				$v_{9,Lysis}$	$f_{BM,XI}$			-1			
11	Growth of X_{AMB}				$-\frac{1}{Y_{AMB}}$		$v_{5,11}$									1		
12	Lysis of X_{AMB}			$f_{BM,SF}$			$v_{5,12}$				$v_{9,Lysis}$	$f_{BM,XI}$				-1		
13	Growth of X_{ASRB}				$-\frac{1}{Y_{ASRB}}$		$v_{5,13}$	$-\frac{1-Y_{ASRB}}{2*Y_{ASRB}}$	$\frac{1-Y_{ASRB}}{2*Y_{ASRB}}$								1	
14	Lysis of X_{ASRB}			$f_{BM,SF}$			$v_{5,14}$				$v_{9,Lysis}$	$f_{BM,XI}$					-1	
15	Aerobic growth of X_{SOB} on S_{H2S}		$-\frac{2-Y_{SOB}}{Y_{SOB}}$			$-\frac{1}{Y_H}$	$v_{5,15}$			$-\frac{1}{Y_{SOB}}$								1
16	Anoxic growth of X_{SOB} on S_{H2S}						$v_{5,16}$	$-\frac{1-Y_{SO}}{0.875*Y_S}$		$-\frac{1}{Y_{SOB}}$								1
17	Lysis of X_{SOB}			$f_{BM,SF}$			$v_{5,17}$				$v_{9,Lysis}$	$f_{BM,XI}$						-1

2.8.3 The CW2D

CW2D is another multi-component model, with a very similar basis to CWM1. This biokinetic model includes the production and degradation of 12 components including dissolved oxygen, organic matter (three fractions of different degradability), ammonium, nitrite, nitrate, and dinitrogen-nitrogen, inorganic phosphorus, and heterotrophic and autotrophic micro-organisms. There are 9 processes considered which include hydrolysis, mineralization of organic matter, nitrification (which is modelled as a two-step process), denitrification, and a lysis process for the micro- organisms. CW2D is set up in the same way as CWM1 with two matrices which give the process reaction rates and stochiometric coefficients connecting the components to the processes.

Like CWM1, CW2D is a biokinetic model and does not factor in the hydraulic flow behaviour of a CW. For this reason, CW2D is used in conjunction with other models. CW2D has been integrated into two comprehensive models, HYDRUS and BIO_PORE, both of which are discussed in more detail in Section 2.9.

2.9 Hydraulic Modelling of Constructed Wetlands

CWs are essentially reactors and one of the factors which affects the extent of reaction is the time the fluid spends in the CW. Investigation into the hydraulic behaviour of a CW allows for the determination of this time and subsequently the effectiveness of the system in reducing contaminant load. Therefore, for CW models to be accurate the characterisation of hydraulic behaviour must be accurate. The flow behaviour of a wetland influences its ability to break down inlet contaminants (Kadlec and Wallace, 2009). There is a distribution of flow velocities within the system and the combination of these gives the overall hydraulic behaviour of the system. The water moving at the maximum velocity in the profile would normally be in the surface layer of the micro-channels, while the lowest velocity is experienced by water that moves near drag-inducing surfaces, such as the wetland bottom (Werner and Kadlec, 2000). Investigations have found that there are 3 different hydraulic zones in CWs; the main flow path, a temporary storage zone, where components and water are exchanged with the main flow path, and a dead zone (Buchberger and Shaw, 1995; Zahraeifard and Deng, 2011). By investigating the hydraulic behaviour of a CW, it is possible to give an indication of whether there are hinderances to ideal flow such bypassing, dispersion, and dead zones. All these factors contribute to the time that wastewater spends in the wetland, known as the residence time. This

in turn relates to how long the water is in the system to break down organics, convert nitrogen species, and degrade other contaminants. If a wetland has poor hydraulic behaviour, then pollutant removal will be poor and conversion for which the system was designed, will not be achieved.

2.9.1 Ideal Reactor Equations

For design purposes, it can be tempting to model CWs using ideal flow behaviour, either as a plug flow reactor (PFR) or as a continuously stirred tank reactor (CSTR). In an ideal PFR every fluid particle moves through the reactor with the same velocity and have the same residence time. There is assumed to be no dispersion or longitudinal mixing. The design equation for a first-order reaction in a PFR is given in Equation 2.16. In an ideal CSTR it is assumed that the system is perfectly mixed which implies that the effluent concentration is the same as the concentration anywhere in the reactor. Equation 2.17 gives the design equation for a first order reaction in an ideal CSTR. However, it has been shown by multiple researchers that the hydraulic behaviour of CWs is far from these ideal cases, and likely lies somewhere in between (Kadlec, 2000; Werner and Kadlec, 2000).

$$C_{i,out} = C_{i,in} e^{-kt} \tag{2.16}$$

$$C_{i,out} = \frac{C_{i,in}}{(1+kt)} \tag{2.17}$$

The reason an ideal PFR equation is often chosen is that the solution to the kinetics is the same as a batch reactor, with time ‘t’ being the same as ‘tau’. While this makes the equation easy to use, it is not necessarily accurate. If the hydraulic behaviour of CWs is to be modelled accurately, non-ideal flow must be considered.

2.9.2 Reasons for Non-ideal Flow

The flow characteristics of CWs are elaborate and non-ideal owing to the changing root structure and the complicated flow pathway of fluid through gravel or soil matrix (Bonner et al., 2017). Factors such as wetland shape (Persson, 2000; Wörman and Kronnäs, 2005), inlet and outlet location (Persson, Somes and Wong, 1999; Suliman, Futsaether, *et al.*, 2006), and vegetation distribution (Persson, Somes and Wong, 1999; Serra, Fernando and Rodríguez, 2004; Kjellin *et al.*, 2007; Keefe *et al.*, 2010) can affect the hydraulic behaviour of CWs. These factors result in non-ideal phenomena like dispersion, short-circuiting, and dead zones.

Dispersion

Dispersion in an effect of the micro-mixing of the fluid in the direction of the flow. This leads to a 'spreading' of the pocket of fluid. This phenomenon occurs because the flow channels are non-ideal and have different lengths and are oriented in different directions.

Short circuiting

Short circuiting occurs when some of the fluid bypasses the main flow channel and follows the path of least resistance, resulting in this pocket of fluid passing through the system in a much shorter period of time than the rest of the fluid.

Dead zones

Dead zones are areas of very low or no flow within a system. In these stagnant pockets the dominant process for solute transport is diffusion. The presence of dead zones decreases the effective volume of the overall system and therefore reduces the system's ability to treat wastewater.

Wetland clogging

Wetland clogging is considered to be one of the biggest operational problems of CWs. This phenomenon is typically caused by the following processes (Kadlec, 2009).

- Deposition of suspended solids at the system inlet;
- Deposition of organic compounds, which are resistant to microbial degradation, at the system inlet;
- Chemical precipitation;
- Introduction of organic matter to the system which encourages growth of microbial biofilms in the plant rhizosphere;
- Growth of plant roots within the packed media; and
- Gas bubble dynamics.

Heterogenous sub-surface media

Gravel and soil are among the most commonly used CW media. These materials are typically heterogeneous in nature and are found to have particle size distributions (Suliman, French, *et al.*, 2006). This variation in particle sizes results in a variation in pore sizes throughout the

wetland that can lead to the development of preferential flows paths. The presence of vegetation also increases the heterogenous nature of the system. Vegetation distribution is a variable barrier to flow in terms of the plant size, shape, and position. As a result, there is bypass and short circuiting around plant mass, forming dead zones, which leads to a hold up of water in certain areas.

2.9.3 Tracer Tests

The most common way to characterise the flow patterns and assess the hydraulic behaviour of a CW is by conducting residence time distribution (RTD) studies or tracer studies (Headley and Kadlec, 2007). The residence time distribution of a reactor gives the probability of a fluid element spending a specific amount of time in the reactor and is characteristic of the mixing that occurs within the system (Fogler, 2006). The RTD is obtained by running a flow tracer study on the system. A flow tracer study is a stimulus-response experiment in which an inert flow tracer is injected either as an impulse or as a step-change in concentration into the system inlet pipe and the tracer concentration is measured continuously at the effluent. An effective tracer study requires the flow to be laminar (Sheridan, Hildebrandt and Glasser, 2013) if the data is to be successfully extrapolated (scaled) to other operational flow rates (as long as they are also laminar). Data from these experiments are then used in RTD modelling methodologies to analyse the flow characteristics of the reactor and can be used to quantify a set of characteristics that describe the hydraulic behaviour of CWs (Bonner *et al.*, 2017). In order for these tracer tests to be effective the tracer used must be conservative, i.e. should not be consumed or degraded (Cucco and Umgiesser, 2006). The tracer should also not be susceptible to biological, chemical, or photochemical decay, should be highly soluble in water, and should be easily detectable and not exist at high background levels within the system. It is also assumed that for any experiment run, the tracer flow behaviour is similar to a normal effluent liquid (Lappalainen *et al.*, 2011).

Impulse-Response tracer tests

The type of tracer study most commonly used to determine the hydrodynamic behaviour of a CW is the impulse-response test (Headley and Kadlec, 2007; Kadlec, 2007). When conducting an impulse-response test a small volume of highly concentrated tracer solution is injected instantaneously (mathematically equivalent to an impulse function) into the inlet of the system and the concentration of the tracer is measured at the effluent at regular time intervals (Fogler,

2006). In Figure 2.8 a graphical representation of the concentration-time response at the inlet (a) and outlet (b) can be seen. The very short impulse is observed to spread (or disperse) through any system. If the results follow a normal (Gaussian) distribution, the flow is normally ideal. The shape of the distribution can tell the experimenter many things: if it is bi- or multi-modal (two or more peaks) it can indicate bypass , if it has a very long tail, it can indicate dead-zones as the tracer 'bleeds' back from the dead-zone into the outlet.

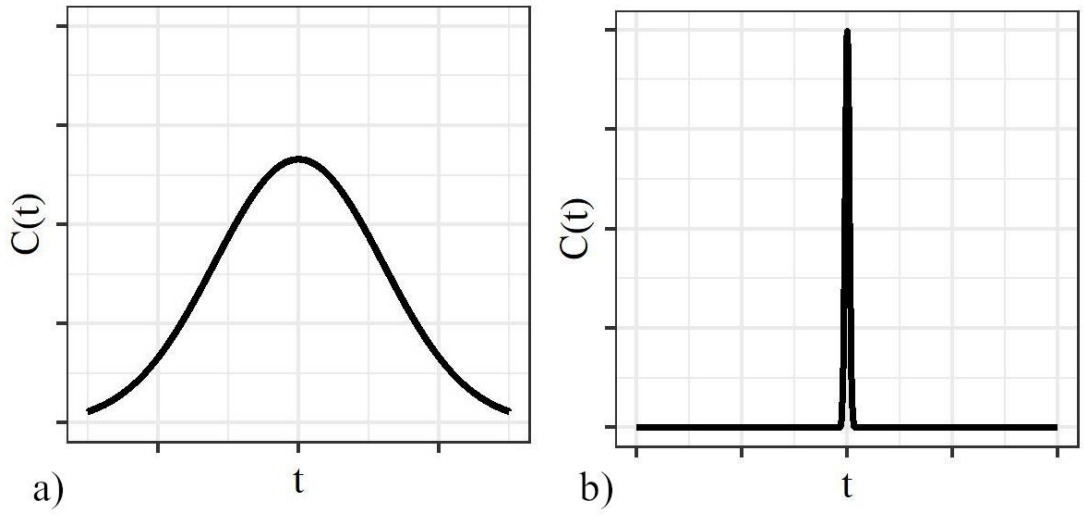

Figure 2.8: *A graphical representation of the concentration-time response of an impulse-response tracer test: inlet (a) and outlet (b).*

The residence time distribution function, E(t), which is a quantitative description of how much time the fluid particles have spent in the reactor, can be obtained from concentration-time data of the impulse-response curve, and is given by Equation 2.18. The basis assumption for Equation 2.18 is that the inlet volumetric flow rate of the system is constant. E(t) is calculated using the area under the concentration-time curve; by doing so the area underneath the E(t) vs t response curve is 1. The calculation of E(t) is important as the first step towards calculating the moments of the distribution (i.e., the first moment is the mean of the RTD, the second moment is the spread of the distribution – these are discussed further later).

$$E(t) = \frac{C(t)}{\int_0^\infty C(t)dt} \tag{2.18}$$

Two of the problems associated with an impulse-response tracer study are ensuring that the injection of tracer takes places over a period of time which is short compared to the residence time of the system, and ensuring negligible dispersion of the tracer between the point of injection and the feed to the system. Another issue than can arise is that if the experiment has

been concluded too early, then the analysis of the concentration-time data from the effluent can lead to inaccuracies. It is important is extrapolate the tail of the impulse-response to prevent this. A further major obstacle with the impulse-response tracer test is that there may be the same concentration at various times (i.e., on the way towards the peak(s) and on the way down from the peak(s)). This means that the actual time a molecule has spent in the reactor is not known, and rather there are probabilities of time that reactants spend in the reactor.

Step change tracer tests

The other primary type of tracer study is a step-change response test. For this experiment a constant rate of tracer is fed into the system starting at $t = 0$. The concentration of this tracer must be significantly higher than the background concentration and easy to quantify analytically. The effluent concentration is monitored at regular time intervals (Vonortas *et al.*, 2011) until the outlet concentration is stable and equal to that of the inlet (this will only happen if the tracer is conservative – if not, the outlet will reach a steady-state value). A graphical representation of the concentration-time behaviour of the typical inlet and outlet response of step-change tracer tests is shown in Figure 2.9.

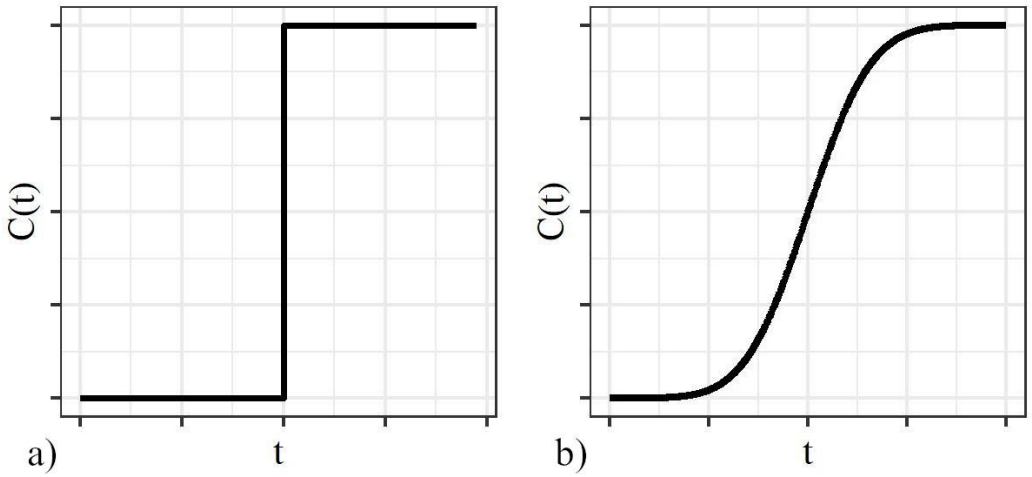

Figure 2.9*: A graphical representation of the concentration-time response of a step-change response tracer test: inlet (a) and outlet (b).*

From the concentration-time data of the step-change response experiment, the cumulative distribution, F(t), can be obtained. F(t) is described as the fraction of effluent that has been in the system for less than time t. The mathematical definition of the cumulation distribution is given in Equation 2.19 (Fogler, 2006). F(t) can also be considered the normalised response to the step input.

$$F(t) = \left[\frac{C_{out}}{C_{inlet}}\right]_{step} \tag{2.19}$$

Some of the challenges associated with step-change response tracer studies include difficulty maintaining a constant feed concentration, a large amount of tracer is required, and the analysis of step-change response data involves differential mathematics rather than integral mathematics. This can result in large errors and a serious increase in noise in the data (Fogler, 2006). One of the benefits of this study is that it is not necessary to know the total amount of tracer added to the system.

The relationship between the residence time distribution function (E(t)) and the cumulative distribution function, is given in Equation 2.20. This integral relationship allows for the conversion from impulse-response data to step change response data, if desired. Because of this relationship it is possible to determine the hydraulic parameters from the cumulative distribution function from the residence time distribution function.

$$\int_0^t E(t)dt = F(t) \tag{2.20}$$

Square input tracer tests

Square input tracer tests are uncommon and not covered in common literature. In this form of tracer study, the feed concentration is increased from 0 to a significantly higher and measurable concentration at t=0 and then at t=t* the feed concentration is stepped back down to 0. Giraldi et al., (2009) used square input tracer tests when conducting tracer tests on VF CWs to determine the hydrodynamics in different saturation conditions (Giraldi *et al.*, 2009). The square input signal was artificially extended to take the form of a step change input signal using Equation 2.21, where C(t) is the normalized tracer concentration and t* is the time where the dosing of tracer for the square input was stopped. In other words, it is essentially a double step-change – one up, and one down.

$$\begin{cases} F(t) = C(t) & , t \leq t^* \\ F(t) = C(t) + F(t - t^*) & , t > t^* \end{cases} \tag{2.21}$$

The response curve of the different types of experiments can be used to quantify the hydraulic behaviour of the system using the method-of-moments analysis as well as other reactor models such as the tanks-in-series model and the advective-dispersive transport models (Langergraber, Giraldi, *et al.*, 2009).

Types of tracers

There are many options of tracers available which include, but are not limited to: salt ions, fluorescent dyes, and stable isotopes, or a combination of these of tracers. All of these options have been used by researchers conducting tracer tests in CWs.

Salt tracers

Salt tracers, also known as ionic tracers, are considered to be effective for studying the hydraulic behaviour of CWs as they are easily soluble and are unlikely to interact with the biota of the system (Lin *et al.*, 2003). Sodium chloride is one of the most common salt tracers and has been used by many researchers. Heiderscheidt et al. (2020) used it to determine the residence time under frozen and frost-free conditions of an unplanted, peat-based, pilot-scale wetland (Heiderscheidt *et al.*, 2020), Sun et al. (2019) used it to determine hydraulic parameters of a horizontal sub-surface flow CW (Sun *et al.*, 2019) and Hua et al. made use of the tracer to investigate the effect of clogging and resting processes on the flow behaviour of a vertical flow CW (Hua *et al.*, 2018). One study used lithium as a tracer to validate the hydraulic model used in a CWM1-RETRASO mechanistic model in the simulation of a horizontal sub-surface flow CW (Mburu *et al.*, 2013), while another used lithium chloride to test the effect of inlet configuration and vegetation type on the hydraulic performance of 18 free water surface wetlands (Bodin *et al.*, 2012). Potassium iodide was used by a group of researchers to determine the hydraulic behaviour of drained peatlands (Postila *et al.*, 2015).

One of the limitations of salt tracers is that the salt solutions typically have higher densities than the wetland water (Bodin *et al.*, 2012) and so a halocline could be formed. This results in the stratification of fluid which prevents mixing and is thermodynamically stable. Density induced stratification may be aided by low flow velocities (Schmid, Hengl and Stephan, 2004). Special care needs to be taken, especially in the case of impulse-response tracer tests, to ensure that salt tracer settling does not take place. Density differences are also affected by temperature, but in FWS wetlands the temperature difference from top to bottom is approximately 1°C which is not considered enough to create stratification (Kadlec and Wallace, 2009). Any temperature differences greater than this may cause a problem (Bodin *et al.*, 2012).

When choosing a salt tracer, choosing one with ions that have minimal interaction with the system is important. For example, Cl^- and Li^+ are good ionic tracers but NO_3^- will be transformed in the system and therefore is not a conservative tracer. It is also important to

consider the charge of the ion and the charge of the wetland medium, to ensure minimal interaction between the two.

Chemical analytical methods most commonly used for salt tracers are electrical conductivity and ion chromatography and, in some cases, atomic absorption spectrophotometry. Electrical conductivity is a cheap and effective method of analysis and can be used as a proxy for determining the concentration of ions in the system.

Fluorescent tracers

The use of fluorescent tracers in the RTD studies of CWs is common. Fluorescent dyes such as fluorescein and rhodamine are inexpensive, easy to handle and easy to detect (Russell *et al.*, 1992). One study used rhodamine WT to evaluate hydraulic behaviour and performance indicators of various wetlands designs and from this information were able to choose the optimum design from the systems tested on (Guo *et al.*, 2019). Guo et al. (2019) used rhodamine WT to determine the residence time and other hydraulic parameters of a tundra wetland and from this were able to determine first-order rate constants of the contaminants which can be used to further improve the wetland design (Hayward and Jamieson, 2015). Another common fluorescent dye tracer is uranine. Pálfy et al. (2017) used uranine to determine the hydraulic behaviour of a wetland treating combined sewer overflow and from this information the researchers were able to identify short circuiting as a limitation of the system (Pálfy *et al.*, 2017), while Laurent et al. (2015) used uranine and sulfurhodamine B to successfully determine the hydrodynamic behaviour of three surface flow CWs (Laurent *et al.*, 2015)**.** These dyes are for the most part conservative but have the potential to adsorb onto certain materials, are susceptible to photodegradation and biodegradation, and can be pH sensitive (Lin *et al.*, 2003; Gerke, Sidle and Mallants, 2013).

Combinations of different types of tracers

A combination of two or more types of tracers is being trialled by wetland researchers for RTD studies. Different tracers have different diffusion coefficients, and this allows researchers to determine the presence and location of stagnant zones and diffusion dominated transport processes (Knorr *et al.*, 2016). Birkigt et al. (2018) conducted a multi-tracer RTD experiment using bromide, uranine and deuterium oxide to determine the flow behaviour in three dimensions of a pilot-scale HSSF CW (Birkigt *et al.*, 2018). From this research it was noted that bromide and deuterium oxide had similar behaviour and the data from the tracer studies yielded similar hydraulic parameters while uranine displayed a different hydraulic behaviour. It was suggested that there was a lag in the response of uranine due to organic matter in the system. Mailard et al. (2016) used bromide, uranine and sulforhodamine-B as tracers to determine the impact of batch versus continuous-flow modes on the dissipation of the chiral herbicide S-metolachlor in a CW (Maillard *et al.*, 2016). These researchers found that plant uptake, sorption, and photodegradation is greater in batch mode operation than continuous flow operation, but the extent for each tracer was slightly different. Bromide was most susceptible to plant uptake, uranine was most susceptible to photodegradation and sulforhodamine-B was most susceptible to sorption (Maillard *et al.*, 2016). Pugliese et al. (2020) used uranine and potassium bromide as conservative tracers to study the hydraulic behaviour of a shallow-deep, compartment-designed sub-surface flow CW and were able to identify the presence of multiple flow paths and internal mixing in shallow zones (Pugliese *et al.*, 2020). Montalván et al. (2017) used natural tracers (Cl^-, Br^-, Na^+, Mg^{2+}) and environmental isotopes (^{18}O, ^{2}H, ^{14}C, ^{13}C and ^{3}H) to estimate residence times of brine waters and identify recharge areas of the different flow subsystems in a hypersaline wetland (Montalván *et al.*, 2017). Bruun et al. used bromide and tritium (in the form of $^{3}H_2O$) to investigate intra-granular diffusion in a woodchip based sub-surface flow CW (Bruun *et al.*, 2016). This study indicated that there may be a slight anion exclusion on bromine in the wood chip matrix.

Other tracer options

While the tracer types mentioned above are the more common, a few others have been used. Bonner et al. (2017) developed a mapping methodology for the use of heat as a non-conservative tracer in HSSF CWs. The researchers were able to accurately quantify the hydraulic parameters of the system being tested on from the mapped heat tracer response. It was shown that if certain parameters of transport can be determined then this technique can be

used. One study used stable isotope ratios of oxygen ($\delta^{18}O$) and hydrogen ($\delta^{2}H$) in water to study the hydrology of forested wetlands (Bugna, Grace and Hsieh, 2020). Through this, the researchers were able to identify the contribution of surface water and rainwater to three different wetland systems and the extent of surface evaporation. Abu-Bakar et al. (2017) investigated the use of microbial tracers and in this study the researchers calibrated and validated the transport and decay of four microbial tracers and used the data to refine a model for better water quality processes in a macro-tidal coastal basin. Modelling the decay of the microbial tracers proved to be more computationally intensive than the researchers expected so the technique is not considered useful for design (Abu-Bakar, Ahmadian and Falconer, 2017).

2.9.4 Hydraulic Modelling Techniques

In an ideal plug-flow system, all fluid particles move through the wetland with the same velocity and reach the system outlet at the same time. This exit time is the simplest way to account for time in a CW and is called the nominal residence time (τ) which is defined in Equation 2.22 (Headley and Kadlec, 2007). The nominal residence time is only a function of velocity ($\dot{v}$) and volume (V) and is an intrinsic parameter of any reactor. This method does not account for any non-ideal flow through the wetland system and a tracer test is not required to determine the nominal residence time. Owing to the non-ideal nature of wetland hydraulic behaviour, the nominal residence time is not considered sufficient to characterise wetland flow behaviour.

$$\tau = \frac{V}{\dot{v}} \tag{2.22}$$

Method-of-moments

In the method-of-moments technique for interpreting RTD data, three parameters are determined: the mass recovery, the mean residence time, and the variance. The mass recovery of tracer in an RTD study is important, especially in an impulse-response study, as many parameters used to quantify the hydraulic behaviour of a system are determined based on the assumption of total mass recovery. A mass recovery of tracer of 80% or higher is generally considered acceptable (Headley and Kadlec, 2007). The percentage of mass recovery of conservative tracer in a tracer study is considered the zeroth moment of the RTD. The mass recovery can be calculated using Equation 2.23 (Holland *et al.*, 2004).

$$M_{out} = \int_0^\infty Q_{out}(t)C_{out}(t)dt \quad (2.23)$$

The first moment of the RTD study is the centroid of the response curve, and is called the mean residence time (t_m), which is the average amount of time that the fluid particles have spent in the reactor. This can be calculated using Equation 2.24 (Fogler, 2006) for impulse-response tracer studies and Equation 2.25 (Bonner *et al.*, 2017) for step-change response tracer studies.

The second moment of the RTD is the variance. The variance is an indication of the spread of the impulse as it passes through the reactor system (Drummond *et al.*, 2012; Jackson *et al.*, 2012). Equation 2.26 (Luo *et al.*, 2008) and Equation 2.27 (Bonner *et al.*, 2017) give the equation used to determine the variance from an impulse-response and step change tracer study, respectively. The variance gives an indication of the global mixing in the system (Giraldi *et al.*, 2009).

$$t_m = \frac{\int_0^\infty tE(t)dt}{\int_0^\infty E(t)dt} \quad (2.24)$$

$$t_m = \int_0^\infty [1 - F(t)]dt \quad (2.25)$$

$$\sigma^2 = \int_0^\infty (t - t_m)^2 E(t)dt \quad (2.26)$$

$$\sigma^2 = 2\int_0^\infty t[1 - F(t)]dt - {t_m}^2 \quad (2.27)$$

Dimensionless variance is calculated using Equation 2.28. The dimensionless variance gives an indication of local mixing.

$${\sigma^2}_0 = \frac{\sigma^2}{{t_m}^2} \quad (2.28)$$

The mean residence time (t_m) can be compared to the nominal residence time (τ) to provide the effective volume utilisation (*e*). This is given in Equation 2.29 (Bodin *et al.*, 2012). The effective volume utilisation is a function of aspect ratio (Molle, Prost-Boucle and Lienard, 2008), positioning of inlet and outlet ports (Sheridan *et al.*, 2013), presence and location of plants in the system, and root density (Pedescoll *et al.*, 2013) as well as the extent of clogging in the system due to biofilm growth (Knowles *et al.*, 2011). Evapotranspiration can influence the mean residence time and effective volume utilisation. If a large fraction of water is lost

from the system due to evapotranspiration it has a concentrating effect on the tracer. This affects the outlet concentrations of tracer obtained during tracer studies which in turn affects the mean residence time and other hydraulic parameters.

$$e = \frac{t_m}{\tau} \tag{2.29}$$

One of the limitations of the method-of-moments is that the anomalies in the tail of the impulse-response tracer test can lead to incorrect estimation of parameters and curve fitting (Kadlec and Wallace, 2009). Early truncation of the tail can also lead to an under estimation of the mean residence time (Martin, 2000). It has been indicated that a disadvantage of using the method-of-moments technique is that a single mean residence time (t_m) can describe an infinite number of distributions, thereby stating that there is a 'loss of information' when determining other parameters, such as dispersion, from the mean residence time (Bachmann and Tsotsas, 2015). The methods of moments is also sensitive to non-continuous data sets (Bodin *et al.*, 2012). The benefit of the method-of-moments technique is that the hydraulic parameters values can be obtained directly from the measured data (Bodin *et al.*, 2012).

The Peclet number (Pe) represents the ratio between the advective and dispersive contributions to solute transport within the system and is defined according to Equation 2.30.

$$Pe = \frac{uL}{D} \tag{2.30}$$

Tanks in Series Model

The tanks-in-series model is a reactor model and is a gamma distribution of residence times. The model is given in Equation 2.31 (Kadlec and Wallace, 2009). In this model the results from the tracer test, either step-change or impulse-response, are analysed to determine how many continuously stirred equally sized tank reactors in series would provide the same response curve as the experimental wetland curve. The number of tanks in series, N, is determined using Equation 2.32 (Bodin *et al.*, 2013). When N=1 there is a large degree of back mixing and the wetland is considered to behave as a CSTR and can be modelled as such. As N tends to infinity the degree of back mixing tends to zero and the behaviour of the wetland tends to that of an ideal plug flow reactor (PFR) and can be modelled as such. In Figure 2.10 the residence time distribution's varying values of N can be found. A physical representation of 6 tanks in series

is given in Figure 2.11. Based on reported literature values, Kadlec & Wallace (2009) estimated that N = 4.1 ± 0.4 for free water surface (FWS) wetlands, and N = 11.0 ± 1.2 for horizontal sub-surface flow wetlands (Kadlec and Wallace, 2009).

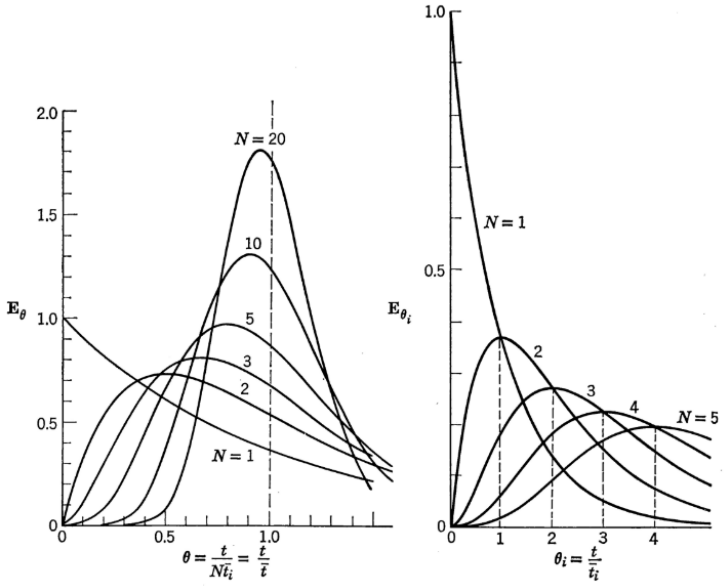

Figure 2.10: *residence time distributions varying values of N (Levenspiel, 1999)(Levenspiel, 1999)*

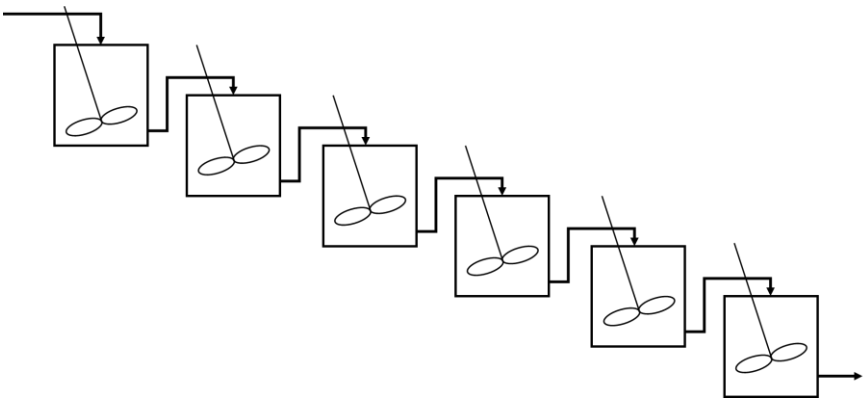

Figure 2.11*: Physical representation of multiple tanks in series where N=6*

$$E(t) = \frac{t^{N-1}}{(N-1)!{\tau_i}^n} e^{-\frac{t}{\tau_i}} \tag{2.31}$$

$$N = \frac{{t_m}^2}{\sigma^2} \tag{2.32}$$

From the number of tanks in series another factor can be determined, the hydraulic efficiency, which is defined in Equation 2.33. Hydraulic efficiency is a measure that can be used to

compare different wetland designs (Persson and Wittgren, 2003). It considers the effective volume utilisation (*e*) as well as the degree of mixing by making use of N.

$$\lambda = e * \left(1 - \frac{1}{N}\right) \tag{2.33}$$

One study used the tanks-in-series model to investigate the hydraulic behaviour of three large-scale surface flow CWs and it was determined that the vegetation density had a large effect on the dispersion of the system (Laurent *et al.*, 2015). Another study used the tanks-in-series model with exchange between active and dead zones to simulate the RTD of a horizontal sub-surface flow CW (Goswami *et al.*, 2019). From this model the researchers were able to determine the optimum inlet flow rate and water level in the CW being studied.

Advective-dispersive transport with retardation and decay

The advective-dispersive transport model with retardation and decay quantifies the transport of a single soluble species which undergoes both decay and retardation. This model is based on the assumptions that the porous media through which fluid flows is homogenous, isotropic and saturated, and that the fluid flow is steady-state and Darcy's Law applies (Wynn and Liehr, 2001). Darcy's Law describes the linear relationship between fluid flow rate and pressure gradient and applies in cases where the flow is laminar, and the porous medium has a large enough surface area exposed to fluid flow. The advective-dispersive transport equation can be used to describe the movement of a chemical tracer in sub-surface media and the one-dimensional form is given in Equation 2.34. This equation describes the transport of a single solute along the length of the reactor and can be applied to horizontal sub-surface flow CWs but cannot be applied to other wetland types. μ and γ are the first-order decay coefficient and zero-order production term, respectively, and can be used for non-conservative reactive chemical tracers (Malaguerra, Albrechtsen and Binning, 2013). R, a chemical retardation factor, is included in the transport equation and is provided in Equation 2.35. This retardation factor includes a distribution coefficient, K_d, which gives an indication of the solute concentration in the solid and the liquid (Morrison, 2015a). A K_d value close to 0 is considered non-sorbing and an increase in the K_d value indicates a larger sorbing tendency. The value depends on the physical characteristics of the tracer and, in some cases, the sub-surface media. D is the hydrodynamic dispersion coefficient and is a measure of describing the mixing of solutes in porous media (Shi *et al.*, 2016).

$$R\frac{\partial C}{\partial t} = D\frac{\partial^2 C}{\partial x^2} - u\frac{\partial C}{\partial x} - \mu C + \gamma \tag{2.34}$$

$$R = 1 + \frac{\rho_b K_d}{\varepsilon} \tag{2.35}$$

Retardation (R), hydrodynamic dispersion (D), and first-order decay (μ) have an effect on the residence time distribution response curve. For materials that are non-sorbing R is equal to 1. This indicates that the transport of the solute is the same as that of the water (Boy-Roura *et al.*, 2018). An increase in the retardation factor, R, indicates that the solute is being adsorbed onto the sub-surface media as solute transport rate decreases (Leij and van Genuchten, 1999). An increase in the hydrodynamic dispersion, D, indicates more micro-mixing in the system. An increase in hydrodynamic dispersion results in the gradient of the response curve being lower as the solute transport is more widely spread. The first-order degradation impacts the final outlet concentration of the response curve and an increase in μ results mean the rate of degradation increases because some of the tracer has been lost due to biological degradation, adsorption, or photo-degradation and less than 100 % of the inlet concentration is achieved at the outlet. This is only the case for non-conservative tracers. There is a constraint on γ, the zero-order production term, as the production of the solute would have an upper limit based on the reaction or processes producing it.

Solving the transport equation for conservative and non-conservative tracers

When a tracer is conservative, it is neither degraded nor produced, this means that $\mu = \gamma = 0$ and the advective-dispersive transport takes the form given in Equation 2.36. The initial condition for Equation 2.36 is given by Equation 2.37. The two boundary conditions used in this case are the step-change in the conservative tracer in the feed to the system at time t=0, given by Equation 2.38 and the semi-infinite assumption given in Equation 2.39.

$$R\frac{\partial C}{\partial t} = D\frac{\partial^2 C}{\partial x^2} - u\frac{\partial C}{\partial x} \tag{2.36}$$

$$C(x, 0) = C_{initial} \tag{2.37}$$

$$\left(-D\frac{\partial C}{\partial x} + uC\right)\Big|_{x=0} = uC_{inlet} \tag{2.38}$$

$$\frac{\partial C}{\partial x}(\infty, t) = 0 \tag{2.39}$$

Under these conditions, Equation 15 can be solved analytically using the method developed by Lindstrom et al. (Lindstrom *et al.*, 1967) through a Laplace transformation. The solution can be found in Equation 2.40, where A(x, t) is a function of the tracer properties and fluid velocity and is presented in Equation 2.41.

$$C(x,t) = C_{intial} + (C_{inlet} - C_{initial}) * A(x,t) \tag{2.40}$$

$$A(x,t) = \frac{1}{2} erfc\left[\frac{Rx-ut}{2(DRt)^{1/2}}\right] + \left(\frac{u^2 t}{\pi DR}\right)^{1/2} exp\left[-\frac{(Rx-ut)^2}{4DRt}\right] -$$

$$\frac{1}{2}\left(1 + \frac{ux}{D} + \frac{u^2 t}{DR}\right) exp\left(\frac{ux}{D}\right) erfc\left[\frac{Rx+ut}{2(DRt)^{1/2}}\right] \tag{2.41}$$

In the case of a non-conservative tracer, it cannot be assumed that there is no degradation or production and so $\mu \neq \gamma \neq 0$ and the analytical solution of the transport equation is different than that of a conservative tracer. An analytical method developed by van Genuchten (van Genuchten, 1981), using Laplace transforms, was used to solve Equation 2.34 under non-conservative conditions. The initial condition and boundary conditions of the transport equation describing the non-conservative tracer are the same as that of the conservative tracer, but the analytical solution is different. The analytical solution is given in Equation 2.42 (van Genuchten, 1981) where A(x,t) is provided in Equation 2.43 and B(x,t) is provided in Equation 2.44.

$$C(x,t) = \left(C_{inlet} - \frac{\gamma}{\mu}\right) * A(x,t) + B(x,t) \tag{2.42}$$

$$A(x,t) = \frac{u}{u+v} * exp\left[\frac{(u-v)x}{2D}\right] erfc\left[\frac{Rx-vt}{2(DRt)^{1/2}}\right] + \frac{u}{u-v} exp\left[\frac{(v+u)x}{2D}\right] * erfc\left[\frac{Rx+vt}{2(DRt)^{1/2}}\right] +$$

$$\frac{u^2}{2\mu D} exp\left(\frac{ux}{D} - \frac{\mu t}{R}\right) * erfc\left[\frac{Rx+ut}{2(DRt)^{1/2}}\right] \tag{2.43}$$

$$B(x,t) = \left(\frac{\gamma}{\mu} - C_{inital}\right) * exp\left(-\frac{\mu t}{R}\right) * \left\{\frac{1}{2} erfc\left[\frac{Rx-ut}{2(DRt)^{1/2}}\right] + \left(\frac{u^2}{\pi RD}\right)^{1/2} * exp\left[-\frac{(Rx-ut)^2}{4DRt}\right] - \frac{1}{2}\left(1 + \frac{ux}{D} + \frac{u^2 t}{DR}\right) * exp\left(\frac{ux}{D}\right) * erfc\left[\frac{Rx-ut}{2(DRt)^{1/2}}\right]\right\} + \frac{\gamma}{\mu} + \left(C_{intial} - \frac{\gamma}{\mu}\right) * exp\left(-\frac{\mu t}{R}\right) \quad (2.44)$$

Factor *v* is given in Equation 2.45.

$$v = u * \left(1 + \frac{4\mu D}{u^2}\right)^{1/2} \quad (2.45)$$

Richard's Equation

Richard's equation is a partial differential equation which is used to describe unsaturated flow in a non-porous medium and is defined according to Equation 2.46 (Giraldi *et al.*, 2009). The relationship between pressure head (h), hydraulic conductivity (K) and water content (θ_w) are described according to van Genuchten-Mualem functions (Equation 2.47 and Equation 2.48) (van Genuchten, 1980). This equation is commonly used to describe the water flow in vertical flow CWs as the flow in these systems is often unsteady and unsaturated (Langergraber and Simunek, 2005). Richard's equation forms one of the partial differential equations in the HYDRUS Wetland module, executed in HYDRUS software (Langergraber and Simunek, 2005). Many researchers have made used of this model to successfully validate and investigate the processes taking place in CWs (Pálfy and Langergraber, 2014; Rizzo *et al.*, 2014).

$$\frac{\partial \theta_w}{\partial t} = +\frac{\partial}{\partial z}\left[K\left(\frac{\partial h}{\partial z} - 1\right)\right] \quad (2.46)$$

$$\begin{cases} \theta_w = \theta_r + \frac{\theta_s - \theta_r}{\left(1+|\alpha h|^{1/(1-m)}\right)^m} & , \quad h < 0 \\ \theta_w = \theta_s & , \quad h \geq 0 \end{cases} \quad (2.47)$$

$$\begin{cases} K = K_s \left(\frac{\theta_w - \theta_r}{\theta_s - \theta_r}\right)^{0.5} * \left[1 - \left(1 - \left(\frac{\theta_w - \theta_r}{\theta_s - \theta_r}\right)^{1/m}\right)^m\right]^2 & , \quad h < 0 \\ K = K_s & , \quad h \geq 0 \end{cases} \quad (2.48)$$

VART model

Variable residence time (VART) model was initially developed as a model for longitudinal dispersion and solute transport in streams (Deng and Jung, 2009). It is based on a 'double-

layer' conceptual model. The upper layer is dominated by advection-transient storage and the lower layer is a diffusion-dominated storage zone (Deng and Jung, 2009). The model is used for FWS wetlands because they have the same 'double layer' that is conceptualised for the VART model. Additionally, streams and FWS wetlands have similar transient storage zones (Martinez and Wise, 2003). The VART model has been used to compute the hydraulic residence time of wetlands filled with two different mediums and was able to accurately predict the RTD for design purposes (Zahraeifard and Deng, 2011). The model was combined with kinetic processes to simulate the removal of total phosphorus and ammonium (Aboukila and Deng, 2018), and BOD (Deng *et al.*, 2016) in FWS CWs and it was found that there was a good simulation of the three contaminants and the combined model is considered an efficient tool for designing CWs and understanding the effects of various processes and mechanisms on the treatment of wastewater in CWs (Deng *et al.*, 2016; Aboukila and Deng, 2018).

Convolution integral

The convolution integral can be used to describe the flow behaviour of a system. This model is not based on physical flow processes but rather the experimental data obtained directly from tracer studies. Sheridan et al. (2014) used the convolution integral to determine the rate constants for the degradation of winery effluent within a sub-surface flow CW (Sheridan, Glasser and Hildebrandt, 2014). These researchers found that because the rate constants obtained from the convolution integral are based directly on the RTD data, they were more accurate than the rate constants determined using the other models investigated. It is also possible to determine the conversion of a reactor, regardless of the degree of non-ideal behaviour, directly from the tracer information for first order reactions. The convolution integral, derived by Levenspiel (1999), is given in Equation 2.49 (Levenspiel, 1999).

$$C_{out}(t) = \int_0^t C_{in}(t - t')E(t')dt' \tag{2.49}$$

It can be shown that Equation 2.49 is an equivalent form of Equation 2.50.

$$C_{out}(t) = \int_0^t C_{in}(t')E(t - t')dt' \tag{2.50}$$

The concise form is given in Equation 2.51.

$$C_{out}(t) = C_{in} * E \tag{2.51}$$

The usefulness of this method arises from the fact that no reactor model is assumed. Rather, the unique data arising from the tracer test are directly utilised. This method was found to be significantly more accurate at modelling the reactor processes than the PFR or tanks-in-series.

2.10 Process Based Models

Process-based models are models which model multiple processes including kinetics, fluid flow, solute transport, the effect of plants, and biofilm growth. These models aim to give a better understanding of the interrelatedness of the processes taking place in CWs. The models require specific software, lots of computational power and an understanding of numerical modelling.

2.10.1 HYDRUS

The HYDRUS Wetland Module is considered to be one of the most comprehensive process-based wetland models (Langergraber, 2016). Implemented in the HYDRUS simulation software (Langergraber and J. Šimůnek, 2006), the model factors in fluid flow, solute transport, fluid uptake by plants, diffusion in the gaseous phase and a multi-component biokinetic model. Table 2.4 gives the individual models used for each of the processes described above. The HYDRUS Wetland module has been used to simulate the treatment of various types of wastewater including combined sewer overflow (Dittmer, Meyer and Langergraber, 2005; Henrichs, Langergraber and Uhl, 2007; Henrichs, Welker and Uhl, 2009; Pálfy *et al.*, 2016), grey water (Karlsson *et al.*, 2015), agricultural run-off (Smethurst *et al.*, 2014), and artificial wastewater (Rizzo *et al.*, 2014; Rizzo and Langergraber, 2016).

2.10.2 BIO_PORE

BIO_PORE is considered the other comprehensive process-based wetland model (Langergraber, 2016). This model is implemented in the COMSOL Multiphysics™ and factors modelled include a biokinetic model, solute transport, plant release of oxygen and uptake of nutrients, and the most novel element is the introduction of a biofilm sub-model. This sub-model was introduced in order to prevent unrealistic and unlimited growth of bacteria. Equations were also included for attachment and detachment of influent particulate components. Because of the biofilm sub-model it is able to predict the dynamic behaviour of CWs over a long period of time. Table 2.4 gives the gives the specific models and processes used in the BIO_PORE simulation.

***Table 2.4**: Breakdown of the different processes and models used in HYDRUS and BIO_PORE*

Process	HYDRUS	BIO_PORE
Flow	Richard's equation (saturated/unsaturated)	Darcy's equation (variable water table, saturated flow)
Solute transport	Advective-dispersive solute transport Adsorption	Advective-dispersive solute transport Adsorption
Biokinetic model	CWM1/CW2D	CWM1
Plant influence	Evapotranspiration Fluid uptake Uptake and release of substances	Evapotranspiration Fluid uptake Uptake and release of substances
Biofilm growth	None	Included

2.11 Research Objectives

The theory presented in this chapter highlights some of the techniques for understanding and modelling CWs. There are, however, a number of gaps including the existence of a model which factors in the biokinetic processes as well as accurately quantifying the hydraulic behaviour of a CW but does not require specific software, extensive computational power, and knowledge of numerical modelling. These gaps lead to this research study and in order to try and fill them, the following research objectives are presented:

f) The primary objective of this thesis is to develop a novel residence time distribution technique in order to improve the accuracy and the measurement and quantification of CW hydraulic flow behaviour.

g) To apply the technique to an existing biokinetic model, the International Water Association's constructed wetland model 1 (CWM1), to improve the accuracy of the predicted output concentrations of contaminants.

h) To modify the matrices of stochiometric coefficients and rate laws given in CWM1 to include a residence time distribution function.

i) To calibrate the model on a small-scale indoor reactor.

j) To validate the model on an established wetland.

Chapter 3: Materials and Methods

This chapter details the experimental procedures and analytical methods which were conducted in order to achieve the objectives stated in Section 2.10. Impulse response tracer studies were conducted on two systems, with the first being a set of vertical flow columns, located at the University of Linköping, Sweden. Tests were conducted on this system first, as the vertical flow columns have a simple configuration and no macrophytes, meaning the hinderances to ideal flow are fewer than in an established CW and therefore the hydraulic behaviour is likely closer to ideal plug-flow. The aim was to conduct tracer studies on a system whose hydraulic flow behaviour is close to ideal plug-flow and therefore allow for the proof of concept of the first technique presented in this thesis. The second set of impulse response tracer studies were conducted on a small-scale CW in Leipzig, Germany. Tests were conducted on this system to validate the first technique on an established system where wetland configuration and macrophyte distribution cause a deviation from ideal plug-flow.

Step-change response tracer tests were also conducted on the small-scale CW in Leipzig, Germany. In the step-change experiments conducted on this system a conservative tracer and a non-conservative tracer were used. The goal of these experiments was to determine the concentration-time response curves of each of the tracers and compare the data to a response which was simulated using the advective-dispersive transport equation. The aim of comparing the data from the experimental response curves and simulated response curves is to validate the second technique presented in this thesis.

3.1 Experimental Procedures

3.1.1 Impulse-response Tracer Studies:

Vertical column studies

Impulse-response tracer studies were conducted on three vertical flow columns, a picture of which can be seen in Figure 3.1. The system was located at the University of Linköping, Sweden. The columns were made of orange PVC and covered with a lid made of the same material. The packing material of the columns was pea gravel which had a diameter of 2 mm-8 mm and a void fraction of 0.36. The columns were identical in size with the dimensions being 0.15 m x 0.4 m (d x h). Each column was filled with the packing media to a height of 0.37 m. The system consisted of two ports, the inlet port at a height of 0.04 m above the base and the

outlet port at a height of 0.37 m above the base. At the inlet and outlet ports, flexible transparent tubing with an internal diameter of 0.02 m was attached. There was ~20 cm of tubing between the inlet port and the feed pump, and ~20 cm from the outlet port to where water was collected. The height of the outlet port determined the height of the water level, which was therefore also at 0.37 m. The water volume of the system was 2.16 l. A peristaltic pump was used to deliver water to the columns at a continuous and consistent flow rate of 31 ml/min. The impulse-response tracer studies were conducted one at a time on the individual vertical flow columns.



Figure 3.1*: Picture of the vertical flow gravel columns on which impulse-response tracer studies were conducted.*

A medical syringe was used to inject tracer into the inlet of the system at a time of $t = 0$. Uranine was used as a tracer. 10 ml of 10 ppm tracer was instantaneously injected into the inlet of the system. A needle was used to pierce the inlet pipe so that tracer could be injected as close to the inlet port as possible, thus minimising mixing before entering the column. The injection site was closed after injection to prevent leaking. Based on the inlet flow rate and volume of the system, the nominal residence time in these impulse-response tracer tests was 70 minutes. The duration of the test was long enough for the concentration of the tracer to reach background concentrations; this took 280 minutes. 4 ml of sample was taken every 4 minutes and stored in a plastic tube until analysis. Samples were analysed within 20 minutes of being taken.

Small-scale constructed wetland

Impulse-response tracer studies were conducted on a horizontal-sub-surface flow (HSSF) constructed wetland (a picture of which is shown in Figure 3.2). This system was located inside a greenhouse at the Hemholtz Centre for Environmental Research – UFZ, in Leipzig Germany. The packing material of the wetland was pea gravel with a diameter of 2 mm-8 mm and a void

fraction of 0.36. The wetland dimensions were 1 m x 0.21 m x 0.15 m (L x H x W). The system was planted with *Juncus effuses*. The wetland consisted of one inlet port at the height of the gravel surface, 21cm from the base, and one outlet port 1.5 cm from the base of the bed. A syphon breaker was used at the wetland outlet for level control. PVC 90° 3-way ball valves were placed on the inlet and outlet lines for tracer injection and sampling. A schematic of the experimental setup is shown in Figure 3.3.

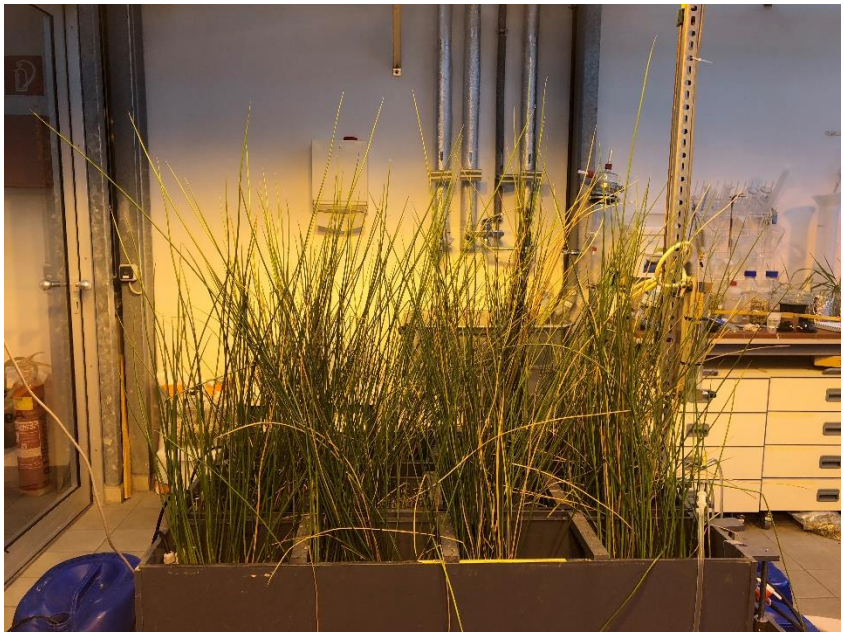

Figure 3.2*: Picture of the HSSF CW on which impulse-response and step change tracer studies were conducted*

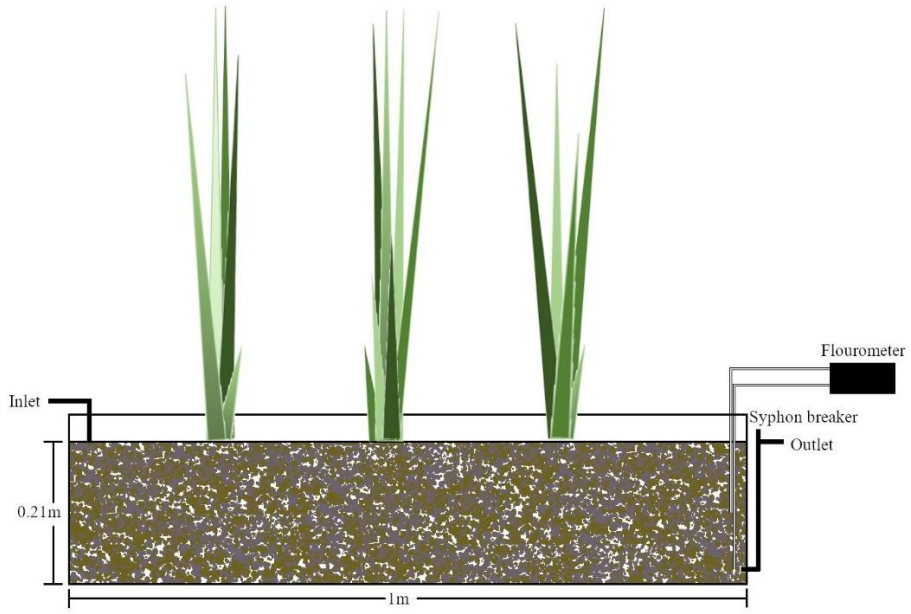

***Figure 3.3**: Schematic of the HSSF CW on which impulse-response and step change tracer studies were conducted*

A medical syringe was used to inject tracer into the inlet of the system at a time of $t = 0$. Uranine was used as a tracer. 10 ml of 3 x 10^4 ppm tracer was instantaneously injected. The syringe tip was inserted into the open end of the 90° 3-way ball valve, the ball valve was opened to allow 3-way flow, and the tracer was injected. The ball valve was returned to the original position and the syringe was removed. Based on the inlet flow rate and volume of the system, the nominal residence time of the system in these impulse-response tracer tests was 4 hours. The test was conducted until the concentration of tracer reached background concentrations.

3.1.2 Step change Response Tracer Studies

Step change tracer studies were conducted on a horizontal-sub-surface flow (HSSF) constructed wetland (a picture of which is shown in Figure 3.2). This system was inside a greenhouse at the Hemholtz Centre for Environmental Research – UFZ, in Leipzig Germany. The packing material of the wetland was pea gravel with a diameter of 2 mm-8 mm and a void fraction of 0.36. The wetland dimensions were 1 m x 0.21 m x 0.15 m (L x H x W). The system was planted with *Juncus effuses*. The wetland consisted of one inlet port at the height of the gravel surface and one outlet port 1.5 cm from the base of the bed. A syphon breaker was used at the wetland outlet for level control. A schematic of the experimental setup is shown in Figure 3.3.

The step-change tracer study was a combined study with a conservative tracer and a non-conservative tracer. Sodium benzoate was used as the non-conservative tracer, specifically because benzoate $(C_7H_5O_2)^-$ is biodegradable under both aerobic and anaerobic conditions (Salanitro *et al.*, no date; Wibbertmann *et al.*, 2005). Uranine was used as the conservative tracer.

Prior to running the step-change experiment, the wetland was flushed with distilled water and TMS3 ,a tracer metal solution, dissolved in distilled water (Kuschk, 1991). The concentration of TMS3 was set such that the ion concentration was the same as the expected ion concentration of the step-change experiment. This was done to acclimatise the microbial groups in the wetlands to the expected ionic concentration which leads to a stable microbial transformation of chemical components, before switching the feed to the inlet solution, which contained tracer solution, at $t = 0$ (which was 16:35 CET). The inlet solution consisted of uranine, sodium benzoate, sodium acetate and ammonium nitrate in distilled water. The use of these compounds was to provide more than one organic feed substrate to the wetlands, in the form of sodium acetate and sodium benzoate, and to provide a nitrogen source as well, in the form of ammonium nitrate. The inlet concentrations of each of these can be found in Table 3.1. The inlet concentrations in this table are the measured concentrations of the ions but were determined based on the inlet concentrations of the compounds. Benzoate, or benzoic acid, does not have a high solubility in water so sodium benzoate is used to introduce it into the system as it has a much higher solubility (Jorge, 2003). A syringe pump was used to feed the sodium acetate and sodium benzoate solutions into the feed line to prevent degradation of the organic carbon in a feed tank. The experiments were run with a theoretical residence time of 72 hours (with an inlet flow rate of 0.23 l/hour) to ensure enough time for the degradation of organic carbon. The duration of the step-change tracer study was three times the theoretical residence time to ensure steady-state operation was achieved (Kadlec and Wallace, 2009). Samples were collected manually for the benzoate concentration, at the outlet and inlet, at the sample points. This was done three times a day at 07:00, 14:00 and 21:00 for the duration of the experiment. An inline fluorometer was used to determine uranine concentration at the outlet.

Table 3.1. *Inlet concentrations of compounds used in the tracer comparing a conservative and non-conservative tracer*

Compound	Concentration
Sodium (mg/L)	24.2
Acetate (mg/L)	13.4
Benzoate (mg/L)	82.1
Ammonium (mg/L)	67.0
Nitrate (mg/L)	201.6
Uranine (ppb)	40

The concentration of acetate, ammonium and nitrate were monitored at the outlet and used as an extra indicator of steady state but were not used for test interpretation.

3.2 Analytical Techniques

3.2.1 Impulse-response – Vertical Column Studies

The samples taken for the impulse response tracer studies conducted on vertical flow columns in Linköping, Sweden were analysed using a FluoroSELECT® fluorometer (Sigma-Aldrich). To calibrate the fluorometer two standards are required, one blank and another of known concentration. The second standard used was 100 ppb. The calibration was done automatically by the FluoroSELECT® fluorometer. Standards of 25 ppb, 50 ppb and 100 ppb were kept on hand and used between every five samples to ensure the calibration still held. Samples were placed in 0.2 µl PCR tubes and then into the fluorometer. Each sample was analysed three times.

3.2.2 Impulse-response – Small Scale Constructed Wetland

To analyse the uranine concentration in the impulse-response tracer studies conducted on a small-scale constructed wetland, a GGUN-FL30 fluorometer was used for automatic, inline detection of uranine at the outlet of the wetland. A sampling rate of 3 minutes was selected, and the data was recorded by a datalogger. The fluorometer drew water from inside the wetland close to the outlet, it was pumped through the detection chamber of the fluorometer and then back into the wetland at a rate such that the concentration of the water was not affected.

3.2.3 Step change – Small Scale Constructed Wetland

To analyse the uranine concentration in the step-change tracer studies conducted on a small-scale constructed wetland, a GGUN-FL30 fluorometer was used for automatic, inline detection

of uranine at the outlet of the wetland. A sampling rate of 5 minutes was selected, and the data was recorded by a datalogger. The fluorometer drew water from a point inside the wetland, close to the outlet, it was pumped through the detection chamber of the fluorometer and then back into the wetland at a rate such that the concentration of the water was not affected.

For the analysis of benzoate in the small-scale constructed wetland, a volume of 5 ml was taken using a syringe for each manual sample and was filtered using a 0.2 µm syringe filter. Each sample was separated into two vials: one for benzoate analysis and one back-up sample. The back-up samples were stored in a dark space to prevent UV degradation of uranine and at -20°C. The samples to be analysed for benzoate were frozen at - 20 °C until analysed using ion chromatography (Thermo Scientific™ – Dionex™ ICS-5000^{+} HPIC™ System).

3.3 Software Used

3.4.1 R Software

R is a programming language and environment for statistical computing and graphics (R Core Team, 2020). R version 4.0.2 (2020-06-22), nickname 'Taking Off Again', on platform x86_64-w64-mingw32 was used for the data analysis of the impulse-response tracer studies conducted in Leipzig, Germany and Linköping, Sweden, as well as the step-change experiments conducted in Leipzig, Germany. RStudio is an add-on to R and provides a user-friendly graphical interface for ease of use.

R was used for non-linear least-squares regression analysis. The package used was 'stats' and the function used was 'nls' (R Core Team, 2020). The default algorithm for the 'nls' function is Gauss-Newton algorithm (R Core Team, 2020).

The package 'ggplot2' was used to generate the figures (Chang, 2014; Wickham, 2016). The code used to generate the figures are given in Appendix A, Appendix E, Appendix F, Appendix G, Appendix I, and Appendix L.

Chapter 4: Development of the mathematical techniques for modelling CW systems

Section 4.2 was presented at the 8th International Symposium of Wetland Pollutant Dynamics and Control, in Aarhus, Denmark (June 2019). (Stephenson, R., Sheridan, C. and Kappelmeyer, U. (2019, June 17-21) *Development of a residence time distribution technique combined with CWM1* [Conference presentation]. 8th International Symposium of Wetland Pollutant Dynamics and Control, in Aarhus, Denmark). The contribution of the co-authors towards the work is primarily that of supervision or collaboration and the experimental work and write-up was conducted by the author of this thesis.

Section 4.3 has been published in Science of the Total Environment and was peer reviewed prior to publication (Stephenson, R., Sheridan, C. and Kappelmeyer, U. (2020) 'A curve-shift technique for the use of non-conservative organic tracers in constructed wetlands', *Science of The Total Environment*. Elsevier B.V., 752, p. 141818. doi: 10.1016/j.scitotenv.2020.141818). The contribution of the co-authors towards the work is primarily that of supervision or collaboration and the experimental work and write-up was conducted by the author of this thesis.

4.1 Introduction

The effectiveness of CWs in reducing the contaminants in wastewater, through the various chemical, biological, and physical processes which take place, is strongly dependent on the hydraulic behaviour of the system. One way of assessing this behaviour is to conduct residence time distribution (RTD) studies (Headley and Kadlec, 2007). In these studies, a tracer is added at the inlet of the wetland and the concentration at the outlet is continuously monitored. Numerical methods are applied to the results of these studies in a set of characteristics that can be used to describe the hydraulic behaviour of the flow through constructed wetlands (Bonner *et al.*, 2017). The current numerical models that are applied to the data from RTD studies were outlined in the literature review (Section 2.8.4). In most of the hydraulic models presented, an assumption is made about the nature of the flow in the system (plug flow, dispersed flow, etc.), and these models are further based on the assumption that the tracer used in the experiment is

not adsorbed, degraded, or accumulates. It has been known for many years that these assumptions are to a greater or lesser extent erroneous for CWs. The heterogenous wetland matrix, the presence of macrophytes (and their continuously changing root structure), together with the physical design configuration can lead to dead zones, short circuiting of the flow, and non-ideal mixing. This means that the flow through the CW can be quite far from ideal. Additionally, the second assumption of conservative tracer behaviour is also not true. Some tracers, such as the uranine, are prone to adsorption in the presence of organic matter or photodegradation, and ionic tracers can result in haloclines which also result in errors in calculations.

As a result of the errors and non-ideal flow conditions listed, two mathematical techniques are presented in this chapter which are not based on these erroneous assumptions.

4.2 Methods-of-Moments Adaptation

The first of the two techniques described here is based on the method-of-moments model and uses data from an impulse-response study. For the methods-of-moments model, no assumption is made about the flow behaviour. This method results in a mean residence time which is used as a representation of the average residence time of all particles of fluid in the system. This can, however, lead to an oversimplification of the hydraulic behaviour. There is a distribution of times that the molecules spend in the reactor. Some may short-circuit through the system and have a residence time much shorter than the mean residence time, while others may get caught in a dead zone and spend a much greater amount of time in the system. These varying times the particles spend in the system affects the reaction time of these individual molecules and consequently, this affects the composition of the outlet stream. The single mean residence time value, from the method-of-moments technique, is most often used for reactor models such as the PFR or CSTR to determine rate constants or predict the extent of contaminant removal in the system. The effect of time on such systems cannot be accurately described with one single mean residence time, especially in non-ideal reacting systems. The model being developed and described in this study can be used to more accurately account for the effect of time on a biological system, or any reactor system, by making use of multiple residence times for specific fractions of the fluid.

The technique presented in this section is based on the concept that there are multiple flow paths in constructed wetlands, each of which has its own residence time. These flow paths

'carry' multiple tiny pockets of fluid which behave as micro-batch reactors. To account for transient and dead zones it can be assumed that when a micro-batch reactor enters a dead zone it remains in place for some time and then re-enters one of the flow paths, moving through the transient zone on the way in, and out, of the dead zone. The residence time of molecules entering and leaving the transient and dead zones will be longer than that of the rest of the molecules in the flow path. There are therefore multiple micro-batch reactors moving along the wetland, although there is no requirement for this batch to flow through the reactor in an ideal manner. As the volume of these micro-batch reactors tends to 0, the batch system tends towards a molecular size. The assumption of batch reactor is made so that each flow path can be analyzed and modelled on its own, irrespective of the reaction rate order.

The design equation of a simple batch reactor with a first-order reaction taking place (Equation 4.1) can be solved to make the outlet concentration the subject of the formula, as is given in Equation 4.2, and time (t) is accounted for in the exponential term. This is the base equation which is to be expanded through the model development presented here. In an ideal reactor, the space-time (as defined by 2.22) could be used to indicate how much time the fluid elements spend inside a system. However, very few reactors behave ideally and so the non-ideal nature of systems must be accounted for.

$$\frac{dC}{dt} = r(C) = -kt \tag{4.1}$$

$$C_{out} = C_{in}e^{-kt} \tag{4.2}$$

To describe and develop the concept it was assumed that the water flow in a CW can be described by two flow paths along the length of wetland, each with half the fluid volume of the system, so two micro-batch reactors had to be modelled. The area under the $E(t)$ curve is then divided into two portions as shown in Figure 4.1. The code used to generate Figure 4.1 can be found in Appendix A. There is an average amount of time that the fluid elements of each portion spend in the reactor, this is defined as tj. The definition of t_m (as shown in Chapter 2) can then be extended to apply to Portion 1 and Portion 2 under the curve and is given by Equations 4.3 and Equation 4.4, respectively. The fraction of the area under the curve for each portion is defined as γ_j and can be conceptualised as a fraction of the total volume of the reactor. γ_1 and γ_2 are described by Equations 4.5 and 4.6, respectively and are defined as weighting factors. The sum of the weighting factors is equal to 1. The weighting factors make it possible to

determine the contribution that each portion makes to the hydraulic flow behaviour of the system. For example, if the areas are each 50% of the total area, they would have a weight factor of 0.5 each and contribute equally to the hydraulic behaviour of the system. From this, it can be said that fraction γ_j, of the fluid passing through the reactor, spends an average time of t_j within the system. Each portion is assumed to behave as its own batch reactor moving along the length of the wetland. Equation 4.2, the solved batch reactor design equation, is then adapted to include the two portions each with their own mean residence time and weight factor. A summation term is included to account for the two portions, and this is given by Equation 4.7.



***Figure 4.1**: E(t) response curve divided into two portions, each with an area of 0.5*

$$t_1 = \frac{\int_{T0}^{T1} tE(t)dt}{\int_{T0}^{T1} E(t)dt} \tag{4.3}$$

$$t_2 = \frac{\int_{T1}^{T2} tE(t)dt}{\int_{T1}^{T2} E(t)dt} \tag{4.4}$$

$$\gamma_1 = \int_{T0}^{T1} E(t)dt \tag{4.5}$$

$$\gamma_2 = \int_{T1}^{T2} E(t)dt \tag{4.6}$$

$$C_{out} = \gamma_1 C_{in} e^{-kt_1} + \gamma_2 C_{in} e^{-kt_2} = \sum_{j=1}^{2} \gamma_j \, C_{in} e^{-kt_j} \tag{4.7}$$

The concept described above can be expanded to include 4 portions as is visually represented in Figure 4.2a. Each of the 4 portions represents a flow path carrying micro-batch reactors with

a specific mean residence time and weight factor. A larger number of portions can also be considered, for example, 10 portions (Figure 4.2b), each with a specific mean residence time and weight factor. The total outlet concentration of the system can then be calculated as a sum of the effect of each portion or flow path. This is given in Equation 4.8 for 4 portions and Equation 4.9 for 10 portions. A more general form is expressed in Equation 4.10 where there are 'n' flow paths in the system and therefore 'n' portions under the curve.

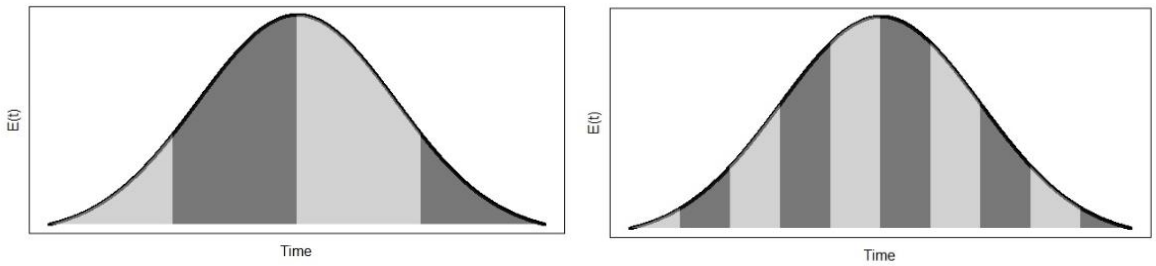

***Figure 4.2**: a) E(t) curve divided into 4 portions. b) E(t) curve divided into 10 portions*

$$C_{out} = \sum_{j=1}^{4} \gamma_j \, C_{in} e^{-kt_j} \tag{4.8}$$

$$C_{out} = \sum_{j=1}^{10} \gamma_j \, C_{in} e^{-kt_j} \tag{4.9}$$

$$C_{out} = \sum_{j=1}^{n} \gamma_j \, C_{in} e^{-kt_j} \tag{4.10}$$

This kinetic and hydraulic modelling are integrated, and this model can be generalised to include non-linear kinetic rates of reaction.

4.3 The curve-shift Technique

The second of the techniques is based on the advective-dispersive transport equation and addresses the issue regarding the assumption of tracer conservation in RTD studies. Tracers are not always conserved across the system, as was mentioned in the literature review. It is also the case that when conducting RTD studies in the field, tracers can be difficult to recover or remove from the environment once the tracer study is over. In order to prevent environmental issues, equipment to recover the material is required which increases the overall cost of conducting the tracer studies in the field. In most cases, even partial recovery of a tracer is not feasible, and the tracers remain in the environment potentially posing problems. To avoid these challenges, it is possible to consider using a non-conservative tracer for conducting RTD studies. The advantage of these types of tracers is that they pose less of an environmental

concern as they typically degrade with time and thus do not remain in the environment after the completion of the tracer study. The aim of the curve-shift technique is to develop a technique that makes use of the degradation predictions and an understanding of transport phenomena to alter the response curve of a non-conservative tracer to give the same information as the response curve of a conservative tracer. In doing so, this would allow for the accurate estimation of hydraulic behaviour parameters for tracers which are not conservative. If achieved, this could make it feasible to use non-conservative tracers in hydraulic tracer studies of constructed wetlands and reduce the environmental footprint of these studies. A technique of this type has rarely been achieved for a biodegradable non-conservative tracer up to this point.

The advective-dispersive transport equation with retardation and decay quantifies the transport of a single solute which can undergo decay and retardation. This equation is based on the assumptions outlined in the literature review. This partial differential equation is given in Equation 4.11 and describes the transport of a single solute along the length of a reactor, in one dimension. It can be used to describe the movement of a chemical tracer in the sub-surface media of a HSSF CW but not for other reactor types as it is assumed that the flow is through porous media (Wynn and Liehr, 2001).

$$R\frac{\partial C}{\partial t} = D\frac{\partial^2 C}{\partial x^2} - u\frac{\partial C}{\partial x} - \mu C + \gamma \tag{4.11}$$

$$R = 1 + \frac{\rho_b K_d}{\varepsilon} \tag{4.12}$$

To show the effect of retardation (R), hydrodynamic dispersion (D), and first-order decay (μ) on the residence time distribution response curve, Equation 4.11 has been solved and simulated for a series of time values (0-1000 in steps of 10) in a hypothetical system. The results of this are shown in Figure 4.3 as an example of the way the equations work (full results based on a real system are presented in Section 7.3). The code used to generate Figure 4.3 can be found in Appendix A. For all cases shown here the velocity of the fluid was assumed to be 0.01 m/s, the initial concentration was assumed to be 0, the inlet concentration was assumed to be 1 (normalised) and the length of the system (x) was assumed to be 1 (normalised). For materials that are non-sorbing R is equal to 1. This indicates that the transport of the solute is the same as that of the water (Boy-Roura *et al.*, 2018). An increase in the retardation factor, R, results in the slowing down of the response curve as the solute is adsorbed onto the sub-surface media

and the solute transport rate decreases (Leij and van Genuchten, 1999). An increase in the hydrodynamic dispersion, D, indicates more micro-mixing in the system. This would result in the solute being more dispersed down the length of the reactor. An increase in D would speed up the time in which the tracer arrives at the outlet initially but would not necessarily speed up the time it takes for the inlet concentration to be reached. An increase in hydrodynamic dispersion results in the gradient of the response curve being lower as the solute transport is more widely spread. The first-order decay (μ) impacts the final outlet concentration of the response curve. An increase in the rate of degradation results in the steady-state outlet concentration being lower than 1. This is because some of the tracer has been lost due to biological degradation, adsorption, or photo-degradation and less than 100 % of the pulse entering the systems (by mass) exits the system in the outlet flow. This is only the case for non-conservative tracers. There is a constraint on γ, the zero-order production term, as the production of the solute would have an upper limit based on the reaction or processes producing it.

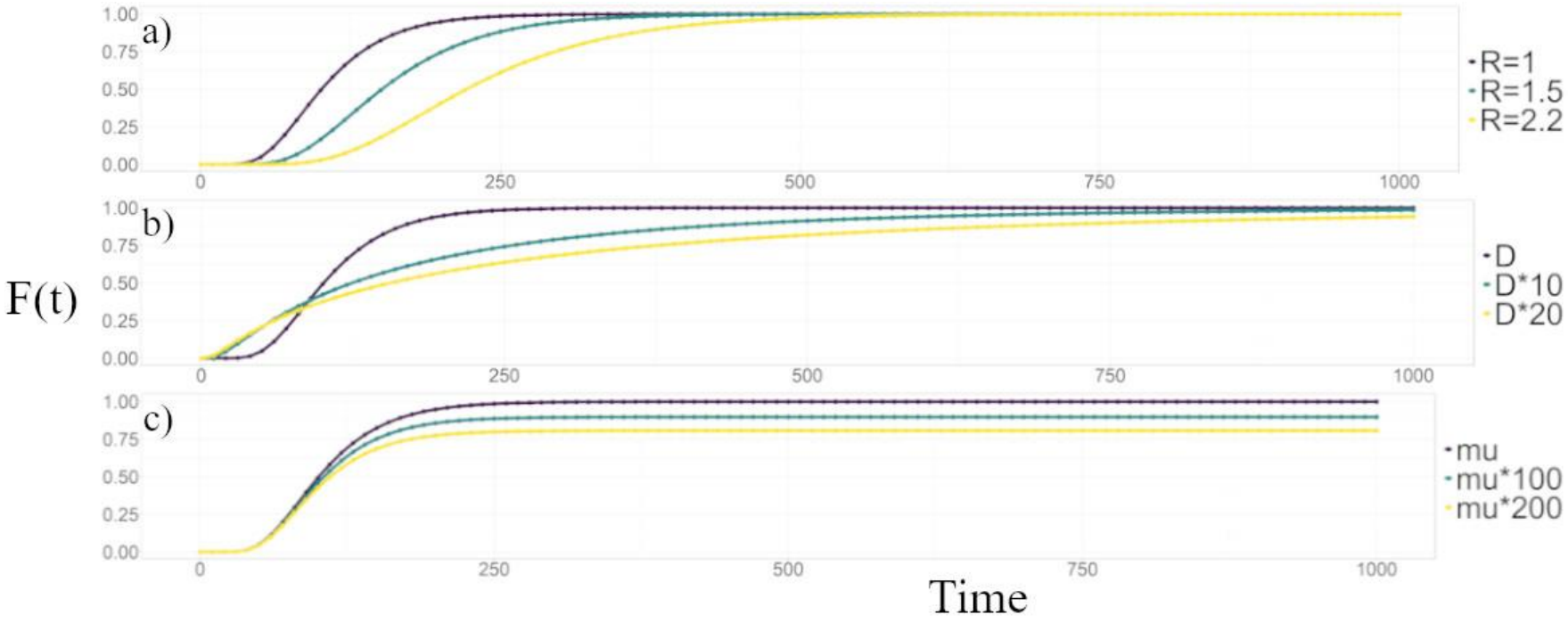

Figure 4.3. *Effect of retardation (a), dispersion (b) and decay (c) on the response curve of a residence time distribution study*

4.3.1 Solving the Transport Equation for Conservative and Non-conservative Tracers

In the case of the conservative nature of the conventional tracer $\mu = \gamma = 0$ and the transport equation takes the form given in Equation 4.13. The initial condition for Equation 4.13 is given by Equation 4.14. The two boundary conditions used in this case are the step-change in the conservative tracer in the feed to the system at time t=0, given by Equation 4.15 and the semi-infinite concentration assumption given in Equation 4.16.

$$R\frac{\partial C}{\partial t} = D\frac{\partial^2 C}{\partial x^2} - u\frac{\partial C}{\partial x} \tag{4.13}$$

$$C(x,0) = C_{initial} \tag{4.14}$$

$$\left(-D\frac{\partial C}{\partial x} + uC\right)\Big|_{x=0} = uC_{inlet} \tag{4.15}$$

$$\frac{\partial C}{\partial x}(\infty, t) = 0 \tag{4.16}$$

Under these conditions, Equation 4.13 can be solved analytically using the method developed by Lindstrom et al. (Lindstrom *et al.*, 1967) through a Laplace transformation. The solution can be found in Equation 4.17, where A(x, t) is a function of the tracer properties and fluid velocity and is presented in Equation 4.20.

$$C(x,t) = C_{intial} + (C_{inlet} - C_{initial})\,A(x,t) \tag{4.17}$$

$$A(x,t) = \frac{1}{2}erfc\left[\frac{Rx-ut}{2(DRt)^{1/2}}\right] + \left(\frac{u^2 t}{\pi DR}\right)^{1/2} exp\left[-\frac{(Rx-ut)^2}{4DRt}\right] -$$

$$\frac{1}{2}\left(1 + \frac{ux}{D} + \frac{u^2 t}{DR}\right) exp\left(\frac{ux}{D}\right) erfc\left[\frac{Rx+ut}{2(DRt)^{1/2}}\right] \tag{4.20}$$

For the case of a non-conservative tracer, it cannot be assumed that there is no degradation or production and so $\mu \neq \gamma \neq 0$ and the analytical solution of the transport equation is different to that of a conservative tracer. An analytical method derived by van Genuchten (van Genuchten, 1981), using Laplace transforms, was used to solve Equation 4.13 under non-conservative conditions. The initial condition and boundary conditions of the transport equation describing the non-conservative tracer are the same as that of the conservative tracer,

but the analytical solution is different. The analytical solution is given in Equation 4.21 (van Genuchten, 1981) where $A(x,t)$ is provided in Equation 4.22 and $B(x,t)$ is provided in Equation 4.23.

$$C(x,t) = \left(C_{inlet} - \frac{\gamma}{\mu}\right) A(x,t) + B(x,t) \tag{4.21}$$

$$A(x,t) = \frac{u}{u+v} exp\left[\frac{(u-v)x}{2D}\right] erfc\left[\frac{Rx-vt}{2(DRt)^{1/2}}\right] + \frac{u}{u-v} exp\left[\frac{(v+u)x}{2D}\right] erfc\left[\frac{Rx+vt}{2(DRt)^{1/2}}\right] + \frac{u^2}{2\mu D} exp\left(\frac{ux}{D} - \frac{\mu t}{R}\right) erfc\left[\frac{Rx+ut}{2(DRt)^{1/2}}\right] \tag{4.22}$$

$$B(x,t) = \left(\frac{\gamma}{\mu} - C_{inital}\right) * exp\left(-\frac{\mu t}{R}\right)\left\{\frac{1}{2} erfc\left[\frac{Rx-ut}{2(DRt)^{1/2}}\right] + \left(\frac{u^2}{\pi RD}\right)^{1/2} exp\left[-\frac{(Rx-ut)^2}{4DRt}\right] - \frac{1}{2}\left(1 + \frac{ux}{D} + \frac{u^2 t}{DR}\right) * exp\left(\frac{ux}{D}\right) erfc\left[\frac{Rx-ut}{2(DRt)^{1/2}}\right]\right\} + \frac{\gamma}{\mu} + \left(C_{intial} - \frac{\gamma}{\mu}\right) * exp\left(-\frac{\mu t}{R}\right) \tag{4.23}$$

Factor v is given in Equation 4.24:

$$v = u\left(1 + \frac{4\mu D}{u^2}\right)^{1/2} \tag{4.24}$$

4.4 Conclusion

This chapter shows the development, and provides the basis, for two techniques which can be used to progress hydraulic modelling efforts for CWs. One is an adapted form of the methods-of-moments technique and the other is a curve-shift technique based on the advective-dispersive transport equation. However, these two techniques must be combined with kinetic models. This is discussed in the following two chapters.

Chapter 5: Introduction of a biokinetic model into the mathematical techniques

Section 5.2 was presented at the 8th International Symposium of Wetland Pollutant Dynamics and Control, in Aarhus, Denmark (June 2019). (Stephenson, R., Sheridan, C. and Kappelmeyer, U. (2019, June 17-21) *Development of a residence time distribution technique combined with CWM1* [Conference presentation]. 8th International Symposium of Wetland Pollutant Dynamics and Control, in Aarhus, Denmark). The contribution of the co-authors towards the work is primarily that of supervision or collaboration and the experimental work and write-up was conducted by the author of this thesis.

Section 5.3 has been published in Science of the Total Environment and was peer reviewed prior to publication (Stephenson, R., Sheridan, C. and Kappelmeyer, U. (2020) 'A curve-shift technique for the use of non-conservative organic tracers in constructed wetlands', *Science of The Total Environment*. Elsevier B.V., 752, p. 141818. doi: 10.1016/j.scitotenv.2020.141818). The contribution of the co-authors towards the work is primarily that of supervision or collaboration and the experimental work and write-up was conducted by the author of this thesis.

5.1: Introduction

The chemical, biological, and physical processes which contribute to the transformation of contaminants in the wastewater entering CWs take place simultaneously and influence one another. This inter-relatedness of processes is what makes these systems challenging to model and is still the subject of CW modelling research (Meyer *et al.*, 2015). Before the modelling of individual kinetic processes can be done, an understanding of the specific processes and how they occur is required. Initial modelling of CWs was based on 'black-box' approaches, which relied on correlations between inlet and outlet concentrations of pollutants rather than the understanding of the processes which contributed to the degradation (J L G Kumar and Zhao, 2011). Modelling of CWs has progressed to include models which are based, not only on the understanding of the individual processes but the inter-relatedness of all the processes. One

such model that aims to achieve this is Constructed Wetlands Model No 1 (CWM1), which focuses on the interrelatedness of biokinetics (Langergraber, Rousseau, *et al.*, 2009).

As described in Chapter 2, the CWM1 is a biokinetic model which models the degradation and production of 16 contaminants (soluble and particulate) via 17 reactions/processes (Langergraber, Rousseau, *et al.*, 2009). The model is set up in two matrices: one with the rate law for each reaction and one that connects each of the contaminants to the reaction rates by the use of stoichiometric coefficients. These two matrices were presented in Section 2.7.2. The CWM1 biokinetic model is comprehensive and the components modelled include organic matter, nitrogen species, sulfur species and bacterial function groups (Langergraber, Rousseau, *et al.*, 2009). However, this model is purely kinetic and does not consider the hydraulic behaviour of a CW. Kinetic modelling techniques rely on reaction time, but reaction time is a function of the hydraulic behaviour of the system. If the reaction time is quantified incorrectly, a kinetic model will not give accurate results, regardless of how detailed and comprehensive it may be. . It cannot be said that reaction time relies only on the hydraulic behaviour of the system and the importance of mixing and local concentration must not be forgotten. Given the non-ideal flow nature of these CWs, kinetic modelling techniques must be combined with accurate hydraulic modelling techniques for effective modelling of the system. In this chapter, a discussion is presented detailing how the CWM1 biokinetic model can be combined with the two techniques for interpreting the data of hydraulic tracer studies, as described in Chapter 4.

5.2 Adapted Method-of-moments technique

The first part of the adapted method-of-moments technique was presented in Section 4.2 and this formed the hydraulic flow modelling part of the technique. For effective modelling of reactors, a kinetic model is also required. The aim of this section of the thesis is to demonstrate how a multi-component, multi-process, kinetic model (such as the CWM1) can be incorporated into the adapted method-of-moments technique.

In the CWM1 model, the reaction rate matrix is a 1 x 17 matrix in which each column gives the reaction rate of one process. The dot product of the reaction rate matrix and the stochiometric coefficient matrix is a 16 x 1 matrix. Each row of the resultant matrix gives the rate of transformation of a specific species. To incorporate the CWM1 model into the adapted

method-of-moments technique, a slight adaptation was made to the structure of the matrices. No changes were made to the reactions rate laws or stochiometric coefficients. The reaction rate matrix was expanded from a 1 x 17 matrix to a 17 x 17 matrix in which each row is identical, and each column still gives the reaction rate of one process, but this is repeated 17 times, for 17 rows. The dot product of this adapted matrix and the original CWM1 stochiometric coefficients matrix is a 16 x 17 matrix, the component transformation rate matrix. In this resultant matrix, at position $R_{i,l}$ the rate transformation of component *'i'* in process *'l'* is given. An example of element $R_{3,5}$ of the component transformation rate matrix is presented in Equation 5.1 (Langergraber, Rousseau, *et al.*, 2009). As Equation 5.1 is a rate of chemical transformation, it is denoted $r_{3,5}$. Fermentation products, such as acetate, (S_A), (which is component 3 in the CWM1) are a substrate for the anoxic growth of heterotrophic bacteria (which is process 5 in the CWM1). The rate at which fermentation products, such as acetate, are consumed during the anoxic growth of heterotrophic bacteria is presented in Equation 5.1. In the component transformation rate matrix, the rate at which a specific component ($i = 1,2,3\ldots,16$) is transformed in a specific process ($l = 1,2,3,\ldots,17$) can be identified. In this way, each component is linked directly with each process. For cells where the coefficient matrix has been left blank in the CWM1, a zero value is used in the matrix dot product. The rate at which each component is degraded in each specific process in the CWM1 is given in Appendix B. The important point to take from this is that it is possible to identify the rate at which a specific component is transformed in a specific process, from the multi-component, multi-process biokinetic model and this makes it possible to work with the individual rates, not just the rate at which the component is transformed in the system as a whole. Being able to work with the individual rates is important for incorporating the biokinetic model into the adapted method-of-moments technique.

$$R_{3,5} = \left(-\frac{1}{Y_H}\right) n_g \, \mu_H \left[\frac{S_A}{K_{SA}+S_A}\right]\left[\frac{S_A}{S_F+S_A}\right]\left[\frac{K_{OH}}{K_{OH}+S_O}\right]\left[\frac{S_{NO}}{K_{NOH}+S_{NO}}\right]\left[\frac{S_{NH}}{K_{NHH}+S_{NH}}\right]\left[\frac{K_{H2SH}}{K_{H2SH}+S_{H2S^*}}\right] X_H \qquad (5.1)$$

The adapted method-of-moments technique, presented in Section 4.2, has been developed assuming first-ordered reaction rates with first-order rate constants. Currently the individual rates are not first-order but linearisation techniques are required to achieve this. The methods used to do this are presented in Section 6.3.2. To demonstrate how a biokinetic model can be incorporated in the adapted method-of-moments technique, it is assumed that the individual rates are first-order. The first order rate constant of the rate at which component ' ' is transformed in process '*l'* is denoted $k_{i,l}$. A matrix is used to present these rates. This matrix

relates the transformation of a specific component in a specific process in the same way that the component transformation rate matrix (Table 5.1) does, but only includes the rate constant, not the full rate law. This means that in row 3, column 5, the first-order rate constant for the rate at which component 3 is transformed in process 5 is stated. As the kinetic model being used in this technique is the CWM1, the matrix has 16 rows and 17 columns, for the 16 components and seventeen processes. This matrix is defined as the first-order rate constant matrix and can be found in Table 5.1.

***Table 5.1**: First-order rate constant matrix for the CWM1 components and processes*

j	process	I	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
		Component	S_O	S_F	S_A	S_I	S_{NH}	S_{NO}	S_{SO4}	S_{H2S}	X_S	X_I	X_H	X_A	X_{FB}	X_{AMB}	X_{ASRB}	X_{SOB}
		Expressed as	O_2	COD	COD	COD	N	N	S	S	COD	COD	COD	COD	COD	COD	COD	COD
1	Hydrolysis		0	$k_{2,1}$	0	$k_{4,1}$	$k_{5,1}$	0	0	0	$k_{9,1}$	0	$k_{11,1}$	0	0	0	0	0
2	Aerobic growth of X_H on S_F		$k_{1,1}$	$k_{2,2}$	0	0	$k_{5,2}$	0	0	0	0	0	$k_{11,2}$	0	0	0	0	0
3	Aerobic growth of X_H on S_A		0	0	0	0	$k_{5,3}$	$k_{6,3}$	0	0	0	0	$k_{11,3}$	0	0	0	0	0
4	Anoxic growth X_H on S_F		$k_{1,4}$	0	$k_{3,4}$	0	$k_{5,4}$	0	0	0	0	0	$k_{11,4}$	0	0	0	0	0
5	Anoxic growth of X_H on S_A		0	0	$k_{3,5}$	0	$k_{5,5}$	$k_{6,5}$	0	0	0	0	$k_{11,5}$	0	0	0	0	0
6	Lysis if X_H		0	$k_{2,6}$	0	0	$k_{5,6}$	0	0	0	$k_{9,6}$	$k_{10,6}$	$k_{11,6}$	0	0	0	0	0
7	Growth of X_A on S_{NH}		$k_{1,7}$	0	0	0	$k_{5,7}$	0	0	0	0	0	0	$k_{12,6}$	0	0	0	0
8	Lysis of X_A		0	$k_{2,8}$	0	0	$k_{5,8}$	0	0	0	$k_{9,8}$	$k_{10,8}$	0	$k_{12,8}$	0	0	0	0
9	Growth of X_{FB}		0	$k_{2,9}$	$k_{3,9}$	0	$k_{5,9}$	0	0	0	0	0	0	0	$k_{13,9}$	0	0	0

10	Lysis of X_{FB}	0	$k_{2,10}$	0	0	$k_{5,10}$	0	0	0	$k_{9,10}$	$k_{10,10}$	0	0	$k_{13,10}$	0	0	0
11	Growth of X_{AMB}	0	0	$k_{3,11}$	0	k_{511}	0	0	0	0	0	0	0	0	$k_{14,11}$	0	0
12	Lysis of X_{AMB}	0	$k_{2,12}$	0	0	$k_{5,12}$	0	0	0	$k_{9,12}$	$k_{10,12}$	0	0	0	$k_{14,12}$	0	0
13	Growth of X_{ASRB}	0	0	$k_{3,13}$	0	$k_{5,13}$	$k_{6,13}$	$k_{1,1}$	0	0	0	0	0	0	0	$k_{15,13}$	0
14	Lysis of X_{ASRB}	0	$k_{2,14}$	0	0	$k_{5,14}$	0	0	0	$k_{9,14}$	$k_{10,14}$	0	0	0	0	$k_{15,14}$	0
15	Aerobic growth of X_{SOB} on S_{H2S}	$k_{1,15}$	0	0	$k_{4,15}$	$k_{5,15}$	0	0	$k_{8,15}$	0	0	0	0	0	0	0	$k_{16,15}$
16	Anoxic growth of X_{SOB} on S_{H2S}	0	0	0	0	$k_{5,16}$	$k_{6,16}$	0	$k_{8,16}$	0	0	0	0	0	0	0	$k_{16,16}$
17	Lysis of X_{SOB}	0	$k_{2,17}$	0	0	$k_{5,17}$	0	0	0	$k_{9,17}$	$k_{10,17}$	0	0	0	0	0	$k_{16,17}$

The concentration of a component at the outlet of a reactor is dependent on the rate at which that component is consumed or produced, and rate laws are used to quantify this. The batch reactor design equation presented in Section 4.2 shows how the outlet concentration of a component is transformed if the rate law that governs its transformation is first order. In this case the first-order rate constant is in the exponent, as is displayed in Equation 5.2 and has been made bold to highlight its position. To incorporate the multi-component, multi-process biokinetic model, the first-order rate constant is replaced with the first-order rate constant matrix, '*A*'. The matrix has been made bold in Equation 5.3 to show that it is in the same position as the first-order rate constant, '*k'* in Equation 5.2. To ensure that all the rates at which a specific component is transformed in each of the processes is accounted for, two summation terms are used. The first summation term is for the components and ensures that rate constants are used from the correct row and the second summation term is for the processes and ensures that all of the processes are accounted for in the rate of transformation. In Equation 5.3 the design equation, which includes the first-order rate law matrix and summation terms, is presented. There are a total of 'm' components and 'p' processes. In the case of CWM1 $m = 16$ and $p = 17$. The contribution of each process to the degradation or production of a specific component can be summed along the row of that component.

$$C_{out} = C_{in} e^{-\boldsymbol{k}t} \tag{5.2}$$

$$C_{out,i} = \sum_{i=1}^{m} C_{in,i}\, e^{-\sum_{l=1}^{p} \boldsymbol{A}_{i,l}\, t} \tag{5.3}$$

An example of how Equation 5.3 can be used is presented in Equation 5.4 to Equation 5.6. For a system with 5 components and 3 processes, $m = 3$ and $p = 4$. From these equations it can be seen that all the processes in which a specific component is transformed, is accounted for in the overall transformation of the component.

$$C_{out,1} = C_{in,1}\, e^{-\sum_{l=1}^{4} \boldsymbol{A}_{\mathbf{1},l}\, t} = C_{in,1} e^{-\left(k_{1,1} + k_{1,2} + k_{1,3} + k_{1,4}\right) * t} \tag{5.4}$$

$$C_{out,2} = C_{in,2}\, e^{-\sum_{l=1}^{4} \boldsymbol{A}_{\mathbf{2},l}\, t} = C_{in,2} e^{-\left(k_{2,1} + k_{2,2} + k_{2,3} + k_{2,4}\right) * t} \tag{5.5}$$

$$C_{out,3} = C_{in,3}\, e^{-\sum_{l=1}^{4} \boldsymbol{A}_{\mathbf{3},l}\, t} = C_{in,3} e^{-\left(k_{3,1} + k_{3,2} + k_{3,3} + k_{3,4}\right) * t} \tag{5.6}$$

The final step in the adapted method-of-moments technique is to combine the concept of multiple time portions, presented in Section 4.2, with the concept of multiple processes and multiple components being modelled, presented in Equation 5.3. By combining the two parts, both the hydraulic modelling and the kinetic modelling are part of the same equation. This is presented in Equation 5.7.

$$C_{out} = \sum_{i=1}^{m} \sum_{j=1}^{n} \gamma_j C_{in,i} e^{\sum_{l=1}^{p} A_{i,l} t_j} \tag{5.7}$$

An example of how Equation 5.7 can be used is presented in Equation 5.8 to Equation 5.10. This example is for three components ($m = 3$), four processes ($p = 4$) and a residence time distribution curve which is broken into 3 portions ($j = 3$).

$$\begin{aligned} C_{out,1} &= C_{in,1} \sum_{j=1}^{n} e^{-\sum_{l=1}^{4} \boldsymbol{A_{1,l}}\, t_j} \\ &= C_{in,1}\Big(e^{-(k_{1,1}+\, k_{1,2}+k_{1,3}+k_{1,4})*t_1} \\ &\quad + e^{-(k_{1,1}+\, k_{1,2}+k_{1,3}+k_{1,4})*t_2} \\ &\quad + e^{-(k_{1,1}+\, k_{1,2}+k_{1,3}+k_{1,4})*t_3}\Big) \end{aligned} \tag{5.8}$$

$$\begin{aligned} C_{out,2} &= C_{in,2} \sum_{j=1}^{n} e^{-\sum_{l=1}^{4} \boldsymbol{A_{2,l}}\, t_j} \\ &= C_{in,2}\Big(e^{-(k_{2,1}+\, k_{2,2}+k_{2,3}+k_{2,4})*t_1} \\ &\quad + e^{-(k_{2,1}+\, k_{2,2}+k_{2,3}+k_{2,4})*t_2} \\ &\quad + e^{-(k_{2,1}+\, k_{2,2}+k_{2,3}+k_{2,4})*t_3}\Big) \end{aligned} \tag{5.9}$$

$$\begin{aligned} C_{out,3} &= C_{in,3} \sum_{j=1}^{n} e^{-\sum_{l=1}^{4} \boldsymbol{A_{3,l}}\, t_j} \\ &= C_{in,3}\Big(e^{-(k_{3,1}+\, k_{3,2}+k_{3,3}+k_{3,4})*t_1} \\ &\quad + e^{-(k_{3,1}+\, k_{3,2}+k_{3,3}+k_{3,4})*t_2} \end{aligned}$$

$$+e^{-(k_{3,1}+\,k_{3,2}+k_{3,3}+k_{3,4})*t_3}\Big) \tag{5.10}$$

In Section 7.2 the validation of this technique is presented.

5.3 The curve-shift technique with CWM1

The curve-shift technique presented in the previous chapter, Section 4.3, is based on the advective-dispersive transport equation. This solute transport model, in its original form, has been used to model the flow through CWs by many researchers, as was described in Section 2.8.4. The partial differential equation is usually combined with some form of the kinetic model, as was done in BIO_PORE and the HYDRUS Wetland Module, both of which used the CWM1 as the biokinetic model (Meyer *et al.*, 2015). The CWM1 matrices are set up as partial differential equations which are solved along with the advective-dispersive transport equation to describe the transport and degradation of the specific contaminants along the length of the wetland and with respect to time. The data from the curve-shift technique can be used in the same way as the original advective-dispersive transport equation. Owing to the presence of multiple partial differential equations, many of which contain multiple terms, this method requires extensive computing power and is more often used for research purposes, rather than design purposes (Meyer *et al.*, 2015).

5.4: Conclusion

For the two residence time distributions techniques which have been presented to be effective in the modelling of CW degradation processes, they need to be combined with kinetic modelling. This is the case for any reactive system. This chapter shows how this is possible for two presented techniques. For the adapted method-of-moments technique, linear reaction rates are required, which is a limitation on the model but does not disqualify it from use. The curve shift technique can be used in the same way that the original advective-dispersive transport equation has been used by other researchers in the modelling of CWs. In the case of the adapted method-of-moments technique, it is still limited by the assumption of first-order rate laws. In the case of the curve-shift technique, the limitation is the need to solve multiple differential equations which requires large amounts of computing power.

Chapter 6: Linearisation of the kinetic rate laws

6.1: Introduction

For the CWM1 biokinetic model to be combined with the adapted method-of-moments technique, the rate at which an individual component is degraded or produced in a specific process needs to be linearised, and in the form of a first-order rate law. Multiple methods were applied to achieve this. Many of the rate laws in CWM1 are governed by Monod kinetics, which can be either first-order or zero-order, depending on concentration. Due to this, it was initially assumed that the conversion of the rates in CWM1 to first order would be possible. The methods used to do this are described in this chapter.

6.2: Linearisation techniques applied to the kinetic rate laws

6.2.1 Taylor Series Approximation

Taylor series approximation can be used to estimate what a function will look like around a specific point. It makes use of the nth derivatives of the function and adds them at a point (Chiprout and Nakhla, 1994). The mathematical definition of the Taylor Series is presented in Equation 6.1 (Bi, 2018).

$$f(x) \approx G(x) = \sum_{n=0}^{\infty} \frac{f^{(n)}}{n!}(x-a)^n = f(a) + \frac{f'(a)}{1!}(x-a) + \frac{f''(a)}{2!}(x-a)^2 + \frac{f^{(3)}(a)}{3!}(x-a)^3 + \frac{f^{(4)}(a)}{4!}(x-a)^4 \ldots \quad (6.1)$$

A special case of the Taylor Series is the McLaurin series which finds the Taylor series of a function around the point $a = 0$. This is given in Equation 6.2 (Bi, 2018).

$$f(x) \approx G(x) = \sum_{n=0}^{\infty} \frac{f^{(n)}}{n!}(x)^n = f(a) + \frac{f'(0)}{1!}(x) + \frac{f''(0)}{2!}(x)^2 + \frac{f^{(3)}(0)}{3!}(x)^3 + \frac{f^{(4)}(0)}{4!}(x)^4 \ldots \quad (6.2)$$

6.2.2 Padé Approximations

A Padé approximant is an approximation of an expression by a rational function of a specified order between zero and infinity (Chiprout and Nakhla, 1994). Padé approximations represent a function f(x) according to Equation 6.3.

$$f(x) = R_N(x) = \frac{\sum_{j=0}^{m} a_j x^i}{1+\sum_{k=0}^{n} b_k x^k} = \frac{a_0+a_1x+a_2x^2+\ldots+a_mx^m}{b_0+b_1x+b_2x^2+\ldots+b_nx^n} \quad (6.3)$$

Where b_0 is always scaled to 1 and N is defined according to Equation 6.4, the number of unknowns is N+1 and $n \geq 1$ and $m \geq 1$.

$$N = n + m \quad (6.4)$$

This approximation technique was one of the methods that were tried to linearise the reaction rates of CWM1.

To determine the coefficients of x, Equation 6.5 is applied, where p_i are the coefficients from the Taylor expansion.

$$f(x) - R_N(x) = p_0 + p_1x + p_2x^2+\ldots+c_Nx^N - \frac{a_0 + a_1x + a_2x^2+\ldots+a_mx^m}{b_0 + b_1x + b_2x^2+\ldots+b_nx^n}$$

$$= \frac{(p_0+p_1x+p_2x^2+\ldots+c_Nx^N)(b_0+b_1x+b_2x^2+\ldots+b_nx^n)-(a_0+a_1x+a_2x^2+\ldots+a_mx^m)}{b_0+b_1x+b_2x^2+\ldots+b_nx^n} \quad (6.5)$$

For $f(0) = R_N(0)$ it implies that

$$p_0 - a_0 = 0 \quad (6.6)$$

For $f(i)(0) = R_N(i)(0), i = 1,2,\ldots,N$ coefficients of powers of x, up to and including x_N, in the numerator must all be zero, as shown below in Table 1. This can be used to determine the coefficients in the Padé approximant.

***Table 6.1**: Coefficients of powers of x in Padé approximants*

Term in Padé approximation	**Coefficient according to Padé approximation**
x	$b_1p_0 + p_1 - a_1 = 0$
x^2	$b_2p_0 + b_1p_1 + p_2 - a_2 = 0$
$\ldots$	
x^{n+m}	$b_mp_{N-m} + b_{m-1}p_{N-m+1}+\ldots+c_N = 0$

6.3: Results of applying the linearisation techniques

6.3.1 Approximation of general forms

The rate at which individual components of the CWM1 are transformed is dependent on multiple processes, and the rates of those processes are dependent on the concentrations of one or more of the other components. This inter-relatedness makes the modelling detailed and accurate but not simple to work with. To aid the linearisation techniques, some assumptions were made. It was assumed that at an instantaneous moment in time, the concentrations of all components remained constant, except the concentration of the component being investigated. Therefore, for that instantaneous moment the rate at which component '*i'* is transformed in process '*l*' is only dependent on the changing concentration of that component and not the other 15 as well. This rate is hereby defined at the 'simplified rate'. An example of how this works is presented in Equation 6.7 to Equation 6.11.

The rate at which the component fermentation products, as acetate, (S_A), is degraded in the anoxic growth of heterotrophic bacteria is given in Equation 6.7. This rate is a function of the concentration fermentation products as acetate, the concentration of fermentable, readily available COD, the concentration of dissolved oxygen, the concentration of ammonium and ammonia nitrogen, the concentration of S_{NO}, and the concentration of dihydrogen-sulphide sulphur. If it was to be assumed that at an instantaneous moment in time (t_s), the concentrations of all other components except fermentation products as acetate were considered to be constant, then Equation 6.7 could be written in the form shown in Equation 6.8.

$$r_{3,5}(S_A, t_s) = \left(-\frac{1}{Y_H}\right) n_g\, \mu_H \left[\frac{S_A(t_s)}{K_{SA}+S_A(t_s)}\right]\left[\frac{S_A(t_s)}{S_F(t_s)+S_A(t_s)}\right]\left[\frac{K_{OH}}{K_{OH}+S_O(t_s)}\right]\left[\frac{S_{NO}(t_s)}{K_{NOH}+S_{NO}(t_s)}\right]\left[\frac{S_{NH}(t_s)}{K_{NHH}+S_{NH}(t_s)}\right]\left[\frac{K_{H2SH}}{K_{H2SH}+S_{H2S^*}(t_s)}\right] X_H(t_s) \tag{6.7}$$

$$r_{3,5}(S_A, t_s) = Q_{3,5}(t_s)\left[\frac{S_A(t_s)}{P_{3,5}(t_s)+S_A(t_s)}\right]\left[\frac{S_A(t_s)}{R_{3,5}(t_s)+S_A(t_s)}\right] \tag{6.8}$$

Where,

$$Q_{3,5}(t_s) = \left(-\frac{1}{Y_H}\right) n_g \mu_H \left[\frac{K_{OH}}{K_{OH}+S_O(t_s)}\right]\left[\frac{S_{NO}(t_s)}{K_{NOH}+S_{NO}(t_s)}\right]\left[\frac{S_{NH}(t_s)}{K_{NHH}+S_{NH}(t_s)}\right]\left[\frac{K_{H2SH}}{K_{H2SH}+S_{H2S^*}(t_s)}\right] X_H(t_s) \tag{6.9}$$

$$P_{3,5}(t_s) = K_{SA} \tag{6.10}$$

$$R_{3,5}(t_s) = S_F(t_s) \tag{6.11}$$

All the concentrations in terms$Q_{3,5}$, $P_{3,5}$ and $R_{3,5}$are constant at time $t = t_s$.

This technique can be applied to each of the rate laws in the rate law matrix and the results are given in Table 6.2. The rate laws contained in this matrix are not all in the same order, nor are they linear, so changes will still have to be made before they can be applied to any proposed model. The definition of $Q_{i,j}$, $P_{i,j}$ and $R_{i,j}$ for $i = 1,2,3\ldots16$ and $j = 1,2,3\ldots17$, according to the technique applied in Equation 6.7 to Equation 6.11 can be found in Appendix C.

***Table 6.2**: Simplified forms of the rate equations of CWM1*

l	process i	1		3	4	5	6	7	8	9	10	11	12	13	14	15	16
	Component	S_O	S_{OF}	S_A	S_I	S_{NH}	S_{NO}	S_{SO4}	S_{H2S}	X_S	X_I	X_H	X_A	X_{FB}	X_{AMB}	X_{ASRB}	X_{SOB}
	Expressed as	O_2	COD	COD	COD	N	N	S	S	COD	COD	COD	COD	COD	COD	COD	COD
1	Hydrolysis		$P_{1,2}$		$P_{1,4}$	$P_{1,5}$				$P_{1,9}\left(\frac{X_S}{Q_{1,9}+X_S}\right)$							
2	Aerobic growth of X_H on S_F	$P_{2,1}\left(\frac{S_O}{Q_{2,1}+S_O}\right)$	$P_{2,2}\left(\frac{S_F}{Q_{2,2}+S_F}\right)\left(\frac{S_F}{R_{2,2}+S_F}\right)$			$P_{2,5}\left(\frac{S_{NH}}{Q_{2,5}+S_{NH}}\right)$						$P_{2,11}$					
3	Aerobic growth of X_H on S_A		$P_{3,2}\left(\frac{S_F}{Q_{3,2}+S_F}\right)\left(\frac{S_F}{R_{3,2}+S_F}\right)$			$P_{3,5}\left(\frac{S_{NH}}{Q_{3,5}+S_{NH}}\right)$	$P_{3,6}\left(\frac{S_{NO}}{Q_{3,6}+S_{NO}}\right)$					$P_{3,11}$					
4	Anoxic growth X_H on S_F	$P_{4,1}\left(\frac{S_O}{Q_{4,1}+S_O}\right)$		$P_{4,3}\left(\frac{S_A}{Q_{4,3}+S_A}\right)\left(\frac{S_A}{R_{4,3}+S_A}\right)$		$P_{4,5}\left(\frac{S_{NH}}{Q_{4,5}+S_{NH}}\right)$						$P_{4,11}$					
5	Anoxic growth of X_H on S_A			$P_{5,3}\left(\frac{S_A}{Q_{5,3}+S_A}\right)\left(\frac{S_A}{R_{5,3}+S_A}\right)$		$P_{5,5}\left(\frac{S_{NH}}{Q_{5,5}+S_{NH}}\right)$	$P_{5,6}\left(\frac{S_{NO}}{Q_{5,6}+S_{NO}}\right)$					$P_{5,11}$					
6	Lysis if X_H		$P_{6,2}$			$P_{6,5}$				$P_{6,9}$	$P_{6,10}$	$P_{6,11}$					
7	Growth of X_A on S_{NH}	$P_{7,1}\left(\frac{S_O}{Q_{7,1}+S_O}\right)$				$P_{7,5}\left(\frac{S_{NH}}{Q_{7,5}+S_{NH}}\right)$	$P_{7,6}$						$P_{7,12}$				
8	Lysis of X_A		$P_{8,2}$			$P_{8,5}$				$P_{8,9}$	$P_{8,10}$		$P_{8,12}$				
9	Growth of X_{FB}		$P_{9,2}\left(\frac{S_F}{Q_{9,2}+S_F}\right)$	$P_{9,3}$		$P_{9,5}\left(\frac{S_{NH}}{Q_{9,5}+S_{NH}}\right)$								$P_{9,13}$			
10	Lysis of X_{FB}		$P_{10,2}$			$P_{10,5}$				$P_{10,9}$	$P_{10,10}$			$P_{10,13}$			
11	Growth of X_{AMB}			$P_{11,3}\left(\frac{S_A}{Q_{11,3}+S_A}\right)$		$P_{11,5}\left(\frac{S_{NH}}{Q_{11,5}+S_{NH}}\right)$									$P_{11,14}$		
12	Lysis of X_{AMB}		$P_{12,2}$			$P_{12,5}$				$P_{12,9}$	$P_{12,10}$				$P_{12,14}$		
13	Growth of X_{ASRB}			$P_{13,3}\left(\frac{S_A}{Q_{13,3}+S_A}\right)$		$P_{13,5}\left(\frac{S_{NH}}{Q_{13,5}+S_{NH}}\right)$		$P_{13,6}\left(\frac{S_{SO4}}{Q_{13,7}+S_{SO4}}\right)$	$P_{13,7}\left(\frac{S_{H2S}}{Q_{13,8}+S_{H2S}}\right)$							$P_{13,15}$	
14	Lysis of X_{ASRB}		$P_{14,2}$			$P_{14,5}$				$P_{14,9}$	$P_{14,10}$					$P_{14,15}$	
15	Aerobic growth of X_{SOB} on S_{H2S}	$P_{15,1}\left(\frac{S_O}{Q_{15,1}+S_O}\right)$			$P_{15,4}$	$P_{15,5}\left(\frac{S_{NH}}{Q_{15,5}+S_{NH}}\right)$			$P_{15,8}\left(\frac{S_{H2S}}{Q_{15,8}+S_{H2S}}\right)$								$P_{15,16}$
16	Anoxic growth of X_{SOB} on S_{H2S}					$P_{16,5}\left(\frac{S_{NH}}{Q_{16,5}+S_{NH}}\right)$	$P_{16,6}\left(\frac{S_{NO}}{Q_{16,6}+S_{NO}}\right)$		$P_{16,8}\left(\frac{S_{H2S}}{Q_{16,8}+S_{H2S}}\right)$								$P_{16,16}$
17	Lysis of X_{SOB}		$P_{17,2}$			$P_{17,5}$				$P_{17,9}$	$P_{17,10}$						$P_{17,16}$

The simplification of the rate equations to represent an instantaneous rate take a few common forms, which are given below in Equation 6.12 and Equation 6.13. These will be referred to as Form 1 and Form 2 respectively.

$$r_{i,l}(C_i, t_s) = P_{i,l}(t_s)\left[\frac{C_i(t_s)}{Q_{i,l}(t_s)+C_i(t_s)}\right] \tag{6.12}$$

$$r_{i,l}(C_i, t_s) = P_{i,l}(t_s)\left[\frac{C_i(t_s)}{Q_{i,l}(t_s)+C_i(t_s)}\right]\left[\frac{C_i(t_s)}{R_{i,l}(t_s)+C_i(t_s)}\right] \tag{6.13}$$

To apply these rate laws to a proposed model, they need to be in a linear form, which is not yet the case. Linear approximations techniques were applied to achieve this. For this, the McLaurin series as well as the Taylor series around a non-zero point were investigated.

Taylor Series

As the aim is to linearise the rate equations, Taylor series expansion was used to find the approximations for $n = 1$. The process is presented in Equation 6.14 to Equation 6.28. The Taylor expansion, and therefore the McLaurin series, requires the derivatives of the function around a point to determine the coefficients of C_i in the approximated function. The first derivative of Equation 6.12 (the Form 1 rate equation) can be found in Equation 6.14. At the point $a = 0$, Equation 6.14 becomes Equation 6.15.

$$r_{i,l}{}'(a) = \frac{P_{i,l}(t)Q_{i,l}(t)}{\left(Q_{i,l}(t)+a\right)^2} \tag{6.14}$$

$$r_{i,l}{}'(0) = \frac{P_{i,l}(t)}{Q_{i,l}(t)} \tag{6.15}$$

The Taylor series approximation and the McLaurin series approximation for Equation 6.12, for the $n = 1$, are shown in Equation 6.16 and Equation 6.17, respectively.

$$r_{i,l}(C_i, t) = \frac{P_{i,l}(t)a}{Q_{i,l}(t)+a} + \frac{1}{1!}\frac{P_{i,l}(t)Q_{i,l}(t)}{\left(Q_{i,l}(t)+a\right)^2}\,(C_i - a)^1 \tag{6.16}$$

$$r_{i,l}(C_i, t) = 0 + \frac{1}{1!}\frac{Q_{i,l}(t)}{P_{i,l}(t)}\,C_i{}^1 = \frac{Q_{i,l}(t)}{P_{i,l}(t)}\,C_i \tag{6.17}$$

The first derivative of Form 2, Equation 6.13, can be found in Equation 6.18.

$$r_{i,l}{}'(a) = \frac{P_{i,l}(t)a\left(\left(Q_{i,l}(t)+R_{i,l}(t)\right)a+2Q_{i,l}(t)R_{i,l}(t)\right)}{\left(a+Q_{i,l}(t)\right)^2\left(a+R_{i,l}(t)\right)^2} \tag{6.18}$$

At the point $a = 0$, Equation 6.18 is equal to 0 which means that the estimated function around that point would be equal to 0. For this reason, a quadratic approximation of Equation 6.13 was conducted, and the second derivative is also required. This is shown in Equation 6.19.

$$r_{i,l}{}^{(2)}(a) = \left(\frac{P_{i,l}(t)a\left(\left(Q_{i,l}(t)+R_{i,l}(t)\right)a+2\,Q_{i,l}(t\,)R_{i,l}(t)\right)}{\left(a+Q_{i,l}(t)\right)^2\left(a+R_{i,l}(t)\right)^2}\right)'$$

$$= P_{i,l}(t)\frac{b_5a^5+b_4a^4+b_3a^3+b_2a^2+b_1a^1+b_0a^0}{\left[\left(a+Q_{i,l}(t)\right)^2\left(a+R_{i,l}(t)\right)^2\right]^2} \tag{6.19}$$

where the coefficients are defined in Equation 6.20 to Equation 6.25.

$$b_5 = 2\left(Q_{i,l}(t) + R_{i,l}(t)\right) \tag{6.20}$$

$$b_4 = 4\left(Q_{i,l}(t) + R_{i,l}(t)\right)^2 + 2Q_{i,l}(t)\,R_{i,l}(t) - 4\left(Q_{i,l}(t) + R_{i,l}(t)\right) \tag{6.21}$$

$$b_3 = 2\left(Q_{i,l}(t) + R_{i,l}(t)\right)\left(Q_{i,l}(t)^2 + R_{i,l}(t)^2 + 4Q_{i,l}(t)R_{i,l}(t)\right) - 6\left(Q_{i,l}(t) + R_{i,l}(t)\right)^2 - 4Q_{i,l}(t)R_{i,l}(t) \tag{6.22}$$

$$b_2 = 4\left(Q_{i,l}(t) + R_{i,l}(t)\right)\left(Q_{i,l}(t)^2R_{i,l}(t) + R_{i,l}(t)^2Q_{i,l}(t)\right) + 2Q_{i,l}(t)\,R_{i,l}(t)\left(Q_{i,l}(t)^2 + R_{i,l}(t)^2 + 4Q_{i,l}(t)R_{i,l}(t)\right) - 2Q_{i,l}(t)\,R_{i,l}(t)\left(Q_{i,l}(t)^2 + R_{i,l}(t)^2 + 4Q_{i,l}(t)R_{i,l}(t)\right) - 12Q_{i,l}(t)\,R_{i,l}(t)\left(Q_{i,l}(t) + R_{i,l}(t)\right) \tag{6.23}$$

$$b_1 = 2\left(Q_{i,l}(t) + R_{i,l}(t)\right)Q_{i,l}(t)^2R_{i,l}(t)^2 + 4Q_{i,l}(t)R_{i,l}(t)\left(Q_{i,l}(t)^2R_{i,l}(t) + R_{i,l}(t)^2Q_{i,l}(t)\right) - 2\left(Q_{i,l}(t) + R_{i,l}(t)\right)\left(Q_{i,l}(t)^2R_{i,l}(t) + R_{i,l}(t)^2Q_{i,l}(t)\right) - 4Q_{i,l}(t)\,R_{i,l}(t)\left(Q_{i,l}(t)^2 + R_{i,l}(t)^2 + 4Q_{i,l}(t)R_{i,l}(t)\right) \tag{6.24}$$

$$b_0 = 2Q_{i,l}(t)^3R_{i,l}(t)^3 + 4Q_{i,l}(t)\,R_{i,l}(t)\left(Q_{i,l}(t)^2R_{i,l}(t) + R_{i,l}(t)^2Q_{i,l}(t)\right) \tag{6.25}$$

At the point $a = 0$, Equation 6.19 becomes Equation 6.26.

$$r_{i,l}{}^{(2)}(0) = \frac{Q_{i,l}(t)\left[2Q_{i,l}(t)^3R_{i,l}(t)^3+4Q_{i,l}(t)\,R_{i,l}(t)\left(Q_{i,l}(t)^2R_{i,l}(t)+R_{i,l}(t)^2Q_{i,l}(t)\right)\right]}{Q_{i,l}(t)^4R_{i,l}(t)^4} \tag{6.26}$$

The Taylor series approximation and the McLaurin series approximation for Equation 6.13 for the power of 1 is shown in Equation 6.27 and Equation 6.28, respectively.

$$P_{i,l}(t) = \frac{a^2}{\left(Q_{i,l}(t)+a\right)\left(R_{i,l}(t)+a\right)} + \frac{P_{i,l}(t)a\left(\left(Q_{i,l}(t)+R_{i,l}(t)\right)a+2\,Q_{i,l}(t\,)R_{i,l}(t)\right)}{\left(a+Q_{i,l}(t)\right)^2\left(a+R_{i,l}(t)\right)^2}(C_i - a) + P_{i,l}(t)\frac{b_5a^5+b_4a^4+b_3a^3+b_2a^2+b_1a^1+b_0a^0}{\left[\left(a+Q_{i,l}(t)\right)^2\left(a+R_{i,l}(t)\right)^2\right]^2}(C_i - a)^2 \tag{6.27}$$

$$r_{i,l}(C_i,t) = 0 + 0 + \frac{1}{2!}\frac{Q_{i,l}(t)\left[2Q_{i,l}(t)^3R_{i,l}(t)^3+4Q_{i,l}(t)\,R_{i,l}(t)\left(Q_{i,l}(t)^2R_{i,l}(t)+R_{i,l}(t)^2Q_{i,l}(t)\right)\right]}{P_{i,l}(t)^4R_{i,l}(t)^4}C_i{}^2$$

$$= \frac{P_{i,l}(t)\left[2Q_{i,l}(t)^3R_{i,l}(t)^3+4Q_{i,l}(t)\,R_{i,l}(t)\left(Q_{i,l}(t)^2R_{i,l}(t)+R_{i,l}(t)^2Q_{i,l}(t)\right)\right]}{2\,Q_{i,l}(t)^4R_{i,l}(t)^4}\,C_i{}^2 \tag{6.28}$$

Padé Approximations

Because the aim is to linearise the reaction rates, N=1 for the Padé approximations. This means that $m = 1$ and $n = 0$. Because of this, Equation 5 takes on the form given in Equation 6.29.

$$f(x) - R^1 = \frac{(p_0+p_1x)(1)-(a_0+a_1x)}{1} \tag{6.29}$$

Therefore

$$p_1 - a_1 = 0 \tag{30}$$

This means that the coefficients of the Padé approximant are equal to the coefficients of the Taylor series in the case of a linear equation. For this reason, Padé approximations were not investigated further.

6.3.2 Approximation of Specific Rates

To determine whether the linearisation techniques could be used to model the component transformation rates, a comparison was done between the rate modelled by CWM1, the rate approximated by the McLaurin series, and the rate approximated by the Taylor series at a point. For each component, the comparison of the three was done over a concentration range appropriate to that components, as determined by literature. A basis concentration for each component was also selected. This basis concentration was defined as the point around which the Taylor series approximation was calculated and the point of comparison for the three techniques. The basis concentration for each component was based on values used by another study which used CWM1 for process simulation (Llorens *et al.*, 2011). The basis concentration used for the sixteen components is presented in Table 6.3.

A negative rate indicates that component *i* is being degraded in process *l*, while a positive rate indicates that the component is being produced in the process. Chemical compositions are discussed separately, where necessary.

***Table 6.3**: Basis concentrations used for each of the components in the CWM1 model, the CWM1 modelled rates and the approximation techniques*

Component	Unit	Basis concentration	Reference
Dissolved oxygen	mg O_2/L	0.86	(Llorens *et al.*, 2011)
Fermentable, readily biodegradable soluble COD.	mg COD/L	170	(Llorens *et al.*, 2011)
Fermentation products as acetate	mg COD/L	27	(Llorens *et al.*, 2011)
Inert soluble COD	mg COD/L	13	(Llorens *et al.*, 2011)
Ammonium and ammonia nitrogen	mg N/L	57	(Llorens *et al.*, 2011)
Nitrate and nitrite nitrogen	mg N/L	50.4	(Llorens, Saaltink and García, 2011)
Sulphate sulphur	mg S/L	34	(Llorens *et al.*, 2011)
Dihydrogen-sulphide sulphur.	mg S/L	35	(Llorens, Saaltink and García, 2011)
Slowly biodegradable particulate COD	mg O_2/L	33	(Llorens *et al.*, 2011)
Inert particulate COD	mg O_2/L	13	(Llorens *et al.*, 2011)
Heterotrophic bacteria	mg COD_{BM}/L	100	(Llorens *et al.*, 2011)
Autotrophic nitrifying bacteria	mg COD_{BM}/L	100	(Llorens *et al.*, 2011)
Fermenting bacteria	mg COD_{BM}/L	100	(Llorens *et al.*, 2011)
Acetotrophic methanogenic bacteria	mg COD_{BM}/L	1000	(Llorens *et al.*, 2011)
Acetotrophic sulphate reducing bacteria	mg COD_{BM}/L	340	(Llorens *et al.*, 2011)
Sulphide oxidising bacteria	mg COD_{BM}/L	210	(Llorens *et al.*, 2011)

Linearisation of the rate at which dissolved oxygen is transformed.

The rate at which dissolved oxygen (S_O) is consumed is dependent on four processes in the CWM1 model. All four of these processes take on the form given in Equation 6.12 when simplified according to the method presented in Equation 6.7 to Equation 6.11. The basis concentration that was used for dissolved oxygen was 0.86 mg O_2/L and the range in which the degradation of dissolved oxygen was modelled was 0 mg O_2/L to 1.29 mg O_2/L.

Transformation of oxygen through the aerobic growth of heterotrophic bacteria on fermentable, readily available COD

In Figure 6.1, a comparison of the relationship between the concentration of dissolved oxygen and the rate at which it is transformed during the aerobic growth of heterotrophic bacteria on fermentable, readily available COD, as predicted by the CWM1, the McLaurin series approximation, and Taylor series approximation around the point 0.86 mg O_2/L, is presented. The CWM1 modelled rate predicted that as concentration of dissolved oxygen increases the rate at which it was consumed in this process increases, but the correlation is not linear. The McLaurin series approximation deviated from the CWM1 modelled rate from a concentration of approximately 0.01720 mg O_2/L. At the basis concentration (0.86 mg O_2/L), the rate determined using the McLaurin series approximation is 5.3 times greater than the rate determined using CWM1. The Taylor series approximation was closer in magnitude to the CWM1 modelled rate, than the McLaurin series approximation. A point at which the Taylor series approximation was furthest from the CWM1 modelled rate was at a concentration of 0 mg O_2/L, within the modelled range. In the range of 0.43 mg O_2/L to 1.30 mg O_2/L, the CWM1 modelled rate flattened out, and the root-mean-square error between the CWM1 modelled rate and the Taylor series approximation was 142 mg O_2/L.d, which is 0.9% of the CWM1 modelled rate in that range. From this analysis it was determined that neither the McLaurin series approximation, nor the Taylor series approximation around the basis concentration was a good estimation of the rate at which oxygen is consumed during the aerobic growth of heterotrophic bacteria on fermentable, readily available COD.

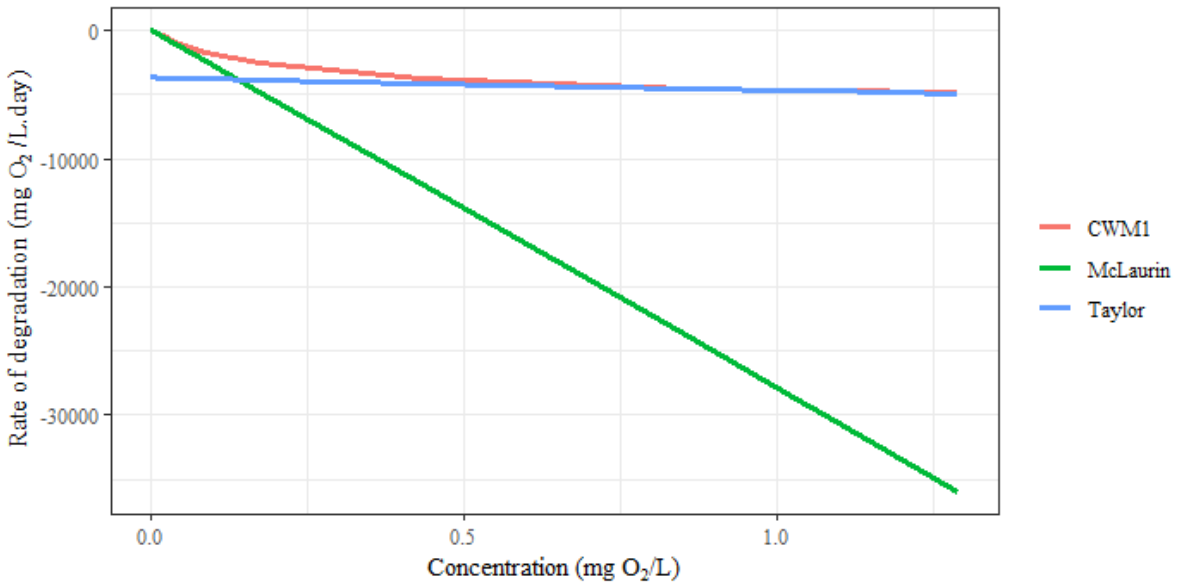

***Figure 6.1**: Comparison of the relationship between the concentration of dissolved oxygen and the rate at which it is transformed during the aerobic growth of heterotrophic bacteria on fermentable, readily available COD, as predicted by the CWM1, the McLaurin series approximation and Taylor series approximation around the point 0.86 mg O_2/L*

Transformation of dissolved oxygen in other processes

The relationship between the concentration of dissolved oxygen and the rate at which it is degraded in the three other concentration-dependent processes (the anoxic growth of heterotrophic bacteria on fermentable, readily available COD, the growth of autotrophic nitrifying bacteria on ammonium and ammonia nitrogen, and the aerobic growth of sulphide oxidising bacteria on dihydrogen-sulphide), is very similar to that of the degradation of aerobic growth of heterotrophic bacteria on fermentable, readily available COD. When linearisation techniques were applied to these processes the same behaviour was found and therefore the same conclusion was made. The magnitude of difference between the McLaurin series approximation and the CWM1 modelled rate at the basis concentration for the three other processes is given in Table 6.4. This is done to give some context to the other results. The full results can be found in Appendix D.

Linearisation of the rate at which fermentable, readily biodegradable COD, is transformed.

The rate at which fermentable, readily biodegradable COD (hereafter referred to as COD) (S_F) is consumed is dependent on ten processes in the CWM1 model. Seven of the ten processes are not dependent on the concentration of COD and so do not need to be linearised. In their

simplified form, two of the processes take on the form given in Equation 6.12 and one takes on the form given in Equation 6.13. The basis concentration of COD used in the model is 170 mg COD/L and the range in which the processes were modelled is 0 mg COD/L to 220 mg COD/L.

Transformation of fermentable, readily biodegradable COD through the erobic growth of heterotrophic bacteria on fermentable, readily biodegradable COD

In Figure 6.2, a comparison of the relationship between the concentration of COD and the rate at which it is transformed during the aerobic growth of heterotrophic bacteria on fermentable, readily available COD, as predicted by the CWM1, the McLaurin series approximation and Taylor series approximation around the point 170 mg COD/L, is presented. The y-axis on the left-hand side gives the rate determined using the CWM1 model and the Taylor series approximation, while the y-axis on the right-hand side gives the rate determined using the McLaurin series approximation. The rate determined using the McLaurin series approximation was several orders of magnitudes greater than the rates determined using the CWM1 model and Taylor series approximation and is shown on a separate axis so that the trend of all three responses can be seen clearly.

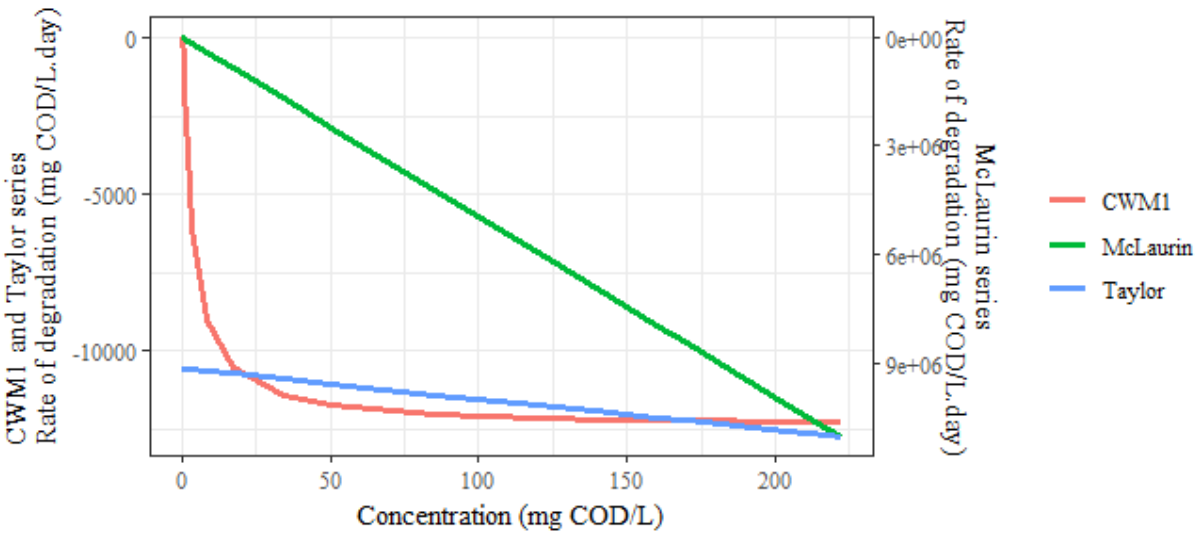

***Figure 6.2**: Comparison of the relationship between the concentration of COD and the rate at which it is transformed during the aerobic growth of heterotrophic bacteria on fermentable, readily available COD, as predicted by the CWM1, the McLaurin series approximation and Taylor series approximation around the point 170 mg COD/L*

All three modelled rates predicted that the higher the concentration of COD, the faster it was degraded in the process. The CWM1 model predicted that the rate of transformation was

dependent on the concentration of COD for the lower concentrations but at approximately 150 mg COD/L the rate was no longer concentration dependent. The CWM1 modelled rate is based on Monod kinetics and therefore this behaviour is not unexpected. The reason for the flattening out of the curve could be because at around this concentration the bacteria are saturated and cannot transform the COD any faster.

The rate predicted by the Taylor series approximation was in the same order of magnitude as the CWM1 modelled rate but did not display the same behaviour around the basis concentration. In the range between 17 mg COD/L and 222 mg COD/L the root-mean-square error between the CWM1 modelled rate and the Taylor series approximation was 410 mg COD/L.d, which is 3.4% of the CWM1 modelled rate. However, when concentrations lower than 17 mg COD/L were included, the error became 5130 mg COD/L.d, which was 60.7% of the mean rate between 0 mg COD/L and 222 mg COD/L. The concentration of COD is likely to fall below 17 mg COD/L and because of this, there is a range in which the Taylor series approximation deviates to a significant extent from the CWM1 modelled rate. From this information, it can be determined that the Taylor series approximation is not a good linear estimate of the rate. A comparison of the McLaurin series predicted rate and the CWM1 modelled rate showed that not only was the trend of the rates different, but they were also magnitudes apart. At the basis concentration, the McLaurin approximation was 692 times greater than the CWM1 modelled data. This difference in magnitude means that the McLaurin series approximation is not a good estimation of the CWM1 modelled rate.

Transformation of fermentable, readily available COD in other processes

A similar type of behaviour was seen for the approximations of the transformation of COD in the aerobic growth of heterotrophic bacteria on fermentation products, as acetate (S_A). The CWM1 modelled rate equation was of the same form and the approximations displayed the same deviations. The factor by which the McLaurin series approximation was out for each of the processes can be found in Table 6.4. Figures comparing the CWM1 modelled rate, and the approximations can be found in Appendix D.

Linearisation of the rate at which fermentation products as acetate, is transformed.

The rate at which fermentation products, as acetate, (hereafter referred to as acetate) (S_A), is transformed is dependent on five processes, according to the CWM1 model. Acetate is transformed through the anoxic growth of heterotrophic bacteria on COD and acetate, and the growth of fermenting bacteria, acetotrophic, methanogenic bacteria and acetotrophic, sulphate reducing bacteria. The growth of acetotrophic, sulphate reducing bacteria is not dependent on the concentration of acetate and so linearisation techniques were not applied to this rate. Two of the other rates take the form of Equation 6.12 and two take the form of Equation 6.13. The basis concentration for acetate in this model is 27 mg COD/L and the range over which the linearisation techniques were applied is 0 mg COD/L to 40 mg COD/L.

Transformation of acetate through the anoxic growth of heterotrophic bacteria on COD

In Figure 6.3 a comparison of the relationship between the concentration of acetate and the rate at which it is transformed during the anoxic growth of heterotrophic bacteria on COD, as predicted by the CWM1, the McLaurin series approximation, and Taylor series approximation around the point 27 mg COD/L, is presented. The y-axis on the left-hand side gives the rate determined using the CWM1 model and the McLaurin series approximation, while the y-axis on the right-hand side gives the rate determined using the Taylor series approximation. The rate determined using Taylor series approximation was several orders of magnitudes greater than the rates determined using the CWM1 model and McLaurin series approximation and is shown on a separate axis so that the trend of all three responses can be seen clearly. The Taylor series approximation was so much greater in magnitude because of one of the original rate constants used in CWM1 was very large and had a dominating effect on the gradient of the response.

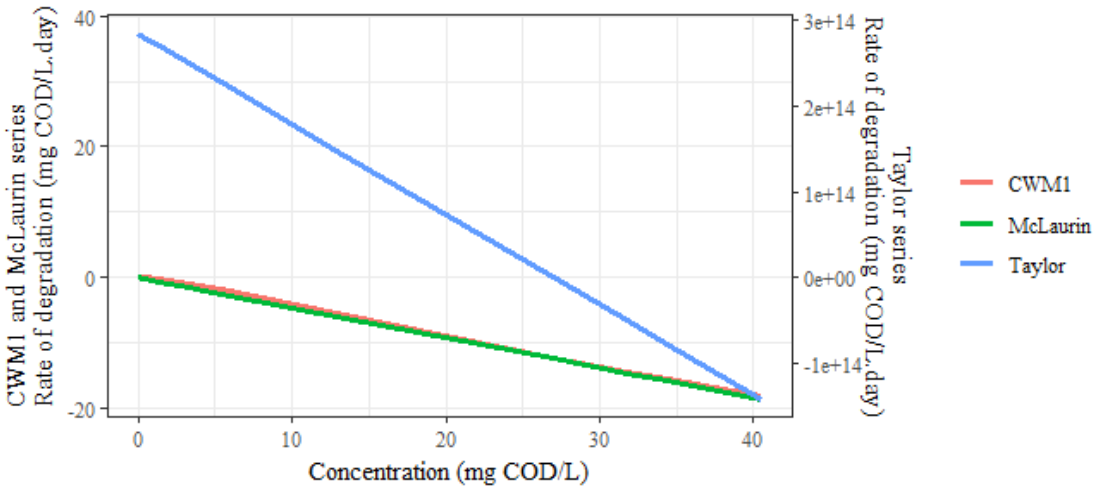

***Figure 6.3**: Comparison of the relationship between the concentration of acetate and the rate at which it is transformed during the anoxic growth of heterotrophic bacteria on COD, as predicted by the CWM1, the McLaurin series approximation and Taylor series approximation around the point 27 mg COD/L*

All three predictions showed that the higher the concentration of acetate, the higher the rate at which it was transformed in the anoxic growth of heterotrophic bacteria on COD. Within the modelled concentration range, the relationship between acetate concentration and the rate at which it is transformed in this process, as predicted by the CWM1 model, was linear. The McLaurin series is a good approximation of the CWM1 modelled rate, with a root-mean-square error of 0.3 mg COD/L.d, which is 3.3% of the average rate, within the modelled concentration range. From this information, it can be said that the McLaurin series approximation can be used to linearise the rate at which acetate is degraded in the anoxic growth of heterotrophic bacteria on COD.

The Taylor series approximation also predicted a linear relationship between the concentration of acetate and the rate at which it was transformed. However, the magnitude of Taylor series approximation was much greater than the CWM1 modelled. The Taylor series approximation also predicts a production of acetate above the basis concentration. The exponents calculated for the Taylor series approximation were very high and so the gradient of the approximation was much steeper than the CWM1 modelled rate.

Transformation of fermentation products, as acetate, in the anoxic growth of heterotrophic bacteria on acetate

The rate at which acetate is transformed in the anoxic growth of heterotrophic bacteria on acetate displayed the same behaviour as the anoxic growth of the bacteria on COD and the

same conclusions about the approximations can be drawn. The root-mean-square error of the McLaurin series approximation for the rate at which acetate is degraded in the anoxic growth of heterotrophic bacteria on acetate was 0.363 mg COD/L.d, which is 3.6% of the average rate, within the modelled concentration range, and the figures which display the comparisons of the approximations as well as the CWM1 modelled rate can be found in Appendix D.

Transformation of acetate in the growth of acetotrophic methanogenic bacteria

In Figure 6.4, a comparison of the relationship between the concentration of acetate and the rate at which it is transformed during the growth of acetotrophic methanogenic bacteria, as predicted by the CWM1, the McLaurin series approximation and Taylor series approximation around the point 27 mg O_2/L, is presented. All three models predicted that as the concentration of acetate increased, the rate at which it was transformed through the growth of acetotrophic methanogenic bacteria increased. The rate of transformation predicted by the CWM1 was not linear.

The higher the concentration of acetate, the greater the deviation of the McLaurin series approximation from the CWM1 modelled rate and at the basis concentration the McLaurin series approximation is 1.48 times higher than the CWM1 modelled rate. The Taylor series approximation around the basis concentration is similar to the CWM1 modelled rate but overestimates the rate of degradation at concentrations higher and lower than the basis concentration. Neither the McLaurin series nor the Taylor series approximation gives an accurate representation of the CWM1 modelled rate.

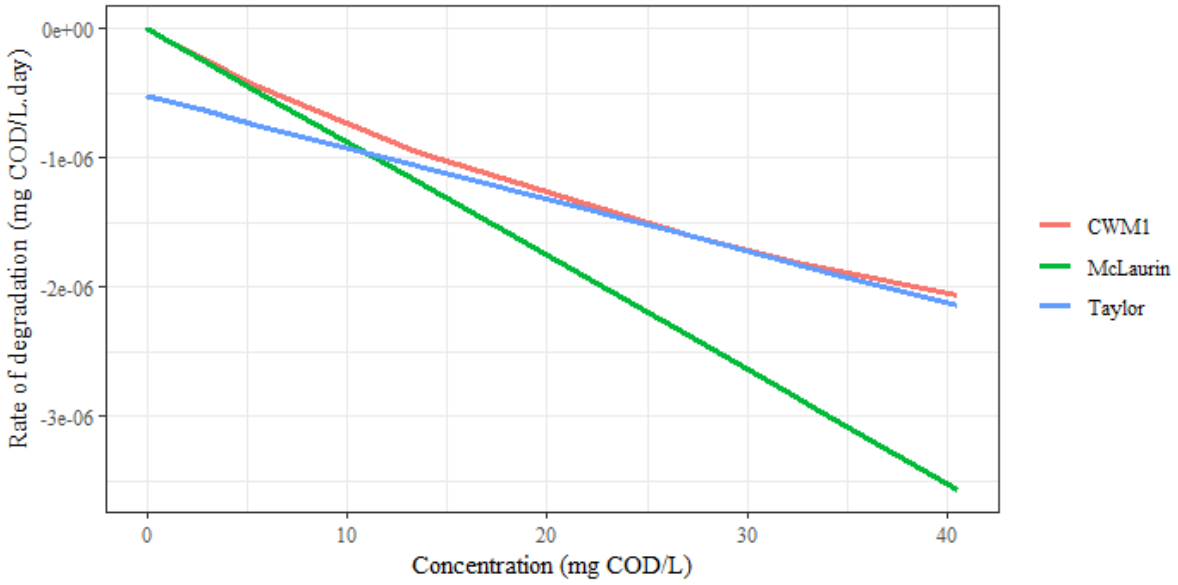

***Figure 6.4**: Comparison of the relationship between the concentration of acetate and the rate at which it is transformed during the growth of acetotrophic methanogenic bacteria, as predicted by the CWM1, the McLaurin series approximation and Taylor series approximation around the point 27 mg O_2/L*

Transformation of fermentation products as acetate in the growth of acetotrophic, sulphate reducing bacteria.

The rate at which acetate is degraded in the growth of acetotrophic, sulphate reducing bacteria had the same behaviour as was described for rate of transformation through the growth of acetotrophic, methanogenic bacteria and the same conclusions about the approximations can be drawn. The factor by which the McLaurin series approximation was out for each of the processes can be found in Table 6.4. Figures comparing the CWM1 modelled rate, and the approximations can be found in Appendix D.

Linearisation of the rate at which ammonium and ammonia nitrogen is transformed.

The rate at which ammonia and ammonium nitrogen (hereafter referred to as ammonium) (S_{NH}) is transformed, is dependent on seventeen processes. Ammonium is degraded in the process of nitrification and the growth of biomass and is produced in the degradation of organic matter and the lysis of biomass. Seven of these seventeen processes are not based on the concentration of ammonium and do not need to be linearised. The other ten processes all take on the form given in Equation 6.12. The basis concentration of ammonium is 57 mg N/L and the range across which the approximations were calculated was 0 mg N/L to 82.5 mg N/L.

Transformation of ammonium through the aerobic growth of heterotrophic bacteria on COD.

In Figure 6.5 a comparison of the relationship between the concentration of ammonium and the rate at which it is transformed during the aerobic growth of heterotrophic bacteria on COD, as predicted by the CWM1, the McLaurin series approximation, and Taylor series approximation around the point 57 mg COD/L, is presented. The y-axis on the left-hand side gives the rate determined using the CWM1 model and the Taylor series approximation, while the y-axis on the right-hand side gives the rate determined using the McLaurin series approximation. The rate determined using the McLaurin series approximation was several orders of magnitudes greater than the rates determined using the CWM1 model and Taylor series approximation and is shown on a separate axis so that the trend of all three responses can be seen clearly.

The relationship between the CWM1 modelled rate and the concentration of ammonium was exponential and as the concentration of ammonium increases, the rate at which it is degraded also increases but begins to flatten out at approximately 10 mg N/L. There comes a point at which the process is limited, not by the concentration of ammonium, but by the rate at which bacteria can degrade ammonium and so the relationship between the concentration of ammonium and the rate at which it is degraded in this process becomes close to zero-order.

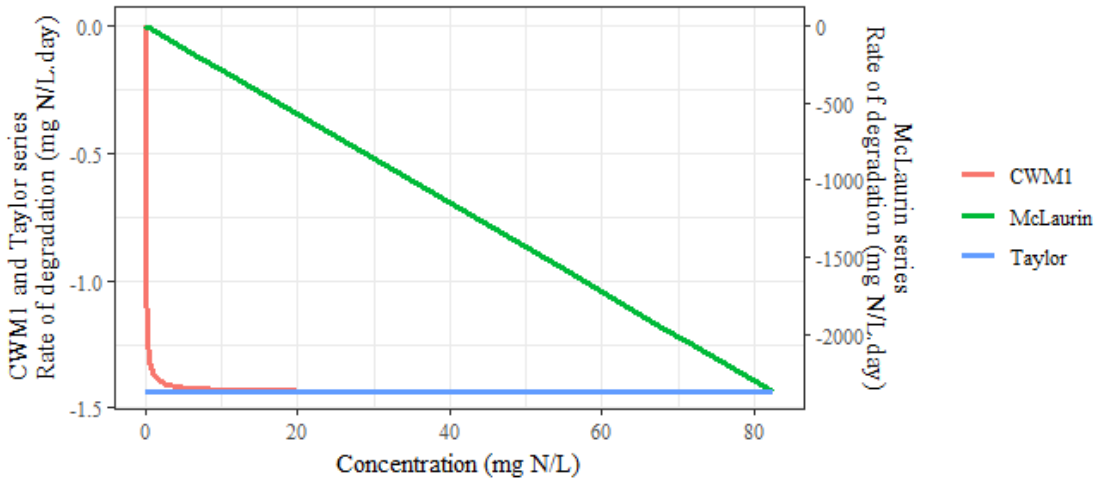

Figure 6.5*: Comparison of the relationship between the concentration of ammonium and the rate at which it is transformed during the aerobic growth of heterotrophic bacteria on COD, as predicted by the CWM1, the McLaurin series approximation and Taylor series approximation around the point 57 mg COD/L*

In Figure 6.5 it can be seen that for the concentration range of 30 mg N/L to 75 mg N/L the Taylor series approximation was very similar to that of the CWM1 modelled rate, with a root mean squared error of 2.93×10^{-4} mg N/L.d, which was 0.02% of the CWM1 modelled rate in that range. However, at concentrations lower than 25 mg N/L, the Taylor series approximation deviated from the CWM1 modelled and was not a good representation of the CWM1 modelled rate. Across the full range modelled, the root mean square error is 0.44 mg N/L.d. At the basis concentration, the McLaurin series approximation rate was 1141 times larger in magnitude than the CWM1 modelled rate. From this it can be stated that the two methods do not give a good enough estimation of the CWM1 modelled rate and linearisation of the rate was not achieved.

Transformation of ammonium and ammonia nitrogen in other processes

The relationship between the concentration of ammonium and the rate at which it is degraded in the six other concentration-dependent processes, is very similar to that of the relationship between the concentration of ammonium and the rate at which it is transformed through the aerobic growth of heterotrophic bacteria on fermentable, readily available COD. The linearisation techniques applied also follow the same behaviours and therefore the same conclusion is made. The magnitude of difference between the McLaurin series approximation and the CWM1 modelled rate at the basis concentration for the six other processes is given in Table 6.4. This is done to give some context to the other results. More details can be found in Appendix D.

Linearisation of the rate at which nitrate and nitrite nitrogen is transformed

The rate at which nitrate and nitrite nitrogen (hereafter referred to as nitrate) (S_{NO}) is degraded and produced is dependent on five processes in the CWM1 model. Nitrate is produced through nitrification and consumed through denitrification and anoxic sulphide oxidation. One of the five processes is not dependent on the concentration of nitrate and so does not need to be linearised in this context. The other four processes all take the form of Equation 6.12. The basis concentration of nitrate is 50.4 mg N/L and the range across which the approximations were compared with the CWM1 modelled is 0 mg N/L to 75.6 mg N/L.

Transformation of nitrate and nitrite nitrogen through the anoxic growth of sulphide oxidising bacteria on dihydrogen-sulphide sulphur

In Figure 6.6 a comparison of the CWM1 modelled rate, the McLaurin series, and the Taylor approximation around the basis concentration (50.4 mg N/L), for the transformation of nitrate through the anoxic growth of sulphide oxidising bacteria on dihydrogen-sulphide sulphur is displayed. The y-axis on the left-hand side gives the rate determined using the CWM1 model and the Taylor series, while the y-axis on the right-hand side gives the rate determined using the McLaurin series. The McLaurin series rate was several orders of magnitudes greater than the CWM1 model and Taylor series rates and has been shown on a separate axis so that the trend of all three responses can be seen clearly.

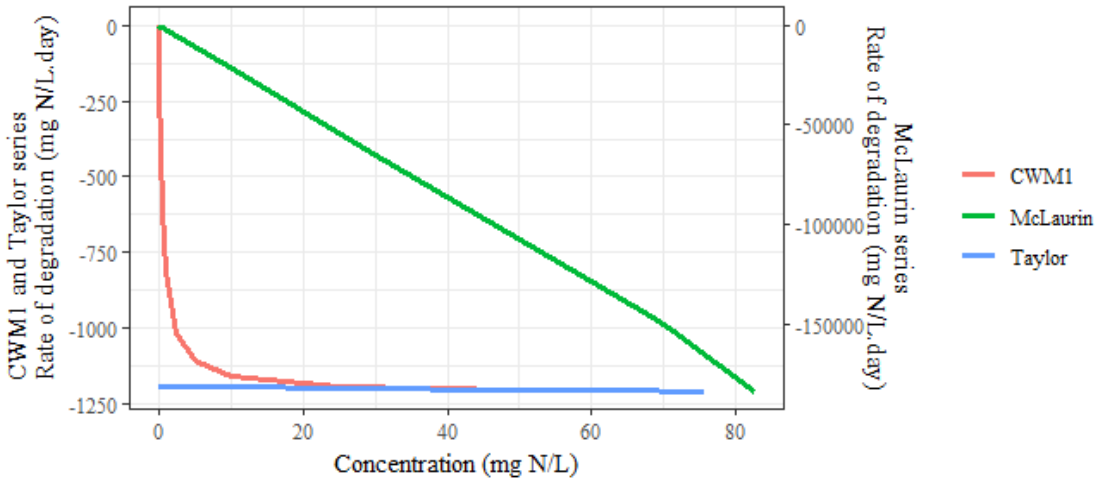

***Figure 6.6**: Comparison of the CWM1 modelled rate, the McLaurin series, and the Taylor approximation around the basis concentration (50.4 mg N/L), for the transformation of nitrate through the anoxic growth of sulphide oxidising bacteria on dihydrogen-sulphide sulphur*

The rate of transformation as predicted by the CWM1 modelled displayed exponential behaviour and flattened out at a relatively low concentration. This happened because the rate at which nitrate is transformed through the anoxic growth of sulphide oxidising bacteria on dihydrogen-sulphide sulphur is not limited by the concentration of nitrate but the rate at which the sulphide oxidising bacteria can transform nitrate. For the Taylor series approximation, it can be seen that in the concentration range of 30 mg N/L to 75 mg N/L the Taylor series approximation is very similar that of the CWM1 modelled rate, with a root mean squared error of 2.76 mg N/L.d, which is 0.23% of the CWM1 modelled rate at that point. However, at a concentration lower than 25 mg N/L, the Taylor series approximation deviates from the CWM1

modelled and is not a good representation of the CWM1 modelled rate. The McLaurin series approximation is a straight line with a much steeper gradient than the flattened-out section of the CWM1 modelled rate. At the basis concentration (50.4 mg N/L), the McLaurin series approximation was 101.8 times greater than the CWM1 modelled rate. From this it can be determined is that the McLaurin series approximation is not an accurate linearisation of the CWM1 modelled rate.

Transformation of nitrate and nitrite nitrogen through other processes

The relationship between the concentration of nitrate and the rate at which it is degraded in the three other concentration-dependent processes (aerobic and anoxic growth of heterotrophic bacteria on acetate and the growth of acetotrophic sulphate reducing bacteria), is very similar to that of the relationship between the substrate and degradation of aerobic growth of sulphide oxidising bacteria on dihydrogen-sulphide sulphur. The linearisation techniques applied also follow the same behaviours and therefore the same conclusion is made. The magnitude of difference between the McLaurin series approximation and the CWM1 modelled rate at the basis concentration for the three other processes is given in Table 6.4. This is done to give some context to the other results. More details can be found in Appendix D.

Linearisation of the rate at which sulphate sulfur is transformed.

The rate at which sulphate sulphur (hereafter referred to as sulphate) (S_{SO4}) is transformed dependent on three processes in the CWM1 model. In aerobic and anoxic sulphide oxidation sulphate is produced but these rates are not dependent on the concentration of the sulphate. Sulphate reducing bacteria use sulphate as an electron acceptor for the oxidation of acetate and is dependent on the concentration of sulphate This rate takes the form of Equation 6.12 in its simplified form. The basis concentration of sulphate is 35 mg S/L and the concentration range across which the approximations were modelled id 0 mg S/L to 52.5 mg S/L.

Transformation of sulphate-sulphur through the growth of acetotrophic, sulphate reducing bacteria.

In Figure 6.7 a comparison of the relationship between the concentration of sulphate and the rate at which it is transformed during the growth of acetotrophic sulphate reducing bacteria, as predicted by the CWM1, the McLaurin series approximation and Taylor series approximation around the point 35 mg O_2/L, is presented. All three models predicted that as the concentration

of sulphate increased, the rate at which it was transformed through the growth of acetotrophic sulphate reducing bacteria increased. The rate of transformation predicted CWM1 was neither linear nor exponential. The Taylor series approximation is only accurate around the basis concentration, but on either side, the Taylor series approximation is greater in magnitude than the CWM1 modelled rate. It can be concluded that this approximation is not a linear estimation of the CWM1 modelled rate. The McLaurin series approximation predicted a linear behaviour but as the concentration of sulphate increased, it deviated further from the CWM1 predicted concentration. At the basis concentration of 35 mg N/L the McLaurin series approximation is 2.84 times greater than the CWM1 modelled rate. This leads to the conclusion the McLaurin series cannot be used for the linear approximation of the degradation of sulphate in the growth of acetotrophic, sulphate reducing bacteria. Given that neither the McLaurin series nor the Taylor series approximation around the basis concentration gives a good linear estimation of the CWM1 modelled rate, it can be said that the rate at which sulphate is degraded cannot be represented in a linear approximation.

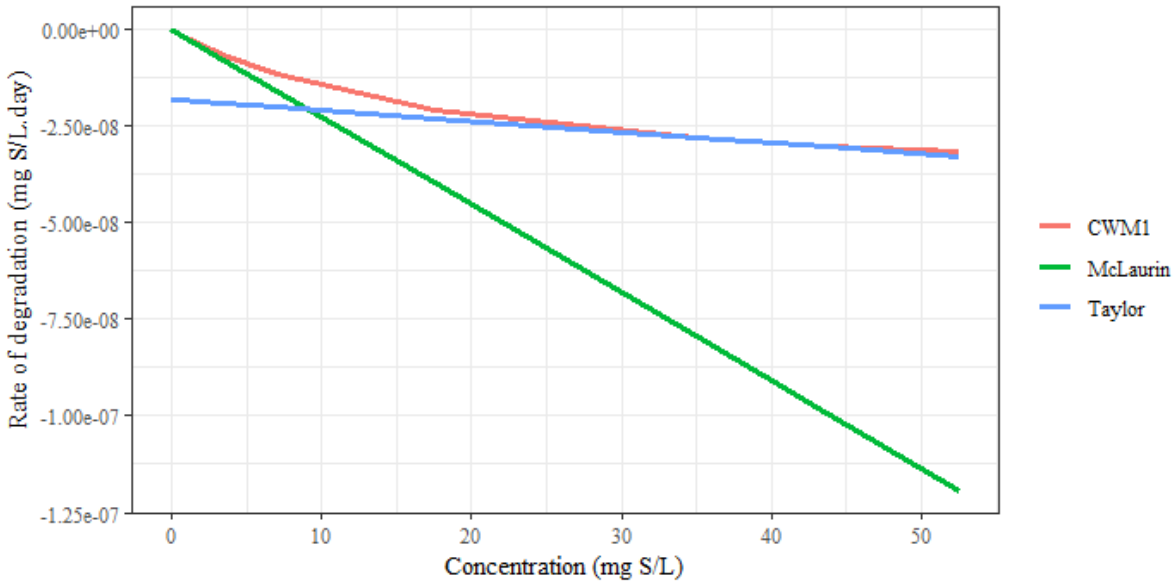

***Figure 6.7**: Comparison of the relationship between the concentration of sulphate and the rate at which it is transformed during the growth of acetotrophic sulphate reducing bacteria, as predicted by the CWM1, the McLaurin series approximation and Taylor series approximation around the point 35 mg O_2/L*

Linearisation of the rate at which dihydrogen-sulphide sulphur is transformed

The rate at which dihydrogen-sulphide sulphur (hereafter referred to us dihydrogen-sulphide) is transformed is dependent on three processes, all of which are dependent on the concentration

of dihydrogen-sulphide sulphur and take the form of Equation 6.12 in their simplified form. Dihydrogen-sulphide sulphur is produced in the growth of acetotrophic, sulphate reducing bacteria and is degraded in the aerobic and anoxic growth of sulphide oxidising bacteria on dihydrogen-sulphide sulphur. The basis concentration of dihydrogen-sulphide sulphur is 34 mg S/L and the concentration range across which the approximations were compared with the CWM1 modelled rate is 0 mg S/L to 51 mg S/L.

Transformation of dihydrogen-sulphide sulphur through the growth of acetotrophic, sulphate reducing bacteria.

In Figure 6.8 a comparison of the relationship between the concentration of dihydrogen-sulphide and the rate at which it is transformed during the growth of acetotrophic sulphate reducing bacteria, as predicted by the CWM1, the McLaurin series approximation and Taylor series approximation around the point 34 mg O_2/L, is presented. As the concentration of dihydrogen-sulphide increased, the rate which it was produced through the growth of acetotrophic sulphate reducing bacteria increased. The Taylor series approximation series was greater than the CWM1 modelled rate for the full concentration range, except at the basis concentration, at which points the rates were equal. As the concentration of dihydrogen-sulphide increased the more the McLaurin series approximation deviated from the CWM1 modelled rate. At the basis concentration, the McLaurin series approximation is 1.25 times greater than the CWM1 modelled rate. Neither the McLaurin series nor the Taylor series approximation is a good estimation of the CWM1 modelled rate.

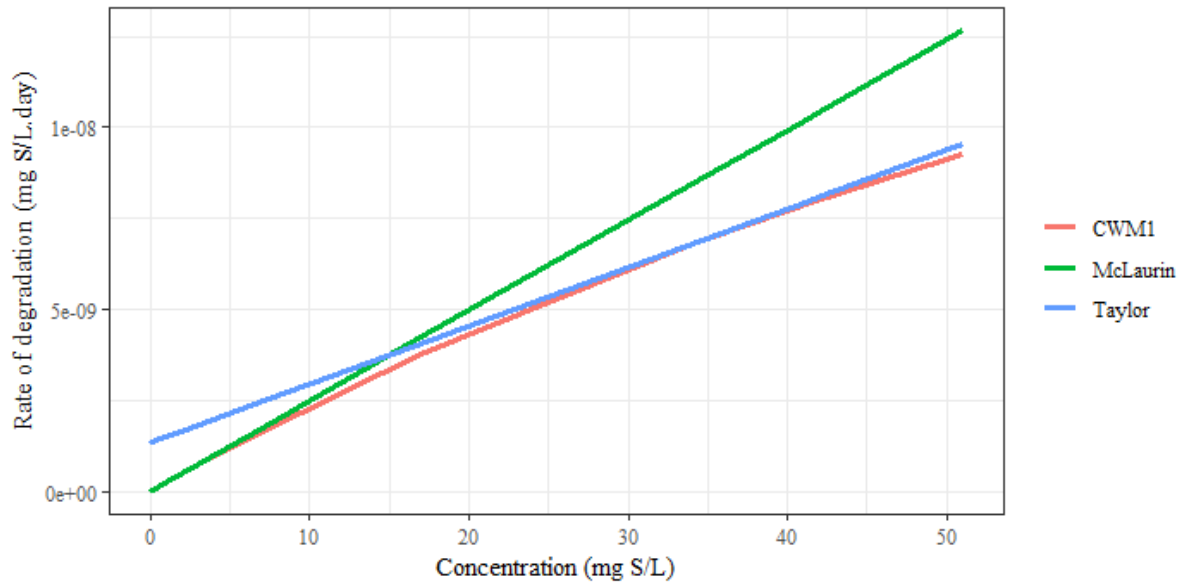

***Figure 6.8**: Comparison of the relationship between the concentration of dihydrogen-sulphide and the rate at which it is transformed during the growth of acetotrophic sulphate reducing bacteria, as predicted by the CWM1, the McLaurin series approximation and Taylor series approximation around the point 34 mg O_2/L*

Transformation of dihydrogen-sulphide sulphate through the aerobic growth of sulphide oxidising bacteria on dihydrogen-sulphide sulphur

In Figure 6.9 a comparison of the relationship between the concentration of dihydrogen-sulphide and the rate at which it is transformed through the aerobic growth of sulphide oxidising bacteria on dihydrogen-sulphide as predicted by the CWM1, the McLaurin series approximation and Taylor series approximation around the point 34 mg O_2/L, is presented. The y-axis on the left-hand side gives the rate determined using the CWM1 model and the Taylor series approximation, while the y-axis on the right-hand side gives the rate determined using the McLaurin series approximation. The rate determined using the McLaurin series approximation was several orders of magnitudes greater than the rates determined using the CWM1 model and Taylor series approximation and is shown on a separate axis so that the trend of all three responses can be seen clearly.

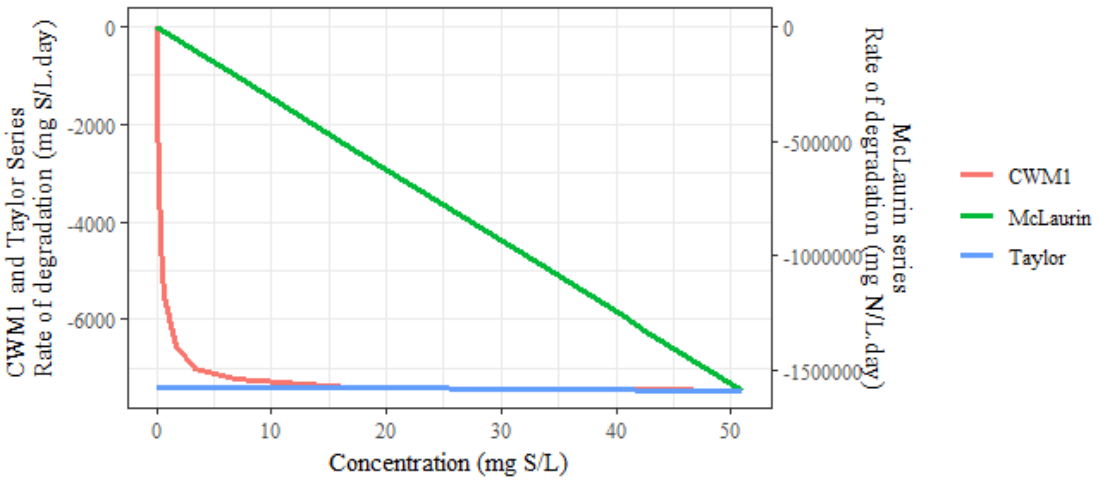

***Figure 6.9**: Comparison of the relationship between the concentration of dihydrogen-sulphide and the rate at which it is transformed through the aerobic growth of sulphide oxidising bacteria on dihydrogen-sulphide as predicted by the CWM1, the McLaurin series approximation and Taylor series approximation around the point 34 mg O_2/L*

The rate predicted by CWM1 modelled was an exponential function, and as the concentration of dihydrogen-sulphide increased, the rate at which it was degraded in this process increased in magnitude, before flattening out at a concentration of approximately10 mg S/L. At that point, the rate of aerobic growth of sulphide oxidising bacteria on dihydrogen-sulphide was not limited by the concentration of dihydrogen-sulphide but rather the rate at which sulphide oxidising bacteria can degrade the dihydrogen-sulphide. In the range of 10 mg S/L and 50 mg S/L the Taylor series approximation was similar to the CWM1 modelled rate and the root mean square error was 66.7 mg S/L.d, which is 0.9% of the CWM1 modelled rate. However, at concentrations lower than 10 mg S/L the error was much larger at 4481 mg S/L.d. From this, it can be said that the Taylor series approximation is not a good estimate of the CWM1 modelled rate. The McLaurin series approximation displayed a linear behaviour and was magnitudes higher than the CWM1 modelled rate. At the basis concentration, (34 mg S/L), the magnitude of the McLaurin series approximation is 143 times greater than the CWM1 modelled rate at the same point. Considering the deviation in the behaviour and the magnitude of the difference at the basis concentration, it can be concluded that the McLaurin series approximation is not an appropriate estimation of the relationship between the concentration of dihydrogen-sulphide sulphur and the rate at which it is degraded in the aerobic growth of sulphide oxidising bacteria on dihydrogen-sulphide sulphur.

Transformation of dihydrogen-sulphide sulphur in other processes

The relationship between the concentration of dihydrogen-sulphide sulphur and the rate at which it is degraded in the anoxic growth of sulphide oxidising bacteria on dihydrogen-sulphide sulphur was very similar to that of the aerobic growth of sulphide oxidising bacteria on dihydrogen-sulphide sulphur. The linearisation techniques applied also follow the same behaviours and therefore the same conclusion is made. The magnitude of difference between the McLaurin series approximation and the CWM1 modelled rate at the basis concentration for the anoxic growth of sulphide oxidising bacteria on dihydrogen-sulphide sulphur is given in Table 6.4. This is done to give some context to the other results. More details can be found in Appendix D.

Linearisation of the rate at which slowly biodegradable particulate COD is transformed

The rate at which slowly biodegradable, particulate COD is degraded and produced is dependent on seven processes. Six of these processes are the lysis of different bacterial groups, in which slowly biodegradable, particulate COD is produced and none of these processes are dependent on the concentration of slowly biodegradable, particulate COD. The one process which is dependent on the concentration of slowly biodegradable, particulate COD is hydrolysis and this rate takes the simplified form given in Equation 6.12. The basis concentration of slowly biodegradable, particulate COD used was 33 mg O_2/L and the concentration range across rate was modelled was 0 mg O_2/L to 49 mg O_2/L.

Transformation of slowly biodegradable particulate COD through hydrolysis

In Figure 6.10 a comparison of the relationship between the concentration of biodegradable, particulate COD, and the rate at which it is transformed through the hydrolysis as predicted by the CWM1, the McLaurin series approximation and Taylor series approximation around the point 33 mg O_2/L, is presented. All three models predicted that as the concentration of biodegradable, particulate COD increased, the rate at which it was transformed through hydrolysis also increased. The CMW1 modelled rate was neither linear nor exponential in the concentration range. From this figure, it can be seen that the McLaurin series deviates from the CWM1 modelled rate at concentrations greater than 0 mg O_2/L. At the basis concentration (33 mg O_2/L) the McLaurin series approximation is 2.65 times greater in magnitude than the CWM1 modelled rate. This deviation indicates that the linear McLaurin series approximation

is not a good estimation of the CWM1 modelled rate. From a comparison of the CWM1 modelled rate and the Taylor series approximation around the basis concentration (33 mg O_2/L) it can be determined that the Taylor series approximation estimates a rate of greater magnitude than the CWM1 modelled rate at every point except the basis concentration. This linear approximation is not a good estimation of the CWM1 modelled rate.

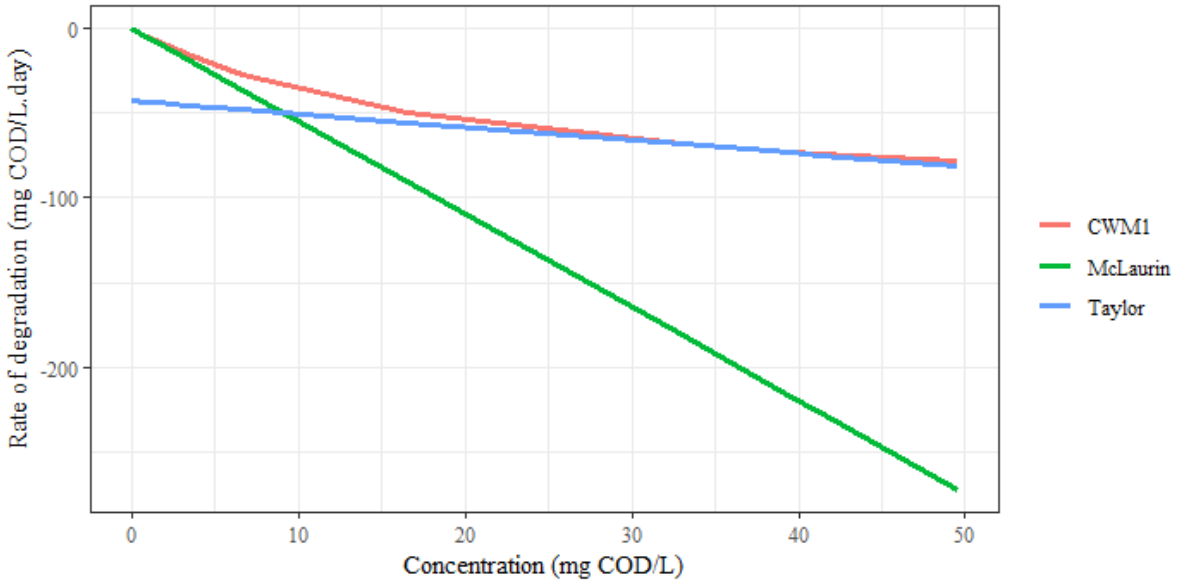

***Figure 6.10**: Comparison of the relationship between the concentration of biodegradable, particulate COD, and the rate at which it is transformed through the hydrolysis as predicted by the CWM1, the McLaurin series approximation and Taylor series approximation around the point 33 mg O_2/L*

The code used and data used to generate Figure 6.1 to Figure 6.10 can be found in Appendix E.

6.3.3 Summary of linear approximation results

In Table 6.4 a comparison of the magnitude of the CWM1 modelled rates and McLaurin series approximation of rates at the basis concentration of each component is given. The Taylor series approximations are not included in this table because the Taylor series approximations were determined around the basis concentration and therefore, at that concentration were equal to the CWM1 modelled rate. The McLaurin series gave similar looking graphs in all cases with the exception of the magnitude of the deviation in all cases given in Table 6.4.

***Table 6.4**: Comparison of the magnitude of the CWM1 modelled rate and the McLaurin series approximation at the basis concentration, for each of the components and processes which are concentration-dependent*

Component	Process	Factor by which the McLaurin series approximation is out when compared to the CWM1 modelled rate, at the basis concentration
Dissolved oxygen	Anoxic growth of heterotrophic bacteria on fermentable, readily biodegradable COD	5.3
	Growth of autotrophic nitrifying bacteria on fermentation products, as acetate	1.86
	Aerobic growth sulphide oxidising bacteria on dihydrogen-sulphur	5.3
Fermentable, readily biodegradable COD	Aerobic growth of heterotrophic bacteria fermentation products, as acetate	692.0
	Growth of fermenting bacteria	7.07
Fermentation products, as acetate	Growth of acetotrophic, sulphate reducing bacteria	2.13
Ammonia and ammonium nitrogen	Aerobic growth of heterotrophic bacteria fermentation products, as acetate	1141
	Anoxic growth of heterotrophic bacteria on fermentable, readily biodegradable COD	1141
	Anoxic growth of heterotrophic bacteria fermentation products, as acetate	1141
	Growth of autotrophic nitrifying bacteria on fermentation products, as acetate	115
	Growth of fermenting bacteria	5701
	Growth of acetotrophic methanogenic bacteria	5701
	Growth of acetotrophic, sulphate reducing bacteria	5701
	Aerobic growth sulphide oxidising bacteria on dihydrogen-sulphur	1141
	Anoxic growth sulphide oxidising bacteria on dihydrogen-sulphur	1141
Nitrate and nitrite nitrogen	Aerobic growth of heterotrophic bacteria fermentation products, as acetate	101.8
	Anoxic growth of heterotrophic bacteria fermentation products, as acetate	101.8
Dihydrogen-sulphide sulphur	Anoxic growth sulphide oxidising bacteria on dihydrogen-sulphur	142.7

Dissolved oxygen

The rate at which dissolved oxygen is removed in CWs is dependent on four processes. For each of these processes, the McLaurin series approximation deviated further from the CWM1 modelled rate as the concentration of dissolved oxygen increased, and therefore the McLaurin series was not used to linearise the reaction rates of dissolved oxygen. The Taylor series approximation was similar in magnitude and gradient to the CWM1 modelled rate but only within a very limited range. The greatest deviation was at low concentrations of dissolved oxygen, and as these concentrations are common in CWs, the Taylor series approximation was not used to linearise the reaction rates of dissolved oxygen.

Fermentable, readily biodegradable COD

The rate of degradation of fermentable, readily available COD in CWs is dependent on three processes. For each of these processes, the McLaurin series approximation deviated further from the CWM1 modelled rate as the concentration of fermentable, readily available COD increased, and therefore the McLaurin series was not used to linearise the reaction rates of fermentable, readily available COD. The Taylor series approximation was within the same magnitude as the CWM1 modelled rate, neither the gradient at the basis concentration nor the type of behaviour displayed were the same. Because of this, the Taylor series will deviate further at higher concentrations and as fermentable, readily available COD is the main COD component (according to CWM1) high concentrations are expected in CWs. This was the case for all three processes and therefore the Taylor series approximation was not used to linearise the reaction rates of fermentable, readily available COD.

Fermentation products, as acetate

The rate of transformation of fermentation products as acetate is dependent on four processes. For two of these processes, the McLaurin series approximation deviated further from the CWM1 modelled as the concentration of fermentation products as acetate increased, and so McLaurin series approximations could not be used for these processes. The Taylor series approximation of the rate at which acetate is transformed in the growth of acetotrophic, methanogenic bacteria and the growth of acetotrophic sulphate reducing bacteria was within the same magnitude as the CWM1 modelled rates but displayed a different trend and would have deviated even more at higher concentrations. Since fermentation products as acetate is a

form of COD, high concentrations are expected in a CW and therefore the Taylor series approximation could not be used for these two processes.

The rate was which acetate is transformed in anoxic growth of heterotrophic bacteria on COD and acetate, showed the best linearisation results. The McLaurin series approximation was similar to the CWM1 modelled, with the gradient and magnitude of the two rates being the same. From this, it can be said that it was possible to linearise two of the rates at which fermentation products as acetate is degraded.

Ammonia and ammonium nitrogen

The rate at which ammonium and ammonia nitrogen is transformed in CWs is dependent on six processes. For each of these processes, the McLaurin series approximation deviated further from the CWM1 modelled rate as the concentration of ammonium and ammonia nitrogen increased, and in some cases, the deviation was out by a factor in excess of 5700. Therefore, the McLaurin series was not used to linearise the reaction rates of ammonium and ammonia nitrogen. The Taylor series approximation had the same magnitude and gradient as the CWM1 modelled rate for almost the full concentration range. The only area in which there was a large difference between the CWM1 modelled rate, and the approximation was at a concentration of 0 mg N/L. The Taylor series approximation could be used to estimate the linear rates of ammonium and ammonia nitrogen in these processes as long as the concentration of ammonium and ammonia nitrogen is greater than 0.

Nitrate and nitrite nitrogen

The rate at which nitrate and nitrite nitrogen is transformed in CWs is dependent on three processes. For each of these processes, the McLaurin series approximation deviated further from the CWM1 modelled rate as the concentration of nitrate and nitrite nitrogen increased, and therefore the McLaurin series was not used to linearise the reaction rates of nitrate and nitrite nitrogen. The Taylor series approximation had a similar magnitude and gradient as the CWM1 modelled rate but only within a very limited range. The greatest deviation was at low concentrations of nitrate and nitrite nitrogen, and as these concentrations are common in CWs, the Taylor series approximation was not used to linearise the reaction rates of nitrate and nitrite nitrogen.

Sulphate sulphur

The rate of transformation of sulphate sulphur in CWs is dependent on one process. The McLaurin series approximation deviated further from the CWM1 modelled rate as the concentration of sulphate sulphur increased, and therefore the McLaurin series was not used to linearise the reaction rates of sulphate sulphur. The Taylor series approximation was within the same magnitude as the CWM1 modelled rate, but both the gradient and line behaviour were not the same. The only point at which they were similar was the basis concentration. Because of this, the Taylor series will deviate further at higher concentrations Therefore the Taylor series approximation was not used to linearise the reaction rates of sulphate sulphur.

Dihydrogen-sulphide sulphur

The rate at which dihydrogen-sulphide sulphur is transformed in CWs is dependent on three processes. For two of these processes (the aerobic and anoxic growth of sulphide oxidising bacteria on dihydrogen-sulphide), the McLaurin series approximation deviated further from the CWM1 modelled rate as the concentration of dihydrogen-sulphide sulphur increased. Therefore, the McLaurin series was not used to linearise these reaction rates of dihydrogen-sulphide sulphur. The Taylor series approximation for these two rates was similar in magnitude and gradient to the CWM1 modelled rate for a large section of the concentration range. The only point at which there was a large difference between the CWM1 modelled rate, and the approximation was at a concentration of 0 mg S/L. The Taylor series approximation could be used to estimate the linear rates of dihydrogen-sulphide sulphur in these processes as long as the concentration of ammonium and ammonia nitrogen is greater than 0.

The approximations of the third process (the growth of acetotrophic sulphate reducing bacteria) yielded different results. Both the Taylor series and McLaurin series approximations were within the same magnitude as the CWM1 modelled rate but had different gradients, and at higher concentrations would deviate significantly from the CWM1 modelled. For this reason, neither the McLaurin series nor the Taylor series approximations can be used in this case.

Slowly biodegradable, particulate COD

The rate of degradation of slowly biodegradable, particulate COD in CWs is dependent on one process. The McLaurin series approximation deviated further from the CWM1 modelled rate as the concentration of slowly biodegradable, particulate COD increased, and therefore the

McLaurin series was not used to linearise the reaction rates of slowly biodegradable, particulate COD. The Taylor series approximation was within the magnitude as the CWM1 modelled rate, but both the gradient and shape of the response were not the same. The only point at which they were similar was the basis concentration. Because of this, the Taylor series will deviate further at higher concentrations, therefore the Taylor series approximation was not used to linearise the reaction rates of slowly biodegradable, particulate COD.

6.4: Conclusion

The aim stated at the beginning of this chapter was to linearise the process reactions rates of CWM1 to be combined with the adapted method-of-moments techniques. Three methods were considered for the approximation of linear reaction rates: Taylor series, McLaurin series and Padé approximations. Upon investigation, it was determined that the Padé approximations and the Taylor series approximations were the same and so only the latter was discussed in detail. The linearisation approximations were applied to every rate in which the concentration of component *'i'* affected the rate at which process *'l'* proceeded.

The McLaurin series approximation proved to be a good estimate for the rate at which fermentation products as acetate was degraded in the anoxic growth of heterotrophic bacteria on fermentable, readily available COD and fermentation products as acetate. However, in no other cases was the McLaurin series an accurate approximation and in many instances was out by factors of greater than 100.

The Taylor series approximation was able to estimate the CWM1 modelled rate within a specific concentration range for the following processes:

- The rate at which dissolved oxygen was transformed through the:
    - Aerobic growth of heterotrophic bacteria on fermentable, readily biodegradable COD
    - Anoxic growth of heterotrophic bacteria on fermentable, readily biodegradable COD
    - Growth of autotrophic nitrifying bacteria on ammonium and ammonia nitrogen
    - Aerobic growth of sulphide oxidising bacteria on dihydrogen-sulphide
- The rate at which ammonium and ammonia nitrogen was transformed through:

    - Aerobic growth of heterotrophic bacteria on fermentable, readily biodegradable COD
    - Aerobic growth of heterotrophic bacteria on fermentation products, as acetate
    - Anoxic growth of heterotrophic bacteria on fermentable, readily biodegradable COD
    - Anoxic growth of heterotrophic bacteria on fermentation products, as acetate
    - Growth of autotrophic nitrifying bacteria on ammonium and ammonia nitrogen
    - Growth of fermenting bacteria
    - Growth of acetotrophic, methanogenic bacteria
    - Growth of acetotrophic sulphate reducing bacteria
    - Aerobic growth of sulphide oxidising bacteria on dihydrogen-sulphide
    - Anoxic growth of sulphide oxidising bacteria on dihydrogen-sulphide
- The rate at which nitrate and nitrite nitrogen transform through the:
    - Aerobic growth of heterotrophic bacteria on fermentation products, as acetate
    - Anoxic growth of heterotrophic bacteria on fermentation products, as acetate
    - Growth of acetotrophic sulphate reducing bacteria
    - Anoxic growth of sulphide oxidising bacteria on dihydrogen-sulphide
- The rate at which dihydrogen-sulphide sulphur is transformed through the:
    - Aerobic growth of sulphide oxidising bacteria
    - Anoxic growth of sulphide oxidising bacteria

In other cases, the Taylor series approximation was in the same range in terms of magnitude, but the gradient was different for the full range and therefore was not a good approximation of the CWM1 modelled rate. This was true for the follow rates.

- The rate at which fermentable, readily available COD is transformed through:
    - Aerobic growth of heterotrophic bacteria on fermentable, readily available COD
    - Aerobic growth of heterotrophic bacteria on fermentation products as acetate
    - Growth of fermenting bacteria
- The rate at which fermentation products, as acetate, is transformed through:
    - Growth of acetotrophic, methanogenic bacteria
    - Growth of acetotrophic, sulphate reducing bacteria
- The rate at which nitrate and nitrite nitrogen is transformed through:
    - Anoxic growth of sulphide oxidising bacteria on dihydrogen-sulphate sulphide

- The rate at which sulphate-sulphide is transformed through:
    - Growth of acetotrophic, sulphate reducing bacteria
- The rate at which dihydrogen-sulphate is transformed through:
    - Growth of acetotrophic, sulphate reducing bacteria

There were two cases in which the Taylor series approximation was in the same magnitude and had the same gradient as the CWM1 modelled rate: the rate at which fermentation products, as acetate, were transformed through the anoxic growth of heterotrophic bacteria on fermentable, readily available COD and the anoxic growth of heterotrophic bacteria on fermentation products as acetate. For these two cases the linearisation technique applied was successful.

While there was some success in the linearisation of the reaction rates of CWM1, it was not achievable for all components in all processes. In order for the CWM1 biokinetic model to be combined with the adapted method-of-moments technique, all rates need to be first-order. This was not achieved using the Taylor series approximation or the McLaurin series approximation. Without the combination of the hydraulic modelling and the kinetic modelling, it is not possible to calibrate the full technique on a CW and only the hydraulic modelling part of the technique can be validated. More work needs to be done to determine if there are specific ranges in which the Taylor series approximation could be effective in linearising the reaction rates or to determine if stepwise Taylor series approximation could be used. It is not recommended that the McLaurin series approximation technique is used. Investigation into the use of other linearisation techniques, could be studied in future work.

Chapter 7: Validation of the modelling techniques on a small-scale indoor reactor

Section 7.3 has been published in Science of the Total Environment and was peer reviewed prior to publication (Stephenson, R., Sheridan, C. and Kappelmeyer, U. (2020) 'A curve-shift technique for the use of non-conservative organic tracers in constructed wetlands', *Science of The Total Environment*. Elsevier B.V., 752, p. 141818. doi: 10.1016/j.scitotenv.2020.141818). The contribution of the co-authors towards the work is primarily that of supervision or collaboration and the experimental work and write-up was conducted by the author of this thesis.

7.1: Introduction

The modelling of CWs is dependent on accurate characterisation of the hydraulic behaviour of the fluid flowing through the CW. The theory and mathematical basis behind the two residence time distribution techniques have been discussed in previous chapters. The next step is to validate these techniques with experimental data. The previous chapter showed that linearisation was not possible for the majority of the reaction rates in CWM1. However, it is still possible to validate the time section of the adapted method-of-moments technique. Validation of the adapted method-of-moments technique and curve-shift technique requires experimental data from residence time distribution studies. Impulse-response tracer studies were conducted for the validation of the adapted method-of-moments technique and step-change tracer studies were conducted for the validation of the curve-shift technique. Experimental data and the application of the techniques to this data is given in this Chapter.

7.2: Method-of-Moments Adaptation

To evaluate the effectiveness of the time section of the adapted method-of-moments technique, impulse-response tracer studies were conducted on two types of systems: a set of columns filled with gravel (similar to that which is used in CWs), and a small-scale CW inside a green house. In both cases uranine was the tracer used. A detailed breakdown of how the experiments were conducted and a description of each of the systems is given in Section 3.1.1.

7.2.1 Impulse-Response Tracer Studies Conducted on Vertical Flow Columns

The first set of experiments conducted to test the time section of the adapted method-of-moments technique was on a set of three identical columns filled with pea gravel. A picture of the columns can be seen in Figure 7.1. This experiment was conducted to assess the effectiveness of the technique in describing the flow of a system which did not contain plants, and where the non-idealities come from the heterogeneity of the system. The columns were made of orange PVC and covered with a lid made of the same material. The packing material of the columns was pea gravel which had a diameter of 2 mm-8 mm and a void fraction of 0.36. The columns were identical in size with the dimensions being 0.15 m x 0.4 m (d x h). Each column was filled with the packing media to a height of 0.37 m. The system consisted of two ports, the inlet port at a height of 0.04 m above the base and the outlet port at a height of 0.37 m above the base. The water volume of the system was 2.16 l. A peristaltic pump was used to deliver water to the columns at a continuous and consistent flow rate of 31 ml/min. The nominal residence time of each of the columns was 79 minutes and the flow velocity was 0.11 m/s. At this velocity the flow was laminar and therefore the information inferred from these tests can be applied to the system at any other flow rate in the laminar range (Levenspiel, 1999). Samples were taken every 4 minutes, which is just over 5% of the nominal residence time and considered frequent enough to accurately capture the hydraulic behaviour of the system. Samples were taken until the concentration of tracer reached background concentrations again and more than 3 times the nominal residence time passed. Details of how the experiment was conducted, as well as the analytical methods used are given in Chapter 3.



***Figure 7.1**: Picture of the vertical flow gravel columns on which impulse-response tracer studies were conducted.*

Results and Discussion

In Figure 7.2 the data from the impulse-response tracer study conducted on the gravel columns is displayed. The black line indicates the mean behaviour of the three vertical flow columns, and the shaded, grey area indicates the standard deviation of the three columns. The peak of the tracer came through the system at a time of 40 minutes, which is just greater than half the nominal residence time. The peak arrived suddenly, with the concentration increasing rapidly from background concentrations of 1.49 ppb to 44 ppb in 24 minutes. This rapid increase, and the time at which it reaches the outlet, indicates that the fluid passes through the system more quickly than expected. There was a long tail after the tracer concentration peaks and it took 240 minutes (from the peak) for the tracer concentration to return to background concentrations. This long tail indicates a large amount of dispersion and micro-mixing in the system. This could be due to the heterogenous nature of the gravel (Suliman, Futsaether and

Oxaal, 2007) but is also a known behaviour of packed bed reactors(Levenspiel, 1999).

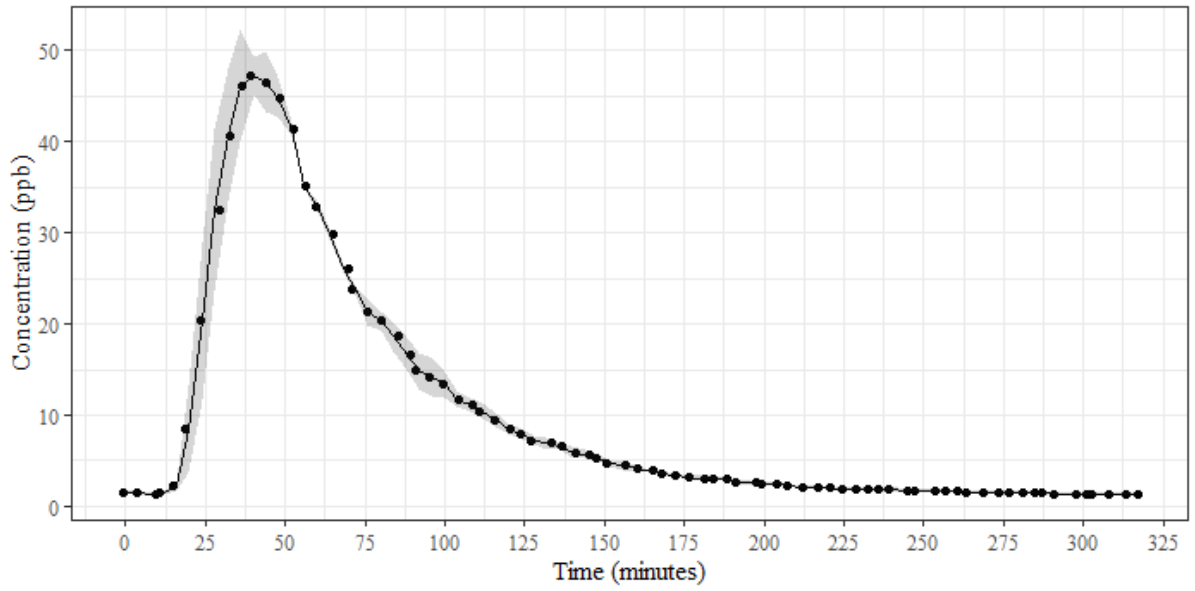

***Figure 7.2**: Results from the impulse-response tracer study conducted on gravel column triplicates*

In Table 7.1 the hydraulic parameters determined from the impulse-response tracer study on the three vertical flow columns are displayed. The peak of the impulse-response curve was at 40 minutes. The mean residence time, as per the definition given in Section 2.8.4, for the vertical flow columns was 80.9 minutes. This is only 2.4% higher than the nominal residence time of the systems. The mean residence time is close to the nominal residence time as a result of a combination of two factors. The first phenomenon is that the peak of the impulse-response curve, which is the highest concentration of tracer, reached the outlet of the system at approximately half the nominal residence time. If this were the only influence on mean residence time, the mean residence time would be significantly lower than the nominal residence time. However, there is a second phenomenon which affects the mean residence time and that is the long tail of the response curve. Dispersion causes the tracer to spread out, which in turn causes a long tail in the impulse-response curve. This has an effect of increasing the mean residence time of the system. The combination of these two factors, one favouring a smaller mean residence time and the other a larger mean residence time means that the actual mean residence time ends up being quite close to the nominal residence time. This is an indication of how a system can display non-ideal behaviour and yet the mean residence time of the system does not show the non-ideal nature.

The number of tanks in series which can be used to describe this system is 1.90. This value is close to 1 (as opposed to infinity) which indicates a large amount of mixing in the system. The long tail of the response is an indication of a large amount of micro-mixing which would lead to an N value close to 1. This micro-mixing could be due to the heterogenous nature of the gravel; a variation in grain size leads to a variation in hydraulic conductivity, and one of the results is micro-mixing (Suliman, Futsaether and Oxaal, 2007). The effective volume ratio of the gravel columns is 1.02. This is not surprising as the mean residence time is very close to the nominal residence time. This value indicates that while there may be dispersion in the system, the full volume of the columns is still being used. The hydraulic efficiency of the columns is 0.485. This parameter factors in the effective volume ratio and the extent of mixing in a system. While the effective volume ratio was higher than 1 (which is a good thing) the small N value, indicative of lots of micro-mixing, means that the system only has a hydraulic efficiency of 48.5%.

***Table 7.1**: Hydraulic parameters obtained from the impulse response tracer studies conducted on gravel column triplicates*

Parameter	**Value**	**Unit**
$\mathbf{t_m}$	80.9	min
$\boldsymbol{\sigma^2}$	3572	min^2
N	1.90	-
λ	0.485	-
e	1.02	-

To validate the time section of the method-of-moments technique, the area under the E(t) vs time curve was broken up into 5 portions of approximately equal area (~20%). The limits of each section were selected such that the areas were approximately equal. In Figure 7.3, the 5 portions into which the area under the E(t) curve was divided into, is presented. The black line is the average response of the three vertical flow columns and the grey shaded area indicates the standard deviation, as in Figure 7.2. Each of the green shaded areas represents approximately 20% of the area under the curve and therefore approximately 20% of the fluid in the system. The specific percentages as well as the mean residence time and variance for each of the shaded portions can be found in Table 7.2.

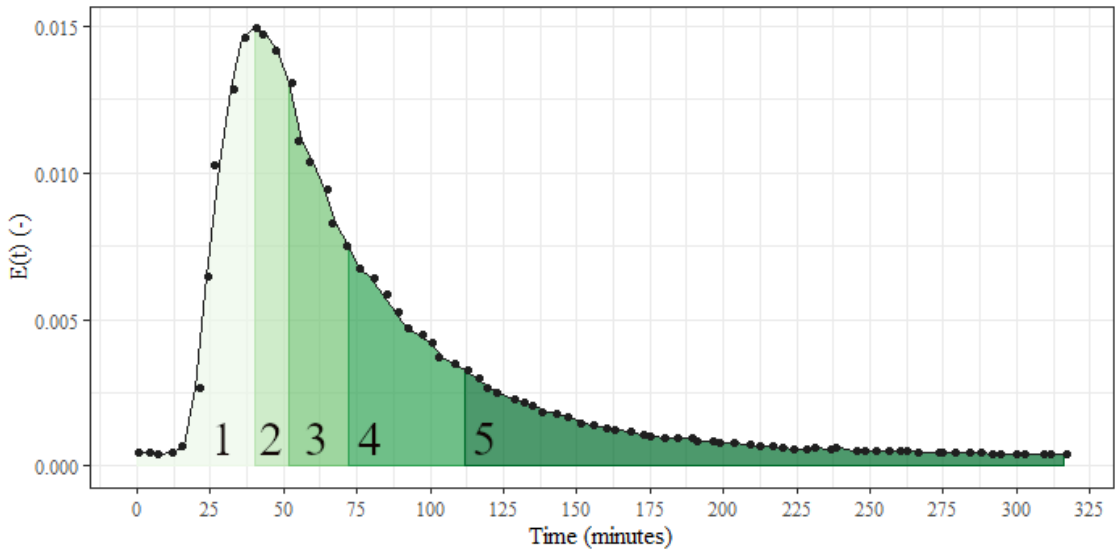

***Figure 7.3**: Results from an impulse-response tracer study conducted on the gravel column triplicates, divided into 5 portions*

Portion 1 of the graph, which was between 0 minutes and 40 minutes had a volume percentage of 23% and a mean residence time of 31 minutes. This means that 23% of the fluid in the system spent an average of 31 minutes in the column before leaving. The nominal residence time of the potion was determined to be 24.22 minutes. The mean residence time was almost double the nominal residence time and this indicates that this portion of fluid took longer to move through the system than expected. The result of this shorter time is that the reaction time during which contaminants can be broken down, is reduced and the outlet concentration of contaminants is higher than if there was ideal plug flow.

Portion 2 of the graph was between 40 minutes and 52 minutes, which was only 12 minutes. While this portion represented a similar fraction of fluid compared to all the other portions, the time period over which it is measured was the smallest, at only 12 minutes. This is because the peak came through in this portion of fluid. This portion had a volume percentage of 17% and a mean residence time of 45.85 minutes. This means that 17% of the volume spent that amount of time in the system. In comparison to the nominal residence time of the portion, which was 51.96 minutes, the mean residence time is 12% lower. This indicates that portion 2 of the fluid spent less time in the system than expected. The consequence of this is that there is less time for contaminants to be broken down in this portion than expected and this will influence the overall ability of the system to break-down contaminants.

The third portion lies between 52 minutes and 72 minutes, a time difference of 20 minutes. This portion has a mean residence time of 61.05 minutes and represents 20% of the total fluid

of the system. The nominal residence time of portion 3 was 65.80 minutes. This is 4 minutes higher than the mean residence time for the portion. Like portion 1 and portion 2, a lower mean residence time than nominal residence time means that the time during which contaminant degradation can take place is less than expected and therefore the expected outlet concentration for the full system is affected.

Portion 4 represented 20% of the fluid of the system and was between 52 minutes and 112 minutes, which was a full 60-minute time period. Portion 4 had a mean residence time of 89.15 minutes. The nominal residence time of the system is 86.03 minutes. Portion 4 is the first portion where the mean residence time was longer than the nominal residence time. The consequence of this was that the contaminants in this portion of fluid spent longer in the system than expected which meant that there is more contaminant degradation in this section than expected. This will have an impact on the contaminant reduction of the full system.

The final portion was between 112 minutes and 316 minutes and was the longest time period of the five sections, at 204 minutes. This portion represented 20% of the fluid in the system and had a mean residence time of 177.7 minutes. The mean residence time of this portion was 41% greater than the nominal residence time of the portion which was 126.1 minutes. This means that there is more time for contaminant degradation than expected which will improve the contaminant removal of the overall system.

The original data and code used to produce Figure 7.2 and Figure 7.3 can be found in Appendix F and Appendix G respectively.

***Table 7.2**: Hydraulic parameters for 5 portion obtained from the impulse response tracer studies conducted on the gravel vertical flow columns.*

Portion	Parameter	Value	Unit
1	t_1	31.00	min
	τ_1	24.22	min
	γ_1	0.23	(-)
	σ^2_1	11.25	min^2
2	t_2	45.85	min
	τ_2	51.96	min
	γ_2	0.17	(-)
	σ^2_2	40.35	min^2
3	t_3	61.05	min
	τ_3	65.80	min
	γ_3	0.20	(-)
	σ^2_3	186.08	min^2
4	t_4	89.15	min
	τ_4	86.03	min
	γ_4	0.20	(-)
	σ^2_4	26.47	min^2
5	t_5	177.70	min
	τ_5	126.10	min
	γ_5	0.20	(-)
	σ^2_5	634.21	min^2

The data obtained from dividing the residence time distribution curve can be used in the adapted method-of-moments technique. This is displayed in Equation 7.1.

$$C_{out} = \sum_{j=1}^{n} \gamma_j \, C_{in} e^{-kt_j} \tag{7.1}$$

For this case n=5 (the number of segments that the RTD was divided into) and therefore Equation 7.1 becomes Equation 7.2.

$$C_{out} = \sum_{j=1}^{5} \gamma_j \, C_{in} e^{-kt_j} \tag{7.2}$$

If Equation 7.2 is expanded out, it becomes Equation 7.3.

$$C_{out} = \gamma_1 \, C_{in} e^{-kt_1} + \gamma_2 \, C_{in} e^{-kt_2} + \gamma_3 \, C_{in} e^{-kt_3} + \gamma_4 \, C_{in} e^{-kt_4} + \gamma_5 \, C_{in} e^{-kt_5} \tag{7.3}$$

The mean residence time for each portion and the nominal residence time for each portion was used in Equation 7.3 to show the effect of using the expected or ideal hydraulic behaviour in the model compared to hydraulic behaviour obtained from tracer studies. The kinetic modelling of the system was based on a theoretical component, with a first-order rate constant *'k'*. The inlet concentration of the theoretical compound was 10 g, and the first-order rate constant was 0.1 min^{-1}.

The nominal residence time for each section, along with the respective fraction of fluid, was substituted into Equation 7.3 and this yielded Equation 7.4. The final outlet concentration of the theoretical concentration is given in Equation 7.5.

$$C_{out} = (0.23)(10)e^{-(0.1)(24.22)} + (0.17)(10)e^{-(0.1)(51.96)} + (0.2)(10)e^{-(0.1)(65.80)} + (0.2)(10)e^{-(0.1)(86.03)} + (0.2)(10)e^{-(0.1)(126.1)} \tag{7.4}$$

$$C_{out} = \ 0.204 + 9.42 * 10^{-3} + 2.78 * 10^{-3} + 3.67 * 10^{-4} + 6.68 \ * 10^{-6} \tag{7.5}$$

$$C_{out} = \ 0.217 \ g$$

The mean residence time for each section, along with the respective fraction of fluid, was substituted into Equation 7.3 and this yielded Equation 7.6. The final outlet concentration of the theoretical concentration is given in Equation 7.7.

$$C_{out} = (0.23)(10)e^{-(0.1)(31.0)} + (0.17)(10)e^{-(0.1)(45.85)} + (0.2)\ (10)e^{-(0.1)(61.05)} + (0.2)\ (10)e^{-(0.1)(89.15)} + (0.2)\ (10)e^{-(0.1)(177.70)} \tag{7.6}$$

$$C_{out} = 0.104 + 0.017 + 4.46\ 10^{-3} + 2.69\ 10^{-4} + 3.83\ 10^{-8} \tag{7.7}$$

$$C_{out} = 0.126\ g$$

The results of Equation 7.5 and Equation 7.7 show that it is possible to use this as a hydraulic modelling technique in situations where the kinetic modelling is based on first-order rate laws. By comparing the two outlet concentration values it can be seen that the outlet concentration calculated using the nominal residence times is greater than the outlet concentration calculated using the mean residence times. This indicates that more contaminant removal was predicted by using the mean residence time (0.126 g) instead of the nominal residence time (0.217 g). A shorter nominal residence time than mean residence time for portion 1 meant that the outlet concentration for that section was double for the nominal residence time than the mean residence time, even though the latter was not double the former. The outlet concentration of a contaminant is not directly proportional to the reaction time, because of the exponent, and therefore, even though the nominal residence time for portion one was half of the mean residence time, the contaminant removal predicted using the mean residence time was not half of that predicted using the nominal residence time. This highlights the effect that residence time has on the contaminant removal in CWs.

7.2.2: Impulse-Response Tracer Studies Conducted on a HSSF Constructed Wetland

The second set of experiments conducted to test the time section of the adapted method-of-moments technique were conducted on a small-scale horizontal sub-surface flow constructed wetland in a greenhouse at Hemholtz Centre for Environmental Research – UFZ, in Leipzig Germany. A schematic of the system can be found in Figure 7.4. This experiment was conducted to assess the effectiveness of the technique in describing the flow of a system in which the non-ideal behaviour comes from the heterogenous nature of the gravel and the plant root structure, like a typical wetland. The packing material of the wetland was pea gravel with a diameter of 2 mm-8 mm and a void fraction of 0.36. The wetland dimensions were 1 m x 0.21 m x 0.15 m (L x H x W). The system was planted with *Juncus effuses*. The volume of the system was 10 L and the inlet flowrate was 2.5 L/hour. This resulted in a nominal residence time of 4 hours. At this velocity the flow is still laminar and therefore the information inferred from these tests can be applied to the system at any other flow rate in the laminar range (Levenspiel, 1999). A GGUN-FL30 fluorometer was used for automatic, inline detection of uranine at the outlet of the wetland, recording every 3 minutes. Full details of how the experiment was conducted, as well as analytical methods are detailed in Chapter 3.

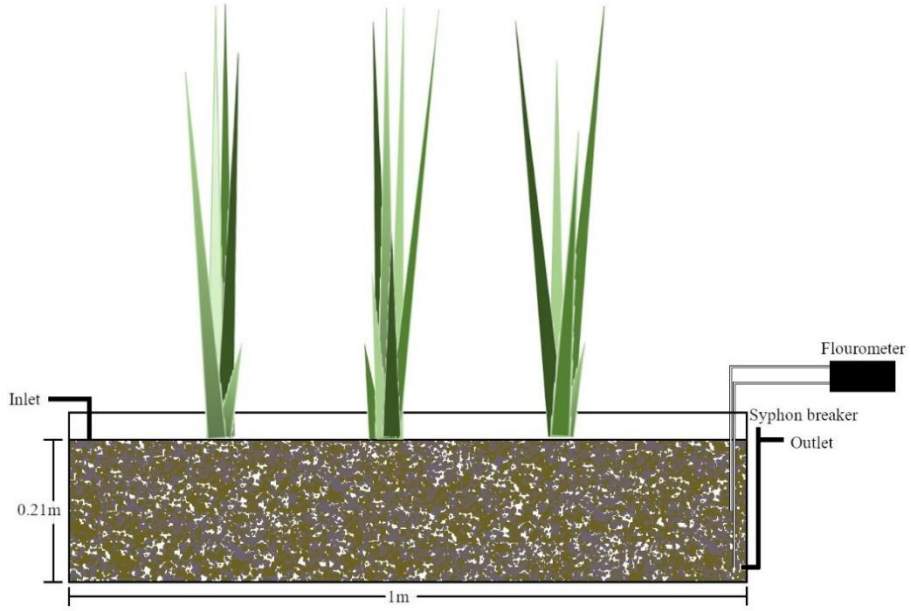

***Figure 7.4**: Schematic of the HSSF CW on which impulse-response and step change tracer studies were conducted*

Results and Discussion

In Figure 7.5 the data from the impulse-response tracer study conducted on the CW is displayed. The tracer started to arrive at the outlet of the CW after 2.4 hours. From this figure it can be seen that there are multiple peaks in the response of the system to the impulse of tracer. This indicates that the fluid took multiple flow paths through the wetland. The highest peak of the tracer came through the system at a time of 4.4 hours, which is slightly higher than the nominal residence time. A second peak arrived at 4.75 hours, a third peak at 6.5 hours and a fourth peak at 7.55 hours. As none of these peaks arrived at the outlet earlier than the nominal residence time of the system, it cannot be said that short-circuiting took place, as short-circuiting implies that fluid takes a path through the wetland, which is shorter, and therefore faster than, the bulk of the fluid. However, it is indicative of separate and preferential flow paths in the system. There is a long tail after the final peak and the tracer concentration only reached background concentrations again after 13.7 hours.

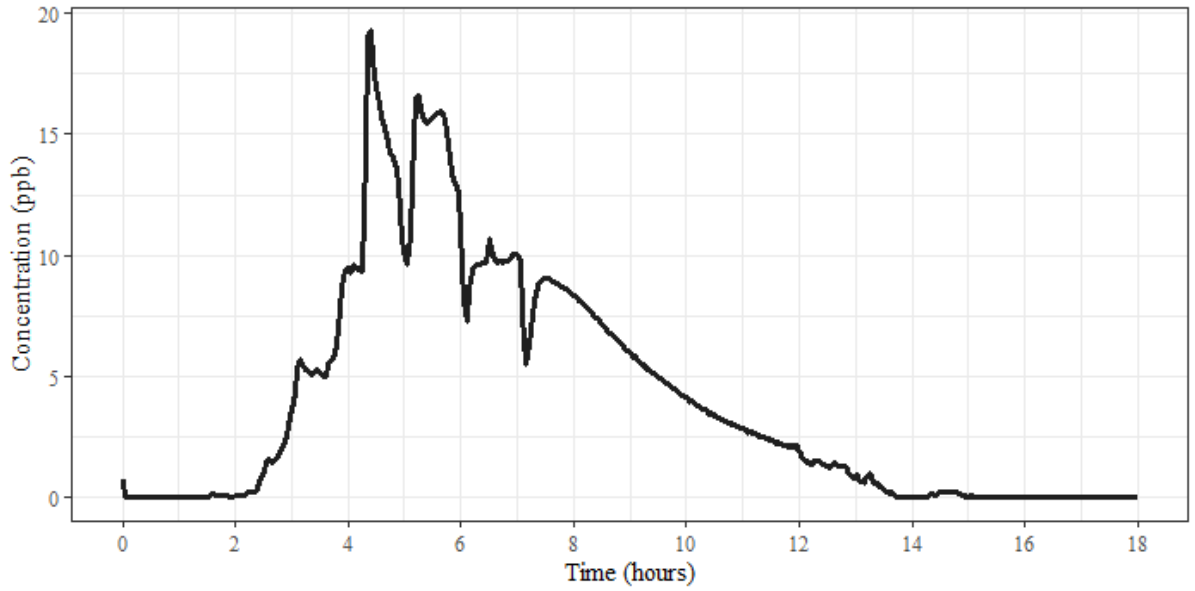

***Figure 7.5**: Results from the impulse-response tracer study conducted on a small-scale HSSF CW*

In Table 7.3 the hydraulic parameters determined from the impulse-response tracer test conducted on a CW are shown. The mean residence time of the system is 6.67 hours. This is 66.75% higher than the nominal residence time of the system. This indicates that the fluid took longer to pass through the system than expected.

The number of tanks-in-series which can be used to describe the small-scale CW is 7.9. This is larger than the TIS values obtained for HSSF CWs found in literature (Kadlec, 2007). A large N values indicates that there is minimal mixing in the system and the CW behaves more like a PFR than a CSTR. This is preferred for a CW (Suliman, Futsaether and Oxaal, 2007). The effective volume ratio of the system is greater than 1. From this it can be determined that the full volume of CW is being used. The hydraulic efficiency of this system is 1.45. This is high for a CW but is due to the large N value and effective volume ratio.

***Table 7.3**: Hydraulic parameters obtained from the impulse response tracer studies conducted on the CW*

Parameter	Value	Unit
$\mathbf{t_m}$	6.67	hour
$\boldsymbol{\sigma^2}$	5.6	$hour^2$
N	7.9	-
λ	1.45	-
e	1.65	-

To validate the time section of the method-of-moments technique on the small-scale CW, the area under the E(t) vs time curve was broken up into 5 portions. This can be seen in Figure 7.6. Each shaded area represents approximately 20% of the area under the curve and therefore approximately 20% of the fluid in the system. The specific percentages as well as the mean residence time and variance for each portion can be found in Table 7.4.

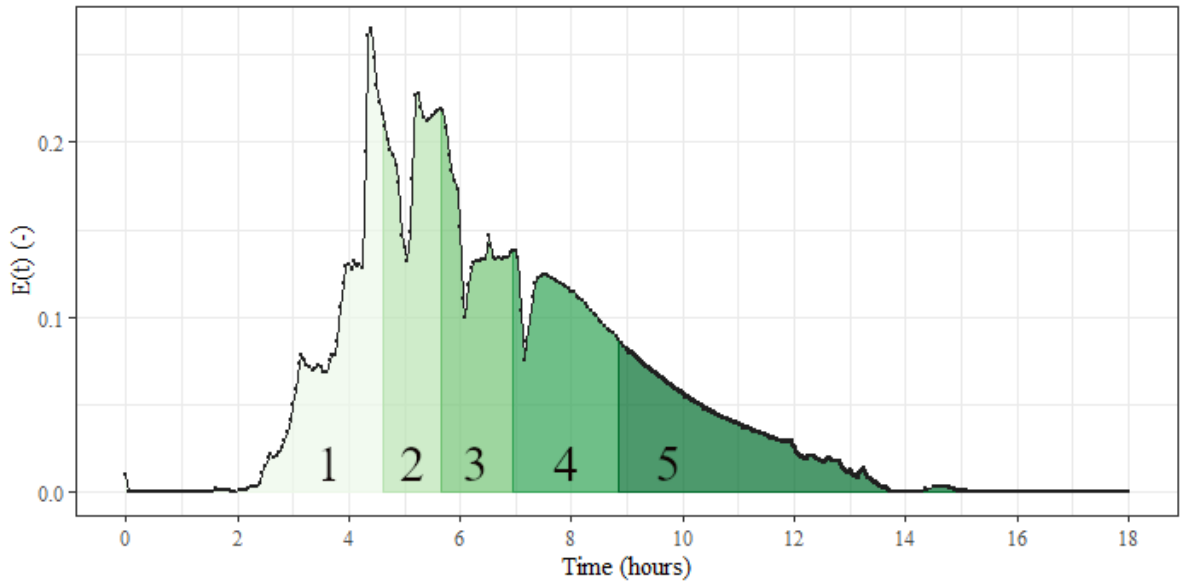

***Figure 7.6**: Results from an impulse-response tracer study conducted on the CW, divided into 5 portions*

Portion 1 was between 0 hours and 4.6 hours and has a mean residence time of 3.90 hours. The mean residence time was very similar to the nominal residence time for the portion. This indicates that the degradation determined using the nominal residence time is a good indication for what is actually taking place in the bed.

Portion 2 had a mean residence time of 5.14 hours and lies between 4.60 hours and 5.65 hours. This time period of just more than 1 hour represents 20% of the fluid. The nominal residence time of the fluid in portion 2 was 5.42 hours which is 4% lower than the mean residence time. This means that the fluid in this portion spent slightly longer in the system than expected and the contaminant degradation for this section will be slightly greater than expected. The first and second peak of the response occurred in portion 2.

Portion 3 was between 5.65 hours and 6.95 hours. This portion had a mean residence time of 6.25 hours and the nominal residence time was 6.41 hours. The difference between the two residence times was 0.16 hours with the nominal residence time being higher. This means that the fluid in this portion spent less time in the system than expected and therefore the contaminant removal in this section will be less than expected. The third peak of the response occurred in portion 3.

Portion 4 represents 21% of the fluid and lies between 6.95 hours and 8.85 hours. This portion has a mean residence time of 7.86 hours. The nominal residence time of this section was 7.78 hours which is 1% lower than the mean residence time. The two residence times are so close that it can be said that this section of fluid spent the expected amount of time in the system.

The final portion was between 8.85 hours and 18 hours, which is the largest time period of the 5 portions, with a duration of 9.15 hours. This portion represents 20% of the fluid in the system as has a mean residence time of 10.49 hours. The nominal residence time of this section was 9.61 hours. This means that the fluid in this section spent 9% longer in the system than expected. This means that there will be greater contaminant removal in this section than expected.

The original data and code used to produce Figure 7.5 and Figure 7.6 can be found in Appendix H and Appendix I, respectively.

***Table 7.4**: Hydraulic parameters for 5 portions obtained from the impulse response tracer studies conducted on the CWs.*

Portion	Parameter	Value	Unit
1	t_1	3.90	hour
	τ_1	3.76	hour
	γ_1	0.21	(-)
	σ^2_1	0.070	$hour^2$
2	t_2	5.14	hour
	τ_2	5.42	hour
	γ_2	0.2	(-)
	σ^2_2	0.333	$hour^2$
3	t_3	6.25	hour
	τ_3	6.42	hour
	γ_3	0.19	(-)
	σ^2_3	1.08	$hour^2$
4	t_4	7.86	hour
	τ_4	7.78	hour
	γ_4	0.21	(-)
	σ^2_4	3.32	$hour^2$
5	t_5	10.49	hour
	τ_5	9.60	hour
	γ_5	0.19	(-)
	σ^2_5	8.40	$hour^2$

The data obtained from dividing the residence time distribution curve from the tracer testes conducted on a HSSF CW can be used in the adapted method-of-moments technique. This is displayed in Equation 7.8 to Equation 7.11. The mean residence time for each portion and the nominal residence time for each portion was used in Equation 7.3 to show the effect of using

the expected or ideal hydraulic behaviour in the model compared to hydraulic behaviour obtained from tracer studies. The kinetic modelling of the system was based on a theoretical component, with a first-order rate constant *'k'*. The inlet concentration of the theoretical compound was 10 g and the first-order rate constant was 0.1 min^{-1}.

The nominal residence time for each section, along with the respective fraction of fluid, was substituted into Equation 7.3 and this yielded Equation 7.8. The final outlet concentration of the theoretical concentration is given in Equation 7.9.

$$C_{out} = (0.21)(10)e^{-(0.1)(3.76)} + (0.2)(10)e^{-(0.1)(5.42)} + (0.19)(10)e^{-(0.1)(6.42)} + (0.21)(10)e^{-(0.1)(7.78)} + (0.19)(10)e^{-(0.1)(9.60)} \quad (7.8)$$

$$C_{out} = 1.44 + 1.16 + 1.00 + 0.96 + 0.72 \quad (7.9)$$

$$C_{out} = 5.30\ g$$

The mean residence time for each section, along with the respective fraction of fluid, was substituted into Equation 7.3 and this yielded Equation 7.10. The final outlet concentration of the theoretical concentration is given in Equation 7.11.

$$C_{out} = (0.21)(10)e^{-(0.1)(3.90)} + (0.2)(10)e^{-(0.1)(5.14)} + (0.19)(10)e^{-(0.1)(6.25)} + (0.21)(10)e^{-(0.1)(7.86)} + (0.19)(10)e^{-(0.1)(10.49)} \quad (7.10)$$

$$C_{out} = 1.42 + 1.20 + 1.02 + 0.96 + 0.67 \quad (7.11)$$

$$C_{out} = 5.26\ g$$

The results of Equation 7.9 and Equation 7.11 show that it is possible to use this as a hydraulic modelling technique in situations where the kinetic modelling is based on first-order rate laws. By comparing the two outlet concentration values it can be seen that the outlet concentration calculated using the nominal residence times is greater than the outlet concentration calculated using the mean residence times. This indicates that more contaminant removal was predicted by using the mean residence time (5.26 g) instead of the nominal residence time (5.30 g). However, the contaminant removal for both was similar and this is due to the mean residence time and the nominal residence time for each of the portions being very close.

Conclusion

The time section of the adapted method-of-moments technique was tested on data from two impulse-response tracer studies. The first was conducted on three columns filled with pea gravel and the second was conducted on small-scale CW in a greenhouse. The area under the curve of the impulse-response data for each experiment was divided into five portions, each with approximately equal area. This technique was combined with a theoretical components and reaction rate to display the full process of using the technique. The results of using this technique with the mean residence time and the nominal residence time were presented. It is possible to divide the area under the residence time distribution curve into more than, or less than, five portions. Increasing the number of portions allows for more in-depth analysis and investigation but is more time consuming.

The time portions can also be divided according to equal time periods, rather than equal areas under the curve. The benefit of equal time periods allows the researcher to investigate the contribution of each batch of fluid to the overall breakdown of contaminants in the system, as they are all equal in volume and therefore have the same starting amount of contaminant. However, dividing the area according to time periods allows the researcher to investigate in which time period the bulk flow occurs and the contribution to contaminant degraded in each time period.

The content presented in this section was used to display the validation and scope of use of the adapted method-of-moments technique with a theoretical first-order rate law. In the following section the validation of the curve-shift technique is presented. The content presented in Section 7.3 has been published in the Science of the Total Environment (Stephenson, Sheridan and Kappelmeyer, 2020) which is an international multi-disciplinary, peer-reviewed journal.

7.3: The Curve Shift Technique

To evaluate the effectiveness of the curve-shift technique, step-change tracer studies were conducted on a small-scale wetland inside a green house. Uranine was used as the conservative tracer and benzoate was used as the non-conservative tracer since uranine is largely conserved. A detailed breakdown of how tests were conducted, and a description of the constructed wetland can be found in Chapter 3, section 3.2.

The data and technique given in this section has been published previously by *Stephenson et al. (2020)* in the Journal of Water Process Engineering.

A non-linear least-squares regression analysis was run in RStudio on the experimental data collected for each of the tracers. The experimental data for uranine was compared a modelled result using the advective-dispersive transport equation *without decay* (Equation 4.17) and the experimental data for benzoate was compared with the modelled results using the advective-dispersive transport equation *with decay* (Equation 4.21). The experimental data for both tracers was in the form of the cumulative distribution curve for the uranine and benzoate. The parameters used to fit these equations to the respective experimental data are given in Table 7.5. This was done in order to determine the values of the retardation factor, R, and the dispersion coefficient, D, for both tracers; and μ for the non-conservative tracer. In previous studies, it has been assumed that R=1, meaning that the solute is non-sorbing, but from the data collected it was clear that this was not the case. The graphical results of the non-linear least squares regression analysis for conservative tracer, uranine, and non-conservative tracer, benzoate, can be found in Figure 7.7 a) and 7.7 b), respectively. In Table 7.6 the values of R, D and μ obtained from the non-linear least-squares regression analysis can be found (Stephenson, Sheridan and Kappelmeyer, 2020).

Table 7.5: *Parameters for the analytical solution of the advective-dispersive transport equation solved for the conservative tracer (uranine) and the non-conservative tracer (benzoate)*

Parameter	**Symbol**	**Value for uranine**	**Value for benzoate**
Fluid velocity	u (m/hour)	0.05	0.05
Inlet concentration	Cin (-)	1	1
Initial concentration	C1 (-)	0.00272253	0.00272253
First-order decay	μ	0	0.01
Zero-order production	γ	0	0
Starting value for hydrodynamic dispersion	D	0.012	0.00014
Starting value for the retardation factor	R	7	4

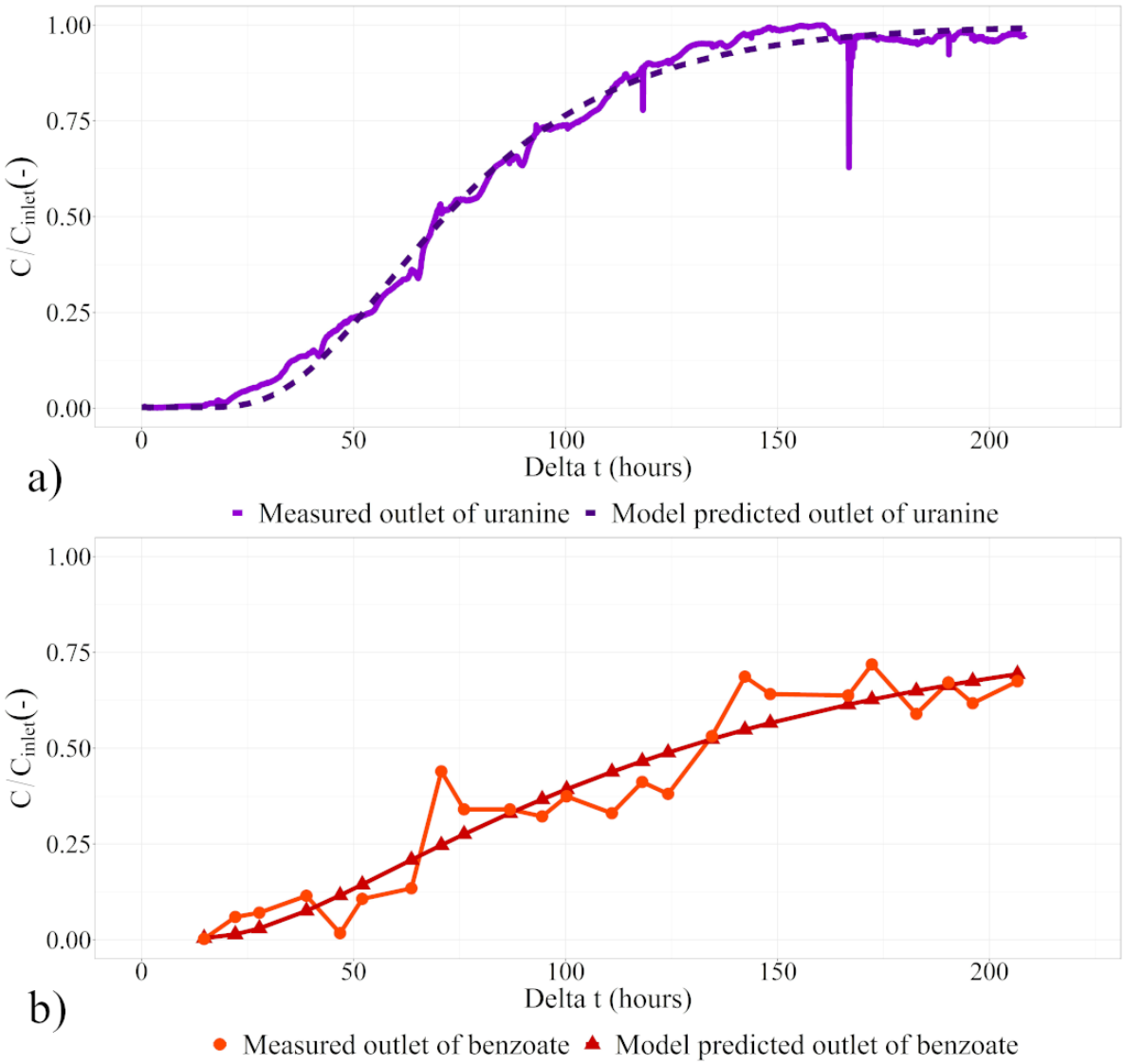

Figure 7.7: *Results of the non-linear least squares regression analysis for conservative tracer, uranine, and non-conservative tracer, benzoate*

Table 7.6: *Parameters obtained from the least-squares regression analysis*

Tracer	R	D	μ	Correlation coefficient	p-value
Uranine	3.550119	0.005961	-	0.997	< 2.2e-16
Benzoate	5.553886	0.021036	0.00949	0.949	1.723e-12

The original data used to produce Figure 7.7 can be found in Appendix J and K. The code used to generate Figure 7.7 and determine the hydraulic parameters for each tracer can be found in Appendix L.

7.3.1: Comparison of the Results Obtained from the Non-Linear Least-squares Analysis for Uranine and Benzoate.

The retardation factor of uranine obtained in the non-linear least-squares analysis is lower than that of benzoate. This is backed up by solubility data for both substances. The solubility of benzoate increases with increasing pH and at the pH of experimental conditions is approximately 29 mg/L (Avdeef and Berger, 2001) and uranine has a solubility of greater than 500 mg/mL (Merck KGaA, 2017). This indicates that uranine is more soluble than benzoate. The less soluble tracer is more likely to be willing to leave the fluid and be adsorbed onto the wetland substrate, which would result in a higher retardation factor in the transport equation. The retardation factor of benzoate is higher than that of uranine which indicates that it is more likely to be adsorbed. The retardation factor for uranine is calculated to be greater than 1, which indicates that sorption does take place. However, inlet concentrations are reached, and it is assumed that the sorption equilibrium is reached and therefore minimal tracer is lost to this mechanism. The hydrodynamic dispersion co-efficient of benzoate obtained in the non-linear least-squares analysis is greater than that of uranine. Molecules of lower molecular weight diffuse faster (Maderuelo, Zarzuelo and Lanao, 2011) and the molar mass of uranine is higher than that of benzoate, being 332.31 g/mol and 121.11 g/mol, respectively. This indicates than benzoate should have a higher hydrodynamic dispersion coefficient than uranine. This is in line with what was found in the regression analysis where the D value for benzoate is approximately 3 times higher than that of uranine.

The results obtained in the non-liner least-squares regression were then used to develop the technique to map the non-conservative tracer response onto the conservative tracer response.

7.3.2: Comparison of Least-squares Regression Model with Experimental Data

Figure 7.8 a) gives the cumulative distribution response (F(t)) for the conservative tracer, uranine, and the non-conservative tracer, benzoate, in the step-change experiment. After approximately 150 hours stable concentrations of both uranine and benzoate have been reached. The difference in the response of each of the substances is due to two major factors. Firstly, the degradation of benzoate, the non-conservative tracer which is indicated by a stable F(t) value, at an average of 0.654, which is significantly lower than 1. This shows that there has been a decay of benzoate, which is expected due to its non-conservative nature. The stable

normalized concentration of uranine is 0.971 which is in line with the assumption that it is a conservative tracer. The second major factor is the delayed response of the benzoate curve which is due to retardation as can be seen in the time interval 50 hours to 150 hours in Figure 7.8 a). This indicates that the transport of benzoate is slower than that of the uranine. In Figure 7.8 b) the comparison of the responses obtained from the non-linear least-squares regression is provided. Because of the noise in the experimental data, the results displayed in Figure 7.8 b) were subsequently used for the curve-shift technique. The hydraulic performance indices obtained from the experimental data and regressions model data can be found in Table 7.7.

Table 7.7. *Hydraulic performance indices of the experimental data and regression models for the step-change experiment.*

	t_m (hours)	N	e	λ	σ^2	Pe
Conservative tracer data	77.99	4.25	1.08	0.8283	1430.99	
Conservative tracer model	78.99	4.63	1.09	0.8601	1348.19	8.3879
Non-conservative tracer data	115.71	1.75	1.60	0.6888	7649.12	
Non-conservative tracer model	116.09	1.77	1.61	0.7030	7601.41	2.397

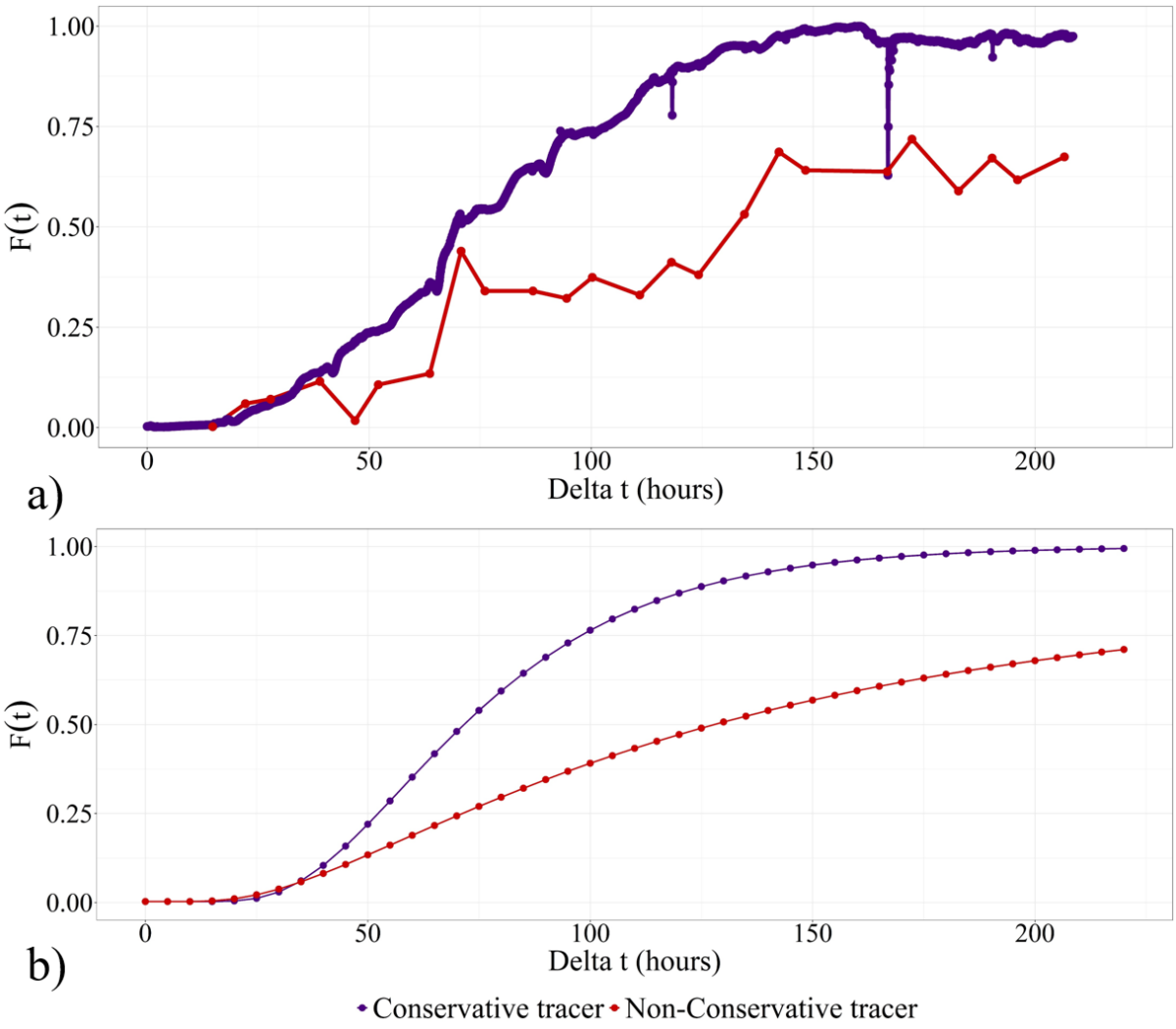

Figure 7.8: *F(t) response of the conservative tracer, uranine, and the non-conservative tracer, benzoate, a) to the step-change tracer experiment and b) presented by the non-linear, least squares regression model.*

7.3.3: Shifting the Tracer Curves

Four techniques were considered for shifting the conservative and non-conservative tracer response curves. These are discussed below.

Mapping 1:

The data from the non-conservative tracer regression model was divided by the maximum value generated by the model with the aim of normalising the response. This ensures a maximum value of F(t)=1 which is required for the calculation of hydraulic parameters and method-of-moments analysis of the residence time distribution. The comparison of this with the conservative tracer regression model response is given in Figure 7.9.

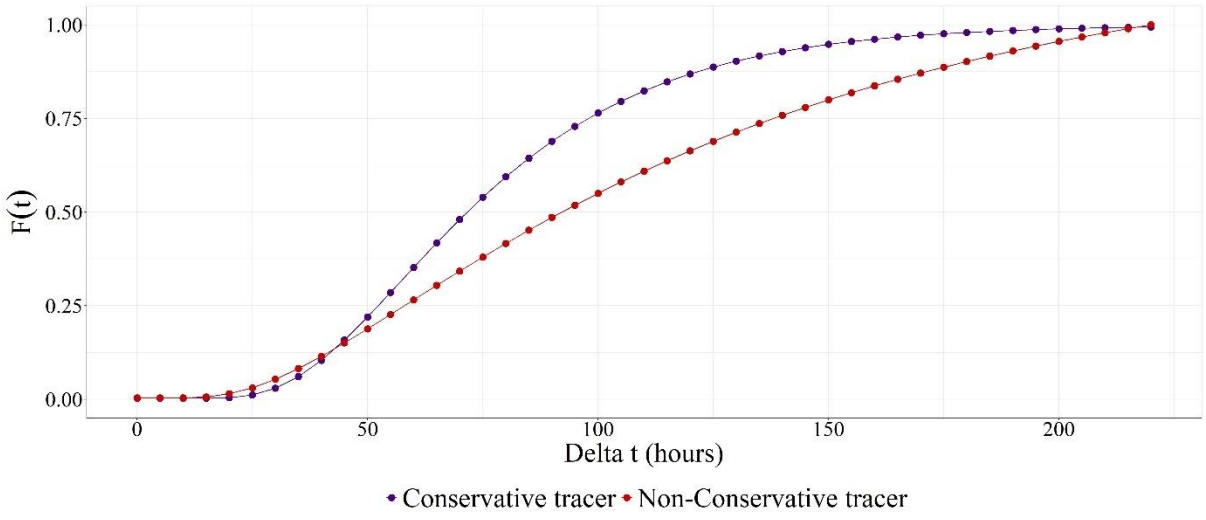

Figure 7.9: *Modeled F(t) response of the conservative tracer, uranine, and the normalised non-conservative tracer, benzoate.*

It can be seen that while the maximum of both is now 1, the shape of the non-conservative tracer response is still different from that of the conservative tracer. This indicates that the effect of either retardation or hydrodynamic dispersion is different and a closer look into these two factors is required.

Mapping 2:

The difference in the two responses given in Figure 7.9 appears to be more of a difference in gradient than a lag in the response, indicating hydrodynamic dispersion (D) would be a better factor to investigate and change. The equation for the hydrodynamic dispersion coefficient is given in Equation 7.12. Hydrodynamic dispersion is a combination of three types of dispersion. Firstly, mechanical dispersion, which can occur in the longitudinal and transversal directions, secondly, molecular dispersion and thirdly macro dispersion. The latter two are often lumped together as one term under the term mechanical dispersion. While the molecular dispersion of the conservative tracer and non-conservative tracer are different, their mechanic dispersions are both a function of sub-surface media and solute and it can be assumed that the mechanical dispersion for two solutes in the same environment would be equal (Equation 7.13) (Marsily, 1986). This leads to the relationship given in Equation 7.14.

$$D = \varepsilon D_m + u[\alpha_l + \alpha_t] \tag{7.12}$$

$$[\alpha_{l,uranine} + \alpha_{t,uranine}] = [\alpha_{l,benzoate} + \alpha_{t,benzoate}] \tag{7.13}$$

$$D_{uranine} = D_{benzoate} - \varepsilon\left[D_{m,benzoate} - D_{m,uranine}\right] \quad (7.14)$$

D_m is the molecular diffusion coefficient of a solute (Marion, 2008). The molecular diffusion coefficient of benzoate is 0.862 x10^{-9} m^2/s (Robinson and Stokes, 1959) and the molecular diffusion coefficient of uranine is 4.5 x 10^{-10} m^2/s (Skagius and Neretnieks, 1986). Using the hydrodynamic dispersion coefficient for benzoate obtained from the regression model (0.020860 m^2/s), the hydrodynamic dispersion coefficient of uranine was calculated to be 0.02086 m^2/s. The molecular diffusion coefficients of the two solutes were too similar to result in a significant difference in the hydrodynamic dispersion coefficients. This is not the same as the hydrodynamic dispersion coefficient of uranine obtained from the regression model, which was approximately 3.5 times lower. The result obtained from solving Equation 7.12 was the basis for keeping the hydrodynamic dispersion coefficient value at 0.020860 m^2/s for the curve-shift technique.

Mapping 3:

From the previous attempt, it was clear that changing the D value was not feasible so some investigation into the retardation factor was done. R is dependent on the distribution coefficient, K_d, which can be defined according to Equation 7.15 (Morrison, 2015b).

$$K_d = f_{om} * K_{om} \quad (7.15)$$

Where f_{om} is the fraction of organic matter in the sub-surface media and K_{om} is the organic matter-water partition coefficient. K_{om} is dependent on K_{ow}, the octanol-water partition coefficient (Berthod and Carda-Broch, 2004). The relationship between K_{om} and K_{ow} for aromatic hydrocarbons is given in Equation 7.16 (Leo *et al.*, 1971). The K_{om} value of uranine is dependent on pH and within the pH range of the experimental setup $\log(K_{om,uranine})$=-0.38 (Oba and Poulson, 2015).

$$log(K_{om}) = 1.01 * log(K_{ow}) - 0.72 \quad (7.16)$$

$\text{Log}(K_{ow,benzoate})$=-2.27(National Center for Biotechnology Information, no date) and from Equation 7.15 it can be determined that $\log(K_{om,benzoate})$=-3.0127. With an assumptions that f_{om}=0.02549 (Cao *et al.*, 2017) the distribution coefficients of benzoate and uranine are determined to be $K_{d,benzoate}$=2.48x10^{-5} and $K_{d,uranine}$=1.06x10^{-2}. This results in the retardation factors of benzoate and uranine to be 1.00 and 1.087 respectively. These theoretical values are

noticeably different from the retardarion factor values obtained from the experimental data. When the theoretical values were used as a constant in the non-linear least squares regression analysis in the comparison of Equation 4.22 and the experimental data, a solution could not be found. This indicates that under these conditions R cannot be equal to 1 for either uranine or benzoate. What can be taken from this is that according to the previous research the retardation factors of benzoate and uranine can be considered similar.

Mapping 4:

From the previous mapping attempts, it is clear that a combination of factors is required to make the curve-shift technique effective. In this set of circumstances it was assumed that the hydrodynamic dispersion factor would be equal to that of benzoate as the rate of dispersion is solute specific and the retardation factor would be equal to that of uranine as it is significantly affected by the sub-surface media. The combination of these two assumptions leads to the comparison response given in Figure 7.10.

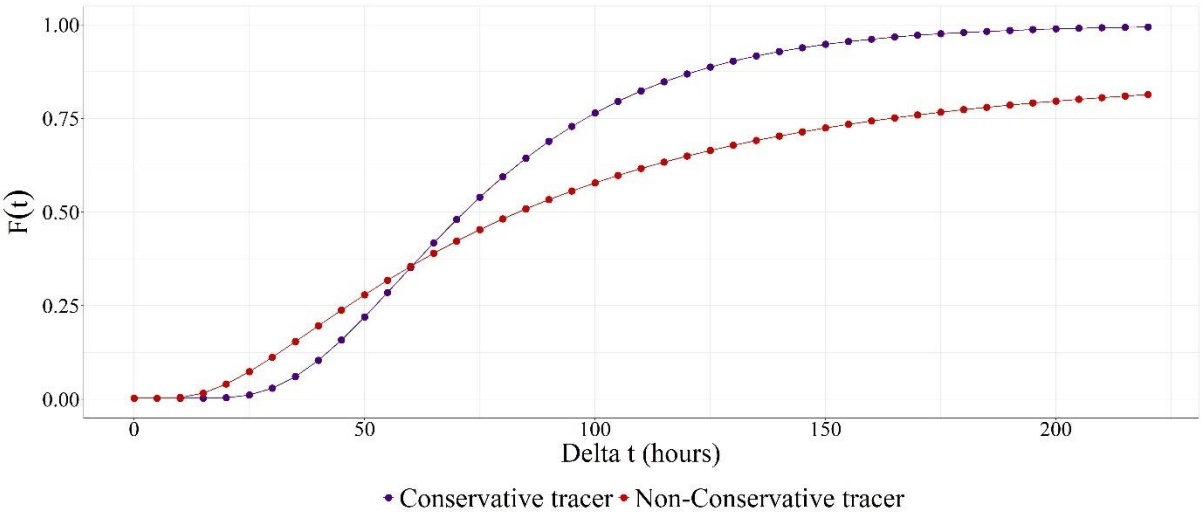

Figure 7.10: *Modeled F(t) response of the conservative tracer, uranine, and the non-conservative tracer, benzoate with R= 3.550119 and D= 0.020860*

These two values were used and then the final values were normalised and this resulted in the response given in Figure 7.11.

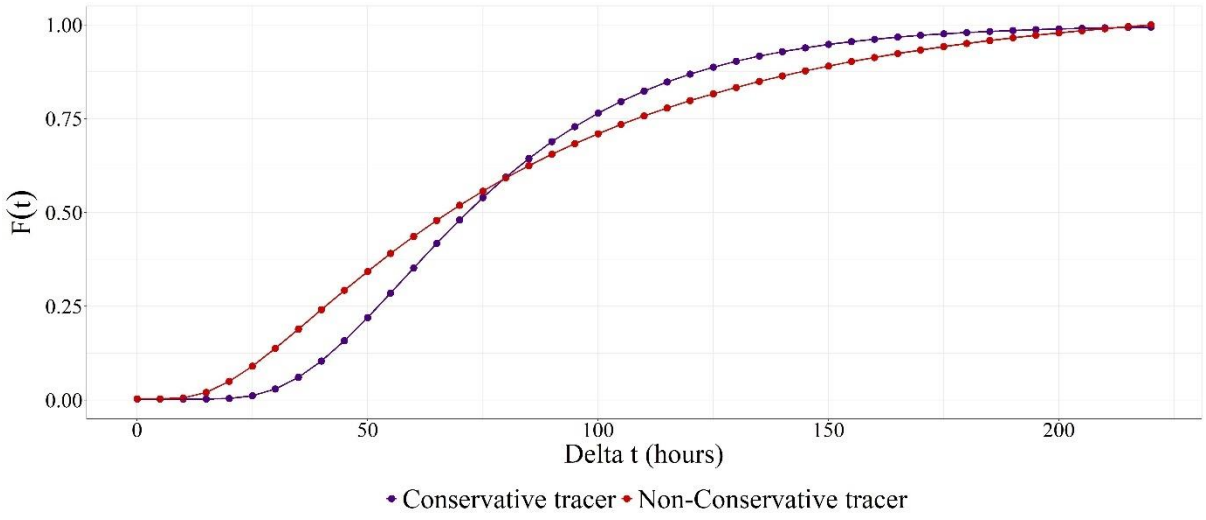

***Figure 7.11**. Modeled F(t) response of the conservative tracer, uranine, and the non-conservative tracer, benzoate with R= 3.550119 and D= 0.020860 and normalised to the maximum of the benzoate model output.*

The hydraulic parameters for interpreting the RTD obtained from the non-conservative response given in Figure 7.10 are indicated in Table 7.8. The correlation coefficient between the mapped response and the tracer model is 0.9922.

***Table 7.8:** Hydraulic performance indices of the mapped non-conservative tracer response*

Parameter	Value
t_m (hours)	79.47 hours
N	2.64
e	1.10
λ	0.687
σ^2	2385.44

The code used to generate Figure 7.9, Figure 7.10 and Figure 7.11 and determine the hydraulic parameters of each mapped response can be found in Appendix L and Appendix M.

7.3.4 Discussion

From the four mapping exercises conducted here, it is clear that attempt 4 was the most accurate in correlating the normalized response curves. The hydraulic parameters calculated from the mapped response of the non-conservative tracer are similar to those of the conservative tracer.

The mean residence time from the regression model of the conservative tracer was 78.99 hours and the mean residence time from the mapping technique is within 0.61% of that, at 79.47 hours. The mean residence time is the most commonly used of the hydraulic parameters, especially in reactor design models (Levenspiel, 1999). It is important for design purposes that an accurate mean residence time is determined as this is the primary sizing parameter

(Zahraeifard and Deng, 2011). A difference of 0.61 % is low enough to be considered negligible and the mean residence time obtained from the mapped non-conservative tracer response curve can be used.

The number of tanks in series calculated from the regression model of the conservative tracer is 4.63 but the number of tanks in series calculated from the mapped non-conservative tracer response is 2.64. This indicates that the mapped non-conservative tracer displays more back mixing in the system than the conservative tracer. This may be due to benzoate, the non-conservative tracer, diffusing faster as it has a smaller molecular weight. This behaviour is also seen in the response curves given in Figure 7.11. It can be seen that the gradient of the conservative tracer is steeper than that of the non-conservative tracer which means that the latter has a greater diffusion, resulting in more mixing and a smaller N than the conservative tracer. The number of tanks in series is dependent on wetland configuration, aspect ratio, the presence of baffles and the location and density of plants. The values obtained in this study are within the range expected for a horizontal sub-surface flow constructed wetland. As the flow paths of the wetland all converge at one outlet point a high degree of back mixing is expected (Bonner *et al.*, 2017).

The effective volume ratio of the conservative response and of the mapped non-conservative response are 1.09 and 1.10, respectively. These are similar and both greater than 1. These effectve volume ratios are higher than the values obtained in some other studies (Suliman, Futsaether, *et al.*, 2006; Sheridan, Hildebrandt and Glasser, 2013; Sheridan, Glasser and Hildebrandt, 2014) but was in line with the effective volume ratio determined by Bonner et al. (2017). The effective volume ratio of a system is affected by the inlet-outlet set-up as well as the wetland configuration (Sabokrouhiyeh *et al.*, 2017). Sheridan (2012) found that when the inlet and the outlet port were close to the surface of the wetland the flow of the water followed a hull shape (Sheridan, 2012). The inlet port of the wetland in this study is at the surface of the gravel while the outlet port is close to the base of the wetland. It is likely that this configuration prevented the hull type fluid flow from forming and the flow was more likely to follow a hysterisis shape resulting in a smaller dead volume and higher effective volume ratio.

There was a substantial difference in the hydraulic efficiencies obtained from the regression model of the conservative tracer (0.86) and the mapped response of the non-conservative tracer (0.68). Since hydraulic efficiency is a function of N, and the difference in N was noted previously, this difference in hydraulic efficiency is expected. Hydraulic efficiency is a

function of the design of a system; its aspect ratio, the presence and location of baffles and the location of islands in a system (Persson, 2000). The hydraulic efficiency values obtained in this study are inline with what is expected for a wetland of this setup.

The technique developed here was based on experiments conducted in a small horizontal sub-surface flow constructed wetland and using the advective-dispersive solute transport equation. It can be applied in larger and outdoor systems as long as the flow through the wetland is laminar. As for most tracer studies all possible outlets of the wetland should be monitored and samples should be taken for tracer concentration to ensure that stead-state has been reached. Steady flow is also an important factor for this technique to be applied.

7.4: Conclusion

The calibration of two novel residence time distribution techniques was given in this Chapter. The first technique was based on the method-of-moments technique which is used to investigate and describe the residence time distribution of a reactive system. This technique was calibrated on two systems; a set of gravel filled columns and a small-scale CW. Two systems were used as they have different factors which contribute to non-ideal flow, with the CW being more intricate. To display the adapted method-of-moments technique the area under the residence time distribution curve was divided into 5 sections, each with equal volume. It is possible to divide the area under the curve into any number of sections. An increase in the number of sections means more in-depth analysis but increased time and computational power. The sections can also be divided into equal time periods, rather than equal areas. The limitation of this techniques lies in the use of first-order reaction rates, which are required for the technique in the current form.

The second technique which was calibrated in this chapter was the curve-shift technique. A methodology by which it is possible to use a non-conservative tracer (such as benzoate or any other compound which is likely to be degraded) to determine the flow characteristics of a HSSF CW. It can be applied in larger and outdoor systems as long as the flow through the wetland is laminar. As for most tracer studies all possible outlets of the wetland should be monitored and samples taken for tracer concentration to ensure that stead-state has been reached. Steady flow is also an important factor for this technique to be applied.

The technique was found to accurately predict the mean residence time of the systems studied. This allows the researcher to consider the use of biodegradable tracers for conducting step-change tracer studies. This has the potential to reduce the environmental impact of research without compromising the integrity of the data gathered. Caution is necessary when using this method – the data obtained from the other moments of the distribution (such as dispersion, retardation, etc.) are not as well quantified. If these are important, they must be given due consideration. There is also considerable scope for this technique to be expanded to other reactor systems such as general chemical or biochemical engineering. Examples include those instances where heat may decompose the tracer, or where the tracer reacts (as opposed to biodegrades) within the reactor itself. The method would most likely need to be adapted somewhat for those circumstances. Further studies on this technique could also be considered to determine the effect of other parameters such as aspect ratio, particle size, the proximity of the Reynold's number to turbulent flow, etc. It is also recommended that more frequent sampling is done than was given in this study to ensure accurate model predictions. It is important for environmental research (and indeed, any research) not to aggravate environmental degradation. This study contributes towards achieving this goal.

Chapter 8: Discussion and concluding remarks.

8.1: Discussion

This chapter provides a summary of the findings of this thesis and relates these findings to the research objectives discussed in Section 2.11.

Objective 1: Develop a novel residence time distribution technique in order to improve the accuracy and the measurement and quantification of CW hydraulic flow behaviour.

The first objective was to develop a novel residence time distribution technique which could be used to quantify the hydraulics of a constructed wetland. The principal goal of this objective was to develop a different way of representing the hydraulic behaviour of a constructed wetland which had some flexibility so that it could be used for design without being computationally intensive but would also allow the researcher to analyse the hydraulic behaviour in detail. Two techniques were developed to address this. The results are summarised below.

Two novel residence time distribution techniques were developed. The first technique was based on the method-of-moments technique for the analysis of data from residence time distribution studies. This technique assumed that there were multiple flow velocity pathways along the length of a constructed wetland and within each flow path there were micro-batch reactors. The theory was that these micro-batch reactors would spend different amounts of time in the system, owing to their different flow paths, and as a result there would be a variation in the reaction time of each of the micro-batch reactors and therefore the pollutants in the water. Each of these flow paths was represented as portion of area under the residence time distribution curve. The fraction of area which represented a specific flow path also determined the percentage of the volume of fluid which the flow path took up in the system. The mean residence time for each portion was be determined and represented in a vector. Because of the assumption of micro-batch reactors, the batch reactor design equation was used, along with first-order rate laws, to determine the pollutant removal of each of the flow paths. The degradation achieved in each flow path was added together to determine the overall degradation of the system. The benefit of the technique presented was that it allowed the user to determine the level of complexity required for their modelling needs by varying the number of flow paths

assumed in the reactor. The decision to divide the system into additional flows paths would require additional computation but would allow for better understanding of pollutant removal and a better analysis of the hydraulic behaviour of the constructed wetlands. The decision to divide the system into fewer paths would mean that the technique is computationally simple but would not necessarily permit an in-depth analysis.

The second technique developed was based on improving the modelling of constructed wetlands from the perspective of environmental impact. For a tracer to accurately describe the flow of water through a constructed wetland, it must not undergo adsorption, biodegradation, or photodegradation. However, these properties of the tracer also mean that it can pose an environmental problem (since those properties are the same as for persistent pollutants) and hence requires correct disposal. Because of this, the use of a non-conservative tracer was investigated. A non-conservative tracer gives a distorted response curve to residence time distribution studies and an understanding of solute transport was required to counter these distortions and relate the non-conservative response to a conservative response This technique was based on the advective-dispersive transport equation, which is used for the transport of a solute through a packed bed in which the solute may degrade. Analytical solutions for the transport equation, with and without decay, were determined. These analytical solutions were used to predict the response curve of a step-change tracer study. An understanding of hydrodynamic dispersion, retardation, and decay was used to shift the response curve of the non-conservative tracer to that of the conservative tracer. From the shifted curve, hydraulic parameters were determined.

Both techniques developed were able to quantify the hydraulic flow behaviour of a constructed wetland. The adapted method-of-moments technique was developed for first-order reaction rate laws and this limits its use currently. However, the development of the technique using rate laws of higher order is recommended for future work. The technique is simple to use and does not require an advanced knowledge of numerical modelling methods or a specific software. The curve-shift technique which was developed was successful in correlating the parameters which affect solute transport and using these parameters to relate the response curve of a conservative and non-conservative tracer. The limitation of this technique is that the advective-dispersive transport equation can only be used for HSSF CWs and therefore is not applicable for all wetland types. It is recommended that further work be done to determine whether a similar technique can be applied on other solute transport equations.

Objective 2: Apply the novel residence time distribution technique to an existing biokinetic model, the International Water Association's constructed wetland model 1 (CWM1), to improve the accuracy of the predicted output concentrations of contaminants.

The second objective of this study was to apply the novel residence time distribution techniques to a biokinetic model; specifically, the Constructed Wetland Model No1. To achieve this objective for the first technique, the two matrices of CWM1 were used. The first matrix contained the reaction rates of the seventeen processes which are modelled in CWM1 and the other contained the stochiometric coefficients which related each of the processes to sixteen components. A dot product of these two matrices produced a matrix in which the transformation of component 'i' in process 'l' was in row *'i'*, column *'l'* of the matrix. For this matrix to be used with the adapted method-of-moments technique, each of the rates was assumed to be first order. This was achieved through linearisation techniques.

It was simpler to combine a biokinetic model with a curve-shift technique. The advective-dispersive transport equation is a partial differential equation which can be solved with other differential equations to describe the flow and degradation of solutes. The use of CWM1 with the curve-shift technique was be achieved in the same way as the biokinetic model has been used with the original advective-dispersive transport equation using partial differential equations.

Objective 3: To modify the matrices of stochiometric coefficients and rate laws given in CWM1 to include a residence time distribution function.

The third objective of this thesis was to modify the matrices of CWM1 to include a residence time distribution function. In the case of the curve-shift technique, this was not necessary since the hydraulic and biokinetic models could be used together in their original forms. However, in the case of the adapted method-of-moments technique, for the biokinetic model and the hydraulic technique to be combined, the reaction rates needed to be first order. This meant that the rate at which component *'i'* was degraded in process *'l'* needed to be linearised. It was assumed that at an instantaneous moment in time, all concentrations and parameters which affected the degradation of component *'i'* were constant, except for the concentration of component *'i'*. This meant that the relationship between component *'i'* and the rate at which it was degraded/produced in process *'l'* could be determine and linearised. Two methods were used to attempt this: Taylor series approximations and McLaurin series approximations. Padé

approximations were also considered but since the first order Padé approximation was mathematically equivalent to the first order Taylor series approximation around the same point, the Padé approximants were not investigated further.

Linearisation of 29 component reaction rate equations in total was attempted. There were cases where the Taylor series approximation and the McLaurin series approximation displayed the same behaviour for multiple rates of transformation of the same component. In these cases, only one transformation rate was discussed in detail. A summary of the components on which linearisation was attempted is given below.

- Dissolved oxygen (S_O): Four processes were modelled for the transformation of dissolved oxygen. In all four cases the relationship between the concentration of dissolved oxygen and the rate it was degraded in process *'l'* was not linear. Even at low concentrations the McLaurin series approximation deviated from the rate determined using the CWM1. At the basis concentration the McLaurin series approximation of transformation rate was 5.3 times greater in magnitude than the original, for three cases, and 1.86 times greater in magnitude for the fourth case. The McLaurin series was not a good approximation for any of the cases of dissolved oxygen. Within a small concentration range of 0.43 mg O_2/L to 1.30 mg O_2/L, the Taylor series approximation was a good representation of the rate determined using the CWM1, but outside of that range the approximation deviated. As very low concentrations of dissolved oxygen are common in constructed wetlands, the deviation at concentrations below 0.43 mg O_2/L of the Taylor series approximation meant that this technique could not be used to linearise the reaction rates of dissolved oxygen.
- Fermentable, readily biodegradable COD (S_F): Three processes were modelled for COD. In all three cases, the higher the concentration of COD the faster it is degraded in the process, but there came a point at which the rate of transformation was not limited by the concentration of COD but by the rate at which the bacteria could degrade COD. The McLaurin series approximation deviated from the original rate at very low concentrations and at the basis concentration was 692 times greater in magnitude than the rate determined using the CWM1, for two cases, and 7.07 times greater in magnitude for the other. The McLaurin series was not a good approximation for any of the rates of transformation of COD. The Taylor series approximation was in the same order of magnitude as the rate determined using the CWM1 but did not display the same

behaviour around the basis concentration or within the given range. This means that neither the Taylor series approximation nor the McLaurin series approximation were suitable to be used for the linearisation of the rates of COD.

- Fermentation products, as acetate, (S_A): Four processes were modelled for the transformation of acetate. Two of these processes, the anoxic growth of heterotrophic bacteria on acetate and COD, displayed the same behaviour. The Taylor series approximation for these two processes deviated from the original rate, above and below the basis concentration, and was not a good estimate of the rate determined using the CWM1. The McLaurin series approximation of these two rates displayed similar behaviour within the given concentration range and the root mean square error for the anoxic growth of heterotrophic bacteria on acetate and COD was 0.3 mg COD/L.d and 0.363 mg COD/L.d, respectively. In these two cases the linearisation of the reaction rates was achieved. For the other two processes which were modelled for acetate, the Taylor series approximation overestimated the rate on both sides of the basis concentration. The McLaurin series approximation deviated from the original rate at concentrations greater than 0 mg COD/L. At the basis concentration the McLaurin series approximation was 1.48 and 2.13 times greater than the original rate for the growth of acetotrophic, methanogenic bacteria and growth of acetotrophic, sulphate reducing bacteria, respectively.
- Ammonium and ammonia nitrogen (S_{NH}): Ten processes were modelled for the transformation of ammonium. They all displayed the same behaviour in terms of the rate determined using the CWM1, Taylor series approximation and McLaurin series approximation. The relationship between the concentration of ammonium and the rate at which it is degraded in the growth of heterotrophic bacteria on COD was exponential and as the concentration of ammonium increased, the rate at which it was transformed also increased but began to flatten out at approximately 10 mg N/L. There came a point at which the process was limited not by the concentration of ammonium, but by the rate at which bacteria could transform ammonium. At the basis concentration, the McLaurin series approximation of rate was 1141 times larger in magnitude than the rate determined using the CWM1 for six processes, 5701 times larger for three processes and 114 times larger for one process. The Taylor series approximation was a good estimate of the rate determined using the CWM1 within the range that the original rate flattened out. The McLaurin series approximation cannot be used for the linearisation

of ammonium but there are ranges in which the Taylor series approximation could be used.

- Nitrate and nitrite nitrogen (S_{NO}): Three processes were modelled for nitrate and all of them displayed similar behaviour for the rate determined using the CWM1, the Taylor series approximation and the McLaurin series approximation. Each of the rates displayed an exponential behaviour and flattened out at a relatively low concentration. The McLaurin series approximation had a much steeper gradient than the flattened-out section of the rate determined using the CWM1. At the basis concentration the McLaurin series approximation was 101.8 times greater than the original rate for all three processes modelled. The Taylor series approximation displayed a similar behaviour to the rate determined using the CWM1 over a small range but at concentrations of less than 25 mg N/L, the two displayed different behaviour. Neither the McLaurin series nor the Taylor series approximation were a good enough linear estimation of the rate determined using the CWM1 for nitrate.
- Sulphate sulphur (S_{SO4}): One process was modelled for sulphate. The relationship between the concentration of sulphate and the rate at which it was transformed in the growth of acetotrophic, sulphate reducing bacteria was not linear. The McLaurin series approximation deviated from the original rate at concentrations greater than 0 mg S/L. At the basis concentration, the McLaurin series approximation was 2.84 times greater than the rate determined using the CWM1. The Taylor series approximation was only a good estimate of the rate determined using the CWM1 at the basis concentration, on either side of this the behaviour of the approximation was very different from that of the rate determined using the CWM1 This means that neither the Taylor series nor the McLaurin series approximation can be used to linearise the rate at which sulphate is degraded in the growth of acetotrophic, sulphate reducing bacteria.
- Dihydrogen-sulphide sulphur (S_{H2S}): Three processes were modelled for the rate at which dihydrogen sulphide is transformed. The relationship between the rate at which dihydrogen-sulphide was transformed in the growth of acetotrophic, sulphate reducing bacteria and the concentration of dihydrogen-sulphide displayed different behaviour to the other two rates. The rate was not exponential and within the given range was close to a linear rate. The McLaurin series approximation deviated more from the rate determined using the CWM1 as the concentration of dihydrogen-sulphide increased. At the basis concentration, the McLaurin series approximation was 1.25 times greater than

the rate determined using the CWM1. The Taylor series approximation was greater than the rate determined using the CWM1 for the full concentration range, except at the basis concentration, at which points the rates were equal. Neither the McLaurin series nor the Taylor series approximation was a good estimation of the rate determined using the CWM1 for this process. The other two processes displayed a different type of behaviour. The relationship between the concentration of dihydrogen-sulphide and the rate at which it was consumed in the aerobic growth of sulphide oxidising bacteria on dihydrogen-sulphide and anoxic growth of sulphide oxidising bacteria on dihydrogen sulphide was exponential and as the concentration of dihydrogen-sulphide increases, the rate at which it was degraded in these two processes increased in magnitude, before flattening out at a concentration of approximately10 mg S/L. The McLaurin series approximation deviated from the rate determined using the CWM1 above a concentration of 0 mg S/L. At the basis concentration the magnitude of the McLaurin series approximation was 143 times greater than the rate determined using the CWM1 for both processes. Within a small range the Taylor series approximation displayed the same behaviour as the rate determined using the CWM1. However, at concentrations lower than 10 mg S/L the deviation increased. The Taylor series approximation could give a linear approximation of the rate determined using the CWM1 within a small concentration range for both in the aerobic growth of sulphide oxidising bacteria on dihydrogen-sulphide and anoxic growth of sulphide oxidising bacteria on dihydrogen-sulphide.

- Slowly biodegradable particulate COD (X_S): One process was modelled for particulate COD. The relationship between concentration of particulate COD and rate at which it was transformed was not linear but neither did it flatten out like the behaviour seen for some of the other components. The McLaurin series deviated from the rate determined using the CWM1 at concentrations greater than 0 mg O_2/L and at the basis concentration the McLaurin series approximation was 2.65 times greater in magnitude than the original rate. The Taylor series approximation estimated a rate of greater magnitude than the original rate at every point except the basis concentration. Neither the McLaurin series nor the Taylor series approximation were a good linear estimation of the rate.

Of the twenty-nine rates for which linear approximation techniques were attempted, only two were successful. These two were the rate at which acetate was degraded in the anoxic growth

of heterotrophic bacteria on acetate and fermentable, readily biodegradable COD and these two displayed the same behaviour. For nineteen of the other rates there was a limited range in which the Taylor series approximation had some accuracy, but not enough to describe the full degradation of the components. There was no success for the linearisation of the remaining eight rates.

Because of the limited success in linearising the rates at which specific components were degraded/produced in specific processes, the CWM1 matrix was not modified to include the residence time distribution function of the adapted method-of-moments technique. Further investigation needs to be done into the use of stepwise linearisation of the rates. Another avenue worth investigating is the use rate laws of higher powers. This will involve changing the adapted method-of-moments technique but may yield more success than linearisation.

Objective 4: To calibrate the model on a small-scale indoor reactor

The fourth objective of this thesis was to calibrate the two techniques on a simple, indoor, HSSF CW reactor. To achieve this, different tracer studies were conducted. Three sets of tracer studies were conducted, two for the adapted method-of-moments technique and one for the curve shift technique. The first set of tracer tests conducted were impulse-response tracer studies and these were conducted on three vertical flow columns. This set of tests was done to calibrate the adapted method-of-moments technique.

- An impulse-response tracer study was conducted on three vertical flow columns.
- The peak of the residence time distribution curve arrived after 40 minutes and there was a long, drawn-out tail. This tail was expected for flow though gravel systems.
- The mean residence time of the system was 80.9 minutes, which was very close to the nominal residence time of 79 minutes and the number of tanks in series was 90. This indicated a large amount of micro-mixing in the system.
- The mean residence time of the system and the nominal residence time were only 1.9 minutes apart and this could lead to the assumption that the system behaves in an ideal manner. But by dividing the area under the curve into portions it is possible to analyse the response in more detail and identify non-ideal flow behaviour, and hence more accurate modelling.
- The area under the curve was divided into five portions, each represented a flow path through the system. Each portion of area was approximately 20% of the total area and

therefore each portion represented approximately 20% of the fluid flowing through the system.

- The mean residence time for portions 1, 2, 3, 4 and 5 were 31.00 minutes, 45.85 minutes, 61.05 minutes, 89.15 minutes, and 177.70 minutes, respectively. Three out of the five portions had a mean residence time greater than the nominal residence time determined for the portion and two had a mean residence time less than the nominal residence time determined for the portion.
- The time period over which each of the portions was distributed is different. This indicates that the mixing is not evenly distributed. As the last portion takes place over the largest time period, it can be said that the effect of mixing was greatest in this portion.
- The data from the experiments were successfully used in the adapted method-of-moments technique with a theoretical kinetic model.
- A comparison between the outlet concentration of a theoretical component using the nominal residence time and mean residence time of each portion was presented and by using the mean residence time more degradation was prediccted.

The second set of impulse-response tracer tests were conducted on a small scale HSSF constructed wetland. This was done to validate the adapted method-of-moments technique on a system more complex than the vertical flow columns.

- The mean residence time of the system was 6.67 hours, which is 2 hours longer than the nominal residence time of the system. This indicated that the water took longer to get through the system than expected.
- Instead of one peak which was seen in the first experiment, there were four peaks in this experiment, coming through at 4.4 hours, 4.75 hours, 6.5 hours, and 7.55 hours. These peaks indicated multiple and semi-distinct flow paths through the wetland and are the cause of the large mean of the residence time distribution.
- The number of tanks-in-series for this system was 7.9. which indicates that while there were multiple flow paths in the system, there was minimal mixing.
- There area under the curve was divided into five portions, each representing a flow path through the system. Each portion of area was approximately 20% of the total area and therefore each portion represented approximately 20% of the fluid flowing through the system.

- The mean residence time for portions 1, 2, 3, 4 and 5 were 3.9 hours, 5.14 hours, 6.25 hours, 7.86 hours, and 10.49 hours, respectively. Three out of the five portions had a mean residence time greater than the nominal residence time determined for the portion and two had a mean residence time less than the nominal residence time determined for the portion. However, the mean residence time and the nominal residence time were not significantly different for all 5.
- The time period over which each of the portions was distributed is different. This indicates that the mixing is not evenly distributed. As the last portion takes place over the largest time period, it can be said that the effect of mixing was greatest in this portion.
- The data from the experiments were used in the adapted method-of-moments technique with a theoretical kinetic model.
- A comparison between the outlet concentration of a theoretical component using the nominal residence time and mean residence time of each portion was presented and by using the mean residence time less degradation was precited. However, as the nominal and mean residence times for each of the sections was so similar the predicted outlet concentrations were also similar.

The third tracer study conducted was a step-change tracer study and this was conducted on a small scale HSSF constructed wetland to validate the curve-shift technique. A non-linear least-squares regression analysis was used to fit the data from the step-change tracer study to an analytically solved form of the advective-dispersive transport equation. The transport equation, without decay, was used for the conservative tracer uranine, and the transport equation with decay was used for the non-conservative tracer, benzoate. The solved advective-dispersive transport equation, with and without decay, was fitted to the benzoate and uranine step-changes response curves, respectively. The fitted curve was used to determine the retardation factor and dispersion coefficient of each of the tracers. A summary of the main findings is given below:

- Four curve-shift techniques were attempted. The first was a normalization of the non-conservative tracer response curve, to make the maximum 1. However, the shape of the non-conservative tracer response curve and the conservative tracer response curve was still different and therefore the hydraulic parameters determined from the non-conservative response curve would be inaccurate.

- The second attempt was to investigate and draw correlations between the hydrodynamic dispersion of each of the tracers, but the investigation showed them to be similar and the dispersion coefficient of the non-conservative tracer was kept as its original value.
- The third technique tried was to investigate a retardation factor, which is a function of the distribution coefficient. The research suggested that the retardation factor for both tracers was equal to 1, however, at this value, the non-linear least-squares regression analysis was not able to find a solution and therefore this cannot be true for either of these tracers. The retardation factors were kept at their original values.
- In the fourth attempt the hydrodynamic dispersion coefficient of benzoate and the retardation factor of uranine was chosen. The results from this were then normalised and this yielded a response curve for the non-conservative tracer which was similar to that of the conservative tracer.
- Hydraulic parameters from each of the responses were compared.
- The technique was found to most accurately predict the mean residence time. Caution is necessary when using this method – the data obtained from the other moments of the distribution (such as dispersion, retardation, etc.) are not as well quantified. If these are important, they must be given due consideration.

Through the conduction of the three tracer studies, two impulse-response and one step change calibration of the two techniques was achieved. It is possible to use the data from the impulse-response tracer studies in the adapted method-of-moments techniques to investigate the non-ideal flow behaviour of constructed wetlands. Work needs to be done to combine the adapted method-of-moments technique with an existing kinetic model. The curve shift technique was successful is estimating hydraulic parameters of a HSSF CW. It is suggested that future work be conducted to determine the applicability of the technique with other non-conservative tracers.

Objective 5: To validate the model on a large-scale outdoor established wetland.

The fifth objective was to validate the techniques on a large scale outdoor established wetland. This was not possible since access to a large-scale outdoor CW could not be granted. The proposed CW was in Leipzig, at the Helmholtz UFZ. The Covid-19 pandemic has precluded international travel and thus, this objective was not achieved. It is suggested that this objective form the basis of future work.

8.2 Concluding remarks

Modelling the hydraulic behaviour of constructed wetlands is not simple and to gain an understanding of the behaviour, residence time distribution studies are required. These are an inexpensive and easy way to investigate the extent of non-ideal behaviour and give an indication of how the system should be modelled. Various methods exist which can be used to model the behaviour of constructed wetlands and these are based either on data from residence time distribution studies or simulations. These methods range from the simple use of a nominal residence time value, which assumes ideal plug flow, to partial differential equations describing advective and dispersive transport in multiple directions.

Two novel residence time distribution techniques were presented in this thesis. The first is a technique based on the method-of-moments technique used for interpreting data from residence time distribution studies. The adapted technique allows the researcher to divide the area under a residence time distribution curve into multiple portions. The number of portions chosen is dependent on the computation power and time available to the researcher. The aim of this technique is to be used with a biokinetic model, such as CWM1, and in the current format the technique requires the reactions rates of the biokinetic model to be first order. While the linearisation of the reaction rates of CWM1 was not achieved, the applicability of the technique in interpreting residence time distribution data was displayed. This was done for a set of simple gravel columns and a horizontal sub-surface flow constructed wetland. The limitation of the technique lies in the need for the reaction rates to be in a format which can undergo differentiation and result in a relatively simple answer.

The second technique which was presented in this thesis was a curve-shift technique in which the response curve of a non-conservative tracer was mapped to that of a conservative tracer. The technique was found to most accurately predict the mean residence time. This allows the researcher to consider the use of biodegradable tracers for conducting step-change tracer studies and in doing so reduce the environmental impact of research without compromising the integrity of the data gathered. Caution is necessary when using this method – the data obtained from the other moments of the distribution (such as dispersion, retardation, etc.) are not as well quantified. If these are important, they must be given due consideration.

Further work is recommended for both the adapted method-of-moments technique and then the curve shift technique. Further investigations into the use of the adapted method-of-moments

technique on other wetland systems, such a vertical flow constructed wetland or free water surface constructed wetlands is suggested. The use of higher order rate laws is recommended, such as second and third order, which can be analytically differentiated. This will allow for the use of more kinetic rate equations. There is also considerable scope for the curve shift technique to be expanded to other reactor systems such as general chemical or biochemical engineering. Examples include those instances where heat may decompose the tracer, or where the tracer reacts (as opposed to biodegrades) within the reactor itself. The method would most likely need to be adapted somewhat for those circumstances. Further studies on this technique could also be considered to determine the effect of other parameters such as aspect ratio, particle size, the proximity of the Reynold's number to turbulent flow, etc. It is important for environmental research (and indeed, any research) not to aggravate environmental degradation. This study contributes towards this goal.

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Appendix A

The code used to generate Figure 4.1, Figure 4.2 and Figure 4.3

```
library(pracma)
library(ggplot2)

xd<-seq(-0.5,0.5,0.0005)
D<-dnorm(xd,0,0.005)
Impulse_in<-data.frame(x=xd,y=D)
Impulse_in_plot<-ggplot(data=Impulse_in)+
  geom_line(aes(x=x,y=y),size=1.5,color="navy blue")+
  xlab('Time')+ylab('Tracer concentration')+
  theme_classic()+
  theme(axis.ticks.x=element_blank(),
        axis.text.x =element_blank(),
        axis.ticks.y=element_blank(),
        axis.text.y = element_blank(),
        axis.title.y = element_text(size = rel(1.8)),
        axis.title.x=element_text(size=rel(1.8)))
plot(Impulse_in_plot)

yd<-seq(-15,15,0.005)
P<-dnorm(yd,0,6)
Impulse_out<-data.frame(x=yd,y=P)
Impulse_out_plot<-ggplot(data=Impulse_out)+
  geom_line(aes(x=x,y=y),size=1.5,color="red")+
  xlab('Time')+ylab('Tracer concentration')+
  theme_classic()+
  theme(axis.ticks.x=element_blank(),
        axis.text.x =element_blank(),
        axis.ticks.y=element_blank(),
        axis.text.y = element_blank(),
        axis.title.y = element_text(size = rel(1.8)),
        axis.title.x=element_text(size=rel(1.8)))
plot(Impulse_out_plot)

SI<-c(rep(0,20),c(0:20),rep(20,20))
SIx<-c(c(-20:0),rep(0,20),c(0:19))
Step_in<-data.frame(x=SIx,y=SI)
Step_in_plot<-ggplot(data=Step_in)+
              geom_line(aes(x=x,y=y),size=1.5,color="navy blue")+
              xlab('Time')+ylab('Tracer concentration')+
              theme_classic()+
              theme(axis.ticks.x=element_blank(),
               axis.text.x =element_blank(),
               axis.ticks.y=element_blank(),
               axis.text.y = element_blank(),
               axis.title.y = element_text(size = rel(1.8)),
               axis.title.x=element_text(size=rel(1.8)))
plot(Step_in_plot)

xseq<-seq(-4,4,0.01)
PP<-pnorm(xseq,0,1)
Step_out<-data.frame(x=xseq,y=PP)
```

```r
Step_out_plot<-ggplot(data=Step_out)+
  geom_line(aes(x=x,y=y),size=1.5,color="red")+
  xlab('Time')+ylab('Tracer concentration')+
  theme_classic()+
  theme(axis.ticks.x=element_blank(),
        axis.text.x =element_blank(),
        axis.ticks.y=element_blank(),
        axis.text.y = element_blank(),
        axis.title.y = element_text(size = rel(1.8)),
        axis.title.x=element_text(size=rel(1.8)))
plot(Step_out_plot)

Full_fill<-ggplot(NULL,aes(x=c(-2.5,2.5)))+
  stat_function(fun=dnorm,
                geom="area",
                fill=rgb((32/255),(56/255),(100/255)),
                args=list(mean=0,sd=0.6),
                xlim=c(-2.5,2.5))+
  xlim(-2.5,2.5)+
  theme_classic()+
  xlab('Time')+ylab('E(t)')+
  theme(axis.ticks.x=element_blank(),
        axis.text.x =element_blank(),
        axis.ticks.y=element_blank(),
        axis.text.y = element_blank(),
        axis.title.y = element_text(size = rel(1.4)),
        axis.title.x=element_text(size=rel(1.4)))
plot(Full_fill)

Half_fill<-ggplot(NULL,aes(x=c(-2.5,2.5)))+
  stat_function(fun=dnorm,
                geom="line",
                args=list(mean=0,sd=0.6),
                xlim=c(-2.5,2.5))+
  stat_function(fun=dnorm,
                geom="area",
                fill=rgb((32/255),(56/255),(100/255)),
                args=list(mean=0,sd=0.6),
                xlim=c(0,2.5))+
  xlim(-2.5,2.5)+
  theme_classic()+
  xlab('Time')+ylab('E(t)')+
  theme(axis.ticks.x=element_blank(),
        axis.text.x =element_blank(),
        axis.ticks.y=element_blank(),
        axis.text.y = element_blank(),
        axis.title.y = element_text(size = rel(1.4)),
        axis.title.x=element_text(size=rel(1.4)))
plot(Half_fill)

Two_fill<-ggplot(NULL,aes(x=c(-2.5,2.5)))+
  stat_function(fun=dnorm,
                geom="line",
                args=list(mean=0,sd=0.6),
                xlim=c(-2.5,2.5))+
  stat_function(fun=dnorm,
                geom="area",
                fill=rgb((32/255),(56/255),(100/255)),
                args=list(mean=0,sd=0.6),
                xlim=c(0,2.5))+
  stat_function(fun=dnorm,
```

```
                geom="area",
                fill="grey",
                args=list(mean=0,sd=0.6),
                xlim=c(-2.5,0))+
  xlim(-2.5,2.5)+
  theme_classic()+
  xlab('Time')+ylab('E(t)')+
  theme(axis.ticks.x=element_blank(),
        axis.text.x =element_blank(),
        axis.ticks.y=element_blank(),
        axis.text.y = element_blank(),
        axis.title.y = element_text(size = rel(1.4)),
        axis.title.x=element_text(size=rel(1.4)))
plot(Two_fill)

Four_fill<-ggplot(NULL,aes(x=c(-2.5,2.5)))+
  stat_function(fun=dnorm,
                geom="line",
                args=list(mean=0,sd=0.6),
                xlim=c(-2.5,2.5))+
  stat_function(fun=dnorm,
                geom="area",
                fill=rgb((32/255),(56/255),(100/255)),
                args=list(mean=0,sd=0.6),
                xlim=c(-2.5,-1))+
  stat_function(fun=dnorm,
                geom="area",
                fill="grey",
                args=list(mean=0,sd=0.6),
                xlim=c(-1,0))+
  stat_function(fun=dnorm,
                geom="area",
                fill=rgb((32/255),(56/255),(100/255)),
                args=list(mean=0,sd=0.6),
                xlim=c(0,1))+
  stat_function(fun=dnorm,
                geom="area",
                fill="grey",
                args=list(mean=0,sd=0.6),
                xlim=c(1,2.5))+
  xlim(-2.5,2.5)+
  theme_classic()+
  xlab('Time')+ylab('E(t)')+
  theme(axis.ticks.x=element_blank(),
        axis.text.x =element_blank(),
        axis.ticks.y=element_blank(),
        axis.text.y = element_blank(),
        axis.title.y = element_text(size = rel(1.4)),
        axis.title.x=element_text(size=rel(1.4)))
plot(Four_fill)

Ten_fill<-ggplot(NULL,aes(x=c(-2.5,2.5)))+
  stat_function(fun=dnorm,
                geom="line",
                args=list(mean=0,sd=0.6),
                xlim=c(-2.5,2.5))+
  stat_function(fun=dnorm,
                geom="area",
                fill=rgb((32/255),(56/255),(100/255)),
                args=list(mean=0,sd=0.6),
                xlim=c(-2.5,-1.8))+
```

```
  stat_function(fun=dnorm,
                geom="area",
                fill="grey",
                args=list(mean=0,sd=0.6),
                xlim=c(-1.8,-1.2))+
  stat_function(fun=dnorm,
                geom="area",
                fill=rgb((32/255),(56/255),(100/255)),
                args=list(mean=0,sd=0.6),
                xlim=c(-1.2,-0.8))+
  stat_function(fun=dnorm,
                geom="area",
                fill="grey",
                args=list(mean=0,sd=0.6),
                xlim=c(-0.8,-0.4))+
  stat_function(fun=dnorm,
                geom="area",
                fill=rgb((32/255),(56/255),(100/255)),
                args=list(mean=0,sd=0.6),
                xlim=c(-0.4,0))+
  stat_function(fun=dnorm,
                geom="area",
                fill="grey",
                args=list(mean=0,sd=0.6),
                xlim=c(0,0.4))+
  stat_function(fun=dnorm,
                geom="area",
                fill=rgb((32/255),(56/255),(100/255)),
                args=list(mean=0,sd=0.6),
                xlim=c(0.4,0.8))+
  stat_function(fun=dnorm,
                geom="area",
                fill="grey",
                args=list(mean=0,sd=0.6),
                xlim=c(0.8,1.2))+
  stat_function(fun=dnorm,
                geom="area",
                fill=rgb((32/255),(56/255),(100/255)),
                args=list(mean=0,sd=0.6),
                xlim=c(1.2,1.8))+
  stat_function(fun=dnorm,
                geom="area",
                fill="grey",
                args=list(mean=0,sd=0.6),
                xlim=c(1.8,2.5))+
  xlim(-2.5,2.5)+
  theme_classic()+
  xlab('Time')+ylab('E(t)')+
  theme(axis.ticks.x=element_blank(),
        axis.text.x =element_blank(),
        axis.ticks.y=element_blank(),
        axis.text.y = element_blank(),
        axis.title.y = element_text(size = rel(1.4)),
        axis.title.x=element_text(size=rel(1.4)))
plot(Ten_fill)
```

```
#Giving examples of how the AD curve changes with different parameter
#values
library(ggplot2)
library(pracma)
library(dgof)
library(scales)
library(pracma)
library("gridExtra")
library("viridis")

#Simple one first

vel<-0.01
time<-c(seq(from=0,to=1000,by=10))
Ret<-1
Disp<-0.001
gamma<-0
Muu<-0.00001
Inlet<-1
Initial<-0
Pos<-1


Conc_1<-(Inlet-(gamma/Muu))*
  ((vel/((vel*(1+((4*Muu*Disp)/(vel^2)))^0.5)+vel))*
     exp(((vel-(vel*(1+((4*Muu*Disp)/(vel^2)))^0.5))*Pos)/(2*Disp))*
     erfc((Ret*Pos-(vel*(1+((4*Muu*Disp)/(vel^2)))^0.5)*time)/
            (2*(Disp*Ret*time)^(1/2)))+
     (vel/(vel-(vel*(1+((4*Muu*Disp)/(vel^2)))^0.5)))*
     exp(((vel+(vel*(1+((4*Muu*Disp)/(vel^2)))^0.5))*Pos)/(2*Disp))*
     erfc((Ret*Pos+(vel*(1+((4*Muu*Disp)/(vel^2)))^0.5)*time)/
            (2*(Disp*Ret*time)^(1/2)))+
     (vel^2/(2*Muu*Disp))*
     exp(((vel*Pos)/(Disp))-((Muu*time)/Ret))*
     erfc((Ret*Pos+vel*time)/(2*(Disp*Ret*time)^(1/2))))+
  ((gamma/Muu)-Initial)*exp(-(Muu*time)/Ret)*
  (0.5*erfc((Ret*Pos-vel*time)/(2*(Disp*Ret*time)^(1/2)))+
     ((vel*time)/(pi*Ret*Disp))^(1/2)*
     exp(-(Ret*Pos-vel*time)^2/(4*Disp*Ret*time))-
     0.5*(1+(vel*Pos/Disp)+((vel^2)*time)/(Disp*Ret))*
     exp(vel*Pos/Disp)*
     erfc(vel*Pos/Disp)*
     erfc((Ret*Pos+vel*time)/(2*(Disp*Ret*time)^(1/2))))+
  (gamma/Muu)+(Initial-(gamma/Muu))*
  exp(-((Muu*time)/(Ret)))

plot(time,Conc_1)

Ret_1<-1.5

Conc_2<-(Inlet-(gamma/Muu))*
  ((vel/((vel*(1+((4*Muu*Disp)/(vel^2)))^0.5)+vel))*
     exp(((vel-(vel*(1+((4*Muu*Disp)/(vel^2)))^0.5))*Pos)/(2*Disp))*
     erfc((Ret_1*Pos-(vel*(1+((4*Muu*Disp)/(vel^2)))^0.5)*time)/
            (2*(Disp*Ret_1*time)^(1/2)))+
     (vel/(vel-(vel*(1+((4*Muu*Disp)/(vel^2)))^0.5)))*
     exp(((vel+(vel*(1+((4*Muu*Disp)/(vel^2)))^0.5))*Pos)/(2*Disp))*
     erfc((Ret_1*Pos+(vel*(1+((4*Muu*Disp)/(vel^2)))^0.5)*time)/
            (2*(Disp*Ret_1*time)^(1/2)))+
     (vel^2/(2*Muu*Disp))*
     exp(((vel*Pos)/(Disp))-((Muu*time)/Ret_1))*
```

```
     erfc((Ret_1*Pos+vel*time)/(2*(Disp*Ret_1*time)^(1/2))))+
  ((gamma/Muu)-Initial)*exp(-(Muu*time)/Ret_1)*
  (0.5*erfc((Ret_1*Pos-vel*time)/(2*(Disp*Ret_1*time)^(1/2)))+
     ((vel*time)/(pi*Ret_1*Disp))^(1/2)*
     exp(-(Ret_1*Pos-vel*time)^2/(4*Disp*Ret_1*time))-
     0.5*(1+(vel*Pos/Disp)+((vel^2)*time)/(Disp*Ret_1))*
     exp(vel*Pos/Disp)*
     erfc(vel*Pos/Disp)*
     erfc((Ret_1*Pos+vel*time)/(2*(Disp*Ret_1*time)^(1/2))))+
  (gamma/Muu)+(Initial-(gamma/Muu))*
  exp(-((Muu*time)/(Ret_1)))

plot(time,Conc_2)

Ret_2<-2.2

Conc_3<-(Inlet-(gamma/Muu))*
  ((vel/((vel*(1+((4*Muu*Disp)/(vel^2)))^0.5)+vel))*
     exp(((vel-(vel*(1+((4*Muu*Disp)/(vel^2)))^0.5))*Pos)/(2*Disp))*
     erfc((Ret_2*Pos-(vel*(1+((4*Muu*Disp)/(vel^2)))^0.5)*time)/
            (2*(Disp*Ret_2*time)^(1/2)))+
     (vel/(vel-(vel*(1+((4*Muu*Disp)/(vel^2)))^0.5)))*
     exp(((vel+(vel*(1+((4*Muu*Disp)/(vel^2)))^0.5))*Pos)/(2*Disp))*
     erfc((Ret_2*Pos+(vel*(1+((4*Muu*Disp)/(vel^2)))^0.5)*time)/
            (2*(Disp*Ret_2*time)^(1/2)))+
     (vel^2/(2*Muu*Disp))*
     exp(((vel*Pos)/(Disp))-((Muu*time)/Ret_2))*
     erfc((Ret_2*Pos+vel*time)/(2*(Disp*Ret_2*time)^(1/2))))+
  ((gamma/Muu)-Initial)*exp(-(Muu*time)/Ret_2)*
  (0.5*erfc((Ret_2*Pos-vel*time)/(2*(Disp*Ret_2*time)^(1/2)))+
     ((vel*time)/(pi*Ret_2*Disp))^(1/2)*
     exp(-(Ret_2*Pos-vel*time)^2/(4*Disp*Ret_2*time))-
     0.5*(1+(vel*Pos/Disp)+((vel^2)*time)/(Disp*Ret_2))*
     exp(vel*Pos/Disp)*
     erfc(vel*Pos/Disp)*
     erfc((Ret_2*Pos+vel*time)/(2*(Disp*Ret_2*time)^(1/2))))+
  (gamma/Muu)+(Initial-(gamma/Muu))*
  exp(-((Muu*time)/(Ret_2)))

plot(time,Conc_3)

Ret_change<-data.frame(Time=c(time,time,time),
                       Response=c(Conc_1,Conc_2,Conc_3),
                       Source=c(c(rep("R=1",times=length(time))),
                                c(rep("R=1.5",times=length(time))),
                                c(rep("R=2.2",times=length(time)))))

Ret_change_plot<-ggplot(data=Ret_change,aes(x=Time,
                                            y=Response,group=Source))+
                 geom_line(aes(color=Source),size=3)+
                 geom_point(aes(color=Source),size=4)+
                 xlab('Time')+
                 ylab('F(t)')+
                 theme_bw()+
                 scale_color_viridis_d()+
                 theme(legend.title = element_blank(),
                       legend.text = element_text(colour='black',
                                                  size=60),
                       axis.text.y=element_text(size=36),
                       axis.text.x=element_text(size=36),
                       text=element_text(family="Times New Roman"),
```

```
                      axis.title.y = element_blank(),
                      axis.title.x = element_blank())
plot(Ret_change_plot)
ggsave(filename = "Retardation change thesis.jpg",
       plot = Ret_change_plot,units="mm",
       width=1000,height=130,dpi=300,limitsize = FALSE)

Disp_1<-Disp*10

Conc_4<-(Inlet-(gamma/Muu))*
  ((vel/((vel*(1+((4*Muu*Disp_1)/(vel^2)))^0.5)+vel))*
     exp(((vel-(vel*(1+((4*Muu*Disp_1)/(vel^2)))^0.5))*Pos)/(2*Disp_1))*
     erfc((Ret*Pos-(vel*(1+((4*Muu*Disp_1)/(vel^2)))^0.5)*time)/
            (2*(Disp_1*Ret*time)^(1/2)))+
     (vel/(vel-(vel*(1+((4*Muu*Disp_1)/(vel^2)))^0.5)))*
     exp(((vel+(vel*(1+((4*Muu*Disp_1)/(vel^2)))^0.5))*Pos)/(2*Disp_1))*
     erfc((Ret*Pos+(vel*(1+((4*Muu*Disp_1)/(vel^2)))^0.5)*time)/
            (2*(Disp_1*Ret*time)^(1/2)))+
     (vel^2/(2*Muu*Disp_1))*
     exp(((vel*Pos)/(Disp_1))-((Muu*time)/Ret))*
     erfc((Ret*Pos+vel*time)/(2*(Disp_1*Ret*time)^(1/2))))+
  ((gamma/Muu)-Initial)*exp(-(Muu*time)/Ret)*
  (0.5*erfc((Ret*Pos-vel*time)/(2*(Disp_1*Ret*time)^(1/2)))+
     ((vel*time)/(pi*Ret*Disp_1))^(1/2)*
     exp(-(Ret*Pos-vel*time)^2/(4*Disp_1*Ret*time))-
     0.5*(1+(vel*Pos/Disp_1)+((vel^2)*time)/(Disp_1*Ret))*
     exp(vel*Pos/Disp_1)*
     erfc(vel*Pos/Disp_1)*
     erfc((Ret*Pos+vel*time)/(2*(Disp_1*Ret*time)^(1/2))))+
  (gamma/Muu)+(Initial-(gamma/Muu))*
  exp(-((Muu*time)/(Ret)))

plot(time,Conc_4)

Disp_2<-Disp*20

Conc_5<-(Inlet-(gamma/Muu))*
  ((vel/((vel*(1+((4*Muu*Disp_2)/(vel^2)))^0.5)+vel))*
     exp(((vel-(vel*(1+((4*Muu*Disp_2)/(vel^2)))^0.5))*Pos)/(2*Disp_2))*
     erfc((Ret*Pos-(vel*(1+((4*Muu*Disp_2)/(vel^2)))^0.5)*time)/
            (2*(Disp_2*Ret*time)^(1/2)))+
     (vel/(vel-(vel*(1+((4*Muu*Disp_2)/(vel^2)))^0.5)))*
     exp(((vel+(vel*(1+((4*Muu*Disp_2)/(vel^2)))^0.5))*Pos)/(2*Disp_2))*
     erfc((Ret*Pos+(vel*(1+((4*Muu*Disp_2)/(vel^2)))^0.5)*time)/
            (2*(Disp_2*Ret*time)^(1/2)))+
     (vel^2/(2*Muu*Disp_2))*
     exp(((vel*Pos)/(Disp_2))-((Muu*time)/Ret))*
     erfc((Ret*Pos+vel*time)/(2*(Disp_2*Ret*time)^(1/2))))+
  ((gamma/Muu)-Initial)*exp(-(Muu*time)/Ret)*
  (0.5*erfc((Ret*Pos-vel*time)/(2*(Disp_2*Ret*time)^(1/2)))+
     ((vel*time)/(pi*Ret*Disp_2))^(1/2)*
     exp(-(Ret*Pos-vel*time)^2/(4*Disp_2*Ret*time))-
     0.5*(1+(vel*Pos/Disp_2)+((vel^2)*time)/(Disp_2*Ret))*
     exp(vel*Pos/Disp_2)*
     erfc(vel*Pos/Disp_2)*
     erfc((Ret*Pos+vel*time)/(2*(Disp_2*Ret*time)^(1/2))))+
  (gamma/Muu)+(Initial-(gamma/Muu))*
  exp(-((Muu*time)/(Ret)))

plot(time,Conc_5)
```

```
Disp_change<-data.frame(Time=c(time,time,time),
                        Response=c(Conc_1,Conc_4,Conc_5),
                        Source=c(c(rep("D",times=length(time))),
                                 c(rep("D*10",times=length(time))),
                                 c(rep("D*20",times=length(time)))))

Disp_change_plot<-ggplot(data=Disp_change,aes(x=Time, y=Response,
                                              group=Source))+
                  geom_line(aes(color=Source),size=3)+
                  geom_point(aes(color=Source),size=4)+
                  xlab('Time')+
                  ylab('F(t)')+
                  theme_bw()+
                  scale_color_viridis_d()+
                  theme(legend.title = element_blank(),
                        legend.text = element_text(colour='black',
                                                   size=60),
                        axis.text.y=element_text(size=36),
                        axis.text.x=element_text(size=36),
                        text=element_text(family="Times New Roman"),
                        axis.title.y = element_blank(),
                        axis.title.x = element_blank())
plot(Disp_change_plot)
ggsave(filename = "Dispersion change thesis.jpg",
       plot = Disp_change_plot,units="mm",
       width=1000,height=130,dpi=300,limitsize = FALSE)

Muu_1<-Muu*100

Conc_6<-(Inlet-(gamma/Muu_1))*
  ((vel/((vel*(1+((4*Muu_1*Disp)/(vel^2)))^0.5)+vel))*
     exp(((vel-(vel*(1+((4*Muu_1*Disp)/(vel^2)))^0.5))*Pos)/(2*Disp))*
     erfc((Ret*Pos-(vel*(1+((4*Muu_1*Disp)/(vel^2)))^0.5)*time)/
            (2*(Disp*Ret*time)^(1/2)))+
     (vel/(vel-(vel*(1+((4*Muu_1*Disp)/(vel^2)))^0.5)))*
     exp(((vel+(vel*(1+((4*Muu_1*Disp)/(vel^2)))^0.5))*Pos)/(2*Disp))*
     erfc((Ret*Pos+(vel*(1+((4*Muu_1*Disp)/(vel^2)))^0.5)*time)/
            (2*(Disp*Ret*time)^(1/2)))+
     (vel^2/(2*Muu_1*Disp))*
     exp(((vel*Pos)/(Disp))-((Muu_1*time)/Ret))*
     erfc((Ret*Pos+vel*time)/(2*(Disp*Ret*time)^(1/2))))+
  ((gamma/Muu_1)-Initial)*exp(-(Muu_1*time)/Ret)*
  (0.5*erfc((Ret*Pos-vel*time)/(2*(Disp*Ret*time)^(1/2)))+
     ((vel*time)/(pi*Ret*Disp))^(1/2)*
     exp(-(Ret*Pos-vel*time)^2/(4*Disp*Ret*time))-
     0.5*(1+(vel*Pos/Disp)+((vel^2)*time)/(Disp*Ret))*
     exp(vel*Pos/Disp)*
     erfc(vel*Pos/Disp)*
     erfc((Ret*Pos+vel*time)/(2*(Disp*Ret*time)^(1/2))))+
  (gamma/Muu_1)+(Initial-(gamma/Muu_1))*
  exp(-((Muu_1*time)/(Ret)))

plot(time,Conc_6)

Muu_2<-Muu*200
Conc_7<-(Inlet-(gamma/Muu_2))*
  ((vel/((vel*(1+((4*Muu_2*Disp)/(vel^2)))^0.5)+vel))*
     exp(((vel-(vel*(1+((4*Muu_2*Disp)/(vel^2)))^0.5))*Pos)/(2*Disp))*
     erfc((Ret*Pos-(vel*(1+((4*Muu_2*Disp)/(vel^2)))^0.5)*time)/
            (2*(Disp*Ret*time)^(1/2)))+
     (vel/(vel-(vel*(1+((4*Muu_2*Disp)/(vel^2)))^0.5)))*
```

```
      exp(((vel+(vel*(1+((4*Muu_2*Disp)/(vel^2)))^0.5))*Pos)/(2*Disp))*
      erfc((Ret*Pos+(vel*(1+((4*Muu_2*Disp)/(vel^2)))^0.5)*time)/
             (2*(Disp*Ret*time)^(1/2)))+
      (vel^2/(2*Muu_2*Disp))*
      exp(((vel*Pos)/(Disp))-((Muu_2*time)/Ret))*
      erfc((Ret*Pos+vel*time)/(2*(Disp*Ret*time)^(1/2))))+
   ((gamma/Muu_2)-Initial)*exp(-(Muu_2*time)/Ret)*
   (0.5*erfc((Ret*Pos-vel*time)/(2*(Disp*Ret*time)^(1/2)))+
      ((vel*time)/(pi*Ret*Disp))^(1/2)*
      exp(-(Ret*Pos-vel*time)^2/(4*Disp*Ret*time))-
      0.5*(1+(vel*Pos/Disp)+((vel^2)*time)/(Disp*Ret))*
      exp(vel*Pos/Disp)*
      erfc(vel*Pos/Disp)*
      erfc((Ret*Pos+vel*time)/(2*(Disp*Ret*time)^(1/2))))+
   (gamma/Muu_2)+(Initial-(gamma/Muu_2))*
   exp(-((Muu_2*time)/(Ret)))

plot(time,Conc_7)

Muu_change<-data.frame(Time=c(time,time,time),
                       Response=c(Conc_1,Conc_6,Conc_7),
                       Source=c(c(rep("mu",times=length(time))),
                                c(rep("mu*100",times=length(time))),
                                c(rep("mu*200",times=length(time)))))

Muu_change_plot<-ggplot(data=Muu_change,aes(x=Time,
                                            y=Response,
                                            group=Source))+
                 geom_line(aes(color=Source),size=3)+
                 geom_point(aes(color=Source),size=4)+
                 xlab('Time')+
                 ylab('F(t)')+
                 theme_bw()+
                 scale_color_viridis_d()+
                 theme(legend.title = element_blank(),
                       legend.text = element_text(colour='black',
                                                  size=60),
                       axis.text.y=element_text(size=36),
                       axis.text.x=element_text(size=36),
                       text=element_text(family="Times New Roman"),
                       axis.title.y = element_blank(),
                       axis.title.x = element_blank())

plot(Muu_change_plot)
ggsave(filename = "Degradation change thesis.jpg",
       plot = Muu_change_plot,units="mm",
       width=1000,height=130,dpi=300,limitsize = FALSE)

gamma_1<--0.00000001*10

Conc_8<-(Inlet-(gamma_1/Muu))*
   ((vel/((vel*(1+((4*Muu*Disp)/(vel^2)))^0.5)+vel))*
      exp(((vel-(vel*(1+((4*Muu*Disp)/(vel^2)))^0.5))*Pos)/(2*Disp))*
      erfc((Ret*Pos-(vel*(1+((4*Muu*Disp)/(vel^2)))^0.5)*time)/
             (2*(Disp*Ret*time)^(1/2)))+
      (vel/(vel-(vel*(1+((4*Muu*Disp)/(vel^2)))^0.5)))*
      exp(((vel+(vel*(1+((4*Muu*Disp)/(vel^2)))^0.5))*Pos)/(2*Disp))*
      erfc((Ret*Pos+(vel*(1+((4*Muu*Disp)/(vel^2)))^0.5)*time)/
             (2*(Disp*Ret*time)^(1/2)))+
      (vel^2/(2*Muu*Disp))*
      exp(((vel*Pos)/(Disp))-((Muu*time)/Ret))*
```

```
     erfc((Ret*Pos+vel*time)/(2*(Disp*Ret*time)^(1/2))))+
  ((gamma_1/Muu)-Initial)*exp(-(Muu*time)/Ret)*
  (0.5*erfc((Ret*Pos-vel*time)/(2*(Disp*Ret*time)^(1/2)))+
     ((vel*time)/(pi*Ret*Disp))^(1/2)*
     exp(-(Ret*Pos-vel*time)^2/(4*Disp*Ret*time))-
     0.5*(1+(vel*Pos/Disp)+((vel^2)*time)/(Disp*Ret))*
     exp(vel*Pos/Disp)*
     erfc(vel*Pos/Disp)*
     erfc((Ret*Pos+vel*time)/(2*(Disp*Ret*time)^(1/2))))+
  (gamma_1/Muu)+(Initial-(gamma_1/Muu))*
  exp(-((Muu*time)/(Ret)))

plot(time,Conc_6)

gamma_2<--0.00000001*20
Conc_9<-(Inlet-(gamma_2/Muu))*
  ((vel/((vel*(1+((4*Muu*Disp)/(vel^2)))^0.5)+vel))*
     exp(((vel-(vel*(1+((4*Muu*Disp)/(vel^2)))^0.5))*Pos)/(2*Disp))*
     erfc((Ret*Pos-(vel*(1+((4*Muu*Disp)/(vel^2)))^0.5)*time)/
            (2*(Disp*Ret*time)^(1/2)))+
     (vel/(vel-(vel*(1+((4*Muu*Disp)/(vel^2)))^0.5)))*
     exp(((vel+(vel*(1+((4*Muu*Disp)/(vel^2)))^0.5))*Pos)/(2*Disp))*
     erfc((Ret*Pos+(vel*(1+((4*Muu*Disp)/(vel^2)))^0.5)*time)/
            (2*(Disp*Ret*time)^(1/2)))+
     (vel^2/(2*Muu*Disp))*
     exp(((vel*Pos)/(Disp))-((Muu*time)/Ret))*
     erfc((Ret*Pos+vel*time)/(2*(Disp*Ret*time)^(1/2))))+
  ((gamma_2/Muu)-Initial)*exp(-(Muu*time)/Ret)*
  (0.5*erfc((Ret*Pos-vel*time)/(2*(Disp*Ret*time)^(1/2)))+
     ((vel*time)/(pi*Ret*Disp))^(1/2)*
     exp(-(Ret*Pos-vel*time)^2/(4*Disp*Ret*time))-
     0.5*(1+(vel*Pos/Disp)+((vel^2)*time)/(Disp*Ret))*
     exp(vel*Pos/Disp)*
     erfc(vel*Pos/Disp)*
     erfc((Ret*Pos+vel*time)/(2*(Disp*Ret*time)^(1/2))))+
  (gamma_2/Muu)+(Initial-(gamma_2/Muu))*
  exp(-((Muu*time)/(Ret)))

plot(time,Conc_9)

Gamma_change<-data.frame(Time=c(time,time,time),
                         Response=c(Conc_1,Conc_8,Conc_9),
                         Source=c(c(rep("gamma",times=length(time))),
                                  c(rep("gamma*100",times=length(time))),
                                  c(rep("gamma*200",times=length(time)))))

Gamma_change_plot<-ggplot(data=Gamma_change,aes(x=Time, y=Response,
                                                group=Source))+
  geom_line(aes(color=Source))+
  geom_point(aes(color=Source))+
  scale_color_viridis_d()+
  theme_bw()+
  theme(legend.title = element_blank(),
        axis.text.x=element_blank())
plot(Gamma_change_plot)
```

Appendix B

Table of the individual rates

j	process	I	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
		Component	S_O	S_F	S_A	S_I	S_{NH}	S_{NO}	S_{SO4}	S_{H2S}	X_S	X_I	X_H	X_A	X_{FB}	X_{AMB}	X_{ASRB}	X_{SOB}
		Expressed as	O_2	COD	COD	COD	N	N	S	S	COD	COD	COD	COD	COD	COD	COD	COD
1	Hydrolysis			$(1-f_{Hyd,SI})*k_h$ $*\left[\frac{\frac{X_s}{X_H+X_{FB}}}{K_X+\frac{X_s}{X_H+X_{FB}}}\right]$ $*(X_H+\eta_h*X_{FB})$		$f_{Hyd,SI}*k_h$ $*\left[\frac{\frac{X_s}{X_H+X_{FB}}}{K_X+\frac{X_s}{X_H+X_{FB}}}\right]$ $*(X_H+\eta_h*X_{FB})$	$v_{5,1}*k_h$ $*\left[\frac{\frac{X_s}{X_H+X_{FB}}}{K_X+\frac{X_s}{X_H+X_{FB}}}\right]$ $*(X_H+\eta_h*X_{FB})$				$-k_h$ $*\left[\frac{\frac{X_s}{X_H+X_{FB}}}{K_X+\frac{X_s}{X_H+X_{FB}}}\right]$ $*(X_H+\eta_h*X_{FB})$		k_h $*\left[\frac{\frac{X_s}{X_H+X_{FB}}}{K_X+\frac{X_s}{X_H+X_{FB}}}\right]$ $*(X_H+\eta_h*X_{FB})$					
2	Aerobic growth of X_H on S_F		$\mu_H*\left[\frac{S_F}{K_{SF}+S_F}\right]$ $*\left[\frac{S_F}{S_F+S_A}\right]$ $*\left[\frac{S_O}{K_{OH}+S_O}\right]$ $*\left[\frac{S_{NH}}{K_{NHH}+S_{NH}}\right]$ $*\left[\frac{K_{H2SH}}{K_{H2SH}+S_{H2S^*}}\right]$ $*X_H$	$\mu_H*\left[\frac{S_F}{K_{SF}+S_F}\right]$ $*\left[\frac{S_F}{S_F+S_A}\right]$ $*\left[\frac{S_O}{K_{OH}+S_O}\right]$ $*\left[\frac{S_{NH}}{K_{NHH}+S_{NH}}\right]$ $*\left[\frac{K_{H2SH}}{K_{H2SH}+S_{H2S^*}}\right]$ $*X_H$			$\mu_H*\left[\frac{S_F}{K_{SF}+S_F}\right]$ $*\left[\frac{S_F}{S_F+S_A}\right]$ $*\left[\frac{S_O}{K_{OH}+S_O}\right]$ $*\left[\frac{S_{NH}}{K_{NHH}+S_{NH}}\right]$ $*\left[\frac{K_{H2SH}}{K_{H2SH}+S_{H2S^*}}\right]$ $*X_H$						$\mu_H*\left[\frac{S_F}{K_{SF}+S_F}\right]$ $*\left[\frac{S_F}{S_F+S_A}\right]$ $*\left[\frac{S_O}{K_{OH}+S_O}\right]$ $*\left[\frac{S_{NH}}{K_{NHH}+S_{NH}}\right]$ $*\left[\frac{K_{H2SH}}{K_{H2SH}+S_{H2S^*}}\right]$ $*X_H$					
3	Aerobic growth of X_H on S_A			$\left(-\frac{1}{Y_H}\right)*n_g*\mu_H$ $*\left[\frac{S_F}{K_{SF}+S_F}\right]$ $*\left[\frac{S_F}{S_F+S_A}\right]$ $*\left[\frac{K_{OH}}{K_{OH}+S_O}\right]$ $*\left[\frac{S_{NO}}{K_{NOH}+S_{NO}}\right]$ $*\left[\frac{S_{NH}}{K_{NHH}+S_{NH}}\right]$ $*\left[\frac{K_{H2SH}}{K_{H2SH}+S_{H2S^*}}\right]$ $*X_H$			$v_{5,3}*n_g*\mu_H$ $*\left[\frac{S_F}{K_{SF}+S_F}\right]$ $*\left[\frac{S_F}{S_F+S_A}\right]$ $*\left[\frac{K_{OH}}{K_{OH}+S_O}\right]$ $*\left[\frac{S_{NO}}{K_{NOH}+S_{NO}}\right]$ $*\left[\frac{S_{NH}}{K_{NHH}+S_{NH}}\right]$ $*\left[\frac{K_{H2SH}}{K_{H2SH}+S_{H2S^*}}\right]$ $*X_H$	$\left(-\frac{1-Y_H}{2.86*Y_H}\right)*n_g$ $*\mu_H*\left[\frac{S_F}{K_{SF}+S_F}\right]$ $*\left[\frac{S_F}{S_F+S_A}\right]$ $*\left[\frac{K_{OH}}{K_{OH}+S_O}\right]$ $*\left[\frac{S_{NO}}{K_{NOH}+S_{NO}}\right]$ $*\left[\frac{S_{NH}}{K_{NHH}+S_{NH}}\right]$ $*\left[\frac{K_{H2SH}}{K_{H2SH}+S_{H2S^*}}\right]*X_H$					$n_g*\mu_H*\left[\frac{S_F}{K_{SF}+S_F}\right]$ $*\left[\frac{S_F}{S_F+S_A}\right]$ $*\left[\frac{K_{OH}}{K_{OH}+S_O}\right]$ $*\left[\frac{S_{NO}}{K_{NOH}+S_{NO}}\right]$ $*\left[\frac{S_{NH}}{K_{NHH}+S_{NH}}\right]$ $*\left[\frac{K_{H2SH}}{K_{H2SH}+S_{H2S^*}}\right]$ $*X_H$					
4	Anoxic growth X_H on S_F		$\left(1-\frac{1}{Y_H}\right)*\mu_H$ $*\left[\frac{S_A}{K_{SA}+S_A}\right]$ $*\left[\frac{S_A}{S_F+S_A}\right]$ $*\left[\frac{S_O}{K_{OH}+S_O}\right]$ $*\left[\frac{S_{NH}}{K_{NHH}+S_{NH}}\right]$ $*\left[\frac{K_{H2SH}}{K_{H2SH}+S_{H2S^*}}\right]$ $*X_H$		$\left(-\frac{1}{Y_H}\right)*\mu_H$ $*\left[\frac{S_A}{K_{SA}+S_A}\right]$ $*\left[\frac{S_A}{S_F+S_A}\right]$ $*\left[\frac{S_O}{K_{OH}+S_O}\right]$ $*\left[\frac{S_{NH}}{K_{NHH}+S_{NH}}\right]$ $*\left[\frac{K_{H2SH}}{K_{H2SH}+S_{H2S^*}}\right]$ $*X_H$		$v_{5,4}*\mu_H*\left[\frac{S_A}{K_{SA}+S_A}\right]$ $*\left[\frac{S_A}{S_F+S_A}\right]$ $*\left[\frac{S_O}{K_{OH}+S_O}\right]$ $*\left[\frac{S_{NH}}{K_{NHH}+S_{NH}}\right]$ $*\left[\frac{K_{H2SH}}{K_{H2SH}+S_{H2S^*}}\right]$ $*X_H$						$\mu_H*\left[\frac{S_A}{K_{SA}+S_A}\right]$ $*\left[\frac{S_A}{S_F+S_A}\right]$ $*\left[\frac{S_O}{K_{OH}+S_O}\right]$ $*\left[\frac{S_{NH}}{K_{NHH}+S_{NH}}\right]$ $*\left[\frac{K_{H2SH}}{K_{H2SH}+S_{H2S^*}}\right]$ $*X_H$					
5	Anoxic growth of X_H on S_A			$\left(-\frac{1}{Y_H}\right)*n_g*\mu_H$ $*\left[\frac{S_A}{K_{SA}+S_A}\right]$ $*\left[\frac{S_A}{S_F+S_A}\right]$ $*\left[\frac{K_{OH}}{K_{OH}+S_O}\right]$ $*\left[\frac{S_{NO}}{K_{NOH}+S_{NO}}\right]$ $*\left[\frac{S_{NH}}{K_{NHH}+S_{NH}}\right]$ $*\left[\frac{K_{H2SH}}{K_{H2SH}+S_{H2S^*}}\right]$ $*X_H$		$v_{5,5}*n_g*\mu_H$ $*\left[\frac{S_A}{K_{SA}+S_A}\right]$ $*\left[\frac{S_A}{S_F+S_A}\right]$ $*\left[\frac{K_{OH}}{K_{OH}+S_O}\right]$ $*\left[\frac{S_{NO}}{K_{NOH}+S_{NO}}\right]$ $*\left[\frac{S_{NH}}{K_{NHH}+S_{NH}}\right]$ $*\left[\frac{K_{H2SH}}{K_{H2SH}+S_{H2S^*}}\right]$ $*X_H$	$\left(-\frac{1-Y_H}{2.86*Y_H}\right)*n_g$ $*\mu_H*\left[\frac{S_A}{K_{SA}+S_A}\right]$ $*\left[\frac{S_A}{S_F+S_A}\right]$ $*\left[\frac{K_{OH}}{K_{OH}+S_O}\right]$ $*\left[\frac{S_{NO}}{K_{NOH}+S_{NO}}\right]$ $*\left[\frac{S_{NH}}{K_{NHH}+S_{NH}}\right]$ $*\left[\frac{K_{H2SH}}{K_{H2SH}+S_{H2S^*}}\right]*X_H$					$n_g*\mu_H*\left[\frac{S_A}{K_{SA}+S_A}\right]$ $*\left[\frac{S_A}{S_F+S_A}\right]$ $*\left[\frac{K_{OH}}{K_{OH}+S_O}\right]$ $*\left[\frac{S_{NO}}{K_{NOH}+S_{NO}}\right]$ $*\left[\frac{S_{NH}}{K_{NHH}+S_{NH}}\right]$ $*\left[\frac{K_{H2SH}}{K_{H2SH}+S_{H2S^*}}\right]$ $*X_H$					
6	Lysis if X_H			$(f_{BM,SF})*b_H*X_H$			$v_{5,6}*b_H*X_H$				$v_{9,Lysis}*b_H*X_H$	$f_{BM,XI}$ $*b_H$ $*X_H$	$-b_H*X_H$					

7	Growth of X_A on S_{NH}	$\left(-\frac{4.57-Y_A}{Y_A}\right)$ $*\mu_A$ $*\left[\frac{S_{NH}}{K_{NHA}+S_{NH}}\right]$ $*\left[\frac{S_O}{K_{OA}+S_O}\right]$ $*\left[\frac{K_{H2SA}}{K_{H2SA}+S_{H2S^*}}\right]$ $*X_A$				$\left(-i_{N,BM}-\frac{1}{Y_A}\right)*\mu_A$ $*\left[\frac{S_{NH}}{K_{NHA}+S_{NH}}\right]$ $*\left[\frac{S_O}{K_{OA}+S_O}\right]$ $*\left[\frac{K_{H2SA}}{K_{H2SA}+S_{H2S^*}}\right]$ $*X_A$	$\left(\frac{1}{Y_A}\right)*\mu_A$ $*\left[\frac{S_{NH}}{K_{NHA}+S_{NH}}\right]$ $*\left[\frac{S_O}{K_{OA}+S_O}\right]$ $*\left[\frac{K_{H2SA}}{K_{H2SA}+S_{H2S^*}}\right]*X_A$						μ_A $*\left[\frac{S_{NH}}{K_{NHA}+S_{NH}}\right]$ $*\left[\frac{S_O}{K_{OA}+S_O}\right]$ $*\left[\frac{K_{H2SA}}{K_{H2SA}+S_{H2S^*}}\right]$ $*X_A$				
8	Lysis of X_A		$(f_{BM,SF})*b_A*X_A$			$v_{5,8}*b_A*X_A$				$v_{9,Lysis}*b_A*X_A$	$f_{BM,XI}$ $*b_A$ $*X_A$		$-b_A*X_A$					
9	Growth of X_{FB}		$\left(-\frac{1}{Y_{FB}}\right)*\mu_{FB}$ $*\left[\frac{S_F}{K_{SFB}+S_F}\right]$ $*\left[\frac{K_{H2SFB}}{K_{H2SFB}+S_{H2S^*}}\right]$ $*\left[\frac{K_{OFB}}{K_{OFB}+S_O}\right]$ $*\left[\frac{K_{NOFB}}{K_{NOFB}+S_{NO}}\right]$ $*\left[\frac{S_{NH}}{K_{NHFB}+S_{NH}}\right]$ $*X_{FB}$	$\left(\frac{1-Y_{FB}}{Y_{FB}}\right)*\mu_{FB}$ $*\left[\frac{S_F}{K_{SFB}+S_F}\right]$ $*\left[\frac{K_{H2SFB}}{K_{H2SFB}+S_{H2S^*}}\right]$ $*\left[\frac{K_{OFB}}{K_{OFB}+S_O}\right]$ $*\left[\frac{K_{NOFB}}{K_{NOFB}+S_{NO}}\right]$ $*\left[\frac{S_{NH}}{K_{NHFB}+S_{NH}}\right]$ $*X_{FB}$		$v_{5,9}*\mu_{FB}$ $*\left[\frac{S_F}{K_{SFB}+S_F}\right]$ $*\left[\frac{K_{H2SFB}}{K_{H2SFB}+S_{H2S^*}}\right]$ $*\left[\frac{K_{OFB}}{K_{OFB}+S_O}\right]$ $*\left[\frac{K_{NOFB}}{K_{NOFB}+S_{NO}}\right]$ $*\left[\frac{S_{NH}}{K_{NHFB}+S_{NH}}\right]$ $*X_{FB}$							$\mu_{FB}*\left[\frac{S_F}{K_{SFB}+S_F}\right]$ $*\left[\frac{K_{H2SFB}}{K_{H2SFB}+S_{H2S^*}}\right]$ $*\left[\frac{K_{OFB}}{K_{OFB}+S_O}\right]$ $*\left[\frac{K_{NOFB}}{K_{NOFB}+S_{NO}}\right]$ $*\left[\frac{S_{NH}}{K_{NHFB}+S_{NH}}\right]$ $*X_{FB}$			
10	Lysis of X_{FB}		$(f_{BM,SF})*b_{FB}*X_{FB}$			$v_{5,10}*b_{FB}*X_{FB}$				$v_{9,Lysis}*b_{FB}*X_{FB}$	$f_{BM,XI}$ $*b_{FB}$ $*X_{FB}$			$-b_{FB}*X_{FB}$				
11	Growth of X_{AMB}			$\left(-\frac{1}{Y_{AMB}}\right)*\mu_{AMB}$ $*\left[\frac{S_A}{K_{SAMB}+S_A}\right]$ $*\left[\frac{K_{H2SAMB}}{K_{H2SAMB}+S_{H2S^*}}\right]$ $*\left[\frac{K_{OAMB}}{K_{OAMB}+S_O}\right]$ $*\left[\frac{K_{NOAMB}}{K_{NOAMB}+S_{NO}}\right]$ $*\left[\frac{S_{NH}}{K_{NHAMB}+S_{NH}}\right]$ $*X_{AMB}$		$v_{5,11}*\mu_{AMB}$ $*\left[\frac{S_A}{K_{SAMB}+S_A}\right]$ $*\left[\frac{K_{H2SAMB}}{K_{H2SAMB}+S_{H2S^*}}\right]$ $*\left[\frac{K_{OAMB}}{K_{OAMB}+S_O}\right]$ $*\left[\frac{K_{NOAMB}}{K_{NOAMB}+S_{NO}}\right]$ $*\left[\frac{S_{NH}}{K_{NHAMB}+S_{NH}}\right]$ $*X_{AMB}$								$\mu_{AMB}*\left[\frac{S_A}{K_{SAMB}+S_A}\right]$ $*\left[\frac{K_{H2SAMB}}{K_{H2SAMB}+S_{H2S^*}}\right]$ $*\left[\frac{K_{OAMB}}{K_{OAMB}+S_O}\right]$ $*\left[\frac{K_{NOAMB}}{K_{NOAMB}+S_{NO}}\right]$ $*\left[\frac{S_{NH}}{K_{NHAMB}+S_{NH}}\right]$ $*X_{AMB}$		
12	Lysis of X_{AMB}		$(f_{BM,SF})*b_{AMB}$ $*X_{AMB}$			$v_{5,12}*b_{AMB}*X_{AMB}$				$v_{9,Lysis}*b_{AMB}$ $*X_{AMB}$	$f_{BM,XI}$ $*b_{AMB}$ $*X_{AMB}$				$-b_{AMB}*X_{AMB}$			
13	Growth of X_{ASRB}			$\mu_{ASRB}*\left[\frac{S_A}{K_{SASRB}+S_A}\right]$ $*\left[\frac{S_{SO4}}{K_{SOASRB}+S_{SO4}}\right]$ $*\left[\frac{K_{H2SASRB}}{K_{H2SASRB}+S_{H2S^*}}\right]$ $*\left[\frac{K_{OASRB}}{K_{OASRB}+S_O}\right]$ $*\left[\frac{K_{NOASRB}}{K_{NOASRB}+S_{NO}}\right]$ $*\left[\frac{S_{NH}}{K_{NHASRB}+S_{NH}}\right]$ $*X_{ASRB}$		$\mu_{ASRB}*\left[\frac{S_A}{K_{SASRB}+S_A}\right]$ $*\left[\frac{S_{SO4}}{K_{SOASRB}+S_{SO4}}\right]$ $*\left[\frac{K_{H2SASRB}}{K_{H2SASRB}+S_{H2S^*}}\right]$ $*\left[\frac{K_{OASRB}}{K_{OASRB}+S_O}\right]$ $*\left[\frac{K_{NOASRB}}{K_{NOASRB}+S_{NO}}\right]$ $*\left[\frac{S_{NH}}{K_{NHASRB}+S_{NH}}\right]$ $*X_{ASRB}$	$\mu_{ASRB}*\left[\frac{S_A}{K_{SASRB}+S_A}\right]$ $*\left[\frac{S_{SO4}}{K_{SOASRB}+S_{SO4}}\right]$ $*\left[\frac{K_{H2SASRB}}{K_{H2SASRB}+S_{H2S^*}}\right]$ $*\left[\frac{K_{OASRB}}{K_{OASRB}+S_O}\right]$ $*\left[\frac{K_{NOASRB}}{K_{NOASRB}+S_{NO}}\right]$ $*\left[\frac{S_{NH}}{K_{NHASRB}+S_{NH}}\right]$ $*X_{ASRB}$										$\mu_{ASRB}*\left[\frac{S_A}{K_{SASRB}+S_A}\right]$ $*\left[\frac{S_{SO4}}{K_{SOASRB}+S_{SO4}}\right]$ $*\left[\frac{K_{H2SASRB}}{K_{H2SASRB}+S_{H2S^*}}\right]$ $*\left[\frac{K_{OASRB}}{K_{OASRB}+S_O}\right]$ $*\left[\frac{K_{NOASRB}}{K_{NOASRB}+S_{NO}}\right]$ $*\left[\frac{S_{NH}}{K_{NHASRB}+S_{NH}}\right]$ $*X_{ASRB}$	
14	Lysis of X_{ASRB}		$(f_{BM,SF})*b_{ASRB}$ $*X_{ASRB}$			$v_{5,14}*b_{ASRB}*X_{ASRB}$				$v_{9,Lysis}*b_{ASRB}$ $*X_{ASRB}$	$f_{BM,XI}$ $*b_{ASRB}$ $*X_{ASRB}$						$-b_{ASRB}*X_{ASRB}$	
15	Aerobic growth of X_{SOB} on S_{H2S}	$\left(-\frac{2-Y_{SOB}}{Y_{SOB}}\right)$ $*\mu_{SOB}$ $*\left[\frac{S_{H2S}}{K_{SSOB}+S_{H2S}}\right]$ $*\left[\frac{S_O}{K_{OSOB}+S_O}\right]$ $*\left[\frac{S_{NH}}{K_{NHSOB}+S_{NH}}\right]$ $*X_{SOB}$			$\left(-\frac{1}{Y_H}\right)*\mu_{SOB}$ $*\left[\frac{S_{H2S}}{K_{SSOB}+S_{H2S}}\right]$ $*\left[\frac{S_O}{K_{OSOB}+S_O}\right]$ $*\left[\frac{S_{NH}}{K_{NHSOB}+S_{NH}}\right]$ $*X_{SOB}$	$v_{5,15}*\mu_{SOB}$ $*\left[\frac{S_{H2S}}{K_{SSOB}+S_{H2S}}\right]$ $*\left[\frac{S_O}{K_{OSOB}+S_O}\right]$ $*\left[\frac{S_{NH}}{K_{NHSOB}+S_{NH}}\right]$ $*X_{SOB}$		$\left(-\frac{1}{Y_{SOB}}\right)*\mu_{SOB}$ $*\left[\frac{S_{H2S}}{K_{SSOB}+S_{H2S}}\right]$ $*\left[\frac{S_O}{K_{OSOB}+S_O}\right]$ $*\left[\frac{S_{NH}}{K_{NHSOB}+S_{NH}}\right]$ $*X_{SOB}$								μ_{SOB} $*\left[\frac{S_{H2S}}{K_{SSOB}+S_{H2S}}\right]$ $*\left[\frac{S_O}{K_{OSOB}+S_O}\right]$ $*\left[\frac{S_{NH}}{K_{NHSOB}+S_{NH}}\right]$ $*X_{SOB}$	
16	Anoxic growth of X_{SOB} on S_{H2S}					$v_{5,16}\mu_{SOB}*\eta_{SOB}$ $*\left[\frac{S_{H2S}}{K_{SSOB}+S_{H2S}}\right]$ $*\left[\frac{S_{NO}}{K_{NOSOB}+S_{NO}}\right]$ $*\left[\frac{K_{OSOB}}{K_{OSOB}+S_O}\right]$ $*\left[\frac{S_{NH}}{K_{NHSOB}+S_{NH}}\right]$ $*X_{SOB}$	$\left(-\frac{1-Y_{SOB}}{0.875*Y_{SOB}}\right)\mu_{SOB}$ $*\eta_{SOB}*\left[\frac{S_{H2S}}{K_{SSOB}+S_{H2S}}\right]$ $*\left[\frac{S_{NO}}{K_{NOSOB}+S_{NO}}\right]$ $*\left[\frac{K_{OSOB}}{K_{OSOB}+S_O}\right]$ $*\left[\frac{S_{NH}}{K_{NHSOB}+S_{NH}}\right]$ $*X_{SOB}$		$\left(-\frac{1}{Y_{SOB}}\right)\mu_{SOB}$ $*\eta_{SOB}$ $*\left[\frac{S_{H2S}}{K_{SSOB}+S_{H2S}}\right]$ $*\left[\frac{S_{NO}}{K_{NOSOB}+S_{NO}}\right]$ $*\left[\frac{K_{OSOB}}{K_{OSOB}+S_O}\right]$ $*\left[\frac{S_{NH}}{K_{NHSOB}+S_{NH}}\right]$ $*X_{SOB}$								$\mu_{SOB}*\eta_{SOB}$ $*\left[\frac{S_{H2S}}{K_{SSOB}+S_{H2S}}\right]$ $*\left[\frac{S_{NO}}{K_{NOSOB}+S_{NO}}\right]$ $*\left[\frac{K_{OSOB}}{K_{OSOB}+S_O}\right]$ $*\left[\frac{S_{NH}}{K_{NHSOB}+S_{NH}}\right]$ $*X_{SOB}$	
17	Lysis of X_{SOB}		$(f_{BM,SF})*b_{SOB}$ $*X_{SOB}$			$v_{5,17}*b_{SOB}*X_{SOB}$				$v_{9,Lysis}*b_{SOB}$ $*X_{SOB}$	$f_{BM,XI}$ $*b_{SOB}$ $*X_{SOB}$							$-b_{SOB}*X_{SOB}$

Appendix B

Constants for the simplified rates presented in Chapter 6.

Dissolved oxygen

Process 2:

$$P_{2,1} = \left[1 - \frac{1}{Y_H}\right] * \mu_H * \left[\frac{S_F}{K_{SF} + S_F}\right] * \left[\frac{S_F}{S_F + S_A}\right] * \left[\frac{S_{NH}}{K_{NHH} + S_{NH}}\right] * \left[\frac{K_{H2SH}}{K_{H2SH} + S_{H2S^*}}\right] * X_H$$

$$Q_{2,1} = K_{OH}$$

Process 4:

$$P_{4,1} = \left[1 - \frac{1}{Y_H}\right] * \mu_H * \left[\frac{S_A}{K_{SA} + S_A}\right] * \left[\frac{S_A}{S_F + S_A}\right] * \left[\frac{S_{NH}}{K_{NHH} + S_{NH}}\right] * \left[\frac{K_{H2SH}}{K_{H2SH} + S_{H2S^*}}\right] * X_H$$

$$Q_{4,1} = K_{OH}$$

Process 7:

$$P_{7,1} = \left[-\frac{4.57 - Y_A}{Y_A}\right] * \mu_A * \left[\frac{S_{NH}}{K_{NHA} + S_{NH}}\right] * \left[\frac{K_{H2SA}}{K_{H2SA} + S_{H2S^*}}\right] * X_A$$

$$Q_{7,1} = K_{OA}$$

Process 15:

$$P_{15,1} = \left[-\frac{2 - Y_{SOB}}{Y_{SOB}}\right] * \mu_{SOB} * \left[\frac{S_{H2S}}{K_{SSOB} + S_{H2S}}\right] * \left[\frac{S_{NH}}{K_{NHSOB} + S_{NH}}\right] * X_{SOB}$$

$$Q_{15,1} = K_{OSOB}$$

Fermentable, readily biodegradable COD

Process 1:

$$P_{1,2} = \left[1 - \mathrm{f_{Hyd,SI}}\right] * k_h * \left[\frac{\frac{X_s}{X_H + X_{FB}}}{K_X + \frac{X_s}{X_H + X_{FB}}}\right] * \left(X_H + \eta_h * X_{FB}\right)$$

Process 2:

$$P_{2,2} = \left[-\frac{1}{Y_H}\right] * \mu_H * \left[\frac{S_O}{K_{OH} + S_O}\right] * \left[\frac{S_{NH}}{K_{NHH} + S_{NH}}\right] * \left[\frac{K_{H2SH}}{K_{H2SH} + S_{H2S^*}}\right] * X_H$$

$$Q_{2,2} = K_{SF}$$

$$R_{2,2} = S_A$$

Process 3:

$$P_{3,2} = \left[-\frac{1}{Y_H}\right] * n_g * \mu_H * \left[\frac{K_{OH}}{K_{OH} + S_O}\right] * \left[\frac{S_{NO}}{K_{NOH} + S_{NO}}\right] * \left[\frac{S_{NH}}{K_{NHH} + S_{NH}}\right] * \left[\frac{K_{H2SH}}{K_{H2SH} + S_{H2S^*}}\right] * X_H$$

$$Q_{3,2} = K_{SF}$$

$$R_{3,2} = S_A$$

Process 6:

$$P_{6,2} = f_{BM,SF} * b_H * X_H$$

Process 8:

$$P_{8,2} = f_{BM,SF} * b_A * X_A$$

Process 9:

$$P_{6,2} = \left[-\frac{1}{Y_{FB}}\right] * \mu_{FB} * \left[\frac{K_{H2SFB}}{K_{H2SFB} + S_{H2S^*}}\right] * \left[\frac{K_{OFB}}{K_{OFB} + S_O}\right] * \left[\frac{K_{NOFB}}{K_{NOFB} + S_{NO}}\right] * \left[\frac{S_{NH}}{K_{NHFB} + S_{NH}}\right] * X_{FB}$$

$$Q_{9,2} = K_{SFB}$$

Process 10:

$$P_{10,2} = f_{BM,SF} * \ b_{FB} * X_{FB}$$

Process 12:

$$P_{12,2} = f_{BM,SF} * b_{AMB} * X_{AMB}$$

Process 14:

$$P_{14,2} = f_{BM,SF} * b_{ASRB} * X_{ASRB}$$

Process 17:

$$P_{17,2} = f_{BM,SF} * b_{SOB} * X_{SOB}$$

Fermentation products as acetate

Process 4:

$$P_{4,3} = \left[-\frac{1}{Y_H}\right] * \mu_H * \left[\frac{S_O}{K_{OH} + S_O}\right] * \left[\frac{S_{NH}}{K_{NHH} + S_{NH}}\right] * \left[\frac{K_{H2SH}}{K_{H2SH} + S_{H2S^*}}\right] * X_H$$

$$Q_{4,3} = K_{SA}$$

$$R_{4,3} = S_F$$

Process 5:

$$P_{5,3} = \left[-\frac{1}{Y_H}\right] * n_g * \mu_H * \left[\frac{K_{OH}}{K_{OH} + S_O}\right] * \left[\frac{S_{NO}}{K_{NOH} + S_{NO}}\right] * \left[\frac{S_{NH}}{K_{NHH} + S_{NH}}\right] * \left[\frac{K_{H2SH}}{K_{H2SH} + S_{H2S^*}}\right] * X_H$$

$$Q_{5,3} = K_{SA}$$

$$R_{5,3} = S_F$$

Process 9:

$$P_{9,3} = \left[\frac{1 - Y_{FB}}{Y_{FB}}\right] * \mu_{FB} * \left[\frac{S_F}{K_{SFB} + S_F}\right] * \left[\frac{K_{H2SFB}}{K_{H2SFB} + S_{H2S^*}}\right] * \left[\frac{K_{OFB}}{K_{OFB} + S_O}\right] * \left[\frac{K_{NOFB}}{K_{NOFB} + S_{NO}}\right] * \left[\frac{S_{NH}}{K_{NHFB} + S_{NH}}\right] * X_{FB}$$

Process 11:

$$P_{11,3} = \left[-\frac{1}{Y_{AMB}}\right] * \mu_{AMB} * \left[\frac{K_{H2SAMB}}{K_{H2SAMB} + S_{H2S^*}}\right] * \left[\frac{K_{OAMB}}{K_{OAMB} + S_O}\right] * \left[\frac{K_{NOAMB}}{K_{NOAMB} + S_{NO}}\right] * \left[\frac{S_{NH}}{K_{NHAMB} + S_{NH}}\right] * X_{AMB}$$

$$Q_{11,3} = K_{SAMB}$$

Process 13:

$$P_{13,3} = \mu_{ASRB} * \left[\frac{S_{SO4}}{K_{SOASRB} + S_{SO4}}\right] * \left[\frac{K_{H2SASRB}}{K_{H2SASRB} + S_{H2S^*}}\right] * \left[\frac{K_{OASRB}}{K_{OASRB} + S_O}\right] * \left[\frac{K_{NOASRB}}{K_{NOASRB} + S_{NO}}\right] * \left[\frac{S_{NH}}{K_{NHASRB} + S_{NH}}\right] * X_{ASRB}$$

$$Q_{13,3} = K_{SASRB}$$

Inert, soluble COD

Process 1:

$$P_{1,4} = \mathrm{f_{Hyd,SI}} * k_h * \left[\frac{\frac{X_s}{X_H + X_{FB}}}{K_X + \frac{X_s}{X_H + X_{FB}}}\right] * \left(X_H + \eta_h * X_{FB}\right)$$

Ammonium and ammonia nitrogen

Process1:

$$P_{1,5} = v_{5,1} * k_h * \left[\frac{\frac{X_s}{X_H + X_{FB}}}{K_X + \frac{X_s}{X_H + X_{FB}}}\right] * \left(X_H + \eta_h * X_{FB}\right)$$

Process 2:

$$P_{2,5} = v_{5,2} * \mu_H * \left[\frac{S_F}{K_{SF} + S_F}\right] * \left[\frac{S_F}{S_F + S_A}\right] * \left[\frac{S_O}{K_{OH} + S_O}\right] * \left[\frac{K_{H2SH}}{K_{H2SH} + S_{H2S^*}}\right] * X_H$$

$$Q_{2,5} = K_{NHH}$$

Process 3:

$$P_{3,5} = v_{5,3} * n_g * \mu_H * \left[\frac{S_F}{K_{SF} + S_F}\right] * \left[\frac{S_F}{S_F + S_A}\right] * \left[\frac{K_{OH}}{K_{OH} + S_O}\right] * \left[\frac{S_{NO}}{K_{NOH} + S_{NO}}\right] * \left[\frac{K_{H2SH}}{K_{H2SH} + S_{H2S^*}}\right] * X_H$$

$$Q_{3,5} = K_{NHH}$$

Process 4:

$$P_{4,5} = v_{5,4} * \mu_H * \left[\frac{S_A}{K_{SA} + S_A}\right] * \left[\frac{S_A}{S_F + S_A}\right] * \left[\frac{S_O}{K_{OH} + S_O}\right] * \left[\frac{K_{H2SH}}{K_{H2SH} + S_{H2S^*}}\right] * X_H$$

$$Q_{4,5} = K_{NHH}$$

Process 5:

$$P_{5,5} = v_{5,5} * n_g * \mu_H * \left[\frac{S_A}{K_{SA} + S_A}\right] * \left[\frac{S_A}{S_F + S_A}\right] * \left[\frac{K_{OH}}{K_{OH} + S_O}\right] * \left[\frac{S_{NO}}{K_{NOH} + S_{NO}}\right] * \left[\frac{K_{H2SH}}{K_{H2SH} + S_{H2S^*}}\right] * X_H$$

$$Q_{5,5} = K_{NHH}$$

Process 6:

$$P_{6,5} = v_{5,6} * b_H * X_H$$

Process 7:

$$P_{7,5} = \left[-i_{N,BM} - \frac{1}{Y_A}\right] * \mu_A * \left[\frac{S_O}{K_{OA} + S_O}\right] * \left[\frac{K_{H2SA}}{K_{H2SA} + S_{H2S^*}}\right] * X_A$$

$$Q_{7,5} = K_{NHA}$$

Process 8:

$$P_{8,5} = v_{5,8} * b_A * X_A$$

Process 9:

$$P_{9,5} = v_{5,9} * \mu_{FB} * \left[\frac{S_F}{K_{SFB} + S_F}\right] * \left[\frac{K_{H2SFB}}{K_{H2SFB} + S_{H2S^*}}\right] * \left[\frac{K_{OFB}}{K_{OFB} + S_O}\right] * \left[\frac{K_{NOFB}}{K_{NOFB} + S_{NO}}\right] * X_{FB}$$

$$Q_{9,5} = K_{NHFB}$$

Process 10:

$$P_{10,5} = v_{5,10} * b_{FB} * X_{FB}$$

Process 11:

$$P_{11,5} = v_{5,11} * \mu_{AMB} * \left[\frac{S_A}{K_{SAMB} + S_A}\right] * \left[\frac{K_{H2SAMB}}{K_{H2SAMB} + S_{H2S^*}}\right] * \left[\frac{K_{OAMB}}{K_{OAMB} + S_O}\right] * \left[\frac{K_{NOAMB}}{K_{NOAMB} + S_{NO}}\right] * X_{AMB}$$

$$Q_{11,5} = K_{NHAMB}$$

Process 12:

$$P_{12,5} = v_{5,12} * b_{AMB} * X_{AMB}$$

Process 13:

$$P_{13,5} = v_{5,13} * \mu_{ASRB} * \left[\frac{S_A}{K_{SASRB} + S_A}\right] * \left[\frac{S_{SO4}}{K_{SOASRB} + S_{SO4}}\right] * \left[\frac{K_{H2SASRB}}{K_{H2SASRB} + S_{H2S^*}}\right] * \left[\frac{K_{OASRB}}{K_{OASRB} + S_O}\right] * \left[\frac{K_{NOASRB}}{K_{NOASRB} + S_{NO}}\right] * X_{ASRB}$$

$$Q_{13,5} = K_{NHASRB}$$

Process 14:

$$P_{14,5} = v_{5,14} * b_{ASRB} * X_{ASRB}$$

Process 15:

$$P_{15,5} = v_{5,15} * \mu_{SOB} * \left[\frac{S_{H2S}}{K_{SSOB} + S_{H2S}}\right] * \left[\frac{S_O}{K_{OSOB} + S_O}\right] * X_{SOB}$$

$$Q_{15,5} = K_{NHSOB}$$

Process 16:

$$P_{16,5} = v_{5,16} * \mu_{SOB} * \eta_{SOB} * \left[\frac{S_{H2S}}{K_{SSOB} + S_{H2S}}\right] * \left[\frac{S_{NO}}{K_{NOSOB} + S_{NO}}\right] * \left[\frac{K_{OSOB}}{K_{OSOB} + S_O}\right] * X_{SOB}$$

$$Q_{15,5} = K_{NHSOB}$$

Process 17:

$$P_{17,5} = v_{5,17} * b_{SOB} * X_{SOB}$$

Nitrate and Nitrite nitrogen

Process 3:

$$P_{3,6} = \left[-\frac{1 - Y_H}{2.86 * Y_H}\right] * n_g * \mu_H * \left[\frac{S_F}{K_{SF} + S_F}\right] * \left[\frac{S_F}{S_F + S_A}\right] * \left[\frac{K_{OH}}{K_{OH} + S_O}\right] * \left[\frac{S_{NH}}{K_{NHH} + S_{NH}}\right] * \left[\frac{K_{H2SH}}{K_{H2SH} + S_{H2S^*}}\right] * X_H$$

$$Q_{3,6} = K_{NOH}$$

Process 5:

$$P_{5,6} = \left[-\frac{1 - Y_H}{2.86 * Y_H}\right] * n_g * \mu_H * \left[\frac{S_A}{K_{SA} + S_A}\right] * \left[\frac{S_A}{S_F + S_A}\right] * \left[\frac{K_{OH}}{K_{OH} + S_O}\right] * \left[\frac{S_{NH}}{K_{NHH} + S_{NH}}\right] * \left[\frac{K_{H2SH}}{K_{H2SH} + S_{H2S^*}}\right] * X_H$$

$$Q_{3,6} = K_{NOH}$$

Process 7:

$$P_{7,6} = \left[\frac{1}{Y_A}\right] * \mu_A * \left[\frac{S_{NH}}{K_{NHA} + S_{NH}}\right] * \left[\frac{S_O}{K_{OA} + S_O}\right] * \left[\frac{K_{H2SA}}{K_{H2SA} + S_{H2S^*}}\right] * X_A$$

Process 10:

$$P_{10,6} = \left[-\frac{1 - Y_{SOB}}{0.875 * Y_{SOB}}\right] * \mu_{FB} * \left[\frac{S_F}{K_{SFB} + S_F}\right] * \left[\frac{K_{H2SFB}}{K_{H2SFB} + S_{H2S^*}}\right] * \left[\frac{K_{OFB}}{K_{OFB} + S_O}\right] * \left[\frac{S_{NH}}{K_{NHFB} + S_{NH}}\right] * X_{FB}$$

$$Q_{10,6} = K_{NOFB}$$

Sulphate sulphur

Process 13:

$$P_{13,7} = \left[-\frac{1 - Y_{ASRB}}{2 * Y_{ASRB}}\right] * \mu_{ASRB} * \left[\frac{S_A}{K_{SASRB} + S_A}\right] * \left[\frac{K_{H2SASRB}}{K_{H2SASRB} + S_{H2S^*}}\right] * \left[\frac{K_{OASRB}}{K_{OASRB} + S_O}\right] * \left[\frac{K_{NOASRB}}{K_{NOASRB} + S_{NO}}\right] * \left[\frac{S_{NH}}{K_{NHASRB} + S_{NH}}\right] * X_{ASRB}$$

$$Q_{13,7} = K_{SOASRB}$$

Process 15:

$$P_{15,7} = \left[\frac{1}{Y_{SOB}}\right] * \mu_{SOB} * \left[\frac{S_{H2S}}{K_{SSOB} + S_{H2S}}\right] * \left[\frac{S_O}{K_{OSOB} + S_O}\right] * \left[\frac{S_{NH}}{K_{NHSOB} + S_{NH}}\right] * X_{SOB}$$

Process 16:

$$P_{16,7} = \left[\frac{1}{Y_{SOB}}\right] * \mu_{SOB} * \left[\frac{S_{H2S}}{K_{SSOB} + S_{H2S}}\right] * \left[\frac{S_O}{K_{OSOB} + S_O}\right] * \left[\frac{S_{NH}}{K_{NHSOB} + S_{NH}}\right] * X_{SOB}$$

Dihydrogen-sulphide sulphur

Process 13:

$$P_{13,8} = \left[\frac{1 - Y_{ASRB}}{2 * Y_{ASRB}}\right] * \mu_{ASRB} * \left[\frac{S_A}{K_{SASRB} + S_A}\right] * \left[\frac{S_{SO4}}{K_{SOASRB} + S_{SO4}}\right] * \left[\frac{K_{OASRB}}{K_{OASRB} + S_O}\right] * \left[\frac{K_{NOASRB}}{K_{NOASRB} + S_{NO}}\right] * \left[\frac{S_{NH}}{K_{NHASRB} + S_{NH}}\right] * X_{ASRB}$$

$$Q_{13,8} = K_{H2SASRB}$$

Process 15:

$$P_{15,8} = \left[-\frac{1}{Y_{SOB}}\right] * \mu_{SOB} * \left[\frac{S_O}{K_{OSOB} + S_O}\right] * \left[\frac{S_{NH}}{K_{NHSOB} + S_{NH}}\right] * X_{SOB}$$

$$Q_{15,8} = K_{SSOB}$$

Process 16:

$$P_{16,8} = \left[-\frac{1}{Y_{SOB}}\right] * \mu_{SOB} * \eta_{SOB} * \left[\frac{S_{NO}}{K_{NOSOB} + S_{NO}}\right] * \left[\frac{K_{OSOB}}{K_{OSOB} + S_O}\right] * \left[\frac{S_{NH}}{K_{NHSOB} + S_{NH}}\right] * X_{SOB}$$

$$Q_{16,8} = K_{SSOB}$$

Slowly biodegradable particulate COD

Process 1:

$$P_{1,9} = (-1)k_h * \left[\frac{\frac{X_s}{X_H + X_{FB}}}{K_X + \frac{X_s}{X_H + X_{FB}}}\right] * \left(X_H + \eta_h * X_{FB}\right)$$

Process 6:

$$P_{6,9} = v_{9,Lysis} * b_H * X_H$$

Process 8:

$$P_{8,9} = v_{9,Lysis} * b_A * X_A$$

Process 10:

$$P_{10,9} = v_{9,Lysis} * b_{FB} * X_{FB}$$

Process 12:

$$P_{12,9} = v_{9,Lysis} * b_{AMB} * X_{AMB}$$

Process 14:

$$P_{14,9} = v_{9,Lysis} * b_{ASRB} * X_{ASRB}$$

Process 17:

$$P_{17,9} = v_{9,Lysis} * b_{SOB} * X_{SOB}$$

Inert particulate COD

Process 6:

$$P_{6,10} = f_{BM,XI} * b_H * X_H$$

Process 8:

$$P_{8,9} = f_{BM,XI} * b_A * X_A$$

Process 10:

$$P_{10,9} = f_{BM,XI} * b_{FB} * X_{FB}$$

Process 12:

$$P_{12,9} = f_{BM,XI} * b_{AMB} * X_{AMB}$$

Process 14:

$$P_{14,9} = f_{BM,XI} * b_{ASRB} * X_{ASRB}$$

Process 17:

$$P_{17,9} = f_{BM,XI} * b_{SOB} * X_{SOB}$$

Heterotrophic bacteria

Process 2:

$$P_{2,11} = \mu_H * \left[\frac{S_F}{K_{SF} + S_F}\right] * \left[\frac{S_F}{S_F + S_A}\right] * \left[\frac{S_O}{K_{OH} + S_O}\right] * \left[\frac{S_{NH}}{K_{NHH} + S_{NH}}\right] * \left[\frac{K_{H2SH}}{K_{H2SH} + S_{H2S^*}}\right]$$

Process 3:

$$P_{3,11} = n_g * \mu_H * \left[\frac{S_F}{K_{SF} + S_F}\right] * \left[\frac{S_F}{S_F + S_A}\right] * \left[\frac{K_{OH}}{K_{OH} + S_O}\right] * \left[\frac{S_{NO}}{K_{NOH} + S_{NO}}\right] * \left[\frac{S_{NH}}{K_{NHH} + S_{NH}}\right] * \left[\frac{K_{H2SH}}{K_{H2SH} + S_{H2S^*}}\right]$$

Process 4:

$$P_{4,11} = \mu_H * \left[\frac{S_A}{K_{SA} + S_A}\right] * \left[\frac{S_A}{S_F + S_A}\right] * \left[\frac{S_O}{K_{OH} + S_O}\right] * \left[\frac{S_{NH}}{K_{NHH} + S_{NH}}\right] * \left[\frac{K_{H2SH}}{K_{H2SH} + S_{H2S^*}}\right]$$

Process 5:

$$P_{5,11} = n_g * \mu_H * \left[\frac{S_A}{K_{SA} + S_A}\right] * \left[\frac{S_A}{S_F + S_A}\right] * \left[\frac{K_{OH}}{K_{OH} + S_O}\right] * \left[\frac{S_{NO}}{K_{NOH} + S_{NO}}\right] * \left[\frac{S_{NH}}{K_{NHH} + S_{NH}}\right] * \left[\frac{K_{H2SH}}{K_{H2SH} + S_{H2S^*}}\right]$$

Process 6:

$$P_{6,11} = -b_H$$

Autotrophic nitrifying bacteria

Process 7:

$$P_{7,12} = \mu_A * \left[\frac{S_{NH}}{K_{NHA} + S_{NH}}\right] * \left[\frac{S_O}{K_{OA} + S_O}\right] * \left[\frac{K_{H2SA}}{K_{H2SA} + S_{H2S^*}}\right]$$

Process 8:

$$P_{8,12} = -b_A$$

Fermenting bacteria

Process 9:

$$P_{9,13} = \mu_{FB} * \left[\frac{S_F}{K_{SFB} + S_F}\right] * \left[\frac{K_{H2SFB}}{K_{H2SFB} + S_{H2S^*}}\right] * \left[\frac{K_{OFB}}{K_{OFB} + S_O}\right] * \left[\frac{K_{NOFB}}{K_{NOFB} + S_{NO}}\right] * \left[\frac{S_{NH}}{K_{NHFB} + S_{NH}}\right]$$

Process 10:

$$P_{10,13} = -b_{FB}$$

Acetotrophic methanogenic bacteria

Process 11:

$$P_{11,14} = \mu_{AMB} * \left[\frac{S_A}{K_{SAMB} + S_A}\right] * \left[\frac{K_{H2SAMB}}{K_{H2SAMB} + S_{H2S^*}}\right] * \left[\frac{K_{OAMB}}{K_{OAMB} + S_O}\right] * \left[\frac{K_{NOAMB}}{K_{NOAMB} + S_{NO}}\right] * \left[\frac{S_{NH}}{K_{NHAMB} + S_{NH}}\right] * X_{AMB}$$

Process 12:

$$P_{12,14} = -b_{AMB}$$

Acetotrophic sulphate reducing bacteria

Process 13:

$$P_{13,15} = \mu_{ASRB} * \left[\frac{S_A}{K_{SASRB} + S_A}\right] * \left[\frac{S_{SO4}}{K_{SOASRB} + S_{SO4}}\right] * \left[\frac{K_{H2SASRB}}{K_{H2SASRB} + S_{H2S^*}}\right] * \left[\frac{K_{OASRB}}{K_{OASRB} + S_O}\right] * \left[\frac{K_{NOASRB}}{K_{NOASRB} + S_{NO}}\right] * \left[\frac{S_{NH}}{K_{NHASRB} + S_{NH}}\right]$$

Process 14:

$$P_{14,15} = -b_{ASRB}$$

Sulphide oxidising bacteria

Process 15:

$$P_{15,16} = \mu_{SOB} * \left[\frac{S_{H2S}}{K_{SSOB} + S_{H2S}}\right] * \left[\frac{S_O}{K_{OSOB} + S_O}\right] * \left[\frac{S_{NH}}{K_{NHSOB} + S_{NH}}\right]$$

Process 16:

$$P_{16,16} = \mu_{SOB} * \eta_{SOB} * \left[\frac{S_{H2S}}{K_{SSOB} + S_{H2S}}\right] * \left[\frac{S_{NO}}{K_{NOSOB} + S_{NO}}\right] * \left[\frac{K_{OSOB}}{K_{OSOB} + S_O}\right] * \left[\frac{S_{NH}}{K_{NHSOB} + S_{NH}}\right]$$

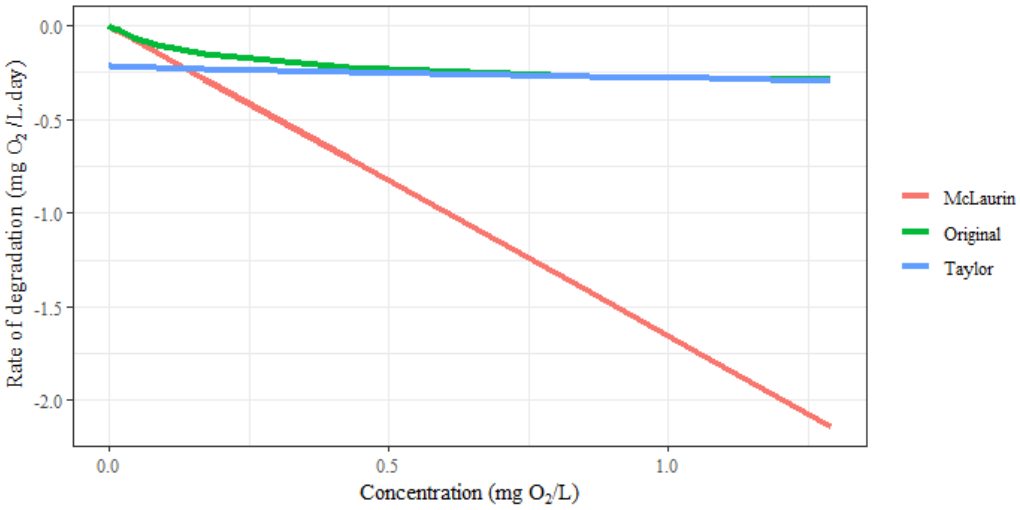
Process 14:

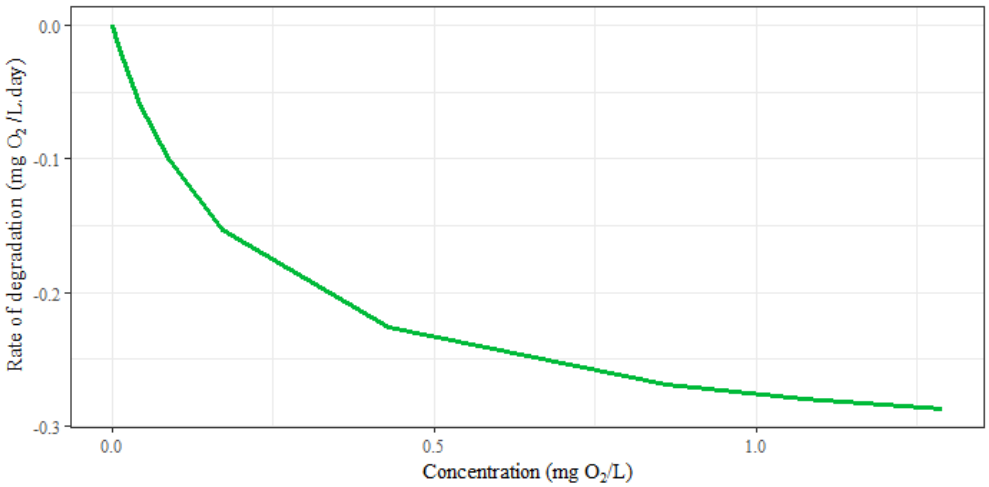
$$P_{17,16} = -b_{SOB}$$

Appendix D: Transformation of components in CWM1 in relation to specific processes

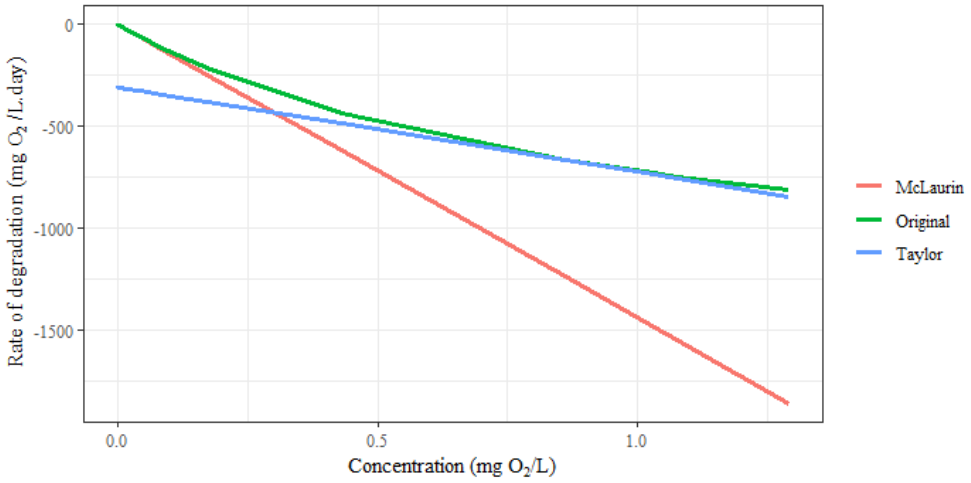
D.1 Dissolved oxygen

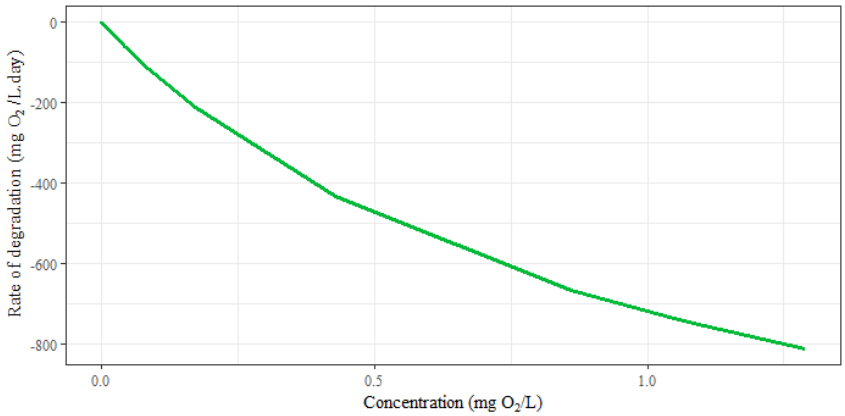
Anoxic growth of XH on SF:



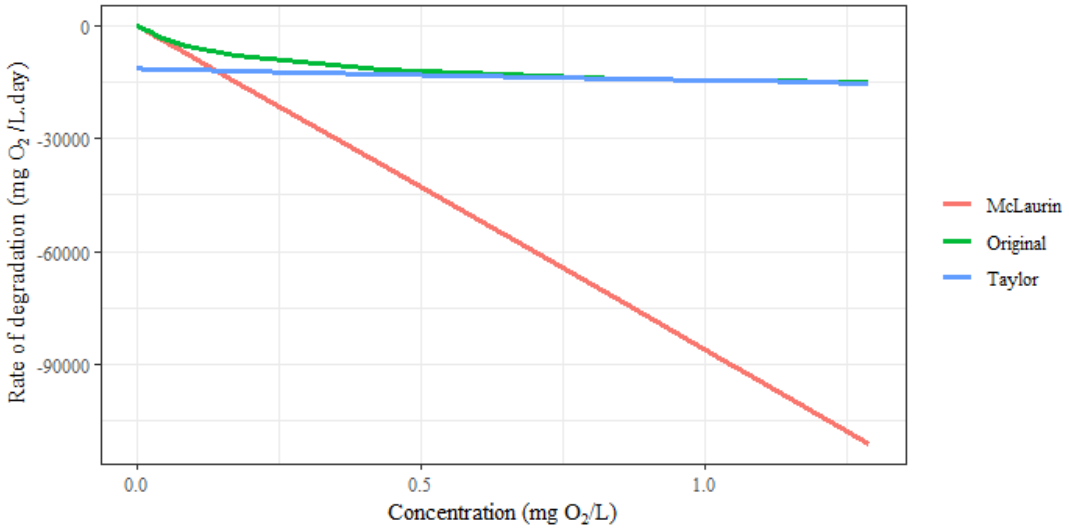


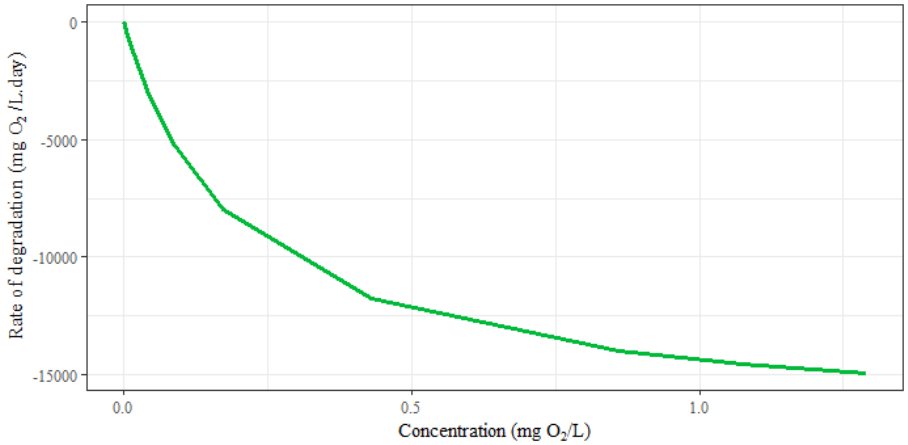
Aerobic growth of XA on SNH





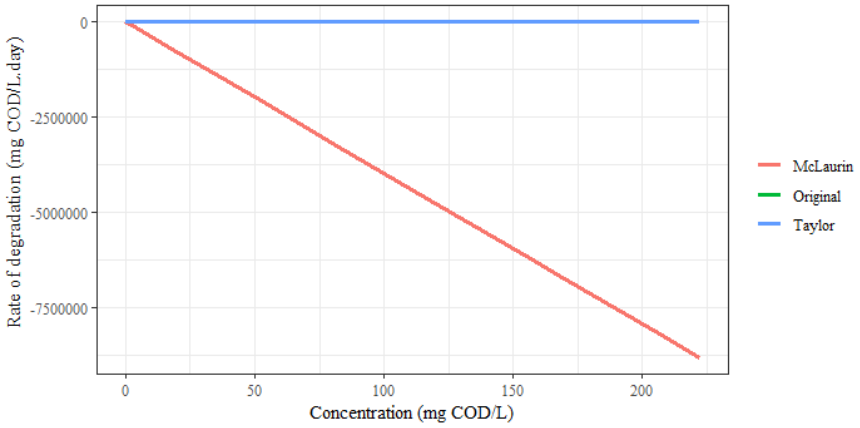
Aerobic growth of XSOB on SH2S

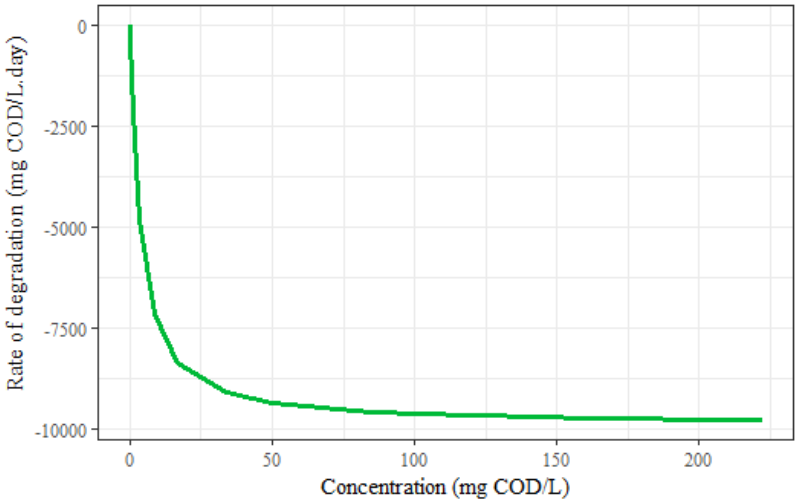


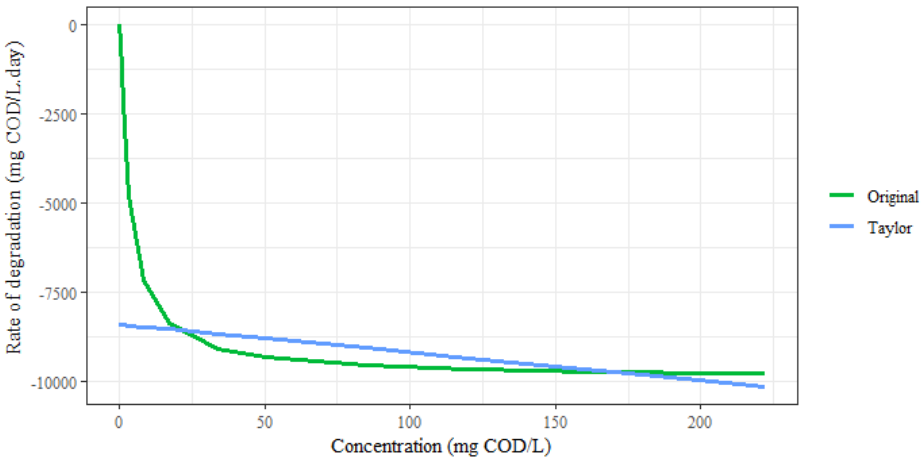


D.2 Fermentable, readily biodegradable COD

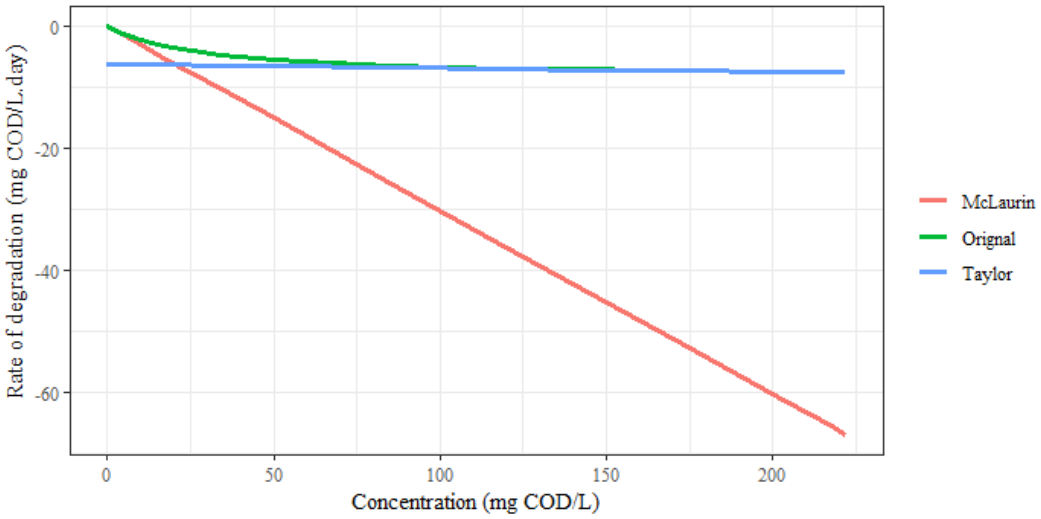
Aerobic growth of XH on SA

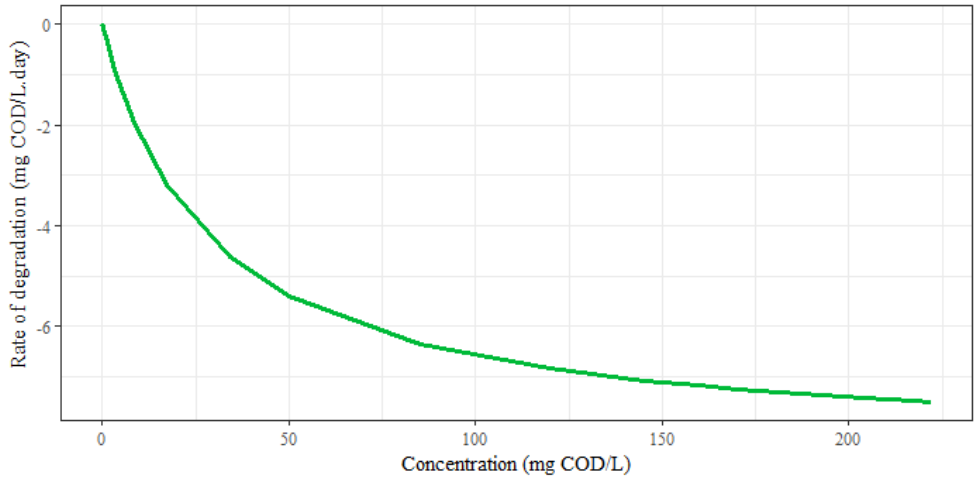


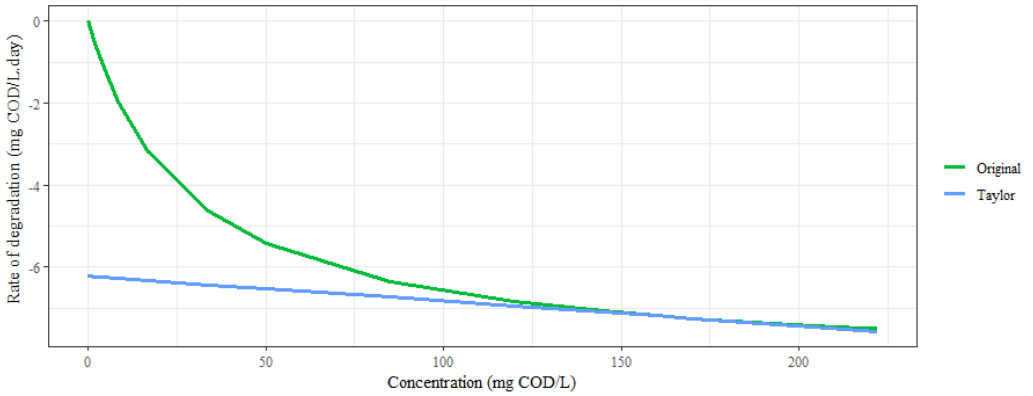




Growth of XFB

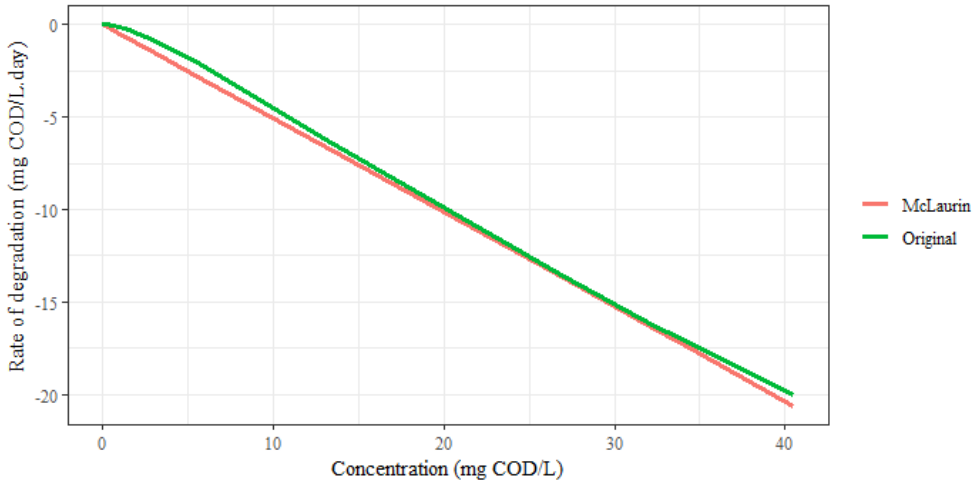


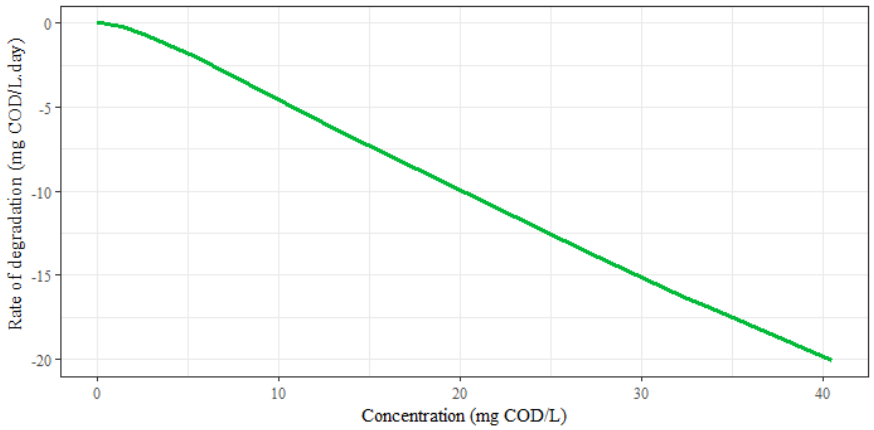




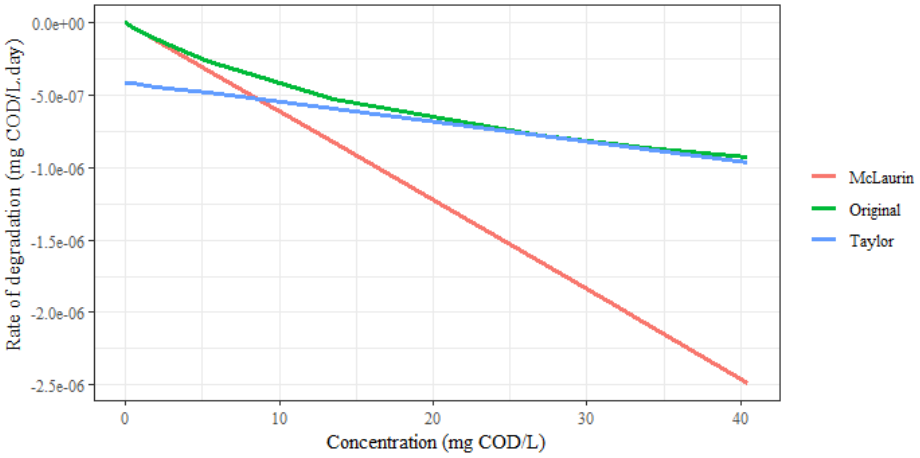
D.3 Fermentation products, as acetate

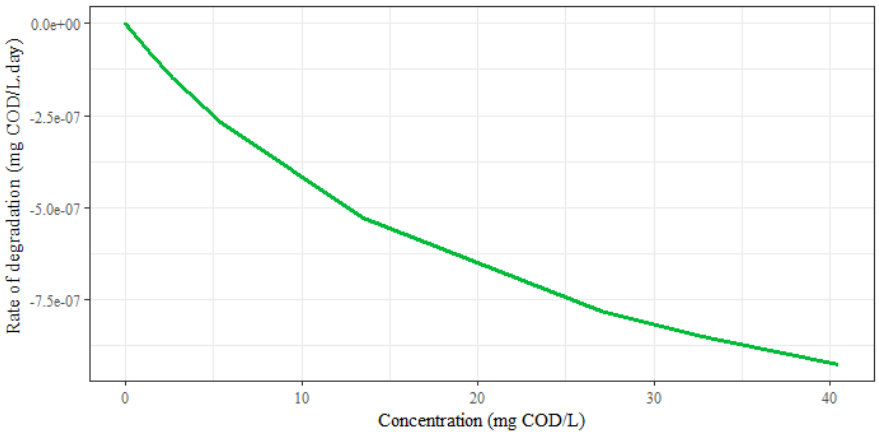
Anoxic growth of XH on SA





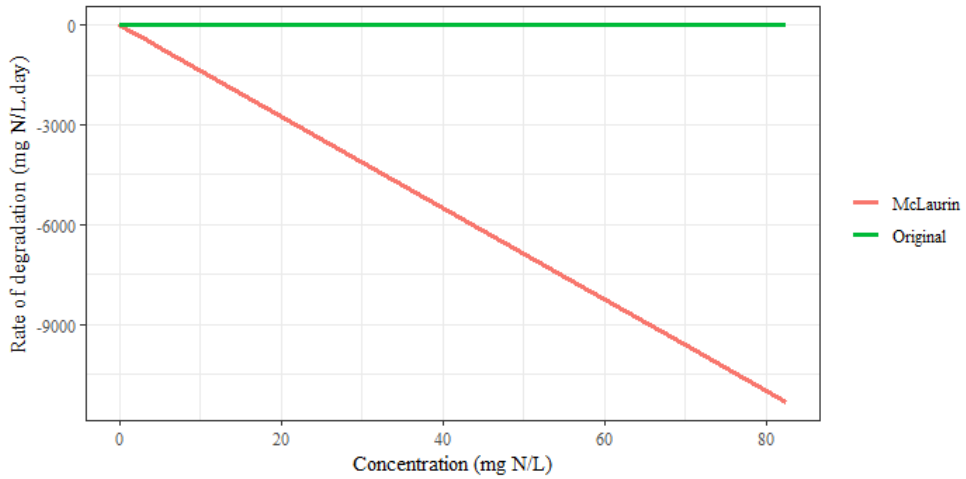
Growth of XASRB

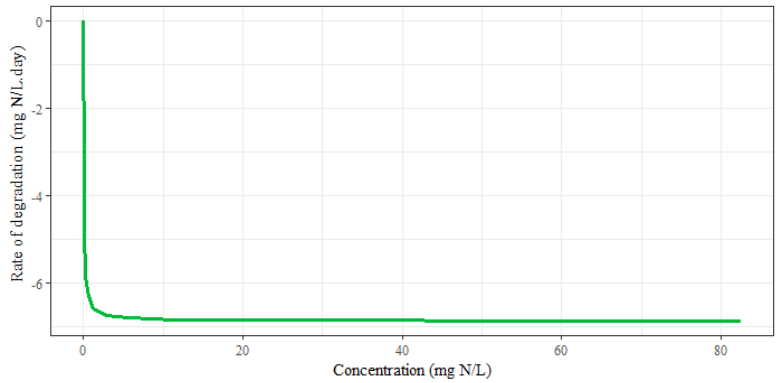


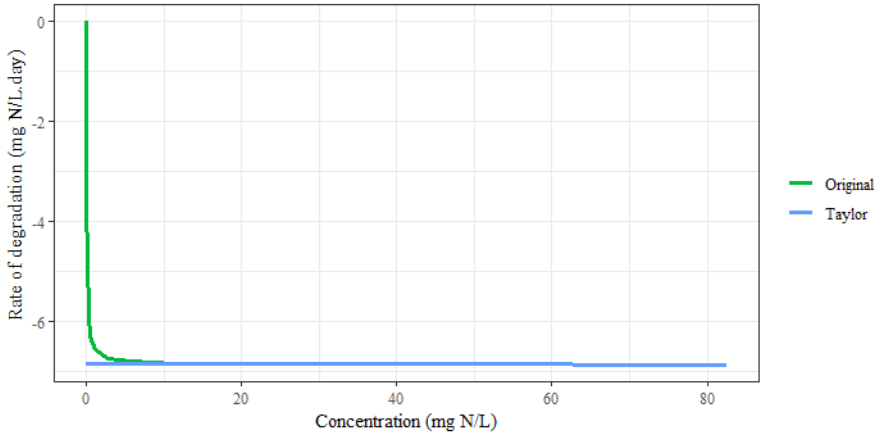


D.4 Ammonium and ammonia nitrogen

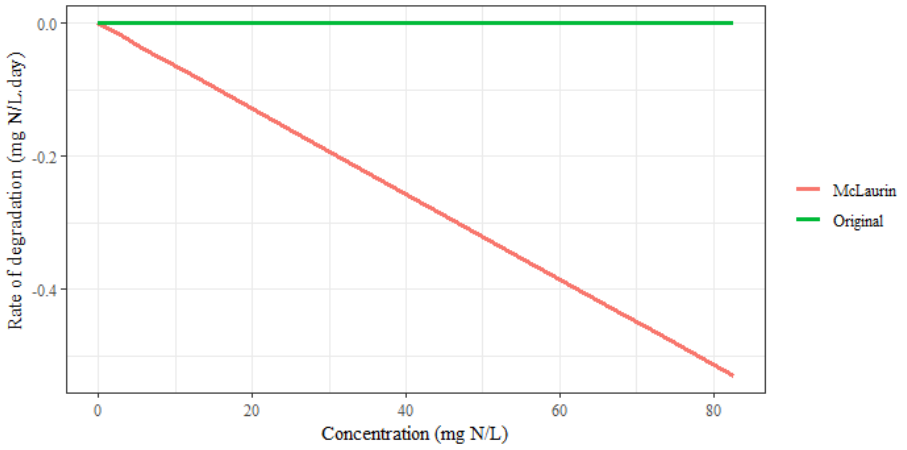
Aerobic growth of XH on SA.

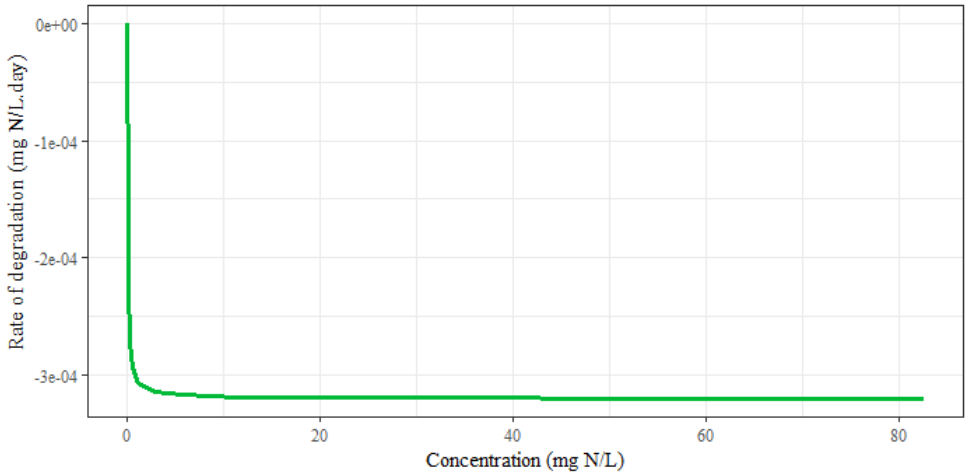


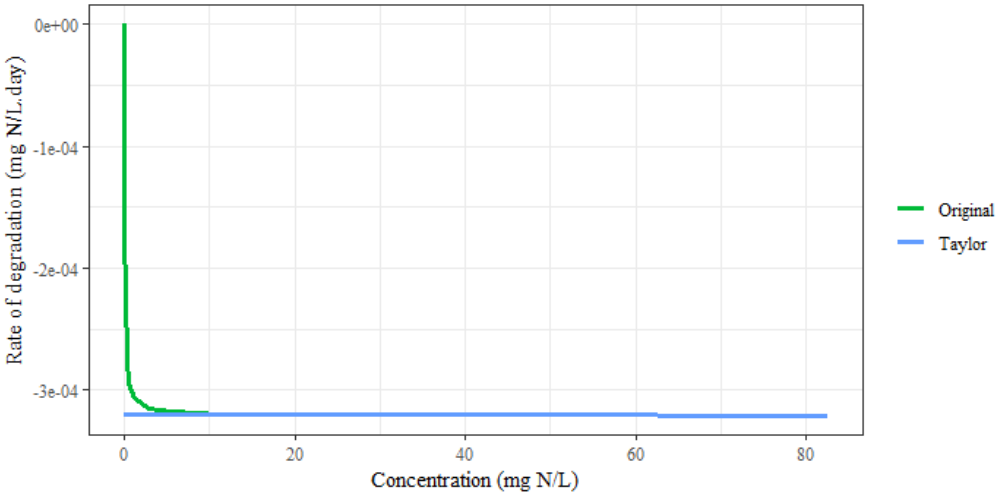




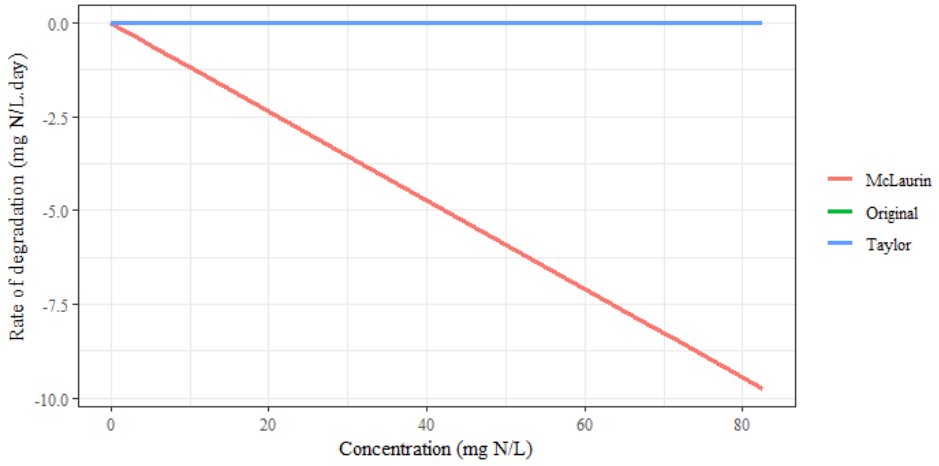
Anoxic growth of XH on SF

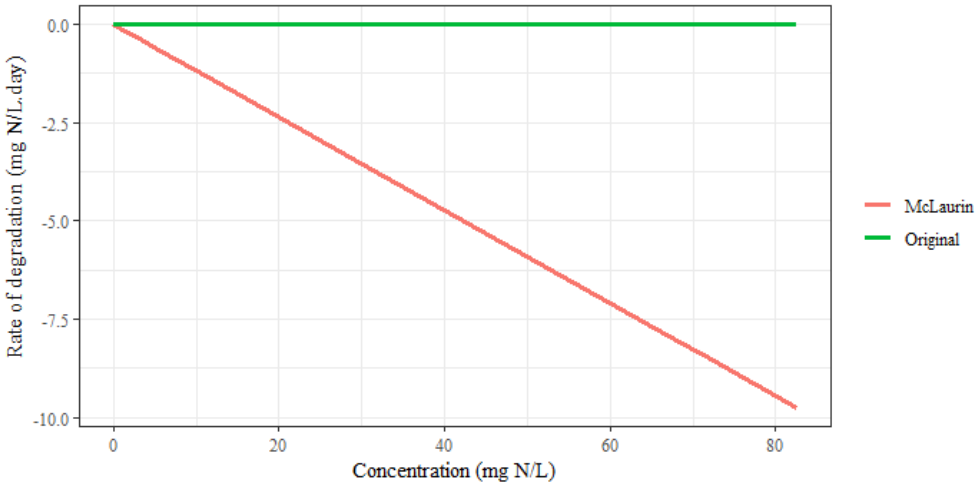


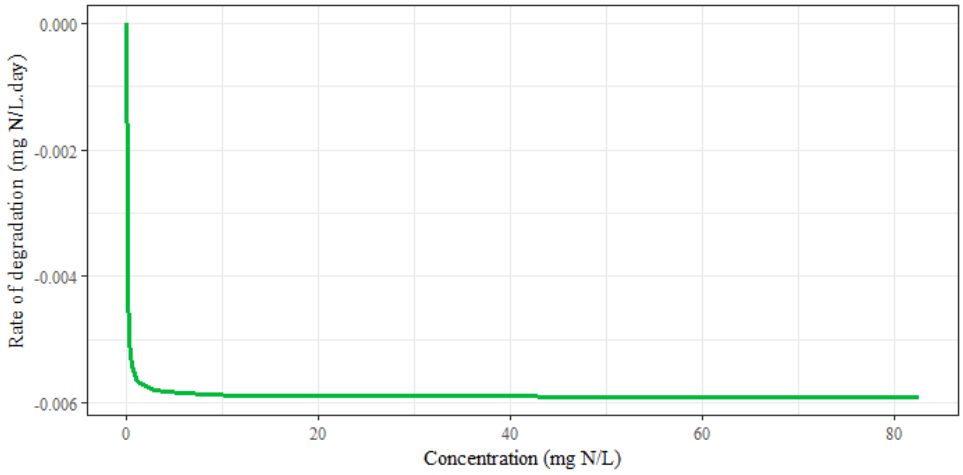


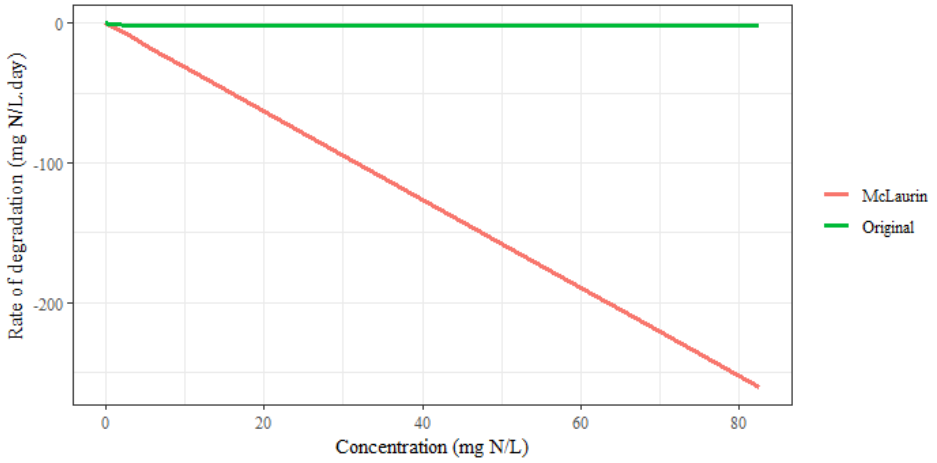


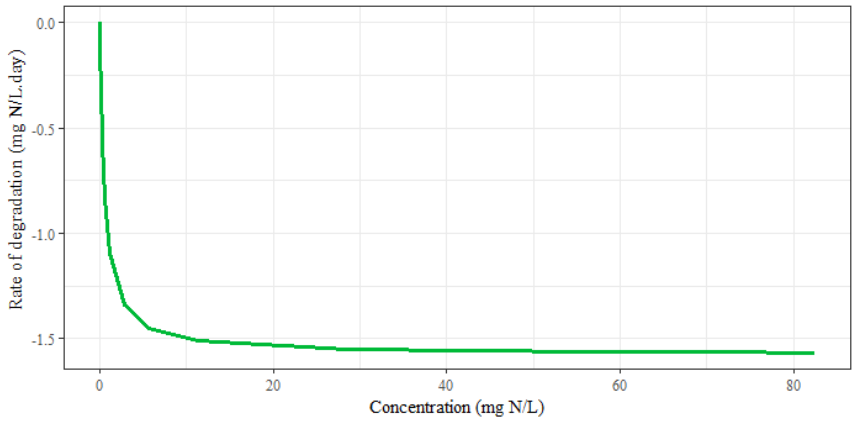
Anoxic growth of XH on SA

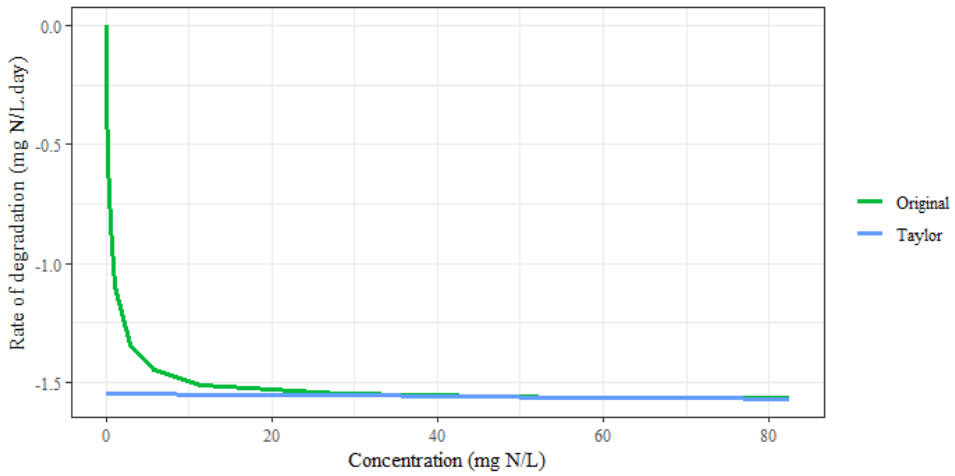




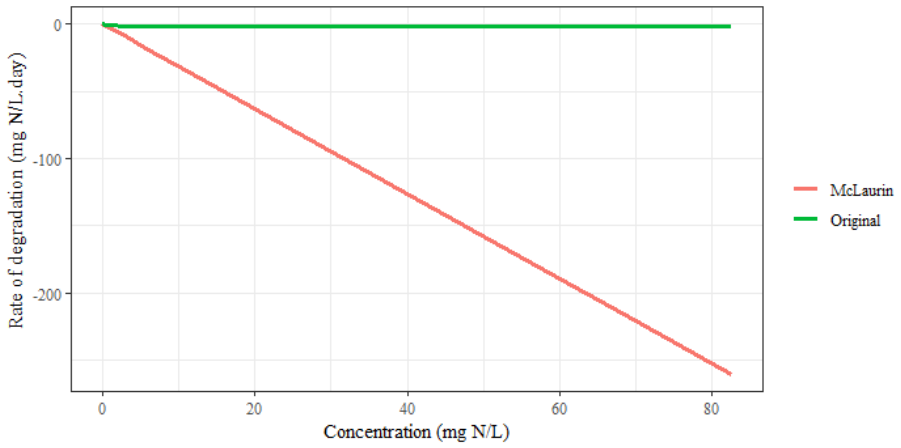


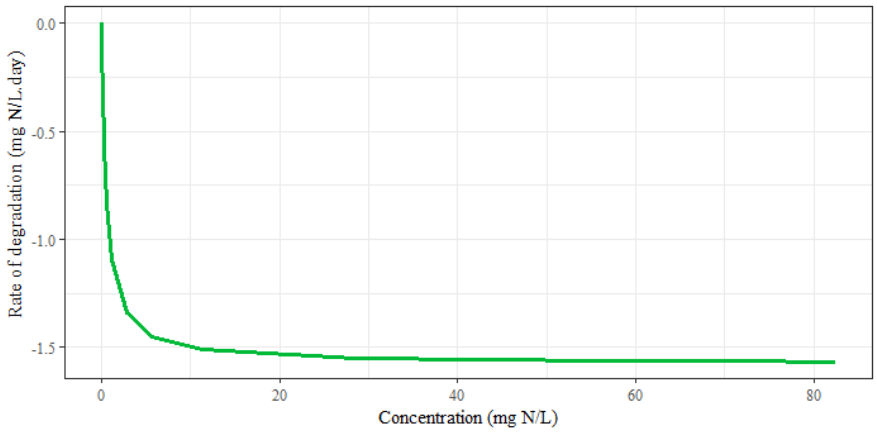

Rate of degradation (mg N/L.day)
0
-100
-200
0
20
40
60
80
Concentration (mg N/L)
McLaurin
Original

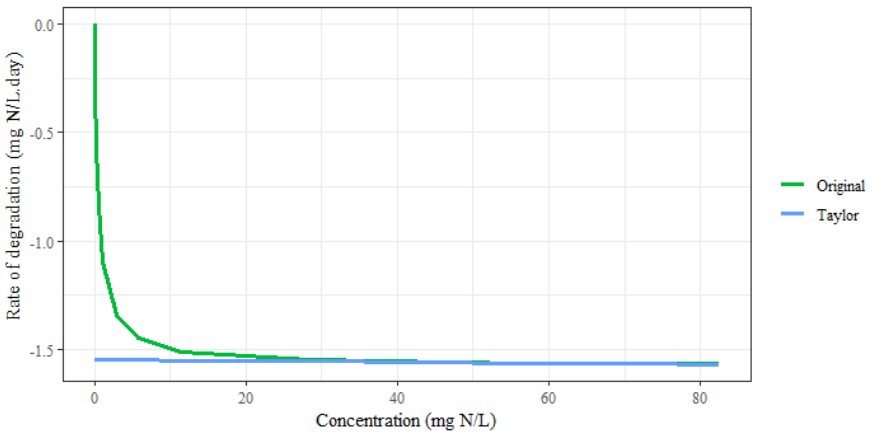

Rate of degradation (mg N/L.day)
0.0
-0.5
-1.0
-1.5
0
20
40
60
80
Concentration (mg N/L)


Rate of degradation (mg N/L.day)
0.0
-0.5
-1.0
-1.5
0
20
40
60
80
Concentration (mg N/L)
Original
Taylor

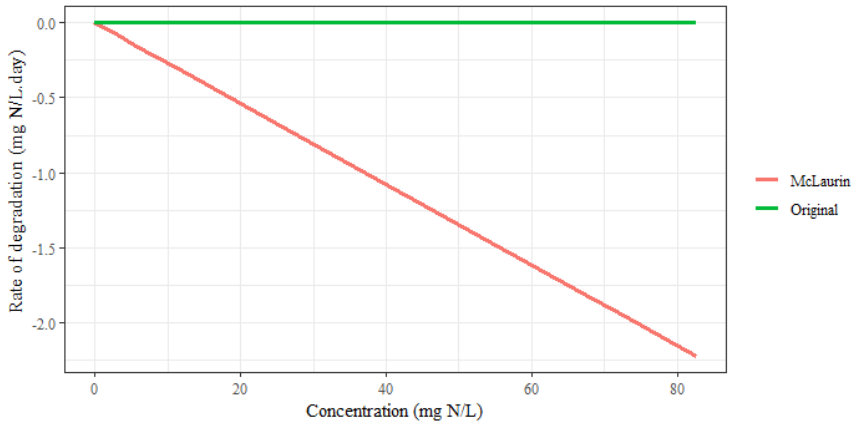
Aerobic growth of XA on SNH

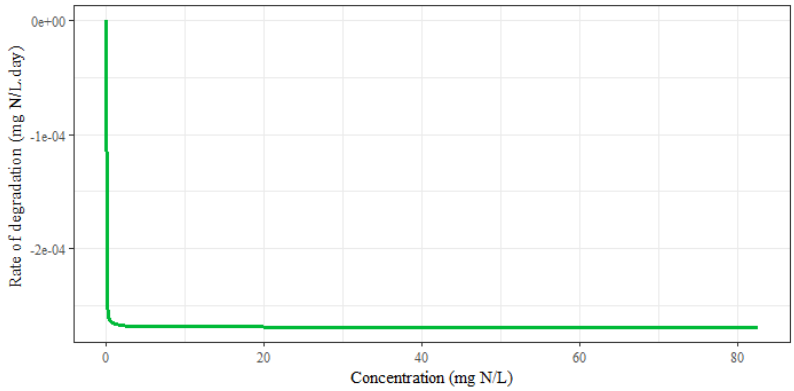


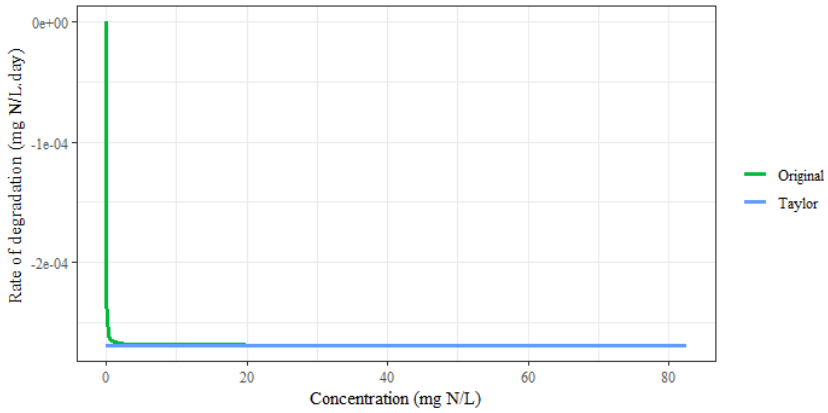




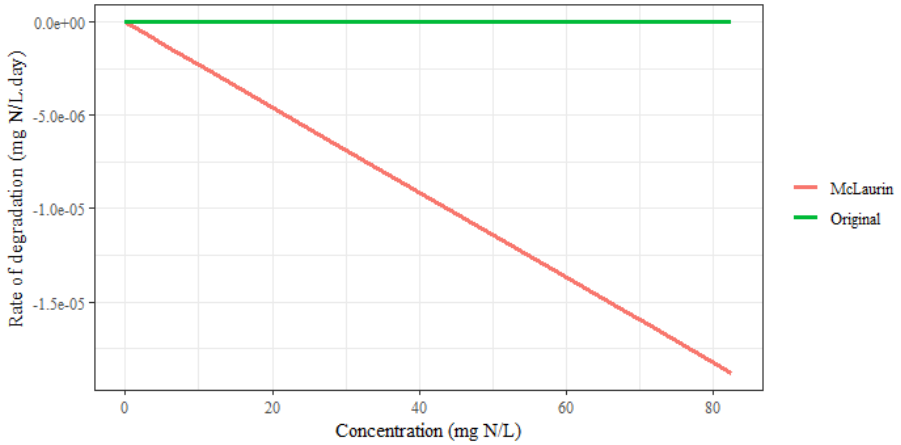
Growth of XFB

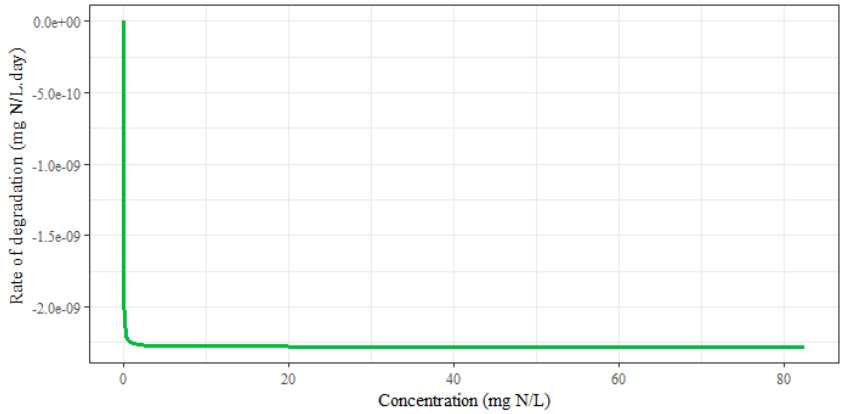


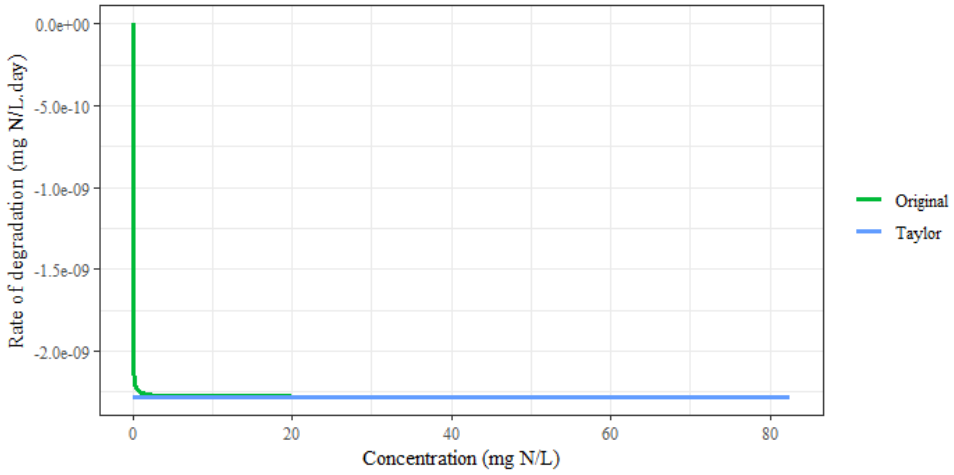




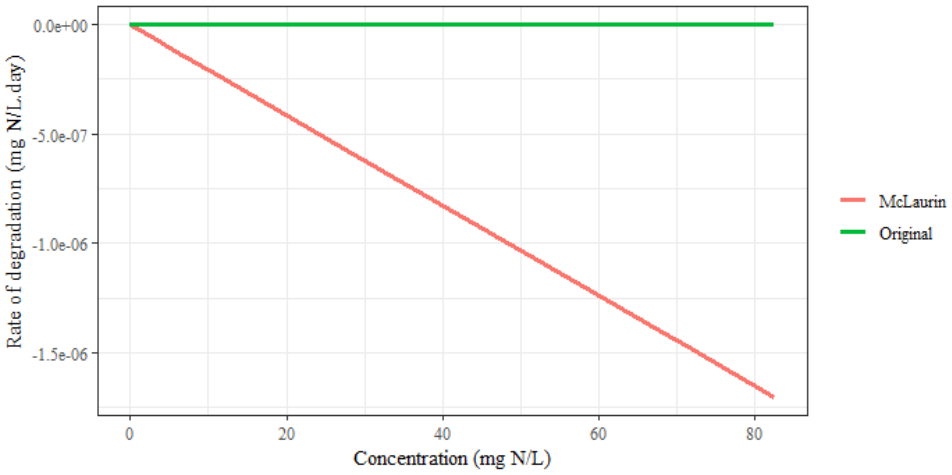
Growth of XAMB

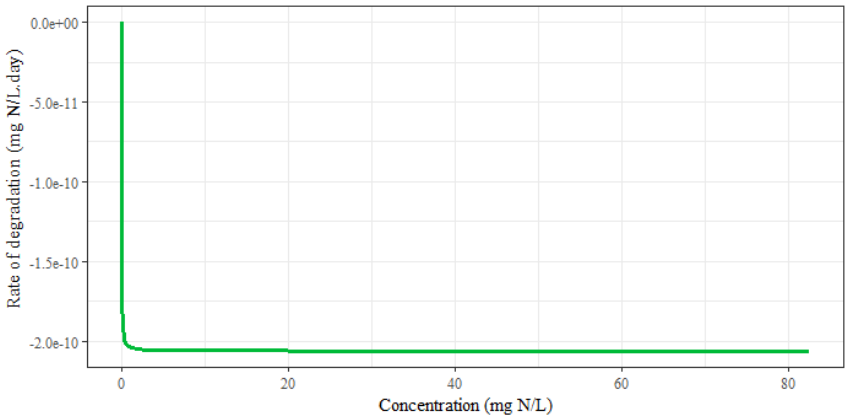


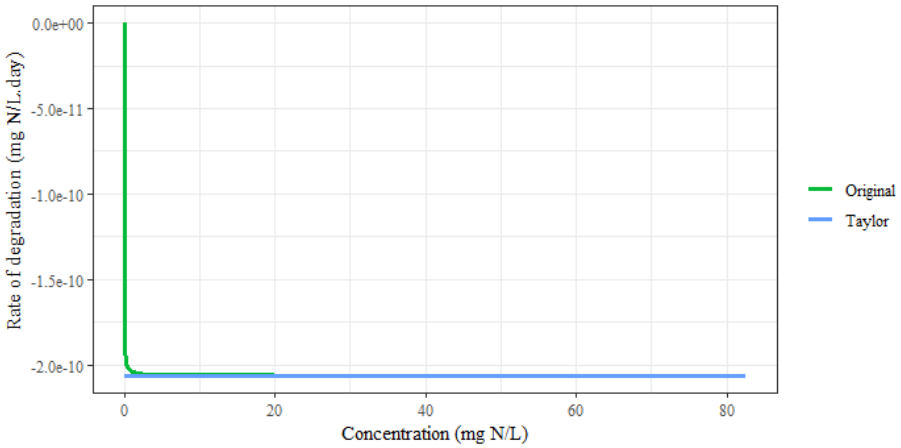




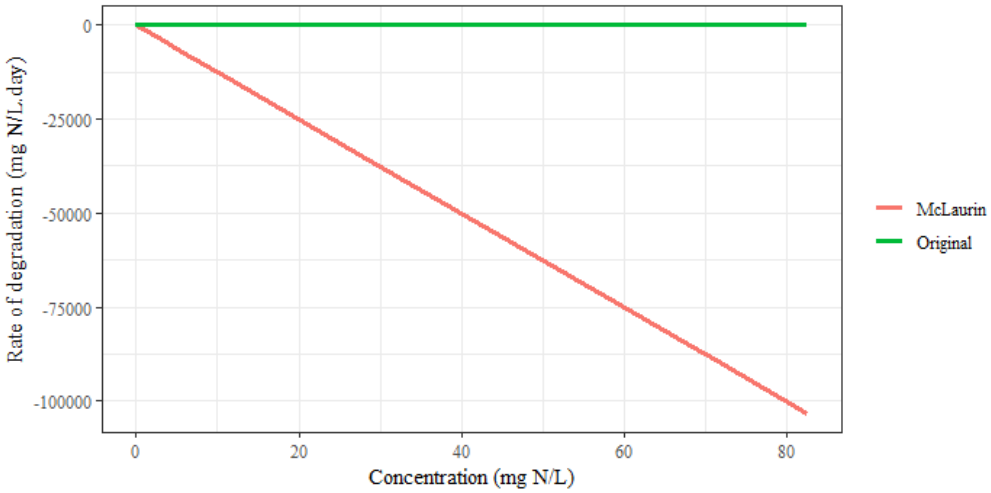
Growth of XASRB

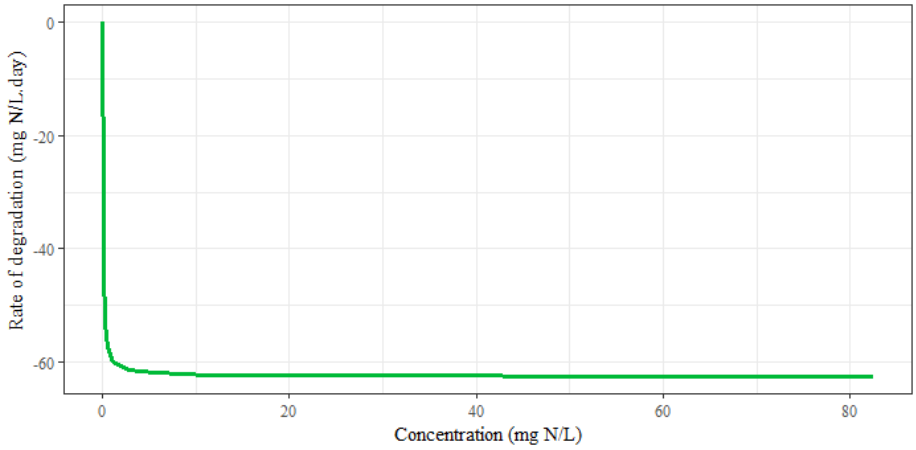


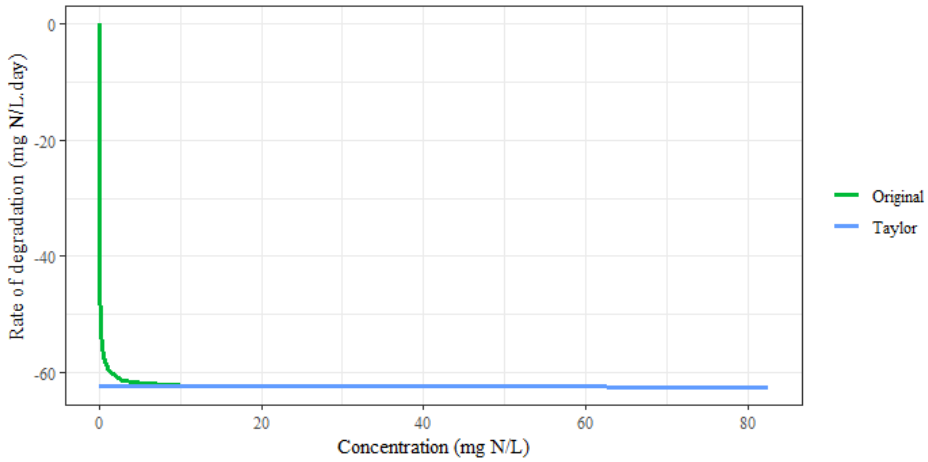




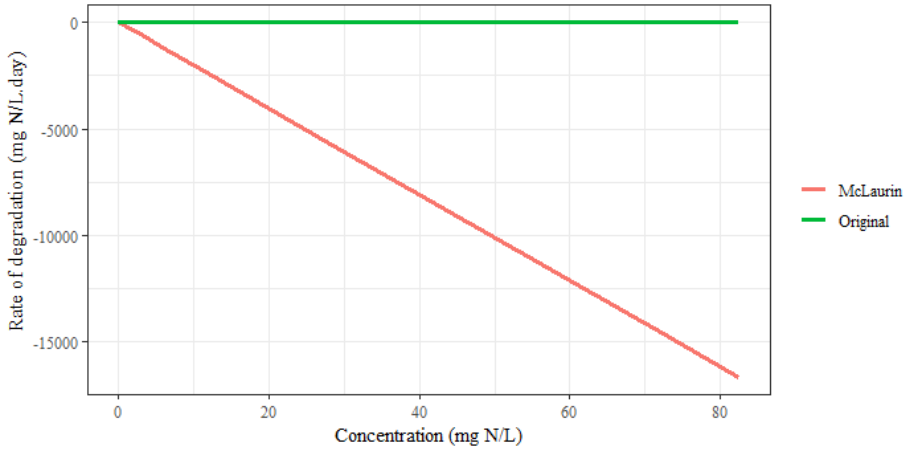
Aerobic growth of XSOB on SH2S

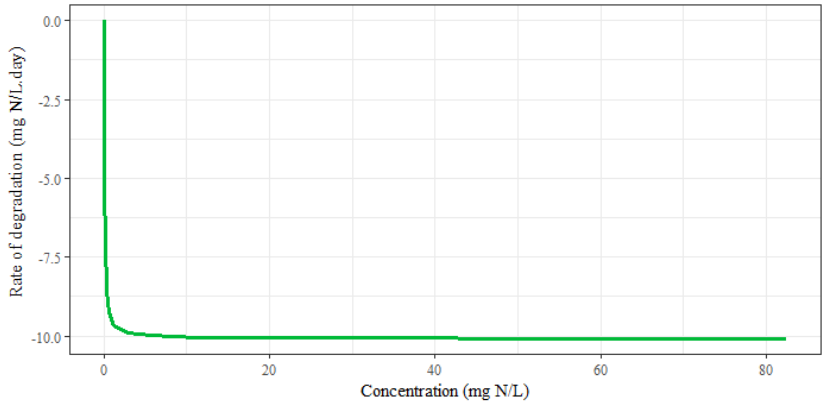


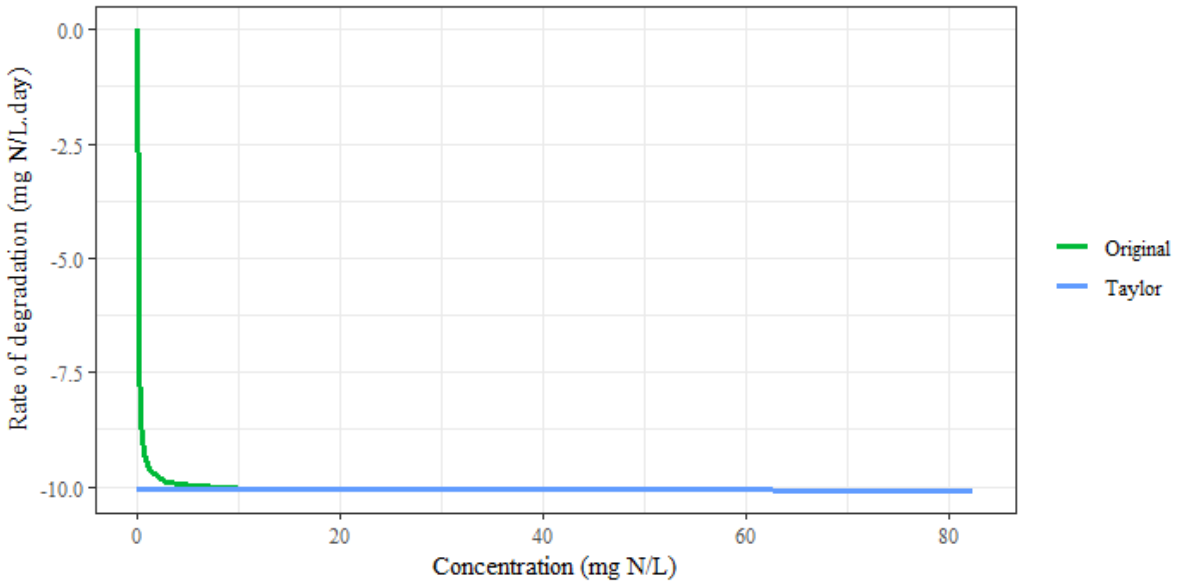




Anoxic growth of XSOB on SH2S

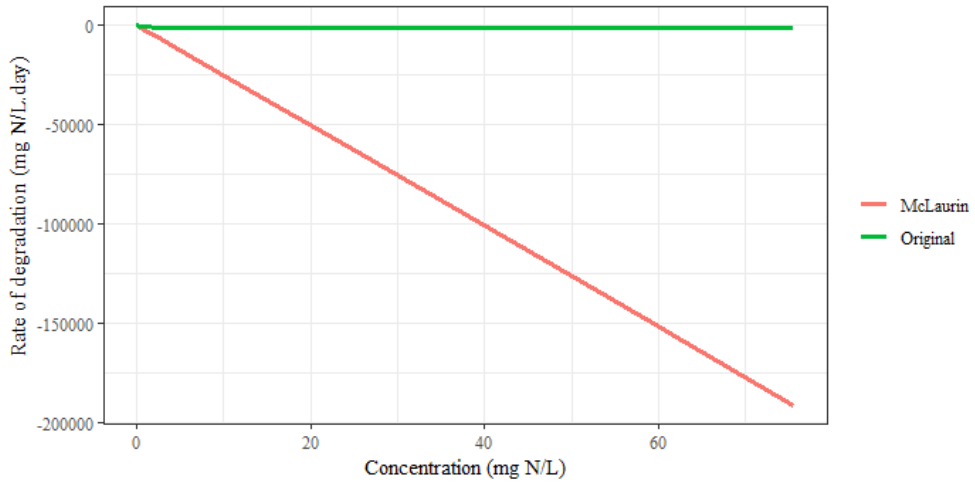


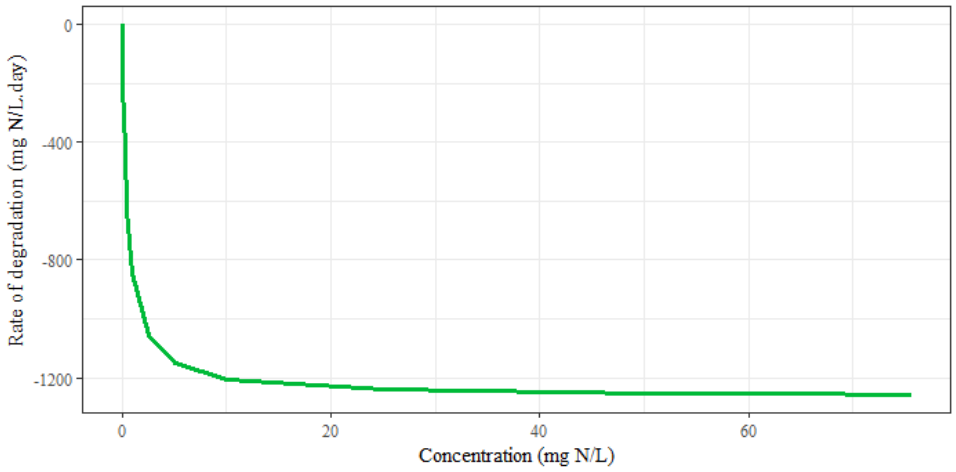


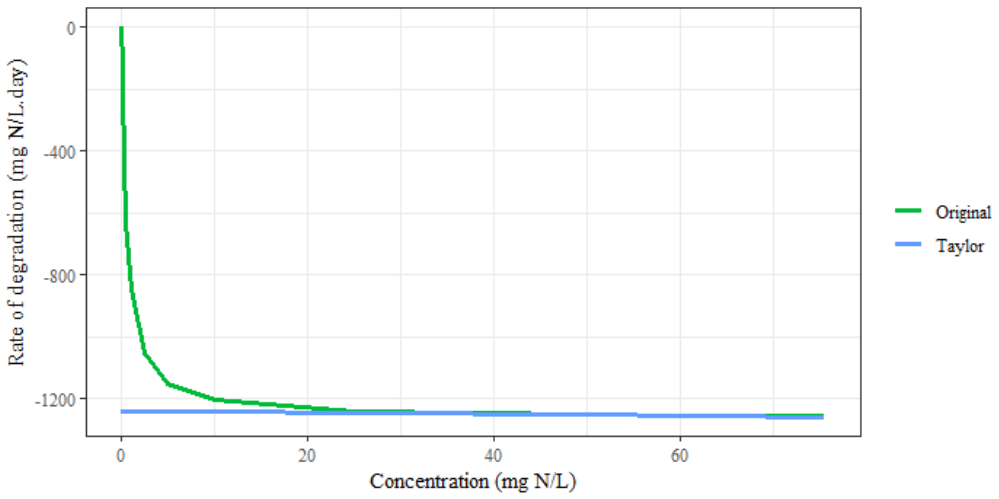


D.5 Nitrate and nitrite nitrogen

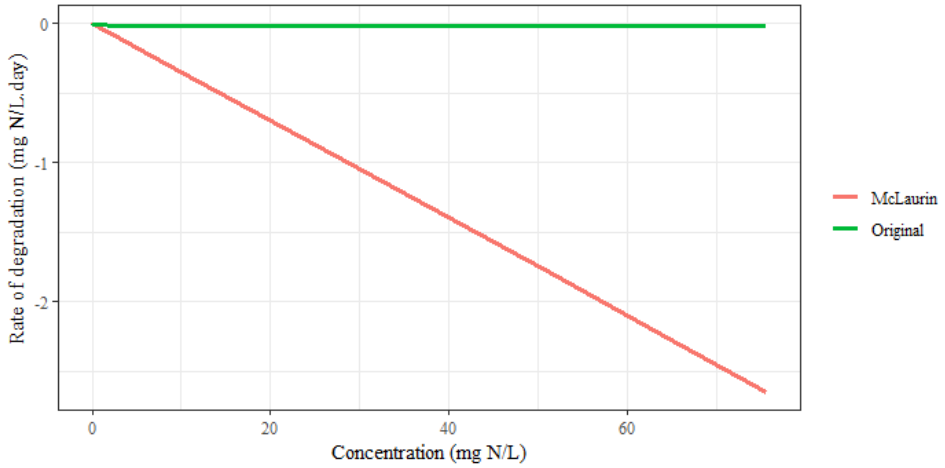
Aerobic growth of XH on SA

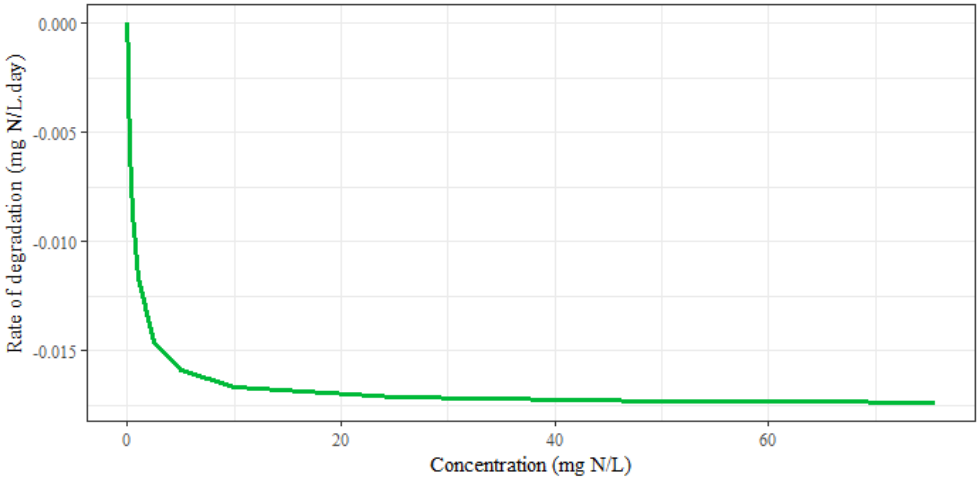


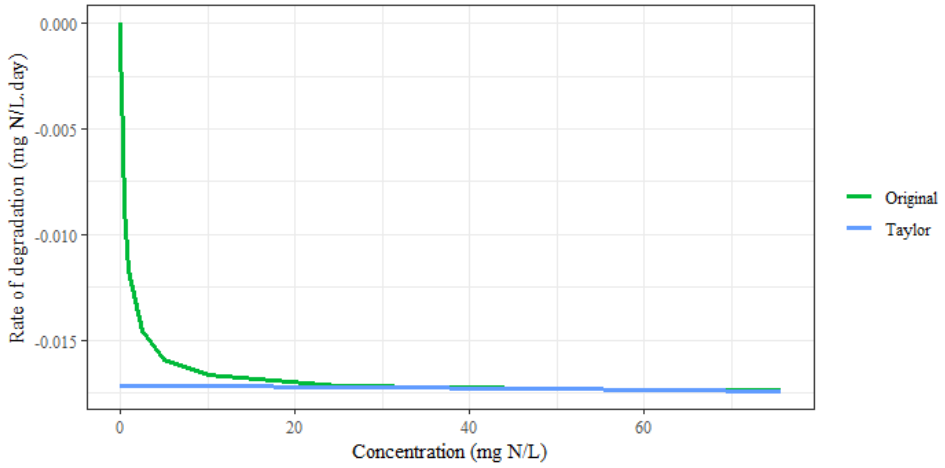




Anoxic growth of XH on SA

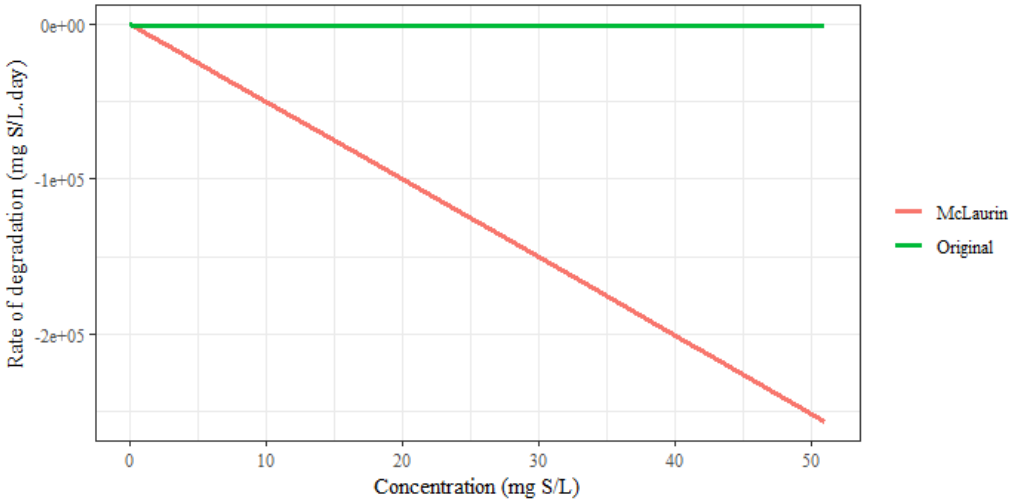


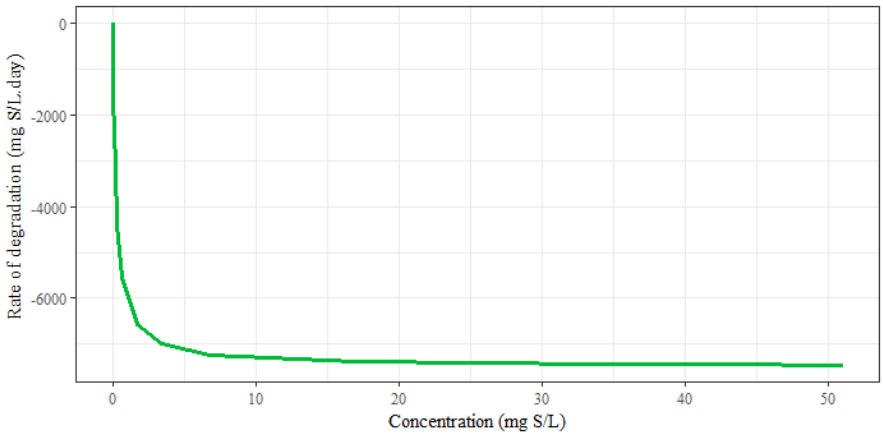


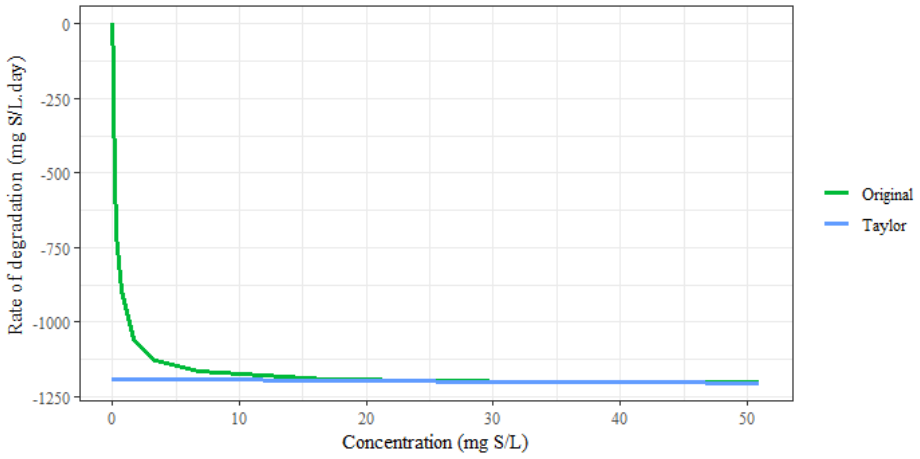


C.6 Dihydrogensulphide sulphur

Anoxic growth of XSOB on SH2S







Appendix E: RStudio code and tables of results used to generate figures in Chapter 6 and Appendix D

E.1Dissolved oxygen comparisons

Aerobic growth of XH on SF

Conc	Rate		
	Original	Taylor	McLaurin
0	0	-3667.58	0
0.00086	-23.8561	-3668.43	-23.9587
0.00172	-47.5088	-3669.29	-47.9174
0.0043	-117.272	-3671.85	-119.793
0.0086	-229.709	-3676.11	-239.587
0.0172	-441.228	-3684.64	-479.174
0.043	-985.954	-3710.23	-1197.93
0.086	-1675.43	-3752.87	-2395.87
0.172	-2576.2	-3838.17	-4791.74
0.43	-3802.97	-4094.04	-11979.3
0.86	-4520.51	-4520.51	-23958.7
1.032	-4667.28	-4691.09	-28750.4
1.075	-4697.78	-4733.74	-29948.4
1.29	-4823.9	-4946.97	-35938

Anoxic growth of XH on SF

Concentration	Rate		
	Original	Taylor	McLaurin
0	0	-0.21809	0
0.00086	-0.00142	-0.21814	-0.00142
0.00172	-0.00283	-0.21819	-0.00285
0.0043	-0.00697	-0.21834	-0.00712
0.0086	-0.01366	-0.21859	-0.01425
0.0172	-0.02624	-0.2191	-0.02849
0.043	-0.05863	-0.22062	-0.07123
0.086	-0.09963	-0.22316	-0.14247
0.172	-0.15319	-0.22823	-0.28493
0.43	-0.22614	-0.24345	-0.71233
0.86	-0.2688	-0.2688	-1.42467
1.032	-0.27753	-0.27895	-1.7096
1.075	-0.27935	-0.28148	-1.78083
1.29	-0.28685	-0.29416	-2.137

Aerobic growth of XA on SNH

Conc	Rate		
	Original	Taylor	McLaurin
0	0	-307.633	0
0.00086	-1.23648	-307.991	-1.23754
0.00172	-2.47084	-308.349	-2.47509
0.0043	-6.16123	-309.422	-6.18772
0.0086	-12.2699	-311.211	-12.3754
0.0172	-24.3324	-314.788	-24.7509
0.043	-59.3262	-325.519	-61.8772
0.086	-113.954	-343.405	-123.754
0.172	-211.185	-379.176	-247.509
0.43	-432.708	-486.49	-618.772
0.86	-665.347	-665.347	-1237.54
1.032	-730.834	-736.889	-1485.05
1.075	-745.509	-754.775	-1546.93
1.29	-810.619	-844.203	-1856.32

Aerobic growth o XSOB on SH2S

Conc	Rate		
	Original	Taylor	McLaurin
0	0	-11344.3	0
0.00086	-73.7903	-11347	-74.1076
0.00172	-146.951	-11349.6	-148.215
0.0043	-362.739	-11357.5	-370.538
0.0086	-710.523	-11370.7	-741.076
0.0172	-1364.78	-11397.1	-1482.15
0.043	-3049.69	-11476.3	-3705.38
0.086	-5182.35	-11608.2	-7410.76
0.172	-7968.56	-11872	-14821.5
0.43	-11763.1	-12663.5	-37053.8
0.86	-13982.6	-13982.6	-74107.6
1.032	-14436.5	-14510.2	-88929.1
1.075	-14530.9	-14642.1	-92634.5
1.29	-14921	-15301.7	-111161

The following code was used to generate the comparisons of the linearisation attempts and the original rates for dissolved oxygen.

```
library(ggplot2)
library(ggthemes)
library(extrafont)
font_import()
loadfonts(device="win")

YH<-0.63;
YFB<-0.053;
YAMB<-0.032;
YASRB<-0.05;
YA<-0.24;
YSOB<-0.12;

KSA<-4;
KSF<-2;
KOH<-0.2;
KNHH<-0.05;
KH2SH<-140;
KNOH<-0.5;
KSFB<-28;
KH2SFB<-140;
KOFB<-0.2;
KNOFB<-0.5;
KNHFB<-0.01;
KSAMB<-56;
KH2SAMB<-140;
KOAMB<-0.0002;
KNOAMB<-0.0005;
KNHAMB<-0.01;
KSASRB<-24;
KSOASRB<-19;
KH2SASRB<-140;
KOASRB<-0.0002;
KNOASRB<-0.0005;
KNHASRB<-0.01;
kH<-3
KNHA<-0.5;
KH2SA<-140;
KOA<-1;
KSSOB<-0.24;
KOSOB<-0.2;
KNHSOB<-0.05;
KNOSOB<-0.5;
KX<-0.1;


muH<-6;
muA<-1;
muFB<-3;
muAMB<-0.085;
muASRB<-0.18;
muSOB<-5.28;
ng<-0.8; #not sure about this value, paper not clear
nuh<-0.1;
nuSOB<-0.7; #no value given, this is an approximation based on other rates
```

```
XH<-100;
XFB<-100;
XAMB<-1000;
XASRB<-340;
XS<-33;
XA<-100;
XSOB<-210;

SF<-170;
SO<-0.86;
SNH<-57;
SH2S<-34;
SNO<-50.4;
SA<-1;
SSO4<-35;

fHYDSI<-0.0;
fBMSF<-0.05;
fBMXI<-0.1;

iNXS<-0.04;
iNSF<-0.03;
iNSI<-0.01;
iNBM<-0.07;
iNXI<-0.03;

P_co_effs<-matrix(c(0,0,0,0,0,0,0,0,(-1)*(XH+nuh*XFB),0,kH*XS,0,0,0,0,0,
                    (1-(1/YH))*muH*

(SF/(KSF+SF))*(SF/(SF+SA))*(SNH/(KNHH*SNH))*(KH2SH/(KH2SH+SH2S))*XH,
                    (1/YH)*muH*

(SO/(KOH+SO))*(SNH/(KNHH*SNH))*(KH2SH/(KH2SH+SH2S))*XH,0,0,
                    ((iNSF/YH)-
iNBM)*(SF/(KSF+SF))*(SF/(SF+SA))*(SO/(KOH+SO))*(KH2SH/(KH2SH+SH2S))*XH,
                    0,0,0,0,0,0,0,0,0,0,
                    0,(-1/YH)*

(ng*muH*(SO/(KOH+SO))*(SNO/(KOH+SNO))*(SNH/(KNHH*SNH))*(KH2SH/(KH2SH+SH2S))
*XH),
                    0,0,(((iNSF/YH)-
iNBM)*ng*muH*(SF/(KSF+SF))*(SF/(SF+SA))*(SO/(KOH+SO))*(SNO/(KOH+SNO))*
                                (KH2SH/(KH2SH+SH2S))*XH),(-((1-
YH)/(2.86*YH)))*ng*muH*(SF/(KSF+SF))*(SF/(SF+SA))*

(SO/(KOH+SO))*(SNH/(KNHH*SNH))*(KH2SH/(KH2SH+SH2S))*XH,0,0,0,0,0,0,0,0,0,
                    (1-
(1/YH))*muH*(SA/(KSA+SA))*(SA/(SF+SA))*(SNH/(KNHH+SNH))*(KH2SH/(KH2SH+SH2S)
)*XH,0,
                    (-
1/YH)*(SNH/(KNHH+SNH))*(SO/(KOH+SO))*(KH2SH/(KH2SH+SH2S))*XH,0,
                    (-
iNBM)*muH*(SA/(KSA+SA))*(SA/(SF+SA))*(SO/(KOH+SO))*(KH2SH/(KH2SH+SH2S)),
                    0,0,0,0,0,0,0,0,0,0,
                    0,0,(-1/YH)*ng*muH*

(KOH/(KOH+SO))*(SNO/(KNOH+SNO))*(SNH/(KNHH+SNH))*(KH2SH/(KH2SH+SH2S))*XH,0,
                    (-iNBM)*ng*muH*

(SA/(KSA+SA))*(SA/(SF+SA))*(KOH/(KOH+SO))*(SNO/(KNOH+SNO))*(KH2SH/(KH2SH+SH
2S))*XH,
```

```
                    (-(1-YH)/(2.86*YH))*ng*muH*

(SA/(KSA+SA))*(SA/(SF+SA))*(KOH/(KOH+SO))*(SNH/(KNHH+SNH))*(KH2SH/(KH2SH+SH
2S))*XH,
                    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,
                    (-(4.57-
YA)/(YA))*muA*(SNH/(KNHA+SNH))*(KH2SA/(KH2SA+SH2S))*XA,0,0,0,
                    (-iNBM-
(1/YA))*muA*(SO/(KOA+SO))*(KH2SA/(KH2SA+SH2S)),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/YFB)*muFB*(KH2SFB/(KH2SFB+SH2S))*

(KOFB/(KOFB+SO))*(KNOFB/(KNOFB+SNO))*(SNH/(KNHFB+SNH))*XFB,0,0,
                    ((iNSF/YFB)-iNBM)*muFB*

(SF/(KSFB+SF))*(KH2SFB/(KH2SFB+SH2S))*(KOFB/(KOFB+SO))*(KNOFB/(KNOFB+SNO)),
                    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/YAMB)*muAMB*(KH2SAMB/(KH2SAMB+SH2S))*(KOAMB/(KOAMB+SO))*(KNOAMB/(KNOAMB+S
NO))*
                      (SNH/(KNHAMB+SNH))*XAMB,0,
                    (-
iNBM)*(SA/(KSAMB+SA))*(KH2SAMB/(KH2SAMB+SH2S))*(KOAMB/(KOAMB+SO))*

(KNOAMB/(KNOAMB+SNO))*(SNH/(KNHAMB+SNH))*XAMB,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/YASRB)*muASRB*(SSO4/(KSOASRB+SSO4))*(KH2SASRB/(KH2SASRB+SH2S))*

(KOASRB/(KOASRB+SO))*(KNOASRB/(KNOASRB+SNO))*(SNH/(KNHASRB+SNH))*XASRB,0,
                    (-
iNBM)*muASRB*(SA/(KSASRB+SA))*(SSO4/(KSOASRB+SSO4))*(KH2SASRB/(KH2SASRB+SH2
S))*
                      (KOASRB/(KOASRB+SO))*(KNOASRB/(KNOASRB+SNO))*XASRB,0,
                    (-(1-
YASRB)/(2*YASRB))*muASRB*(SA/(KSASRB+SA))*(KH2SASRB/(KH2SASRB+SH2S))*

(KOASRB/(KOASRB+SO))*(KNOASRB/(KNOASRB+SNO))*(SNH/(KNHASRB+SNH))*XASRB,
                    ((1-
YASRB)/(2*YASRB))*muASRB*(SA/(KSASRB+SA))*(SSO4/(KSOASRB+SSO4))*

(KOASRB/(KOASRB+SO))*(KNOASRB/(KNOASRB+SNO))*(SNH/(KNHASRB+SNH))*XASRB,
                    0,0,0,0,0,0,0,
                    0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
                    (-(2-
YSOB)/YSOB)*muSOB*(SH2S/(KSSOB+SH2S))*(SNH/(KNHSOB+SNH))*XSOB,0,0,0,
                    (-
iNBM)*muSOB*(SH2S/(KSSOB+SH2S))*(SO/(KOSOB+SO))*XSOB,0,0,
                    (-
1/YSOB)*muSOB*(SO/(KOSOB+SO))*(SNH/(KNHSOB+SNH))*XSOB,0,0,0,0,0,0,0,
                    0,0,0,0,(-
iNBM)*muSOB*nuSOB*(SH2S/(KSSOB+SH2S))*(SNO/(KNOSOB+SNO))*(KOSOB/(KOSOB+SO))
*XSOB,
                    (-(1-
YSOB)/(0.875*YSOB))*muSOB*nuSOB*(SH2S/(KSSOB+SH2S))*(KOSOB/(KOSOB+SO))*
                      (SNH/(KNHSOB+SNH))*XSOB,0,
                    (-
1/YSOB)*muSOB*nuSOB*(SNO/(KNOSOB+SNO))*(KOSOB/(KOSOB+SO))*(SNH/(KNHSOB+SNH)
)*XSOB,
```

```
                    0,0,0,0,0,0,0,0,
                    0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0),
                  nrow=17,byrow=TRUE)

Q_co_effs<-matrix(c(0,0,0,0,0,0,0,0,KX*(XH+XFB),0,nuh*XFB,0,0,0,0,0,
                    KOH,KSF,0,0,KNHH,0,0,0,0,0,0,0,0,0,0,0,
                    0,KSF,0,0,KNHH,KNOH,0,0,0,0,0,0,0,0,0,0,
                    KOH,0,KSA,0,KNHH,0,0,0,0,0,0,0,0,0,0,0,
                    0,0,KSA,0,KNHH,KNOH,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,
                    KOA,0,0,0,KNHA,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,KSFB,0,0,KNHFB,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,KSAMB,0,KNHAMB,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,KSASRB,0,KNHASRB,0,KSOASRB,KH2SASRB,0,0,0,0,0,0,0,0,
                    0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
                    KOSOB,0,0,0,KNHSOB,0,0,KSSOB,0,0,0,0,0,0,0,0,
                    0,0,0,0,KNHSOB,KNOSOB,0,KSSOB,0,0,0,0,0,0,0,0,
                    0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0),nrow=17,byrow=TRUE)

R1<-KX
R2<-SA
R3<-SA
R4<-SF
R5<-SF
T1<-XS+KX*XFB

SO_Conc<-
c(0,0.00086,0.00172,0.0043,0.0086,0.0172,0.043,0.086,0.172,0.43,0.86,1.032,
1.075,1.29)
O_std_Conc<-0.86

SO_2_O<-P_co_effs[2,1]*SO_Conc/(Q_co_effs[2,1]+SO_Conc)
SO_2_M<-P_co_effs[2,1]*SO_Conc/Q_co_effs[2,1]
SO_2_T1<-(P_co_effs[2,1]*O_std_Conc/(O_std_Conc+Q_co_effs[2,1]))+

((P_co_effs[2,1]*Q_co_effs[2,1])/(O_std_Conc+Q_co_effs[2,1])^2)*
              (SO_Conc-O_std_Conc)
SO_4_O<-P_co_effs[4,1]*SO_Conc/(Q_co_effs[4,1]+SO_Conc)
SO_4_M<-P_co_effs[4,1]*SO_Conc/Q_co_effs[4,1]
SO_4_T1<-(P_co_effs[4,1]*O_std_Conc/(O_std_Conc+Q_co_effs[4,1]))+
           ((P_co_effs[4,1]*Q_co_effs[4,1])/(O_std_Conc+Q_co_effs[4,1])^2)*
             (SO_Conc-O_std_Conc)
SO_7_O<-P_co_effs[7,1]*SO_Conc/(Q_co_effs[7,1]+SO_Conc)
SO_7_M<-P_co_effs[7,1]*SO_Conc/Q_co_effs[7,1]
SO_7_T1<-(P_co_effs[7,1]*O_std_Conc/(O_std_Conc+Q_co_effs[7,1]))+
           ((P_co_effs[7,1]*Q_co_effs[7,1])/(O_std_Conc+Q_co_effs[7,1])^2)*
            (SO_Conc-O_std_Conc)
SO_15_O<-P_co_effs[15,1]*SO_Conc/(Q_co_effs[15,1]+SO_Conc)
SO_15_M<-P_co_effs[15,1]*SO_Conc/Q_co_effs[15,1]
SO_15_T1<-(P_co_effs[15,1]*O_std_Conc/(O_std_Conc+Q_co_effs[15,1]))+

((P_co_effs[15,1]*Q_co_effs[15,1])/(O_std_Conc+Q_co_effs[15,1])^2)*
              (SO_Conc-O_std_Conc)

Rate_SO_2<-data.frame(Conc=c(SO_Conc,SO_Conc,SO_Conc),
                      Rate=c(SO_2_O,SO_2_T1,SO_2_M),
                      Eqn=c(rep('Original',times=length(SO_Conc)),
```

```
                          rep("Taylor",times=length(SO_Conc)),
                          rep("McLaurin",times=length(SO_Conc))))

Rate_SO_2_plot<-ggplot(data=Rate_SO_2)+
                  geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
                  ylab(expression(paste("Rate of degradation (mg O  "[2],"
/L.day)")))+
                  xlab(expression(paste("Concentration (mg O"[2],"/L)")))+
                  theme_bw()+
                  theme(legend.title = element_blank(),
                        text=element_text(family="Times New Roman"))
plot(Rate_SO_2_plot)

Org_SO_2<-data.frame(Conc=c(SO_Conc),
                     Rate=c(SO_2_O))
Org_SO_2_plot<-ggplot(data=Org_SO_2)+
               geom_line(aes(x=Conc,y=Rate),size=1.3,color='#00BA38')+
  ylab(expression(paste("Rate of degradation (mg O  "[2]," /L.day)")))+
  xlab(expression(paste("Concentration (mg O"[2],"/L)")))+
  theme_bw()+
  theme(legend.title = element_blank(),
        text=element_text(family="Times New Roman"))
plot(Org_SO_2_plot)

Rate_SO_4<-data.frame(Conc=c(SO_Conc,SO_Conc,SO_Conc),
                      Rate=c(SO_4_O,SO_4_T1,SO_4_M),
                      Eqn=c(rep('Original',times=length(SO_Conc)),
                          rep("Taylor",times=length(SO_Conc)),
                          rep("McLaurin",times=length(SO_Conc))))

Rate_SO_4_plot<-ggplot(data=Rate_SO_4)+
                 geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
                 ylab(expression(paste("Rate of degradation (mg O  "[2],"
/L.day)")))+
                 xlab(expression(paste("Concentration (mg O"[2],"/L)")))+
                 theme_bw()+
                 theme(legend.title = element_blank(),
                 text=element_text(family="Times New Roman"))
plot(Rate_SO_4_plot)

Org_SO_4<-data.frame(Conc=c(SO_Conc),
                     Rate=c(SO_4_O))
Org_SO_4_plot<-ggplot(data=Org_SO_4)+
               geom_line(aes(x=Conc,y=Rate),size=1.3,color='#00BA38')+
               ylab(expression(paste("Rate of degradation (mg O  "[2],"
/L.day)")))+
               xlab(expression(paste("Concentration (mg O"[2],"/L)")))+
               theme_bw()+
               theme(legend.title = element_blank(),
               text=element_text(family="Times New Roman"))
plot(Org_SO_4_plot)

Rate_SO_7<-data.frame(Conc=c(SO_Conc,SO_Conc,SO_Conc),
                      Rate=c(SO_7_O,SO_7_T1,SO_7_M),
                      Eqn=c(rep('Original',times=length(SO_Conc)),
                          rep("Taylor",times=length(SO_Conc)),
                          rep("McLaurin",times=length(SO_Conc))))

Rate_SO_7_plot<-ggplot(data=Rate_SO_7)+
                 geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
```

```
                ylab(expression(paste("Rate of degradation (mg O  "[2],"
/L.day)")))+
                xlab(expression(paste("Concentration (mg O"[2],"/L)")))+
                theme_bw()+
                theme(legend.title = element_blank(),
                      text=element_text(family="Times New Roman"))
plot(Rate_SO_7_plot)

Org_SO_7<-data.frame(Conc=c(SO_Conc),
                     Rate=c(SO_7_O))
Org_SO_7_plot<-ggplot(data=Org_SO_7)+
                geom_line(aes(x=Conc,y=Rate),size=1.3,color='#00BA38')+
                ylab(expression(paste("Rate of degradation (mg O  "[2],"
/L.day)")))+
                xlab(expression(paste("Concentration (mg O"[2],"/L)")))+
                theme_bw()+
                theme(legend.title = element_blank(),
                text=element_text(family="Times New Roman"))
plot(Org_SO_7_plot)

Rate_SO_15<-data.frame(Conc=c(SO_Conc,SO_Conc,SO_Conc),
                       Rate=c(SO_15_O,SO_15_T1,SO_15_M),
                       Eqn=c(rep('Original',times=length(SO_Conc)),
                             rep("Taylor",times=length(SO_Conc)),
                             rep("McLaurin",times=length(SO_Conc))))

Rate_SO_15_plot<-ggplot(data=Rate_SO_15)+
                  geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
                  ylab(expression(paste("Rate of degradation (mg O  "[2],"
/L.day)")))+
                  xlab(expression(paste("Concentration (mg O"[2],"/L)")))+
                  theme_bw()+
                  theme(legend.title = element_blank(),
                        text=element_text(family="Times New Roman"))
plot(Rate_SO_15_plot)

Org_SO_15<-data.frame(Conc=c(SO_Conc),
                      Rate=c(SO_15_O))
Org_SO_15_plot<-ggplot(data=Org_SO_15)+
                geom_line(aes(x=Conc,y=Rate),size=1.3,color='#00BA38')+
                ylab(expression(paste("Rate of degradation (mg O  "[2],"
/L.day)")))+
                xlab(expression(paste("Concentration (mg O"[2],"/L)")))+
                theme_bw()+
                theme(legend.title = element_blank(),
                      text=element_text(family="Times New Roman"))
plot(Org_SO_15_plot)
```

E.2 Fermentable, readily biodegradable COD

Aerobic growth of XH on SF

	Rate		
Conc	Original	Taylor	McLaurin
0	0	10551.53	0
0.17	141.5352	10553.2	8455.143
0.34	458.4049	10554.87	16910.29
0.85	1703.858	10559.86	42275.72
1.7	3597.033	10568.19	84551.43
3.4	6049.556	10584.85	169102.9
8.5	9006.105	10634.84	422757.2
17	10507.12	10718.14	845514.3
34	11407.73	10884.74	1691029
50	11721.37	11041.55	2486807
85	12006.94	11384.56	4227572
120	12129.12	11727.57	5968337
145	12180.86	11972.58	7211740
160	12204.25	12119.58	7957782
170	12217.58	12217.58	8455143
204	12253.25	12550.79	10146172
217.5	12264.35	12683.1	10817610
222	12267.76	12727.2	11041423

Aerobic growth of XH on SA

	Rate		
Conc	Original	Taylor	McLaurin
0	0	-8407.86	0
0.17	-112.781	-8409.19	-6737.38
0.34	-365.274	-8410.52	-13474.8
0.85	-1357.7	-8414.5	-33686.9
1.7	-2866.25	-8421.14	-67373.8
3.4	-4820.52	-8434.41	-134748
8.5	-7176.41	-8474.24	-336869
17	-8372.47	-8540.62	-673738
34	-9090.11	-8673.38	-1347476
50	-9340.04	-8798.32	-1981582
85	-9567.58	-9071.65	-3368690
120	-9664.94	-9344.97	-4755797
145	-9706.17	-9540.2	-5746588
160	-9724.81	-9657.34	-6341063
170	-9735.44	-9735.44	-6737379
204	-9763.86	-10000.9	-8084855
217.5	-9772.7	-10106.4	-8619882
222	-9775.41	-10141.5	-8798225

Growth of XFB

	Rate		
Conc	Original	Taylor	McLaurin
0	0	-6.22145	0
0.17	-0.05093	-6.22248	-0.05124
0.34	-0.10125	-6.2235	-0.10248
0.85	-0.24866	-6.22658	-0.2562
1.7	-0.48308	-6.2317	-0.51241
3.4	-0.91385	-6.24195	-1.02481
8.5	-1.9654	-6.27269	-2.56204
17	-3.18831	-6.32392	-5.12407
34	-4.62819	-6.42639	-10.2481
50	-5.41003	-6.52284	-15.0708
85	-6.34841	-6.73381	-25.6204
120	-6.84296	-6.94478	-36.1699
145	-7.07369	-7.09547	-43.7053
160	-7.18268	-7.18589	-48.2266
170	-7.24616	-7.24616	-51.2407
204	-7.42107	-7.4511	-61.4889
217.5	-7.47708	-7.53248	-65.558
222	-7.49441	-7.5596	-66.9144

The following code was used to generate the comparisons of the linearisation attempts and the original rates for fermentable, biodegradable COD.

```
library(ggplot2)
library(ggthemes)
library(extrafont)
font_import()
loadfonts(device="win")

YH<-0.63;
YFB<-0.053;
YAMB<-0.032;
YASRB<-0.05;
YA<-0.24;
YSOB<-0.12;

KSA<-4;
KSF<-2;
KOH<-0.2;
KNHH<-0.05;
KH2SH<-140;
KNOH<-0.5;
KSFB<-28;
KH2SFB<-140;
KOFB<-0.2;
KNOFB<-0.5;
KNHFB<-0.01;
KSAMB<-56;
KH2SAMB<-140;
KOAMB<-0.0002;
KNOAMB<-0.0005;
KNHAMB<-0.01;
KSASRB<-24;
KSOASRB<-19;
KH2SASRB<-140;
KOASRB<-0.0002;
KNOASRB<-0.0005;
KNHASRB<-0.01;
kH<-3
KNHA<-0.5;
KH2SA<-140;
KOA<-1;
KSSOB<-0.24;
KOSOB<-0.2;
KNHSOB<-0.05;
KNOSOB<-0.5;
KX<-0.1;


muH<-6;
muA<-1;
muFB<-3;
muAMB<-0.085;
muASRB<-0.18;
muSOB<-5.28;
ng<-0.8; #not sure about this value, paper not clear
nuh<-0.1;
nuSOB<-0.7; #no value given, this is an approximation based on other rates
```

```
XH<-100;
XFB<-100;
XAMB<-1000;
XASRB<-340;
XS<-33;
XA<-100;
XSOB<-210;

SF<-170;
SO<-0.86;
SNH<-57;
SH2S<-34;
SNO<-50.4;
SA<-1;
SSO4<-35;

fHYDSI<-0.0;
fBMSF<-0.05;
fBMXI<-0.1;

iNXS<-0.04;
iNSF<-0.03;
iNSI<-0.01;
iNBM<-0.07;
iNXI<-0.03;

P_co_effs<-matrix(c(0,0,0,0,0,0,0,0,(-1)*(XH+nuh*XFB),0,kH*XS,0,0,0,0,0,
                    (1-(1/YH))*muH*

(SF/(KSF+SF))*(SF/(SF+SA))*(SNH/(KNHH*SNH))*(KH2SH/(KH2SH+SH2S))*XH,
                    (1/YH)*muH*

(SO/(KOH+SO))*(SNH/(KNHH*SNH))*(KH2SH/(KH2SH+SH2S))*XH,0,0,
                    ((iNSF/YH)-
iNBM)*(SF/(KSF+SF))*(SF/(SF+SA))*(SO/(KOH+SO))*(KH2SH/(KH2SH+SH2S))*XH,
                    0,0,0,0,0,0,0,0,0,0,
                    0,(-1/YH)*

(ng*muH*(SO/(KOH+SO))*(SNO/(KOH+SNO))*(SNH/(KNHH*SNH))*(KH2SH/(KH2SH+SH2S))
*XH),
                    0,0,(((iNSF/YH)-
iNBM)*ng*muH*(SF/(KSF+SF))*(SF/(SF+SA))*(SO/(KOH+SO))*(SNO/(KOH+SNO))*
                                (KH2SH/(KH2SH+SH2S))*XH),(-((1-
YH)/(2.86*YH)))*ng*muH*(SF/(KSF+SF))*(SF/(SF+SA))*

(SO/(KOH+SO))*(SNH/(KNHH*SNH))*(KH2SH/(KH2SH+SH2S))*XH,0,0,0,0,0,0,0,0,0,
                    (1-
(1/YH))*muH*(SA/(KSA+SA))*(SA/(SF+SA))*(SNH/(KNHH+SNH))*(KH2SH/(KH2SH+SH2S)
)*XH,0,
                    (-
1/YH)*(SNH/(KNHH+SNH))*(SO/(KOH+SO))*(KH2SH/(KH2SH+SH2S))*XH,0,
                    (-
iNBM)*muH*(SA/(KSA+SA))*(SA/(SF+SA))*(SO/(KOH+SO))*(KH2SH/(KH2SH+SH2S)),
                    0,0,0,0,0,0,0,0,0,0,
                    0,0,(-1/YH)*ng*muH*

(KOH/(KOH+SO))*(SNO/(KNOH+SNO))*(SNH/(KNHH+SNH))*(KH2SH/(KH2SH+SH2S))*XH,0,
                    (-iNBM)*ng*muH*

(SA/(KSA+SA))*(SA/(SF+SA))*(KOH/(KOH+SO))*(SNO/(KNOH+SNO))*(KH2SH/(KH2SH+SH
2S))*XH,
```

```
                    (-(1-YH)/(2.86*YH))*ng*muH*

(SA/(KSA+SA))*(SA/(SF+SA))*(KOH/(KOH+SO))*(SNH/(KNHH+SNH))*(KH2SH/(KH2SH+SH
2S))*XH,
                    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,
                    (-(4.57-
YA)/(YA))*muA*(SNH/(KNHA+SNH))*(KH2SA/(KH2SA+SH2S))*XA,0,0,0,
                    (-iNBM-
(1/YA))*muA*(SO/(KOA+SO))*(KH2SA/(KH2SA+SH2S)),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/YFB)*muFB*(KH2SFB/(KH2SFB+SH2S))*

(KOFB/(KOFB+SO))*(KNOFB/(KNOFB+SNO))*(SNH/(KNHFB+SNH))*XFB,0,0,
                    ((iNSF/YFB)-iNBM)*muFB*

(SF/(KSFB+SF))*(KH2SFB/(KH2SFB+SH2S))*(KOFB/(KOFB+SO))*(KNOFB/(KNOFB+SNO)),
                    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/YAMB)*muAMB*(KH2SAMB/(KH2SAMB+SH2S))*(KOAMB/(KOAMB+SO))*(KNOAMB/(KNOAMB+S
NO))*
                      (SNH/(KNHAMB+SNH))*XAMB,0,
                    (-
iNBM)*(SA/(KSAMB+SA))*(KH2SAMB/(KH2SAMB+SH2S))*(KOAMB/(KOAMB+SO))*

(KNOAMB/(KNOAMB+SNO))*(SNH/(KNHAMB+SNH))*XAMB,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/YASRB)*muASRB*(SSO4/(KSOASRB+SSO4))*(KH2SASRB/(KH2SASRB+SH2S))*

(KOASRB/(KOASRB+SO))*(KNOASRB/(KNOASRB+SNO))*(SNH/(KNHASRB+SNH))*XASRB,0,
                    (-
iNBM)*muASRB*(SA/(KSASRB+SA))*(SSO4/(KSOASRB+SSO4))*(KH2SASRB/(KH2SASRB+SH2
S))*
                      (KOASRB/(KOASRB+SO))*(KNOASRB/(KNOASRB+SNO))*XASRB,0,
                    (-(1-
YASRB)/(2*YASRB))*muASRB*(SA/(KSASRB+SA))*(KH2SASRB/(KH2SASRB+SH2S))*

(KOASRB/(KOASRB+SO))*(KNOASRB/(KNOASRB+SNO))*(SNH/(KNHASRB+SNH))*XASRB,
                    ((1-
YASRB)/(2*YASRB))*muASRB*(SA/(KSASRB+SA))*(SSO4/(KSOASRB+SSO4))*

(KOASRB/(KOASRB+SO))*(KNOASRB/(KNOASRB+SNO))*(SNH/(KNHASRB+SNH))*XASRB,
                    0,0,0,0,0,0,0,
                    0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
                    (-(2-
YSOB)/YSOB)*muSOB*(SH2S/(KSSOB+SH2S))*(SNH/(KNHSOB+SNH))*XSOB,0,0,0,
                    (-
iNBM)*muSOB*(SH2S/(KSSOB+SH2S))*(SO/(KOSOB+SO))*XSOB,0,0,
                    (-
1/YSOB)*muSOB*(SO/(KOSOB+SO))*(SNH/(KNHSOB+SNH))*XSOB,0,0,0,0,0,0,0,
                    0,0,0,0,(-
iNBM)*muSOB*nuSOB*(SH2S/(KSSOB+SH2S))*(SNO/(KNOSOB+SNO))*(KOSOB/(KOSOB+SO))
*XSOB,
                    (-(1-
YSOB)/(0.875*YSOB))*muSOB*nuSOB*(SH2S/(KSSOB+SH2S))*(KOSOB/(KOSOB+SO))*
                      (SNH/(KNHSOB+SNH))*XSOB,0,
                    (-
1/YSOB)*muSOB*nuSOB*(SNO/(KNOSOB+SNO))*(KOSOB/(KOSOB+SO))*(SNH/(KNHSOB+SNH)
)*XSOB,
```

```
                    0,0,0,0,0,0,0,0,
                    0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0),
                  nrow=17,byrow=TRUE)

Q_co_effs<-matrix(c(0,0,0,0,0,0,0,0,KX*(XH+XFB),0,nuh*XFB,0,0,0,0,0,
                    KOH,KSF,0,0,KNHH,0,0,0,0,0,0,0,0,0,0,0,
                    0,KSF,0,0,KNHH,KNOH,0,0,0,0,0,0,0,0,0,0,
                    KOH,0,KSA,0,KNHH,0,0,0,0,0,0,0,0,0,0,0,
                    0,0,KSA,0,KNHH,KNOH,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,
                    KOA,0,0,0,KNHA,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,KSFB,0,0,KNHFB,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,KSAMB,0,KNHAMB,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,KSASRB,0,KNHASRB,0,KSOASRB,KH2SASRB,0,0,0,0,0,0,0,0,
                    0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
                    KOSOB,0,0,0,KNHSOB,0,0,KSSOB,0,0,0,0,0,0,0,0,
                    0,0,0,0,KNHSOB,KNOSOB,0,KSSOB,0,0,0,0,0,0,0,0,
                    0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0),nrow=17,byrow=TRUE)

R1<-KX
R2<-SA
R3<-SA
R4<-SF
R5<-SF
T1<-XS+KX*XFB

SF_2_X5<-2*(Q_co_effs[2,2]+R2)
SF_2_X4<-4*((Q_co_effs[2,2]+R2)^2)+2*Q_co_effs[2,2]*R2-
4*(Q_co_effs[2,2]+R2)
SF_2_X3<-
2*(Q_co_effs[2,2]+R2)*((Q_co_effs[2,2]^2)+(R2^2)+4*Q_co_effs[2,2]*R2)+4*Q_c
o_effs[2,2]*R2-
         6*((Q_co_effs[2,2]+R2)^2)-8*Q_co_effs[2,2]*R2
SF_2_X2<-
4*(Q_co_effs[2,2]+R2)*(((Q_co_effs[2,2]^2)*R2)+(R2^2)*Q_co_effs[2,2])+

2*Q_co_effs[2,2]*R2*((Q_co_effs[2,2]^2)+(R2^2)+4*Q_co_effs[2,2]*R2)-

2*(Q_co_effs[2,2]+R2)*((Q_co_effs[2,2]^2)+R2^2+4*Q_co_effs[2,2]*R2)-
         12*Q_co_effs[2,2]*R2*(Q_co_effs[2,2]+R2)
SF_2_X1<-2*(Q_co_effs[2,2]+R2)*((Q_co_effs[2,2]^2)*(R2^2))+
         4*Q_co_effs[2,2]*R2*((Q_co_effs[2,2]^2)*R2+(R2^2)*Q_co_effs[2,2])-

2*(Q_co_effs[2,2]+R2)*((Q_co_effs[2,2]^2)*R2+(R2^2)*Q_co_effs[2,2])-

4*Q_co_effs[2,2]*R2*((Q_co_effs[2,2]^2)+(R2^2)+4*Q_co_effs[2,2]*R2)
SF_2_X0<-2*(Q_co_effs[2,2]^3)*(R2^3)+
         4*Q_co_effs[2,2]*R2*((Q_co_effs[2,2]^2)*R2+(R2^2)*Q_co_effs[2,2])

SF_3_X5<-2*(Q_co_effs[3,2]+R3)
SF_3_X4<-4*((Q_co_effs[3,2]+R3)^2)+2*Q_co_effs[3,2]*R3-
4*(Q_co_effs[3,2]+R3)
SF_3_X3<-
2*(Q_co_effs[3,2]+R3)*((Q_co_effs[3,2]^2)+(R3^2)+4*Q_co_effs[3,2]*R3)+4*Q_c
o_effs[3,2]*R3-
         6*((Q_co_effs[3,2]+R3)^2)-8*Q_co_effs[3,2]*R3
```

```
SF_3_X2<-
4*(Q_co_effs[3,2]+R3)*(((Q_co_effs[3,2]^2)*R3)+(R3^2)*Q_co_effs[3,2])+

2*Q_co_effs[3,2]*R3*((Q_co_effs[3,2]^2)+(R3^2)+4*Q_co_effs[3,2]*R3)-

2*(Q_co_effs[3,2]+R3)*((Q_co_effs[3,2]^2)+R3^2+4*Q_co_effs[3,2]*R3)-
         12*Q_co_effs[3,2]*R3*(Q_co_effs[3,2]+R3)
SF_3_X1<-2*(Q_co_effs[3,2]+R3)*((Q_co_effs[3,2]^2)*(R3^2))+
         4*Q_co_effs[3,2]*R3*((Q_co_effs[3,2]^2)*R3+(R3^2)*Q_co_effs[3,2])-

2*(Q_co_effs[3,2]+R3)*((Q_co_effs[3,2]^2)*R3+(R3^2)*Q_co_effs[3,2])-

4*Q_co_effs[3,2]*R3*((Q_co_effs[3,2]^2)+(R3^2)+4*Q_co_effs[3,2]*R3)
SF_3_X0<-2*(Q_co_effs[3,2]^3)*(R3^3)+
         4*Q_co_effs[3,2]*R3*((Q_co_effs[3,2]^2)*R3+(R3^2)*Q_co_effs[3,2])


#SF Rates
SF_Conc<-
c(0,0.17,0.34,0.85,1.7,3.4,8.5,17,34,50,85,120,145,160,170,204,217.5,222)
F_std_Conc<-170

SF_2_O<-
P_co_effs[2,2]*(SF_Conc/(Q_co_effs[2,2]+SF_Conc))*(SF_Conc)/(R2+SF_Conc)
SF_2_M<-P_co_effs[2,2]*SF_2_X0/((Q_co_effs[2,2]^4)*(R2^4))*SF_Conc
SF_2_T1<-
((P_co_effs[2,2]*(F_std_Conc^2))/((F_std_Conc+Q_co_effs[2,2])*(F_std_Conc+R
2)))+

(((P_co_effs[2,2]*F_std_Conc*((Q_co_effs[2,2]+R2)*F_std_Conc+2*Q_co_effs[2,
2]*R2))/

((((F_std_Conc+Q_co_effs[2,2])^2))*((F_std_Conc+R2)^2)))*(SF_Conc-
F_std_Conc))+

P_co_effs[2,2]*((SF_2_X5*(F_std_Conc^5)+(SF_2_X4^4)*(F_std_Conc^4)+

(SF_2_X3^3)*(F_std_Conc^3)+(SF_2_X2^2)*(F_std_Conc^2)+
                              SF_2_X1*F_std_Conc+SF_2_X0)/

(((F_std_Conc+Q_co_effs[2,2])^4)*((F_std_Conc+R2)^4)))*
                               (SF_Conc-F_std_Conc)
SF_3_O<-
P_co_effs[3,2]*(SF_Conc/(Q_co_effs[3,2]+SF_Conc))*(SF_Conc)/(R3+SF_Conc)
SF_3_M<-P_co_effs[3,2]*SF_3_X0/((Q_co_effs[3,2]^4)*(R3^4))*SF_Conc
SF_3_T1<-
((P_co_effs[3,2]*(F_std_Conc^2))/((F_std_Conc+Q_co_effs[3,2])*(F_std_Conc+R
3)))+

(((P_co_effs[3,2]*F_std_Conc*((Q_co_effs[3,2]+R3)*F_std_Conc+2*Q_co_effs[3,
2]*R3))/
      ((((F_std_Conc+Q_co_effs[3,2])^2))*((F_std_Conc+R3)^2)))*(SF_Conc-
F_std_Conc))+

P_co_effs[3,2]*((SF_3_X5*(F_std_Conc^5)+(SF_3_X4^4)*(F_std_Conc^4)+
                     (SF_3_X3^3)*(F_std_Conc^3)+(SF_3_X2^2)*(F_std_Conc^2)+
                    SF_3_X1*F_std_Conc+SF_3_X0)/
                   (((F_std_Conc+Q_co_effs[3,2])^4)*((F_std_Conc+R3)^4)))*
                 (SF_Conc-F_std_Conc)

SF_9_O<-P_co_effs[9,2]*SF_Conc/(Q_co_effs[9,2]+SF_Conc)
```

```
SF_9_M<-P_co_effs[9,2]*SF_Conc/Q_co_effs[9,2]
SF_9_T1<-(P_co_effs[9,2]*F_std_Conc/(F_std_Conc+Q_co_effs[9,2]))+

((P_co_effs[9,2]*Q_co_effs[9,2])/(F_std_Conc+Q_co_effs[9,2])^2)*(SF_Conc-
F_std_Conc)

Rate_SF_2<-data.frame(Conc=c(SF_Conc,SF_Conc,SF_Conc),
                      Rate=c(SF_2_O,SF_2_T1,SF_2_M),
                      Eqn=c(rep('Original',times=length(SF_Conc)),
                            rep('Taylor',times=length(SF_Conc)),
                            rep("McLaurin",times=length(SF_Conc))))

Rate_SF_2_plot<-ggplot(data=Rate_SF_2)+
                geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
                ylab(expression(paste("Rate of degradation (mg
COD/L.day)")))+
                xlab(expression(paste("Concentration (mg COD/L)")))+
                theme_bw()+
                theme(legend.title = element_blank(),
                  text=element_text(family="Times New Roman"))
plot(Rate_SF_2_plot)

Tay_SF_2<-data.frame(Conc=c(SF_Conc,SF_Conc),
                      Rate=c(SF_2_O,SF_2_T1),
                      Eqn=c(rep('Original',times=length(SF_Conc)),
                            rep("Taylor",times=length(SF_Conc))))

Tay_SF_2_plot<-ggplot(data=Tay_SF_2)+
                geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
                scale_color_manual(values=c('#00BA38','#619CFF'))+
                ylab(expression(paste("Rate of degradation (mg
COD/L.day)")))+
                xlab(expression(paste("Concentration (mg COD/L)")))+
                theme_bw()+
                theme(legend.title = element_blank(),
                  text=element_text(family="Times New Roman"))
plot(Tay_SF_2_plot)

Org_SF_2<-data.frame(Conc=c(SF_Conc),
                     Rate=c(SF_2_O))

Org_SF_2_plot<-ggplot(data=Org_SF_2)+
                geom_line(aes(x=Conc,y=Rate),size=1.3,color='#00BA38')+
                ylab(expression(paste("Rate of degradation (mg
COD/L.day)")))+
                xlab(expression(paste("Concentration (mg COD/L)")))+
                theme_bw()+
                theme(legend.title = element_blank(),
                text=element_text(family="Times New Roman"))
plot(Org_SF_2_plot)


Rate_SF_3<-data.frame(Conc=c(SF_Conc,SF_Conc,SF_Conc),
                      Rate=c(SF_3_O,SF_3_T1,SF_3_M),
                      Eqn=c(rep('Original',times=length(SF_Conc)),
                            rep("Taylor",times=length(SF_Conc)),
                            rep("McLaurin",times=length(SF_Conc))))

Rate_SF_3_plot<-ggplot(data=Rate_SF_3)+
                geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
                theme_bw()+
```

```
                theme(legend.title = element_blank(),
                  text=element_text(family="Times New Roman"))+
                ylab(expression(paste("Rate of degradation (mg
COD/L.day)")))+
                xlab(expression(paste("Concentration (mg COD/L)")))
plot(Rate_SF_3_plot)

Tay_SF_3<-data.frame(Conc=c(SF_Conc,SF_Conc),
                     Rate=c(SF_3_O,SF_3_T1),
                     Eqn=c(rep('Original',times=length(SF_Conc)),
                           rep("Taylor",times=length(SF_Conc))))

Tay_SF_3_plot<-ggplot(data=Tay_SF_3)+
                geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
                scale_color_manual(values=c('#00BA38','#619CFF'))+
                ylab(expression(paste("Rate of degradation (mg
COD/L.day)")))+
                xlab(expression(paste("Concentration (mg COD/L)")))+
                theme_bw()+
                theme(legend.title = element_blank(),
                text=element_text(family="Times New Roman"))
plot(Tay_SF_3_plot)

Org_SF_3<-data.frame(Conc=c(SF_Conc),
                     Rate=c(SF_3_O))

Org_SF_3_plot<-ggplot(data=Org_SF_3)+
                geom_line(aes(x=Conc,y=Rate),size=1.3,color='#00BA38')+
                ylab(expression(paste("Rate of degradation (mg
COD/L.day)")))+
                xlab(expression(paste("Concentration (mg COD/L)")))+
                theme_bw()+
                theme(legend.title = element_blank(),
                  text=element_text(family="Times New Roman"))
plot(Org_SF_3_plot)

Rate_SF_9<-data.frame(Conc=c(SF_Conc,SF_Conc,SF_Conc),
                      Rate=c(SF_9_O,SF_9_T1,SF_9_M),
                      Eqn=c(rep('Orignal',times=length(SF_Conc)),
                            rep("Taylor",times=length(SF_Conc)),
                            rep("McLaurin",times=length(SF_Conc))))

Rate_SF_9_plot<-ggplot(data=Rate_SF_9)+
                geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
                ylab(expression(paste("Rate of degradation (mg
COD/L.day)")))+
                xlab(expression(paste("Concentration (mg COD/L)")))+
                theme_bw()+
                theme(legend.title = element_blank(),
                  text=element_text(family="Times New Roman"))
plot(Rate_SF_9_plot)

Tay_SF_9<-data.frame(Conc=c(SF_Conc,SF_Conc),
                      Rate=c(SF_9_O,SF_9_T1),
                      Eqn=c(rep('Original',times=length(SF_Conc)),
                            rep("Taylor",times=length(SF_Conc))))

Tay_SF_9_plot<-ggplot(data=Tay_SF_9)+
                geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
                scale_color_manual(values=c('#00BA38','#619CFF'))+
```

```
                ylab(expression(paste("Rate of degradation (mg
COD/L.day)")))+
                xlab(expression(paste("Concentration (mg COD/L)")))+
                theme_bw()+
                theme(legend.title = element_blank(),
                      text=element_text(family="Times New Roman"))
plot(Tay_SF_9_plot)

Org_SF_9<-data.frame(Conc=c(SF_Conc),
                     Rate=c(SF_9_O))

Org_SF_9_plot<-ggplot(data=Org_SF_9)+
                geom_line(aes(x=Conc,y=Rate),size=1.3,color='#00BA38')+
                ylab(expression(paste("Rate of degradation (mg
COD/L.day)")))+
                xlab(expression(paste("Concentration (mg COD/L)")))+
                theme_bw()+
                theme(legend.title = element_blank(),
                  text=element_text(family="Times New Roman"))
plot(Org_SF_9_plot)
```

E.3 Fermentation products, as acetate

Anoxic growth of XH on SF

Conc	Rate		
	Original	Taylor	McLaurin
0	0	28496871	0
0.027	-0.00011	2.85E+14	-0.01243
0.054	-0.00044	2.84E+14	-0.02486
0.135	-0.00268	2.84E+14	-0.06214
0.27	-0.01038	2.82E+14	-0.12429
0.54	-0.03899	2.79E+14	-0.24857
1.35	-0.20582	2.71E+14	-0.62143
2.7	-0.65224	2.56E+14	-1.24285
5.4	-1.83097	2.28E+14	-2.4857
13.5	-5.87548	1.42E+14	-6.21426
27	-12.358	-12.358	-12.4285
32.4	-14.7512	-5.7E+13	-14.9142
33.75	-15.3314	-7.1E+13	-15.5356
40.5	-18.1279	-1.4E+14	-18.6428

Anoxic growth of XH on SA

Conc	Rate		
	Original	Taylor	McLaurin
0	0	3.15E+14	0
0.027	-0.00012	3.15E+14	-0.01374
0.054	-0.00048	3.14E+14	-0.02747
0.135	-0.00296	3.13E+14	-0.06869
0.27	-0.01147	3.12E+14	-0.13737
0.54	-0.0431	3.09E+14	-0.27475
1.35	-0.22749	2.99E+14	-0.68687
2.7	-0.72093	2.83E+14	-1.37374
5.4	-2.02379	2.52E+14	-2.74748
13.5	-6.49425	1.57E+14	-6.8687
27	-13.6595	-13.6595	-13.7374
32.4	-16.3047	-6.3E+13	-16.4849
33.75	-16.9461	-7.9E+13	-17.1718
40.5	-20.037	-1.6E+14	-20.6061

Growth of XAMB

Conc	Rate		
	Original	Taylor	McLaurin
0	0	-5.22E-07	0
0.027	-2.38E-09	-5.23E-07	-2.38E-09
0.054	-4.75E-09	-5.24E-07	-4.75E-09
0.135	-1.19E-08	-5.27E-07	-1.19E-08
0.27	-2.36E-08	-5.32E-07	-2.38E-08
0.54	-4.71E-08	-5.43E-07	-4.75E-08
1.35	-1.16E-07	-5.76E-07	-1.19E-07
2.7	-2.27E-07	-6.30E-07	-2.38E-07
5.4	-4.33E-07	-7.38E-07	-4.75E-07
13.5	-9.57E-07	-1.06E-06	-1.19E-06
27	-1.60E-06	-1.60E-06	-2.38E-06
32.4	-1.81E-06	-1.82E-06	-2.85E-06
33.75	-1.85E-06	-1.87E-06	-2.97E-06
40.5	-2.07E-06	-2.14E-06	-3.56E-06

Growth of XASRB

Conc	Rate		
	Original	Taylor	McLaurin
0	0	-4.13E-07	0
0.027	-1.65E-09	-4.13E-07	-1.66E-09
0.054	-3.30E-09	-4.13E-07	-3.31E-09
0.135	-8.23E-09	-4.14E-07	-8.28E-09
0.27	-1.64E-08	-4.16E-07	-1.66E-08
0.54	-3.24E-08	-4.20E-07	-3.31E-08
1.35	-7.84E-08	-4.31E-07	-8.28E-08
2.7	-1.49E-07	-4.49E-07	-1.66E-07
5.4	-2.70E-07	-4.86E-07	-3.31E-07
13.5	-5.30E-07	-5.96E-07	-8.28E-07
27	-7.79E-07	-7.79E-07	-1.66E-06
32.4	-8.46E-07	-8.53E-07	-1.99E-06
33.75	-8.60E-07	-8.71E-07	-2.07E-06
40.5	-9.24E-07	-9.63E-07	-2.48E-06

The following code was used to generate the comparisons of the linearisation attempts and the original rates for fermentation products, as acetate.

```
library(ggplot2)
library(ggthemes)
library(extrafont)
font_import()
loadfonts(device="win")

YH<-0.63;
YFB<-0.053;
YAMB<-0.032;
YASRB<-0.05;
YA<-0.24;
YSOB<-0.12;

KSA<-4;
KSF<-2;
KOH<-0.2;
KNHH<-0.05;
KH2SH<-140;
KNOH<-0.5;
KSFB<-28;
KH2SFB<-140;
KOFB<-0.2;
KNOFB<-0.5;
KNHFB<-0.01;
KSAMB<-56;
KH2SAMB<-140;
KOAMB<-0.0002;
KNOAMB<-0.0005;
KNHAMB<-0.01;
KSASRB<-24;
KSOASRB<-19;
KH2SASRB<-140;
KOASRB<-0.0002;
KNOASRB<-0.0005;
KNHASRB<-0.01;
kH<-3
KNHA<-0.5;
KH2SA<-140;
KOA<-1;
KSSOB<-0.24;
KOSOB<-0.2;
KNHSOB<-0.05;
KNOSOB<-0.5;
KX<-0.1;


muH<-6;
muA<-1;
muFB<-3;
muAMB<-0.085;
muASRB<-0.18;
muSOB<-5.28;
ng<-0.8; #not sure about this value, paper not clear
nuh<-0.1;
nuSOB<-0.7; #no value given, this is an approximation based on other rates
```

```
XH<-100;
XFB<-100;
XAMB<-1000;
XASRB<-340;
XS<-33;
XA<-100;
XSOB<-210;

SF<-170;
SO<-0.86;
SNH<-57;
SH2S<-34;
SNO<-50.4;
SA<-1;
SSO4<-35;

fHYDSI<-0.0;
fBMSF<-0.05;
fBMXI<-0.1;

iNXS<-0.04;
iNSF<-0.03;
iNSI<-0.01;
iNBM<-0.07;
iNXI<-0.03;

P_co_effs<-matrix(c(0,0,0,0,0,0,0,0,(-1)*(XH+nuh*XFB),0,kH*XS,0,0,0,0,0,
                    (1-(1/YH))*muH*

(SF/(KSF+SF))*(SF/(SF+SA))*(SNH/(KNHH*SNH))*(KH2SH/(KH2SH+SH2S))*XH,
                    (1/YH)*muH*

(SO/(KOH+SO))*(SNH/(KNHH*SNH))*(KH2SH/(KH2SH+SH2S))*XH,0,0,
                    ((iNSF/YH)-
iNBM)*(SF/(KSF+SF))*(SF/(SF+SA))*(SO/(KOH+SO))*(KH2SH/(KH2SH+SH2S))*XH,
                    0,0,0,0,0,0,0,0,0,0,
                    0,(-1/YH)*

(ng*muH*(SO/(KOH+SO))*(SNO/(KOH+SNO))*(SNH/(KNHH*SNH))*(KH2SH/(KH2SH+SH2S))
*XH),
                    0,0,(((iNSF/YH)-
iNBM)*ng*muH*(SF/(KSF+SF))*(SF/(SF+SA))*(SO/(KOH+SO))*(SNO/(KOH+SNO))*
                                (KH2SH/(KH2SH+SH2S))*XH),(-((1-
YH)/(2.86*YH)))*ng*muH*(SF/(KSF+SF))*(SF/(SF+SA))*

(SO/(KOH+SO))*(SNH/(KNHH*SNH))*(KH2SH/(KH2SH+SH2S))*XH,0,0,0,0,0,0,0,0,0,
                    (1-
(1/YH))*muH*(SA/(KSA+SA))*(SA/(SF+SA))*(SNH/(KNHH+SNH))*(KH2SH/(KH2SH+SH2S)
)*XH,0,
                    (-
1/YH)*(SNH/(KNHH+SNH))*(SO/(KOH+SO))*(KH2SH/(KH2SH+SH2S))*XH,0,
                    (-
iNBM)*muH*(SA/(KSA+SA))*(SA/(SF+SA))*(SO/(KOH+SO))*(KH2SH/(KH2SH+SH2S)),
                    0,0,0,0,0,0,0,0,0,0,
                    0,0,(-1/YH)*ng*muH*

(KOH/(KOH+SO))*(SNO/(KNOH+SNO))*(SNH/(KNHH+SNH))*(KH2SH/(KH2SH+SH2S))*XH,0,
                    (-iNBM)*ng*muH*

(SA/(KSA+SA))*(SA/(SF+SA))*(KOH/(KOH+SO))*(SNO/(KNOH+SNO))*(KH2SH/(KH2SH+SH
2S))*XH,
```

```
                    (-(1-YH)/(2.86*YH))*ng*muH*

(SA/(KSA+SA))*(SA/(SF+SA))*(KOH/(KOH+SO))*(SNH/(KNHH+SNH))*(KH2SH/(KH2SH+SH
2S))*XH,
                    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,
                    (-(4.57-
YA)/(YA))*muA*(SNH/(KNHA+SNH))*(KH2SA/(KH2SA+SH2S))*XA,0,0,0,
                    (-iNBM-
(1/YA))*muA*(SO/(KOA+SO))*(KH2SA/(KH2SA+SH2S)),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/YFB)*muFB*(KH2SFB/(KH2SFB+SH2S))*

(KOFB/(KOFB+SO))*(KNOFB/(KNOFB+SNO))*(SNH/(KNHFB+SNH))*XFB,0,0,
                    ((iNSF/YFB)-iNBM)*muFB*

(SF/(KSFB+SF))*(KH2SFB/(KH2SFB+SH2S))*(KOFB/(KOFB+SO))*(KNOFB/(KNOFB+SNO)),
                    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/YAMB)*muAMB*(KH2SAMB/(KH2SAMB+SH2S))*(KOAMB/(KOAMB+SO))*(KNOAMB/(KNOAMB+S
NO))*
                      (SNH/(KNHAMB+SNH))*XAMB,0,
                    (-
iNBM)*(SA/(KSAMB+SA))*(KH2SAMB/(KH2SAMB+SH2S))*(KOAMB/(KOAMB+SO))*

(KNOAMB/(KNOAMB+SNO))*(SNH/(KNHAMB+SNH))*XAMB,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/YASRB)*muASRB*(SSO4/(KSOASRB+SSO4))*(KH2SASRB/(KH2SASRB+SH2S))*

(KOASRB/(KOASRB+SO))*(KNOASRB/(KNOASRB+SNO))*(SNH/(KNHASRB+SNH))*XASRB,0,
                    (-
iNBM)*muASRB*(SA/(KSASRB+SA))*(SSO4/(KSOASRB+SSO4))*(KH2SASRB/(KH2SASRB+SH2
S))*
                      (KOASRB/(KOASRB+SO))*(KNOASRB/(KNOASRB+SNO))*XASRB,0,
                    (-(1-
YASRB)/(2*YASRB))*muASRB*(SA/(KSASRB+SA))*(KH2SASRB/(KH2SASRB+SH2S))*

(KOASRB/(KOASRB+SO))*(KNOASRB/(KNOASRB+SNO))*(SNH/(KNHASRB+SNH))*XASRB,
                    ((1-
YASRB)/(2*YASRB))*muASRB*(SA/(KSASRB+SA))*(SSO4/(KSOASRB+SSO4))*

(KOASRB/(KOASRB+SO))*(KNOASRB/(KNOASRB+SNO))*(SNH/(KNHASRB+SNH))*XASRB,
                    0,0,0,0,0,0,0,
                    0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
                    (-(2-
YSOB)/YSOB)*muSOB*(SH2S/(KSSOB+SH2S))*(SNH/(KNHSOB+SNH))*XSOB,0,0,0,
                    (-
iNBM)*muSOB*(SH2S/(KSSOB+SH2S))*(SO/(KOSOB+SO))*XSOB,0,0,
                    (-
1/YSOB)*muSOB*(SO/(KOSOB+SO))*(SNH/(KNHSOB+SNH))*XSOB,0,0,0,0,0,0,0,
                    0,0,0,0,(-
iNBM)*muSOB*nuSOB*(SH2S/(KSSOB+SH2S))*(SNO/(KNOSOB+SNO))*(KOSOB/(KOSOB+SO))
*XSOB,
                    (-(1-
YSOB)/(0.875*YSOB))*muSOB*nuSOB*(SH2S/(KSSOB+SH2S))*(KOSOB/(KOSOB+SO))*
                      (SNH/(KNHSOB+SNH))*XSOB,0,
                    (-
1/YSOB)*muSOB*nuSOB*(SNO/(KNOSOB+SNO))*(KOSOB/(KOSOB+SO))*(SNH/(KNHSOB+SNH)
)*XSOB,
```

```
                    0,0,0,0,0,0,0,0,
                    0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0),
                  nrow=17,byrow=TRUE)

Q_co_effs<-matrix(c(0,0,0,0,0,0,0,0,KX*(XH+XFB),0,nuh*XFB,0,0,0,0,0,
                    KOH,KSF,0,0,KNHH,0,0,0,0,0,0,0,0,0,0,0,
                    0,KSF,0,0,KNHH,KNOH,0,0,0,0,0,0,0,0,0,0,
                    KOH,0,KSA,0,KNHH,0,0,0,0,0,0,0,0,0,0,0,
                    0,0,KSA,0,KNHH,KNOH,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,
                    KOA,0,0,0,KNHA,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,KSFB,0,0,KNHFB,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,KSAMB,0,KNHAMB,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,KSASRB,0,KNHASRB,0,KSOASRB,KH2SASRB,0,0,0,0,0,0,0,0,
                    0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
                    KOSOB,0,0,0,KNHSOB,0,0,KSSOB,0,0,0,0,0,0,0,0,
                    0,0,0,0,KNHSOB,KNOSOB,0,KSSOB,0,0,0,0,0,0,0,0,
                    0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0),nrow=17,byrow=TRUE)
R1<-KX
R2<-SA
R3<-SA
R4<-SF
R5<-SF
T1<-XS+KX*XFB

SA_4_X5<-2*(Q_co_effs[4,3]+R4)
SA_4_X4<-4*((Q_co_effs[4,3]+R4)^2)+2*Q_co_effs[4,3]*R4-
4*(Q_co_effs[4,3]+R4)
SA_4_X3<-
2*(Q_co_effs[4,3]+R4)*((Q_co_effs[4,3]^2)+(R4^2)+4*Q_co_effs[4,3]*R4)+4*Q_c
o_effs[4,3]*R4-
         6*((Q_co_effs[4,3]+R4)^2)-8*Q_co_effs[4,3]*R4
SA_4_X2<-
4*(Q_co_effs[4,3]+R4)*(((Q_co_effs[4,3]^2)*R4)+(R4^2)*Q_co_effs[4,3])+

2*Q_co_effs[4,3]*R4*((Q_co_effs[4,3]^2)+(R4^2)+4*Q_co_effs[4,3]*R4)-

2*(Q_co_effs[4,3]+R4)*((Q_co_effs[4,3]^2)+R4^2+4*Q_co_effs[4,3]*R4)-
         12*Q_co_effs[4,3]*R4*(Q_co_effs[4,3]+R4)
SA_4_X1<-2*(Q_co_effs[4,3]+R4)*((Q_co_effs[4,3]^2)*(R4^2))+
         4*Q_co_effs[4,3]*R4*((Q_co_effs[4,3]^2)*R4+(R4^2)*Q_co_effs[4,3])-

2*(Q_co_effs[4,3]+R4)*((Q_co_effs[4,3]^2)*R4+(R4^2)*Q_co_effs[4,3])-

4*Q_co_effs[4,3]*R4*((Q_co_effs[4,3]^2)+(R4^2)+4*Q_co_effs[4,3]*R4)
SA_4_X0<-2*(Q_co_effs[4,3]^3)*(R4^3)+
         4*Q_co_effs[4,3]*R4*((Q_co_effs[4,3]^2)*R4+(R4^2)*Q_co_effs[4,3])

SA_5_X5<-2*(Q_co_effs[5,3]+R5)
SA_5_X4<-4*((Q_co_effs[5,3]+R5)^2)+2*Q_co_effs[5,3]*R5-
4*(Q_co_effs[5,3]+R5)
SA_5_X3<-
2*(Q_co_effs[5,3]+R5)*((Q_co_effs[5,3]^2)+(R5^2)+4*Q_co_effs[5,3]*R5)+4*Q_c
o_effs[5,3]*R5-
         6*((Q_co_effs[5,3]+R5)^2)-8*Q_co_effs[5,3]*R5
SA_5_X2<-
4*(Q_co_effs[5,3]+R5)*(((Q_co_effs[5,3]^2)*R5)+(R5^2)*Q_co_effs[5,3])+
```

```
2*Q_co_effs[5,3]*R5*((Q_co_effs[5,3]^2)+(R5^2)+4*Q_co_effs[5,3]*R5)-

2*(Q_co_effs[5,3]+R5)*((Q_co_effs[5,3]^2)+R5^2+4*Q_co_effs[5,3]*R5)-
         12*Q_co_effs[5,3]*R5*(Q_co_effs[5,3]+R5)
SA_5_X1<-2*(Q_co_effs[5,3]+R5)*((Q_co_effs[5,3]^2)*(R5^2))+
         4*Q_co_effs[5,3]*R5*((Q_co_effs[5,3]^2)*R5+(R5^2)*Q_co_effs[5,3])-

2*(Q_co_effs[5,3]+R5)*((Q_co_effs[5,3]^2)*R5+(R5^2)*Q_co_effs[5,3])-

4*Q_co_effs[5,3]*R5*((Q_co_effs[5,3]^2)+(R5^2)+4*Q_co_effs[5,3]*R5)
SA_5_X0<-2*(Q_co_effs[5,3]^3)*(R5^3)+
         4*Q_co_effs[5,3]*R5*((Q_co_effs[5,3]^2)*R5+(R5^2)*Q_co_effs[5,3])


#SF Rates
SA_Conc<-
c(0,0.027,0.054,0.135,0.27,0.54,1.35,2.7,5.4,13.5,27,32.4,33.75,40.5)
A_std_Conc<-27

SA_4_O<-
P_co_effs[4,3]*(SA_Conc/(Q_co_effs[4,3]+SA_Conc))*(SA_Conc)/(R4+SA_Conc)
SA_4_M<-P_co_effs[4,3]*SA_4_X0/((Q_co_effs[4,3]^4)*(R4^4))*SA_Conc
SA_4_T1<-
((P_co_effs[4,3]*(A_std_Conc^2))/((A_std_Conc+Q_co_effs[4,3])*(A_std_Conc+R
4)))+

(((P_co_effs[4,3]*A_std_Conc*((Q_co_effs[4,3]+R4)*A_std_Conc+2*Q_co_effs[4,
3]*R4))/
        ((((A_std_Conc+Q_co_effs[4,3])^2))*((A_std_Conc+R4)^2)))*(SA_Conc-
A_std_Conc))+

P_co_effs[4,3]*((SA_4_X5*(A_std_Conc^5)+(SA_4_X4^4)*(A_std_Conc^4)+
                    (SA_4_X3^3)*(A_std_Conc^3)+(SA_4_X2^2)*(A_std_Conc^2)+
                    SA_4_X1*A_std_Conc+SA_4_X0)/
                   (((A_std_Conc+Q_co_effs[4,3])^4)*((A_std_Conc+R4)^4)))*
                   (SA_Conc-A_std_Conc)
SA_5_O<-
P_co_effs[5,3]*(SA_Conc/(Q_co_effs[5,3]+SA_Conc))*(SA_Conc)/(R5+SA_Conc)
SA_5_M<-P_co_effs[5,3]*SA_5_X0/((Q_co_effs[5,3]^4)*(R5^4))*SA_Conc
SA_5_T1<-
((P_co_effs[5,3]*(A_std_Conc^2))/((A_std_Conc+Q_co_effs[5,3])*(A_std_Conc+R
5)))+

(((P_co_effs[5,3]*A_std_Conc*((Q_co_effs[5,3]+R5)*A_std_Conc+2*Q_co_effs[5,
3]*R5))/

((((A_std_Conc+Q_co_effs[5,3])^2))*((A_std_Conc+R5)^2)))*(SA_Conc-
A_std_Conc))+

P_co_effs[5,3]*((SA_5_X5*(A_std_Conc^5)+(SA_5_X4^4)*(A_std_Conc^4)+
                    (SA_5_X3^3)*(A_std_Conc^3)+(SA_5_X2^2)*(A_std_Conc^2)+
                    SA_5_X1*A_std_Conc+SA_5_X0)/
                   (((A_std_Conc+Q_co_effs[5,3])^4)*((A_std_Conc+R5)^4)))*
                   (SA_Conc-A_std_Conc)

SA_11_O<-P_co_effs[11,3]*SA_Conc/(Q_co_effs[11,3]+SA_Conc)
SA_11_M<-P_co_effs[11,3]*SA_Conc/Q_co_effs[11,3]
SA_11_T1<-(P_co_effs[11,3]*A_std_Conc/(A_std_Conc+Q_co_effs[11,3]))+

((P_co_effs[11,3]*Q_co_effs[11,3])/(A_std_Conc+Q_co_effs[11,3])^2)*
```

```
          (SA_Conc-A_std_Conc)

SA_13_O<-P_co_effs[13,3]*SA_Conc/(Q_co_effs[13,3]+SA_Conc)
SA_13_M<-P_co_effs[13,3]*SA_Conc/Q_co_effs[13,3]
SA_13_T1<-(P_co_effs[13,3]*A_std_Conc/(A_std_Conc+Q_co_effs[13,3]))+

((P_co_effs[13,3]*Q_co_effs[13,3])/(A_std_Conc+Q_co_effs[13,3])^2)*
          (SA_Conc-A_std_Conc)


Rate_SA_4<-data.frame(Conc=c(SA_Conc,SA_Conc,SA_Conc),
                      Rate=c(SA_4_O,SA_4_T1,SA_4_M),
                      Eqn=c(rep('Original',times=length(SA_Conc)),
                            rep("Taylor",times=length(SA_Conc)),
                            rep("McLaurin",times=length(SA_Conc))))

Rate_SA_4_plot<-ggplot(data=Rate_SA_4)+
                geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
                theme_bw()+
                theme(legend.title = element_blank(),
                  text=element_text(family="Times New Roman"))+
                ylab(expression(paste("Rate of degradation (mg
COD/L.day)")))+
                xlab(expression(paste("Concentration (mg COD/L)")))
plot(Rate_SA_4_plot)

Org_SA_4<-data.frame(Conc=c(SA_Conc),
                     Rate=c(SA_4_O))

Org_SA_4_plot<-ggplot(data=Org_SA_4)+
                geom_line(aes(x=Conc,y=Rate),size=1.3,color='#00BA38')+
                ylab(expression(paste("Rate of degradation (mg
COD/L.day)")))+
                xlab(expression(paste("Concentration (mg COD/L)")))+
                theme_bw()+
                theme(legend.title = element_blank(),
                    text=element_text(family="Times New Roman"))
plot(Org_SA_4_plot)

Rate_SA_4_Mc<-data.frame(Conc=c(SA_Conc,SA_Conc),
                      Rate=c(SA_4_O,SA_4_M),
                      Eqn=c(rep('Original',times=length(SA_Conc)),
                            rep("McLaurin",times=length(SA_Conc))))

Rate_SA_4_Mc_plot<-ggplot(data=Rate_SA_4_Mc)+
                   geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
                   theme_bw()+
                   scale_color_manual(values=c('#F8766D','#00BA38'))+
                   theme(legend.title = element_blank(),
                     text=element_text(family="Times New Roman"))+
                   ylab(expression(paste("Rate of degradation (mg
COD/L.day)")))+
                   xlab(expression(paste("Concentration (mg COD/L)")))
plot(Rate_SA_4_Mc_plot)



Rate_SA_5<-data.frame(Conc=c(SA_Conc,SA_Conc,SA_Conc),
                      Rate=c(SA_5_O,SA_5_T1,SA_5_M),
                      Eqn=c(rep('Original',times=length(SA_Conc)),
                            rep("Taylor",times=length(SA_Conc)),
```

```
                          rep("McLaurin",times=length(SA_Conc))))

Rate_SA_5_plot<-ggplot(data=Rate_SA_5)+
                geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
                theme(legend.title = element_blank(),
                  text=element_text(family="Times New Roman"))+
                ylab(expression(paste("Rate of degradation (mg
COD/L.day)")))+
                xlab(expression(paste("Concentration (mg COD/L)")))
plot(Rate_SA_5_plot)

Org_SA_5<-data.frame(Conc=c(SA_Conc),
                     Rate=c(SA_5_O))

Org_SA_5_plot<-ggplot(data=Org_SA_5)+
                geom_line(aes(x=Conc,y=Rate),size=1.3,color='#00BA38')+
                ylab(expression(paste("Rate of degradation (mg
COD/L.day)")))+
                xlab(expression(paste("Concentration (mg COD/L)")))+
                theme_bw()+
                theme(legend.title = element_blank(),
                  text=element_text(family="Times New Roman"))
plot(Org_SA_5_plot)

Rate_SA_5_Mc<-data.frame(Conc=c(SA_Conc,SA_Conc),
                         Rate=c(SA_5_O,SA_5_M),
                         Eqn=c(rep('Original',times=length(SA_Conc)),
                               rep("McLaurin",times=length(SA_Conc))))

Rate_SA_5_Mc_plot<-ggplot(data=Rate_SA_5_Mc)+
                   geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
                   scale_color_manual(values=c('#F8766D','#00BA38'))+
                   theme_bw()+
                   theme(legend.title = element_blank(),
                   text=element_text(family="Times New Roman"))+
                   ylab(expression(paste("Rate of degradation (mg
COD/L.day)")))+
                   xlab(expression(paste("Concentration (mg COD/L)")))
plot(Rate_SA_5_Mc_plot)


Rate_SA_11<-data.frame(Conc=c(SA_Conc,SA_Conc,SA_Conc),
                       Rate=c(SA_11_O,SA_11_T1,SA_11_M),
                       Eqn=c(rep('Original',times=length(SA_Conc)),
                             rep("Taylor",times=length(SA_Conc)),
                             rep("McLaurin",times=length(SA_Conc))))

Rate_SA_11_plot<-ggplot(data=Rate_SA_11)+
                  geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
                  theme_bw()+
                  theme(legend.title = element_blank(),
                    text=element_text(family="Times New Roman"))+
                  ylab(expression(paste("Rate of degradation (mg
COD/L.day)")))+
                  xlab(expression(paste("Concentration (mg COD/L)")))
plot(Rate_SA_11_plot)

Org_SA_11<-data.frame(Conc=c(SA_Conc),
                      Rate=c(SA_11_O))

Org_SA_11_plot<-ggplot(data=Org_SA_11)+
```

```
                geom_line(aes(x=Conc,y=Rate),size=1.3,color='#00BA38')+
                ylab(expression(paste("Rate of degradation (mg
COD/L.day)")))+
                xlab(expression(paste("Concentration (mg COD/L)")))+
                theme_bw()+
                theme(legend.title = element_blank(),
                  text=element_text(family="Times New Roman"))
plot(Org_SA_11_plot)


Rate_SA_13<-data.frame(Conc=c(SA_Conc,SA_Conc,SA_Conc),
                       Rate=c(SA_13_O,SA_13_T1,SA_13_M),
                       Eqn=c(rep('Original',times=length(SA_Conc)),
                             rep("Taylor",times=length(SA_Conc)),
                             rep("McLaurin",times=length(SA_Conc))))

Rate_SA_13_plot<-ggplot(data=Rate_SA_13)+
                  geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
                  theme_bw()+
                  theme(legend.title = element_blank(),
                    text=element_text(family="Times New Roman"))+
                  ylab(expression(paste("Rate of degradation (mg
COD/L.day)")))+
                  xlab(expression(paste("Concentration (mg COD/L)")))
plot(Rate_SA_13_plot)

Org_SA_13<-data.frame(Conc=c(SA_Conc),
                      Rate=c(SA_13_O))

Org_SA_13_plot<-ggplot(data=Org_SA_13)+
                geom_line(aes(x=Conc,y=Rate),size=1.3,color='#00BA38')+
                ylab(expression(paste("Rate of degradation (mg
COD/L.day)")))+
                xlab(expression(paste("Concentration (mg COD/L)")))+
                theme_bw()+
                theme(legend.title = element_blank(),
                      text=element_text(family="Times New Roman"))
plot(Org_SA_13_plot)
```

E.4 Ammonium and ammonia nitrogen

Aerobic growth of XH on SF

	Rate		
Conc	Original	Taylor	McLaurin
0	0	-1.43305	0
0.057	-0.76474	-1.43305	-1.63655
0.114	-0.99789	-1.43305	-3.27309
0.285	-1.2213	-1.43306	-8.18273
0.57	-1.31979	-1.43306	-16.3655
1.14	-1.37525	-1.43308	-32.7309
2.85	-1.41082	-1.43311	-81.8273
5.7	-1.42308	-1.43318	-163.655
11.4	-1.4293	-1.4333	-327.309
28.5	-1.43305	-1.43368	-818.273
57	-1.43431	-1.43431	-1636.55
68.4	-1.43452	-1.43456	-1963.85
71.25	-1.43456	-1.43462	-2045.68
82.5	-1.4347	-1.43487	-2368.68

Aerobic growth of XH on SA

Conc	Rate		
	Original	Taylor	McLaurin
0	0	-6.85146	0
0.057	-3.65625	-6.85146	-7.82437
0.114	-4.77096	-6.85147	-15.6487
0.285	-5.83908	-6.85149	-39.1218
0.57	-6.30998	-6.85152	-78.2437
1.14	-6.5751	-6.85158	-156.487
2.85	-6.74515	-6.85176	-391.218
5.7	-6.8038	-6.85206	-782.437
11.4	-6.83351	-6.85266	-1564.87
28.5	-6.85146	-6.85446	-3912.18
57	-6.85747	-6.85747	-7824.37
68.4	-6.85847	-6.85867	-9389.24
71.25	-6.85867	-6.85897	-9780.46
82.5	-6.85932	-6.86016	-11324.7

Anoxic growth of XH on SF

Conc	Rate		
	Original	Taylor	McLaurin
0	0	-0.00032	0
0.057	-0.00017	-0.00032	-0.00037
0.114	-0.00022	-0.00032	-0.00073
0.285	-0.00027	-0.00032	-0.00183
0.57	-0.00029	-0.00032	-0.00366
1.14	-0.00031	-0.00032	-0.00731
2.85	-0.00032	-0.00032	-0.01828
5.7	-0.00032	-0.00032	-0.03656
11.4	-0.00032	-0.00032	-0.07311
28.5	-0.00032	-0.00032	-0.18278
57	-0.00032	-0.00032	-0.36556
68.4	-0.00032	-0.00032	-0.43867
71.25	-0.00032	-0.00032	-0.45695
82.5	-0.00032	-0.00032	-0.5291

Anoxic growth of XH on SA

Conc	Rate		
	Original	Taylor	McLaurin
0	0	-0.0059	0
0.057	-0.00315	-0.0059	-0.00673
0.114	-0.00411	-0.0059	-0.01347
0.285	-0.00503	-0.0059	-0.03367
0.57	-0.00543	-0.0059	-0.06734
1.14	-0.00566	-0.0059	-0.13469
2.85	-0.00581	-0.0059	-0.33672
5.7	-0.00586	-0.0059	-0.67343
11.4	-0.00588	-0.0059	-1.34686
28.5	-0.0059	-0.0059	-3.36716
57	-0.0059	-0.0059	-6.73432
68.4	-0.0059	-0.0059	-8.08118
71.25	-0.0059	-0.0059	-8.4179
82.5	-0.0059	-0.0059	-9.74704

Growth of XA on SNH

Conc	Rate		
	Original	Taylor	McLaurin
0	0	-1.54883	0
0.057	-0.16129	-1.54884	-0.17968
0.114	-0.29263	-1.54885	-0.35935
0.285	-0.57222	-1.54889	-0.89839
0.57	-0.83961	-1.54896	-1.79677
1.14	-1.09559	-1.5491	-3.59355
2.85	-1.34088	-1.54951	-8.98387
5.7	-1.44901	-1.55018	-17.9677
11.4	-1.50989	-1.55154	-35.9355
28.5	-1.54894	-1.55562	-89.8387
57	-1.56241	-1.56241	-179.677
68.4	-1.56468	-1.56513	-215.613
71.25	-1.56513	-1.56581	-224.597
82.5	-1.56662	-1.56849	-260.059

Growth of XFB

Conc	Rate		
	Original	Taylor	McLaurin
0	0	0.001905	0
0.057	0.001621	0.001905	0.01086
0.114	0.001752	0.001905	0.021721
0.285	0.001841	0.001905	0.054302
0.57	0.001872	0.001905	0.108605
1.14	0.001889	0.001905	0.21721
2.85	0.001899	0.001905	0.543025
5.7	0.001902	0.001905	1.08605
11.4	0.001904	0.001905	2.172099
28.5	0.001905	0.001905	5.430248
57	0.001905	0.001905	10.8605
68.4	0.001905	0.001905	13.0326
71.25	0.001905	0.001905	13.57562
82.5	0.001905	0.001905	15.71914

Growth of XAMB

	Rate		
Conc	Original	Taylor	McLaurin
0	0	-2.28E-09	0
0.057	-1.94E-09	-2.28E-09	-1.30E-08
0.114	-2.09E-09	-2.28E-09	-2.60E-08
0.285	-2.20E-09	-2.28E-09	-6.49E-08
0.57	-2.24E-09	-2.28E-09	-1.30E-07
1.14	-2.26E-09	-2.28E-09	-2.60E-07
2.85	-2.27E-09	-2.28E-09	-6.49E-07
5.7	-2.27E-09	-2.28E-09	-1.30E-06
11.4	-2.28E-09	-2.28E-09	-2.60E-06
28.5	-2.28E-09	-2.28E-09	-6.49E-06
57	-2.28E-09	-2.28E-09	-1.30E-05
68.4	-2.28E-09	-2.28E-09	-1.56E-05
71.25	-2.28E-09	-2.28E-09	-1.62E-05
82.5	-2.28E-09	-2.28E-09	-1.88E-05

Growth of XASRB

Conc	Rate		
	Original	Taylor	McLaurin
0	0	-2.06E-10	0
0.057	-1.75E-10	-2.06E-10	-1.17E-09
0.114	-1.90E-10	-2.06E-10	-2.35E-09
0.285	-1.99E-10	-2.06E-10	-5.87E-09
0.57	-2.03E-10	-2.06E-10	-1.17E-08
1.14	-2.04E-10	-2.06E-10	-2.35E-08
2.85	-2.05E-10	-2.06E-10	-5.87E-08
5.7	-2.06E-10	-2.06E-10	-1.17E-07
11.4	-2.06E-10	-2.06E-10	-2.35E-07
28.5	-2.06E-10	-2.06E-10	-5.87E-07
57	-2.06E-10	-2.06E-10	-1.17E-06
68.4	-2.06E-10	-2.06E-10	-1.41E-06
71.25	-2.06E-10	-2.06E-10	-1.47E-06
82.5	-2.06E-10	-2.06E-10	-1.70E-06

Aerobic growth of XSOB on SH2S

Conc	Rate		
	Original	Taylor	McLaurin
0	0	-62.4205	0
0.057	-33.3104	-62.4206	-71.2843
0.114	-43.466	-62.4206	-142.569
0.285	-53.1972	-62.4208	-356.421
0.57	-57.4873	-62.4211	-712.843
1.14	-59.9028	-62.4216	-1425.69
2.85	-61.452	-62.4233	-3564.21
5.7	-61.9863	-62.426	-7128.43
11.4	-62.257	-62.4315	-14256.9
28.5	-62.4206	-62.4479	-35642.1
57	-62.4753	-62.4753	-71284.3
68.4	-62.4844	-62.4862	-85541.2
71.25	-62.4862	-62.489	-89105.4
82.5	-62.4922	-62.4998	-103175

Anoxic growth of XSOB on SH2S

Conc	Rate		
	Original	Taylor	McLaurin
0	0	-10.0617	0
0.057	-5.36936	-10.0617	-11.4904
0.114	-7.00636	-10.0617	-22.9809
0.285	-8.57495	-10.0617	-57.4521
0.57	-9.26647	-10.0618	-114.904
1.14	-9.65582	-10.0618	-229.809
2.85	-9.90554	-10.0621	-574.521
5.7	-9.99168	-10.0625	-1149.04
11.4	-10.0353	-10.0634	-2298.09
28.5	-10.0617	-10.0661	-5745.21
57	-10.0705	-10.0705	-11490.4
68.4	-10.072	-10.0723	-13788.5
71.25	-10.0723	-10.0727	-14363
82.5	-10.0732	-10.0744	-16630.9

The following code was used to generate the comparisons of the linearisation attempts and the original rates for ammonia and ammonium nitrogen

```
library(ggplot2)


library(ggthemes)
library(extrafont)
font_import()
loadfonts(device="win")

YH<-0.63;
YFB<-0.053;
YAMB<-0.032;
YASRB<-0.05;
YA<-0.24;
YSOB<-0.12;

KSA<-4;
KSF<-2;
KOH<-0.2;
KNHH<-0.05;
KH2SH<-140;
KNOH<-0.5;
KSFB<-28;
KH2SFB<-140;
KOFB<-0.2;
KNOFB<-0.5;
KNHFB<-0.01;
KSAMB<-56;
KH2SAMB<-140;
KOAMB<-0.0002;
KNOAMB<-0.0005;
KNHAMB<-0.01;
KSASRB<-24;
KSOASRB<-19;
KH2SASRB<-140;
KOASRB<-0.0002;
KNOASRB<-0.0005;
KNHASRB<-0.01;
kH<-3
KNHA<-0.5;
KH2SA<-140;
KOA<-1;
KSSOB<-0.24;
KOSOB<-0.2;
KNHSOB<-0.05;
KNOSOB<-0.5;
KX<-0.1;


muH<-6;
muA<-1;
muFB<-3;
muAMB<-0.085;
muASRB<-0.18;
muSOB<-5.28;
ng<-0.8; #not sure about this value, paper not clear
nuh<-0.1;
```

```
nuSOB<-0.7; #no value given, this is an approximation based on other rates

XH<-100;
XFB<-100;
XAMB<-1000;
XASRB<-340;
XS<-33;
XA<-100;
XSOB<-210;

SF<-170;
SO<-0.86;
SNH<-57;
SH2S<-34;
SNO<-50.4;
SA<-1;
SSO4<-35;

fHYDSI<-0.0;
fBMSF<-0.05;
fBMXI<-0.1;

iNXS<-0.04;
iNSF<-0.03;
iNSI<-0.01;
iNBM<-0.07;
iNXI<-0.03;

P_co_effs<-matrix(c(0,0,0,0,0,0,0,0,(-1)*(XH+nuh*XFB),0,kH*XS,0,0,0,0,0,
                    (1-(1/YH))*muH*

(SF/(KSF+SF))*(SF/(SF+SA))*(SNH/(KNHH*SNH))*(KH2SH/(KH2SH+SH2S))*XH,
                    (1/YH)*muH*

(SO/(KOH+SO))*(SNH/(KNHH*SNH))*(KH2SH/(KH2SH+SH2S))*XH,0,0,
                    ((iNSF/YH)-
iNBM)*(SF/(KSF+SF))*(SF/(SF+SA))*(SO/(KOH+SO))*(KH2SH/(KH2SH+SH2S))*XH,
                    0,0,0,0,0,0,0,0,0,0,0,
                    0,(-1/YH)*

(ng*muH*(SO/(KOH+SO))*(SNO/(KOH+SNO))*(SNH/(KNHH*SNH))*(KH2SH/(KH2SH+SH2S))
*XH),
                    0,0,(((iNSF/YH)-
iNBM)*ng*muH*(SF/(KSF+SF))*(SF/(SF+SA))*(SO/(KOH+SO))*(SNO/(KOH+SNO))*
                              (KH2SH/(KH2SH+SH2S))*XH),(-((1-
YH)/(2.86*YH)))*ng*muH*(SF/(KSF+SF))*(SF/(SF+SA))*

(SO/(KOH+SO))*(SNH/(KNHH*SNH))*(KH2SH/(KH2SH+SH2S))*XH,0,0,0,0,0,0,0,0,0,
                    (1-
(1/YH))*muH*(SA/(KSA+SA))*(SA/(SF+SA))*(SNH/(KNHH+SNH))*(KH2SH/(KH2SH+SH2S)
)*XH,0,
                    (-
1/YH)*(SNH/(KNHH+SNH))*(SO/(KOH+SO))*(KH2SH/(KH2SH+SH2S))*XH,0,
                    (-
iNBM)*muH*(SA/(KSA+SA))*(SA/(SF+SA))*(SO/(KOH+SO))*(KH2SH/(KH2SH+SH2S)),
                    0,0,0,0,0,0,0,0,0,0,
                    0,0,(-1/YH)*ng*muH*

(KOH/(KOH+SO))*(SNO/(KNOH+SNO))*(SNH/(KNHH+SNH))*(KH2SH/(KH2SH+SH2S))*XH,0,
                    (-iNBM)*ng*muH*
```

```
(SA/(KSA+SA))*(SA/(SF+SA))*(KOH/(KOH+SO))*(SNO/(KNOH+SNO))*(KH2SH/(KH2SH+SH
2S))*XH,
                        (-(1-YH)/(2.86*YH))*ng*muH*

(SA/(KSA+SA))*(SA/(SF+SA))*(KOH/(KOH+SO))*(SNH/(KNHH+SNH))*(KH2SH/(KH2SH+SH
2S))*XH,
                      0,0,0,0,0,0,0,0,0,
                      0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
                      (-(4.57-
YA)/(YA))*muA*(SNH/(KNHA+SNH))*(KH2SA/(KH2SA+SH2S))*XA,0,0,0,
                      (-iNBM-
(1/YA))*muA*(SO/(KOA+SO))*(KH2SA/(KH2SA+SH2S)),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/YFB)*muFB*(KH2SFB/(KH2SFB+SH2S))*

(KOFB/(KOFB+SO))*(KNOFB/(KNOFB+SNO))*(SNH/(KNHFB+SNH))*XFB,0,0,
                      ((iNSF/YFB)-iNBM)*muFB*

(SF/(KSFB+SF))*(KH2SFB/(KH2SFB+SH2S))*(KOFB/(KOFB+SO))*(KNOFB/(KNOFB+SNO)),
                      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/YAMB)*muAMB*(KH2SAMB/(KH2SAMB+SH2S))*(KOAMB/(KOAMB+SO))*(KNOAMB/(KNOAMB+S
NO))*
                        (SNH/(KNHAMB+SNH))*XAMB,0,
                      (-
iNBM)*(SA/(KSAMB+SA))*(KH2SAMB/(KH2SAMB+SH2S))*(KOAMB/(KOAMB+SO))*

(KNOAMB/(KNOAMB+SNO))*(SNH/(KNHAMB+SNH))*XAMB,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/YASRB)*muASRB*(SSO4/(KSOASRB+SSO4))*(KH2SASRB/(KH2SASRB+SH2S))*

(KOASRB/(KOASRB+SO))*(KNOASRB/(KNOASRB+SNO))*(SNH/(KNHASRB+SNH))*XASRB,0,
                      (-
iNBM)*muASRB*(SA/(KSASRB+SA))*(SSO4/(KSOASRB+SSO4))*(KH2SASRB/(KH2SASRB+SH2
S))*
                        (KOASRB/(KOASRB+SO))*(KNOASRB/(KNOASRB+SNO))*XASRB,0,
                      (-(1-
YASRB)/(2*YASRB))*muASRB*(SA/(KSASRB+SA))*(KH2SASRB/(KH2SASRB+SH2S))*

(KOASRB/(KOASRB+SO))*(KNOASRB/(KNOASRB+SNO))*(SNH/(KNHASRB+SNH))*XASRB,
                      ((1-
YASRB)/(2*YASRB))*muASRB*(SA/(KSASRB+SA))*(SSO4/(KSOASRB+SSO4))*

(KOASRB/(KOASRB+SO))*(KNOASRB/(KNOASRB+SNO))*(SNH/(KNHASRB+SNH))*XASRB,
                      0,0,0,0,0,0,0,
                      0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
                      (-(2-
YSOB)/YSOB)*muSOB*(SH2S/(KSSOB+SH2S))*(SNH/(KNHSOB+SNH))*XSOB,0,0,0,
                      (-
iNBM)*muSOB*(SH2S/(KSSOB+SH2S))*(SO/(KOSOB+SO))*XSOB,0,0,
                      (-
1/YSOB)*muSOB*(SO/(KOSOB+SO))*(SNH/(KNHSOB+SNH))*XSOB,0,0,0,0,0,0,0,
                      0,0,0,0,(-
iNBM)*muSOB*nuSOB*(SH2S/(KSSOB+SH2S))*(SNO/(KNOSOB+SNO))*(KOSOB/(KOSOB+SO))
*XSOB,
                      (-(1-
YSOB)/(0.875*YSOB))*muSOB*nuSOB*(SH2S/(KSSOB+SH2S))*(KOSOB/(KOSOB+SO))*
                        (SNH/(KNHSOB+SNH))*XSOB,0,
```

```
                    (-
1/YSOB)*muSOB*nuSOB*(SNO/(KNOSOB+SNO))*(KOSOB/(KOSOB+SO))*(SNH/(KNHSOB+SNH)
)*XSOB,
                    0,0,0,0,0,0,0,0,
                    0,0,0,0,0,0,0,0,0,0,0,0,0,0,0),
                  nrow=17,byrow=TRUE)

Q_co_effs<-matrix(c(0,0,0,0,0,0,0,0,KX*(XH+XFB),0,nuh*XFB,0,0,0,0,0,
                    KOH,KSF,0,0,KNHH,0,0,0,0,0,0,0,0,0,0,0,
                    0,KSF,0,0,KNHH,KNOH,0,0,0,0,0,0,0,0,0,0,
                    KOH,0,KSA,0,KNHH,0,0,0,0,0,0,0,0,0,0,0,
                    0,0,KSA,0,KNHH,KNOH,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,
                    KOA,0,0,0,KNHA,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,KSFB,0,0,KNHFB,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,KSAMB,0,KNHAMB,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,KSASRB,0,KNHASRB,0,KSOASRB,KH2SASRB,0,0,0,0,0,0,0,0,
                    0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
                    KOSOB,0,0,0,KNHSOB,0,0,KSSOB,0,0,0,0,0,0,0,0,
                    0,0,0,0,KNHSOB,KNOSOB,0,KSSOB,0,0,0,0,0,0,0,0,
                    0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0),nrow=17,byrow=TRUE)

R1<-KX
R2<-SA
R3<-SA
R4<-SF
R5<-SF
T1<-XS+KX*XFB

SNH_Conc<-
c(0,0.057,0.114,0.285,0.57,1.14,2.85,5.7,11.4,28.5,57,68.4,71.25,82.5)
NH_std_Conc<-57

SNH_2_O<-P_co_effs[2,5]*SNH_Conc/(Q_co_effs[2,5]+SNH_Conc)
SNH_2_M<-P_co_effs[2,5]*SNH_Conc/Q_co_effs[2,5]
SNH_2_T1<-(P_co_effs[2,5]*NH_std_Conc/(NH_std_Conc+Q_co_effs[2,5]))+

((P_co_effs[2,5]*Q_co_effs[2,5])/(NH_std_Conc+Q_co_effs[2,5])^2)*(SNH_Conc-
NH_std_Conc)
SNH_3_O<-P_co_effs[3,5]*SNH_Conc/(Q_co_effs[3,5]+SNH_Conc)
SNH_3_M<-P_co_effs[3,5]*SNH_Conc/Q_co_effs[3,5]
SNH_3_T1<-(P_co_effs[3,5]*NH_std_Conc/(NH_std_Conc+Q_co_effs[3,5]))+

((P_co_effs[3,5]*Q_co_effs[3,5])/(NH_std_Conc+Q_co_effs[3,5])^2)*(SNH_Conc-
NH_std_Conc)
SNH_4_O<-P_co_effs[4,5]*SNH_Conc/(Q_co_effs[4,5]+SNH_Conc)
SNH_4_M<-P_co_effs[4,5]*SNH_Conc/Q_co_effs[4,5]
SNH_4_T1<-(P_co_effs[4,5]*NH_std_Conc/(NH_std_Conc+Q_co_effs[4,5]))+

((P_co_effs[4,5]*Q_co_effs[4,5])/(NH_std_Conc+Q_co_effs[4,5])^2)*(SNH_Conc-
NH_std_Conc)
SNH_5_O<-P_co_effs[5,5]*SNH_Conc/(Q_co_effs[5,5]+SNH_Conc)
SNH_5_M<-P_co_effs[5,5]*SNH_Conc/Q_co_effs[5,5]
SNH_5_T1<-(P_co_effs[5,5]*NH_std_Conc/(NH_std_Conc+Q_co_effs[5,5]))+

((P_co_effs[5,5]*Q_co_effs[5,5])/(NH_std_Conc+Q_co_effs[5,5])^2)*(SNH_Conc-
NH_std_Conc)
```

```
SNH_7_O<-P_co_effs[7,5]*SNH_Conc/(Q_co_effs[7,5]+SNH_Conc)
SNH_7_M<-P_co_effs[7,5]*SNH_Conc/Q_co_effs[7,5]
SNH_7_T1<-(P_co_effs[7,5]*NH_std_Conc/(NH_std_Conc+Q_co_effs[7,5]))+

((P_co_effs[7,5]*Q_co_effs[7,5])/(NH_std_Conc+Q_co_effs[7,5])^2)*(SNH_Conc-
NH_std_Conc)
SNH_9_O<-P_co_effs[9,5]*SNH_Conc/(Q_co_effs[9,5]+SNH_Conc)
SNH_9_M<-P_co_effs[9,5]*SNH_Conc/Q_co_effs[9,5]
SNH_9_T1<-(P_co_effs[9,5]*NH_std_Conc/(NH_std_Conc+Q_co_effs[9,5]))+

((P_co_effs[9,5]*Q_co_effs[9,5])/(NH_std_Conc+Q_co_effs[9,5])^2)*(SNH_Conc-
NH_std_Conc)
SNH_11_O<-P_co_effs[11,5]*SNH_Conc/(Q_co_effs[11,5]+SNH_Conc)
SNH_11_M<-P_co_effs[11,5]*SNH_Conc/Q_co_effs[11,5]
SNH_11_T1<-(P_co_effs[11,5]*NH_std_Conc/(NH_std_Conc+Q_co_effs[11,5]))+

((P_co_effs[11,5]*Q_co_effs[11,5])/(NH_std_Conc+Q_co_effs[11,5])^2)*(SNH_Co
nc-NH_std_Conc)
SNH_13_O<-P_co_effs[13,5]*SNH_Conc/(Q_co_effs[13,5]+SNH_Conc)
SNH_13_M<-P_co_effs[13,5]*SNH_Conc/Q_co_effs[13,5]
SNH_13_T1<-(P_co_effs[13,5]*NH_std_Conc/(NH_std_Conc+Q_co_effs[13,5]))+

((P_co_effs[13,5]*Q_co_effs[13,5])/(NH_std_Conc+Q_co_effs[13,5])^2)*(SNH_Co
nc-NH_std_Conc)
SNH_15_O<-P_co_effs[15,5]*SNH_Conc/(Q_co_effs[15,5]+SNH_Conc)
SNH_15_M<-P_co_effs[15,5]*SNH_Conc/Q_co_effs[15,5]
SNH_15_T1<-(P_co_effs[15,5]*NH_std_Conc/(NH_std_Conc+Q_co_effs[15,5]))+

((P_co_effs[15,5]*Q_co_effs[15,5])/(NH_std_Conc+Q_co_effs[15,5])^2)*(SNH_Co
nc-NH_std_Conc)
SNH_16_O<-P_co_effs[16,5]*SNH_Conc/(Q_co_effs[16,5]+SNH_Conc)
SNH_16_M<-P_co_effs[16,5]*SNH_Conc/Q_co_effs[16,5]
SNH_16_T1<-(P_co_effs[16,5]*NH_std_Conc/(NH_std_Conc+Q_co_effs[16,5]))+

((P_co_effs[16,5]*Q_co_effs[16,5])/(NH_std_Conc+Q_co_effs[16,5])^2)*(SNH_Co
nc-NH_std_Conc)

Rate_SNH_2<-data.frame(Conc=c(SNH_Conc,SNH_Conc,SNH_Conc),
                       Rate=c(SNH_2_O,SNH_2_T1,SNH_2_M),
                       Eqn=c(rep('Original',times=length(SA_Conc)),
                             rep("Taylor",times=length(SA_Conc)),
                             rep("McLaurin",times=length(SA_Conc))))

Rate_SNH_2_plot<-ggplot(data=Rate_SNH_2)+
                  geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
                  theme_bw()+
                  theme(legend.title = element_blank(),
                        text=element_text(family="Times New Roman"))+
                  ylab(expression(paste("Rate of degradation (mg
N/L.day)")))+
                  xlab(expression(paste("Concentration (mg N/L)")))
plot(Rate_SNH_2_plot)

Tay_SNH_2<-data.frame(Conc=c(SNH_Conc,SNH_Conc),
                      Rate=c(SNH_2_O,SNH_2_T1),
                      Eqn=c(rep('Original',times=length(SNH_Conc)),
                            rep("Taylor",times=length(SNH_Conc))))

Tay_SNH_2_plot<-ggplot(data=Tay_SNH_2)+
                geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
                scale_color_manual(values=c('#00BA38','#619CFF'))+
```

```
                ylab(expression(paste("Rate of degradation (mg
N/L.day)")))+
                xlab(expression(paste("Concentration (mg N/L)")))+
                theme_bw()+
                theme(legend.title = element_blank(),
                      text=element_text(family="Times New Roman"))
plot(Tay_SNH_2_plot)

Mc_SNH_2<-data.frame(Conc=c(SNH_Conc,SNH_Conc),
                     Rate=c(SNH_2_O,SNH_2_M),
                     Eqn=c(rep('Original',times=length(SNH_Conc)),
                           rep("McLaurin",times=length(SNH_Conc))))

Mc_SNH_2_plot<-ggplot(data=Mc_SNH_2)+
                geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
                scale_color_manual(values=c('#F8766D','#00BA38'))+
                ylab(expression(paste("Rate of degradation (mg
N/L.day)")))+
                xlab(expression(paste("Concentration (mg N/L)")))+
                theme_bw()+
                theme(legend.title = element_blank(),
                      text=element_text(family="Times New Roman"))
plot(Mc_SNH_2_plot)

Org_SNH_2<-data.frame(Conc=c(SNH_Conc),
                      Rate=c(SNH_2_O))

Org_SNH_2_plot<-ggplot(data=Org_SNH_2)+
                geom_line(aes(x=Conc,y=Rate),size=1.3,color='#00BA38')+
                ylab(expression(paste("Rate of degradation (mg
N/L.day)")))+
                xlab(expression(paste("Concentration (mg N/L)")))+
                theme_bw()+
                theme(legend.title = element_blank(),
                  text=element_text(family="Times New Roman"))
plot(Org_SNH_2_plot)


Rate_SNH_3<-data.frame(Conc=c(SNH_Conc,SNH_Conc,SNH_Conc),
                       Rate=c(SNH_3_O,SNH_3_T1,SNH_3_M),
                       Eqn=c(rep('Original',times=length(SNH_Conc)),
                             rep("Taylor",times=length(SNH_Conc)),
                             rep("McLaurin",times=length(SNH_Conc))))

Rate_SNH_3_plot<-ggplot(data=Rate_SNH_3)+
                 geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
                 theme_bw()+
                 theme(legend.title = element_blank(),
                       text=element_text(family="Times New Roman"))+
                ylab(expression(paste("Rate of degradation (mg
N/L.day)")))+
                xlab(expression(paste("Concentration (mg N/L)")))
plot(Rate_SNH_3_plot)

Tay_SNH_3<-data.frame(Conc=c(SNH_Conc,SNH_Conc),
                      Rate=c(SNH_3_O,SNH_3_T1),
                      Eqn=c(rep('Original',times=length(SNH_Conc)),
                            rep("Taylor",times=length(SNH_Conc))))

Tay_SNH_3_plot<-ggplot(data=Tay_SNH_3)+
                geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
```

```
                scale_color_manual(values=c('#00BA38','#619CFF'))+
                ylab(expression(paste("Rate of degradation (mg
N/L.day)")))+
                xlab(expression(paste("Concentration (mg N/L)")))+
                theme_bw()+
                theme(legend.title = element_blank(),
                      text=element_text(family="Times New Roman"))
plot(Tay_SNH_3_plot)

Mc_SNH_3<-data.frame(Conc=c(SNH_Conc,SNH_Conc),
                     Rate=c(SNH_3_O,SNH_3_M),
                     Eqn=c(rep('Original',times=length(SNH_Conc)),
                           rep("McLaurin",times=length(SNH_Conc))))

Mc_SNH_3_plot<-ggplot(data=Mc_SNH_3)+
                  geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
                  scale_color_manual(values=c('#F8766D','#00BA38'))+
                  ylab(expression(paste("Rate of degradation (mg
N/L.day)")))+
                  xlab(expression(paste("Concentration (mg N/L)")))+
                  theme_bw()+
                  theme(legend.title = element_blank(),
                        text=element_text(family="Times New Roman"))
plot(Mc_SNH_3_plot)

Org_SNH_3<-data.frame(Conc=c(SNH_Conc),
                      Rate=c(SNH_3_O))

Org_SNH_3_plot<-ggplot(data=Org_SNH_3)+
                geom_line(aes(x=Conc,y=Rate),size=1.3,color='#00BA38')+
                ylab(expression(paste("Rate of degradation (mg
N/L.day)")))+
                xlab(expression(paste("Concentration (mg N/L)")))+
                theme_bw()+
                theme(legend.title = element_blank(),
                      text=element_text(family="Times New Roman"))
plot(Org_SNH_3_plot)
plot(SNH_Conc,SNH_3_O)

Rate_SNH_4<-data.frame(Conc=c(SNH_Conc,SNH_Conc,SNH_Conc),
                       Rate=c(SNH_4_O,SNH_4_T1,SNH_4_M),
                       Eqn=c(rep('Original',times=length(SNH_Conc)),
                             rep("Taylor",times=length(SNH_Conc)),
                             rep("McLaurin",times=length(SNH_Conc))))

Rate_SNH_4_plot<-ggplot(data=Rate_SNH_4)+
                  geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
                  theme_bw()+
                  theme(legend.title = element_blank(),
                      text=element_text(family="Times New Roman"))+
                  ylab(expression(paste("Rate of degradation (mg
N/L.day)")))+
                  xlab(expression(paste("Concentration (mg N/L)")))
plot(Rate_SNH_4_plot)

Tay_SNH_4<-data.frame(Conc=c(SNH_Conc,SNH_Conc),
                      Rate=c(SNH_4_O,SNH_4_T1),
                      Eqn=c(rep('Original',times=length(SNH_Conc)),
                            rep("Taylor",times=length(SNH_Conc))))

Tay_SNH_4_plot<-ggplot(data=Tay_SNH_4)+
```

```
                geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
                scale_color_manual(values=c('#00BA38','#619CFF'))+
                ylab(expression(paste("Rate of degradation (mg
N/L.day)")))+
                xlab(expression(paste("Concentration (mg N/L)")))+
                theme_bw()+
                theme(legend.title = element_blank(),
                      text=element_text(family="Times New Roman"))
plot(Tay_SNH_4_plot)

Mc_SNH_4<-data.frame(Conc=c(SNH_Conc,SNH_Conc),
                     Rate=c(SNH_4_O,SNH_4_M),
                     Eqn=c(rep('Original',times=length(SNH_Conc)),
                           rep("McLaurin",times=length(SNH_Conc))))

Mc_SNH_4_plot<-ggplot(data=Mc_SNH_4)+
                geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
                scale_color_manual(values=c('#F8766D','#00BA38'))+
                ylab(expression(paste("Rate of degradation (mg
N/L.day)")))+
                xlab(expression(paste("Concentration (mg N/L)")))+
                theme_bw()+
                theme(legend.title = element_blank(),
                      text=element_text(family="Times New Roman"))
plot(Mc_SNH_4_plot)

Org_SNH_4<-data.frame(Conc=c(SNH_Conc),
                      Rate=c(SNH_4_O))

Org_SNH_4_plot<-ggplot(data=Org_SNH_4)+
                geom_line(aes(x=Conc,y=Rate),size=1.3,color='#00BA38')+
                ylab(expression(paste("Rate of degradation (mg
N/L.day)")))+
                xlab(expression(paste("Concentration (mg N/L)")))+
                theme_bw()+
                theme(legend.title = element_blank(),
                      text=element_text(family="Times New Roman"))
plot(Org_SNH_4_plot)


Rate_SNH_5<-data.frame(Conc=c(SNH_Conc,SNH_Conc,SNH_Conc),
                       Rate=c(SNH_5_O,SNH_5_T1,SNH_5_M),
                       Eqn=c(rep('Original',times=length(SNH_Conc)),
                             rep("Taylor",times=length(SNH_Conc)),
                             rep("McLaurin",times=length(SNH_Conc))))

Rate_SNH_5_plot<-ggplot(data=Rate_SNH_5)+
                  geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
                  theme_bw()+
                  theme(legend.title = element_blank(),
                        text=element_text(family="Times New Roman"))+
                  ylab(expression(paste("Rate of degradation (mg
N/L.day)")))+
                  xlab(expression(paste("Concentration (mg N/L)")))
plot(Rate_SNH_5_plot)

Tay_SNH_5<-data.frame(Conc=c(SNH_Conc,SNH_Conc),
                      Rate=c(SNH_5_O,SNH_5_T1),
                      Eqn=c(rep('Original',times=length(SNH_Conc)),
                            rep("Taylor",times=length(SNH_Conc))))
```

```
Tay_SNH_5_plot<-ggplot(data=Tay_SNH_5)+
                geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
                scale_color_manual(values=c('#00BA38','#619CFF'))+
                ylab(expression(paste("Rate of degradation (mg
N/L.day)")))+
                xlab(expression(paste("Concentration (mg N/L)")))+
                theme_bw()+
                theme(legend.title = element_blank(),
                      text=element_text(family="Times New Roman"))
plot(Tay_SNH_5_plot)

Mc_SNH_5<-data.frame(Conc=c(SNH_Conc,SNH_Conc),
                     Rate=c(SNH_5_O,SNH_5_M),
                     Eqn=c(rep('Original',times=length(SNH_Conc)),
                           rep("McLaurin",times=length(SNH_Conc))))

Mc_SNH_5_plot<-ggplot(data=Mc_SNH_5)+
                geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
                scale_color_manual(values=c('#F8766D','#00BA38'))+
                ylab(expression(paste("Rate of degradation (mg
N/L.day)")))+
                xlab(expression(paste("Concentration (mg N/L)")))+
                theme_bw()+
                theme(legend.title = element_blank(),
                      text=element_text(family="Times New Roman"))
plot(Mc_SNH_5_plot)

Org_SNH_5<-data.frame(Conc=c(SNH_Conc),
                      Rate=c(SNH_5_O))

Org_SNH_5_plot<-ggplot(data=Org_SNH_5)+
                geom_line(aes(x=Conc,y=Rate),size=1.3,color='#00BA38')+
                ylab(expression(paste("Rate of degradation (mg
N/L.day)")))+
                xlab(expression(paste("Concentration (mg N/L)")))+
                theme_bw()+
                theme(legend.title = element_blank(),
                      text=element_text(family="Times New Roman"))
plot(Org_SNH_5_plot)


Rate_SNH_7<-data.frame(Conc=c(SNH_Conc,SNH_Conc,SNH_Conc),
                       Rate=c(SNH_7_O,SNH_7_T1,SNH_7_M),
                       Eqn=c(rep('Original',times=length(SNH_Conc)),
                             rep("Taylor",times=length(SNH_Conc)),
                             rep("McLaurin",times=length(SNH_Conc))))

Rate_SNH_7_plot<-ggplot(data=Rate_SNH_7)+
                 geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
                 theme_bw()+
                 theme(legend.title = element_blank(),
                   text=element_text(family="Times New Roman"))+
                 ylab(expression(paste("Rate of degradation (mg
N/L.day)")))+
                 xlab(expression(paste("Concentration (mg N/L)")))
plot(Rate_SNH_7_plot)

Tay_SNH_7<-data.frame(Conc=c(SNH_Conc,SNH_Conc),
                      Rate=c(SNH_7_O,SNH_7_T1),
                      Eqn=c(rep('Original',times=length(SNH_Conc)),
                            rep("Taylor",times=length(SNH_Conc))))
```

```
Tay_SNH_7_plot<-ggplot(data=Tay_SNH_7)+
                geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
                scale_color_manual(values=c('#00BA38','#619CFF'))+
                ylab(expression(paste("Rate of degradation (mg
N/L.day)")))+
                xlab(expression(paste("Concentration (mg N/L)")))+
                theme_bw()+
                theme(legend.title = element_blank(),
                      text=element_text(family="Times New Roman"))
plot(Tay_SNH_7_plot)

Mc_SNH_7<-data.frame(Conc=c(SNH_Conc,SNH_Conc),
                     Rate=c(SNH_7_O,SNH_7_M),
                     Eqn=c(rep('Original',times=length(SNH_Conc)),
                           rep("McLaurin",times=length(SNH_Conc))))

Mc_SNH_7_plot<-ggplot(data=Mc_SNH_7)+
                geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
                scale_color_manual(values=c('#F8766D','#00BA38'))+
                ylab(expression(paste("Rate of degradation (mg
N/L.day)")))+
                xlab(expression(paste("Concentration (mg N/L)")))+
                theme_bw()+
                theme(legend.title = element_blank(),
                      text=element_text(family="Times New Roman"))
plot(Mc_SNH_7_plot)

Org_SNH_7<-data.frame(Conc=c(SNH_Conc),
                      Rate=c(SNH_7_O))

Org_SNH_7_plot<-ggplot(data=Org_SNH_7)+
                geom_line(aes(x=Conc,y=Rate),size=1.3,color='#00BA38')+
                ylab(expression(paste("Rate of degradation (mg
N/L.day)")))+
                xlab(expression(paste("Concentration (mg N/L)")))+
                theme_bw()+
                theme(legend.title = element_blank(),
                      text=element_text(family="Times New Roman"))
plot(Org_SNH_7_plot)

Rate_SNH_9<-data.frame(Conc=c(SNH_Conc,SNH_Conc,SNH_Conc),
                       Rate=c(SNH_9_O,SNH_9_T1,SNH_9_M),
                       Eqn=c(rep('Original',times=length(SNH_Conc)),
                             rep("Taylor",times=length(SNH_Conc)),
                             rep("McLaurin",times=length(SNH_Conc))))

Rate_SNH_9_plot<-ggplot(data=Rate_SNH_9)+
                 geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
                 theme_bw()+
                 theme(legend.title = element_blank(),
                       text=element_text(family="Times New Roman"))+
                 ylab(expression(paste("Rate of degradation (mg
N/L.day)")))+
                 xlab(expression(paste("Concentration (mg N/L)")))
plot(Rate_SNH_9_plot)

Tay_SNH_9<-data.frame(Conc=c(SNH_Conc,SNH_Conc),
                      Rate=c(SNH_9_O,SNH_9_T1),
                      Eqn=c(rep('Original',times=length(SNH_Conc)),
                            rep("Taylor",times=length(SNH_Conc))))
```

```
Tay_SNH_9_plot<-ggplot(data=Tay_SNH_9)+
                geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
                scale_color_manual(values=c('#00BA38','#619CFF'))+
                ylab(expression(paste("Rate of degradation (mg
N/L.day)")))+
                xlab(expression(paste("Concentration (mg N/L)")))+
                theme_bw()+
                theme(legend.title = element_blank(),
                      text=element_text(family="Times New Roman"))
plot(Tay_SNH_9_plot)

Mc_SNH_9<-data.frame(Conc=c(SNH_Conc,SNH_Conc),
                     Rate=c(SNH_9_O,SNH_9_M),
                     Eqn=c(rep('Original',times=length(SNH_Conc)),
                           rep("McLaurin",times=length(SNH_Conc))))

Mc_SNH_9_plot<-ggplot(data=Mc_SNH_9)+
                geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
                scale_color_manual(values=c('#F8766D','#00BA38'))+
                ylab(expression(paste("Rate of degradation (mg
N/L.day)")))+
                xlab(expression(paste("Concentration (mg N/L)")))+
                theme_bw()+
                theme(legend.title = element_blank(),
                      text=element_text(family="Times New Roman"))
plot(Mc_SNH_9_plot)

Org_SNH_9<-data.frame(Conc=c(SNH_Conc),
                      Rate=c(SNH_9_O))

Org_SNH_9_plot<-ggplot(data=Org_SNH_9)+
                geom_line(aes(x=Conc,y=Rate),size=1.3,color='#00BA38')+
                ylab(expression(paste("Rate of degradation (mg
N/L.day)")))+
                xlab(expression(paste("Concentration (mg N/L)")))+
                theme_bw()+
                theme(legend.title = element_blank(),
                      text=element_text(family="Times New Roman"))
plot(Org_SNH_9_plot)

Rate_SNH_11<-data.frame(Conc=c(SNH_Conc,SNH_Conc,SNH_Conc),
                        Rate=c(SNH_11_O,SNH_11_T1,SNH_11_M),
                        Eqn=c(rep('Original',times=length(SNH_Conc)),
                              rep("Taylor",times=length(SNH_Conc)),
                              rep("McLaurin",times=length(SNH_Conc))))

Rate_SNH_11_plot<-ggplot(data=Rate_SNH_11)+
                  geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
                  theme_bw()+
                  theme(legend.title = element_blank(),
                    text=element_text(family="Times New Roman"))+
                  ylab(expression(paste("Rate of degradation (mg
N/L.day)")))+
                  xlab(expression(paste("Concentration (mg N/L)")))
plot(Rate_SNH_11_plot)

Tay_SNH_11<-data.frame(Conc=c(SNH_Conc,SNH_Conc),
                       Rate=c(SNH_11_O,SNH_11_T1),
                       Eqn=c(rep('Original',times=length(SNH_Conc)),
                             rep("Taylor",times=length(SNH_Conc))))
```

```
Tay_SNH_11_plot<-ggplot(data=Tay_SNH_11)+
                  geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
                  scale_color_manual(values=c('#00BA38','#619CFF'))+
                  ylab(expression(paste("Rate of degradation (mg
N/L.day)")))+
                  xlab(expression(paste("Concentration (mg N/L)")))+
                  theme_bw()+
                  theme(legend.title = element_blank(),
                        text=element_text(family="Times New Roman"))
plot(Tay_SNH_11_plot)

Mc_SNH_11<-data.frame(Conc=c(SNH_Conc,SNH_Conc),
                      Rate=c(SNH_11_O,SNH_11_M),
                      Eqn=c(rep('Original',times=length(SNH_Conc)),
                            rep("McLaurin",times=length(SNH_Conc))))

Mc_SNH_11_plot<-ggplot(data=Mc_SNH_11)+
                geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
                scale_color_manual(values=c('#F8766D','#00BA38'))+
                ylab(expression(paste("Rate of degradation (mg
N/L.day)")))+
                xlab(expression(paste("Concentration (mg N/L)")))+
                theme_bw()+
                theme(legend.title = element_blank(),
                      text=element_text(family="Times New Roman"))
plot(Mc_SNH_11_plot)

Org_SNH_11<-data.frame(Conc=c(SNH_Conc),
                       Rate=c(SNH_11_O))

Org_SNH_11_plot<-ggplot(data=Org_SNH_11)+
                  geom_line(aes(x=Conc,y=Rate),size=1.3,color='#00BA38')+
                  ylab(expression(paste("Rate of degradation (mg
N/L.day)")))+
                  xlab(expression(paste("Concentration (mg N/L)")))+
                  theme_bw()+
                  theme(legend.title = element_blank(),
                        text=element_text(family="Times New Roman"))
plot(Org_SNH_11_plot)
Rate_SNH_13<-data.frame(Conc=c(SNH_Conc,SNH_Conc,SNH_Conc),
                        Rate=c(SNH_13_O,SNH_13_T1,SNH_13_M),
                        Eqn=c(rep('Original',times=length(SNH_Conc)),
                              rep("Taylor",times=length(SNH_Conc)),
                              rep("McLaurin",times=length(SNH_Conc))))

Rate_SNH_13_plot<-ggplot(data=Rate_SNH_13)+
                  geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
                  theme_bw()+
                  theme(legend.title = element_blank(),
                  text=element_text(family="Times New Roman"))+
                  ylab(expression(paste("Rate of degradation (mg
N/L.day)")))+
                  xlab(expression(paste("Concentration (mg N/L)")))
plot(Rate_SNH_13_plot)


Tay_SNH_13<-data.frame(Conc=c(SNH_Conc,SNH_Conc),
                       Rate=c(SNH_13_O,SNH_13_T1),
                       Eqn=c(rep('Original',times=length(SNH_Conc)),
                             rep("Taylor",times=length(SNH_Conc))))
```

```
Tay_SNH_13_plot<-ggplot(data=Tay_SNH_13)+
                  geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
                  scale_color_manual(values=c('#00BA38','#619CFF'))+
                  ylab(expression(paste("Rate of degradation (mg
N/L.day)")))+
                  xlab(expression(paste("Concentration (mg N/L)")))+
                  theme_bw()+
                  theme(legend.title = element_blank(),
                        text=element_text(family="Times New Roman"))
plot(Tay_SNH_13_plot)

Mc_SNH_13<-data.frame(Conc=c(SNH_Conc,SNH_Conc),
                      Rate=c(SNH_13_O,SNH_13_M),
                      Eqn=c(rep('Original',times=length(SNH_Conc)),
                            rep("McLaurin",times=length(SNH_Conc))))

Mc_SNH_13_plot<-ggplot(data=Mc_SNH_13)+
                geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
                scale_color_manual(values=c('#F8766D','#00BA38'))+
                ylab(expression(paste("Rate of degradation (mg
N/L.day)")))+
                xlab(expression(paste("Concentration (mg N/L)")))+
                theme_bw()+
                theme(legend.title = element_blank(),
                      text=element_text(family="Times New Roman"))
plot(Mc_SNH_13_plot)

Org_SNH_13<-data.frame(Conc=c(SNH_Conc),
                       Rate=c(SNH_13_O))

Org_SNH_13_plot<-ggplot(data=Org_SNH_13)+
                  geom_line(aes(x=Conc,y=Rate),size=1.3,color='#00BA38')+
                  ylab(expression(paste("Rate of degradation (mg
N/L.day)")))+
                  xlab(expression(paste("Concentration (mg N/L)")))+
                  theme_bw()+
                  theme(legend.title = element_blank(),
                        text=element_text(family="Times New Roman"))
plot(Org_SNH_13_plot)

Rate_SNH_15<-data.frame(Conc=c(SNH_Conc,SNH_Conc,SNH_Conc),
                        Rate=c(SNH_15_O,SNH_15_T1,SNH_15_M),
                        Eqn=c(rep('Original',times=length(SNH_Conc)),
                              rep("Taylor",times=length(SNH_Conc)),
                              rep("McLaurin",times=length(SNH_Conc))))

Rate_SNH_15_plot<-ggplot(data=Rate_SNH_15)+
                  geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
                  theme_bw()+
                  theme(legend.title = element_blank(),
                    text=element_text(family="Times New Roman"))+
                  ylab(expression(paste("Rate of degradation (mg
N/L.day)")))+
                  xlab(expression(paste("Concentration (mg N/L)")))
plot(Rate_SNH_15_plot)

Tay_SNH_15<-data.frame(Conc=c(SNH_Conc,SNH_Conc),
                       Rate=c(SNH_15_O,SNH_15_T1),
                       Eqn=c(rep('Original',times=length(SNH_Conc)),
                             rep("Taylor",times=length(SNH_Conc))))
```

```
Tay_SNH_15_plot<-ggplot(data=Tay_SNH_15)+
                  geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
                  scale_color_manual(values=c('#00BA38','#619CFF'))+
                  ylab(expression(paste("Rate of degradation (mg
N/L.day)")))+
                  xlab(expression(paste("Concentration (mg N/L)")))+
                  theme_bw()+
                  theme(legend.title = element_blank(),
                        text=element_text(family="Times New Roman"))
plot(Tay_SNH_15_plot)

Mc_SNH_15<-data.frame(Conc=c(SNH_Conc,SNH_Conc),
                      Rate=c(SNH_15_O,SNH_15_M),
                      Eqn=c(rep('Original',times=length(SNH_Conc)),
                            rep("McLaurin",times=length(SNH_Conc))))

Mc_SNH_15_plot<-ggplot(data=Mc_SNH_15)+
                geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
                scale_color_manual(values=c('#F8766D','#00BA38'))+
                ylab(expression(paste("Rate of degradation (mg
N/L.day)")))+
                xlab(expression(paste("Concentration (mg N/L)")))+
                theme_bw()+
                theme(legend.title = element_blank(),
                      text=element_text(family="Times New Roman"))
plot(Mc_SNH_15_plot)

Org_SNH_15<-data.frame(Conc=c(SNH_Conc),
                       Rate=c(SNH_15_O))

Org_SNH_15_plot<-ggplot(data=Org_SNH_15)+
                  geom_line(aes(x=Conc,y=Rate),size=1.3,color='#00BA38')+
                  ylab(expression(paste("Rate of degradation (mg
N/L.day)")))+
                  xlab(expression(paste("Concentration (mg N/L)")))+
                  theme_bw()+
                  theme(legend.title = element_blank(),
                        text=element_text(family="Times New Roman"))
plot(Org_SNH_15_plot)

Rate_SNH_16<-data.frame(Conc=c(SNH_Conc,SNH_Conc,SNH_Conc),
                        Rate=c(SNH_16_O,SNH_16_T1,SNH_16_M),
                        Eqn=c(rep('Original',times=length(SNH_Conc)),
                              rep("Taylor",times=length(SNH_Conc)),
                              rep("McLaurin",times=length(SNH_Conc))))

Rate_SNH_16_plot<-ggplot(data=Rate_SNH_16)+
                  geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
                  theme_bw()+
                  theme(legend.title = element_blank(),
                    text=element_text(family="Times New Roman"))+
                  ylab(expression(paste("Rate of degradation (mg
N/L.day)")))+
                  xlab(expression(paste("Concentration (mg N/L)")))
plot(Rate_SNH_16_plot)

Tay_SNH_16<-data.frame(Conc=c(SNH_Conc,SNH_Conc),
                       Rate=c(SNH_16_O,SNH_16_T1),
                       Eqn=c(rep('Original',times=length(SNH_Conc)),
                             rep("Taylor",times=length(SNH_Conc))))
```

```
Tay_SNH_16_plot<-ggplot(data=Tay_SNH_16)+
                  geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
                  scale_color_manual(values=c('#00BA38','#619CFF'))+
                  ylab(expression(paste("Rate of degradation (mg
N/L.day)")))+
                  xlab(expression(paste("Concentration (mg N/L)")))+
                  theme_bw()+
                  theme(legend.title = element_blank(),
                        text=element_text(family="Times New Roman"))
plot(Tay_SNH_16_plot)

Mc_SNH_16<-data.frame(Conc=c(SNH_Conc,SNH_Conc),
                      Rate=c(SNH_16_O,SNH_16_M),
                      Eqn=c(rep('Original',times=length(SNH_Conc)),
                            rep("McLaurin",times=length(SNH_Conc))))

Mc_SNH_16_plot<-ggplot(data=Mc_SNH_16)+
                geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
                scale_color_manual(values=c('#F8766D','#00BA38'))+
                ylab(expression(paste("Rate of degradation (mg
N/L.day)")))+
                xlab(expression(paste("Concentration (mg N/L)")))+
                theme_bw()+
                theme(legend.title = element_blank(),
                      text=element_text(family="Times New Roman"))
plot(Mc_SNH_16_plot)

Org_SNH_16<-data.frame(Conc=c(SNH_Conc),
                       Rate=c(SNH_16_O))

Org_SNH_16_plot<-ggplot(data=Org_SNH_16)+
                  geom_line(aes(x=Conc,y=Rate),size=1.3,color='#00BA38')+
                  ylab(expression(paste("Rate of degradation (mg
N/L.day)")))+
                  xlab(expression(paste("Concentration (mg N/L)")))+
                  theme_bw()+
                  theme(legend.title = element_blank(),
                        text=element_text(family="Times New Roman"))
plot(Org_SNH_16_plot)
```

the plots

E.5 Nitrate and nitrite nitrogen

Aerobic growth of XH on SA

Conc	Rate		
	Original	Taylor	McLaurin
0	0	-1239.76	0
0.054	-123.252	-1239.77	-136.564
0.1008	-212.149	-1239.78	-254.919
0.252	-423.734	-1239.82	-637.297
0.504	-634.758	-1239.88	-1274.59
1.008	-845.221	-1240	-2549.19
2.52	-1055.13	-1240.37	-6372.97
5.04	-1150.35	-1240.99	-12745.9
10.08	-1204.72	-1242.22	-25491.9
25.2	-1239.88	-1245.91	-63729.7
50.4	-1252.06	-1252.06	-127459
60.48	-1254.11	-1254.52	-152951
63	-1254.52	-1255.13	-159324
75.6	-1256.17	-1258.21	-191189

Anoxic growth of XH on SA

Conc	Rate		
	Original	Taylor	McLaurin
0	0	-0.01714	0
0.054	-0.0017	-0.01714	-0.00189
0.1008	-0.00293	-0.01714	-0.00353
0.252	-0.00586	-0.01715	-0.00881
0.504	-0.00878	-0.01715	-0.01763
1.008	-0.01169	-0.01715	-0.03525
2.52	-0.01459	-0.01715	-0.08813
5.04	-0.01591	-0.01716	-0.17626
10.08	-0.01666	-0.01718	-0.35252
25.2	-0.01715	-0.01723	-0.8813
50.4	-0.01731	-0.01731	-1.7626
60.48	-0.01734	-0.01735	-2.11512
63	-0.01735	-0.01736	-2.20325
75.6	-0.01737	-0.0174	-2.64389

Aerobic growth of XSOB on SH2S

Conc	Rate		
	Original	Taylor	McLaurin
0	0	-1193.87	0
0.054	-118.691	-1193.89	-131.509
0.1008	-204.298	-1193.9	-245.484
0.252	-408.052	-1193.93	-613.711
0.504	-611.266	-1193.99	-1227.42
1.008	-813.94	-1194.11	-2454.84
2.52	-1016.08	-1194.47	-6137.11
5.04	-1107.78	-1195.06	-12274.2
10.08	-1160.13	-1196.24	-24548.4
25.2	-1193.99	-1199.8	-61371.1
50.4	-1205.72	-1205.72	-122742
60.48	-1207.7	-1208.09	-147291
63	-1208.09	-1208.68	-153428
75.6	-1209.68	-1211.64	-184113

The following code was used to generate the comparisons of the linearisation attempts and the original rates for nitrate and nitrite nitrogen

```
library(ggplot2)
library(ggthemes)
library(extrafont)
font_import()
loadfonts(device="win")

YH<-0.63;
YFB<-0.053;
YAMB<-0.032;
YASRB<-0.05;
YA<-0.24;
YSOB<-0.12;

KSA<-4;
KSF<-2;
KOH<-0.2;
KNHH<-0.05;
KH2SH<-140;
KNOH<-0.5;
KSFB<-28;
KH2SFB<-140;
KOFB<-0.2;
KNOFB<-0.5;
KNHFB<-0.01;
KSAMB<-56;
KH2SAMB<-140;
KOAMB<-0.0002;
KNOAMB<-0.0005;
KNHAMB<-0.01;
KSASRB<-24;
KSOASRB<-19;
KH2SASRB<-140;
KOASRB<-0.0002;
KNOASRB<-0.0005;
KNHASRB<-0.01;
kH<-3
KNHA<-0.5;
KH2SA<-140;
KOA<-1;
KSSOB<-0.24;
KOSOB<-0.2;
KNHSOB<-0.05;
KNOSOB<-0.5;
KX<-0.1;


muH<-6;
muA<-1;
muFB<-3;
muAMB<-0.085;
muASRB<-0.18;
muSOB<-5.28;
ng<-0.8; #not sure about this value, paper not clear
nuh<-0.1;
nuSOB<-0.7; #no value given, this is an approximation based on other rates
```

```
XH<-100;
XFB<-100;
XAMB<-1000;
XASRB<-340;
XS<-33;
XA<-100;
XSOB<-210;

SF<-170;
SO<-0.86;
SNH<-57;
SH2S<-34;
SNO<-50.4;
SA<-1;
SSO4<-35;

fHYDSI<-0.0;
fBMSF<-0.05;
fBMXI<-0.1;

iNXS<-0.04;
iNSF<-0.03;
iNSI<-0.01;
iNBM<-0.07;
iNXI<-0.03;

P_co_effs<-matrix(c(0,0,0,0,0,0,0,0,(-1)*(XH+nuh*XFB),0,kH*XS,0,0,0,0,0,
                    (1-(1/YH))*muH*

(SF/(KSF+SF))*(SF/(SF+SA))*(SNH/(KNHH*SNH))*(KH2SH/(KH2SH+SH2S))*XH,
                    (1/YH)*muH*

(SO/(KOH+SO))*(SNH/(KNHH*SNH))*(KH2SH/(KH2SH+SH2S))*XH,0,0,
                    ((iNSF/YH)-
iNBM)*(SF/(KSF+SF))*(SF/(SF+SA))*(SO/(KOH+SO))*(KH2SH/(KH2SH+SH2S))*XH,
                    0,0,0,0,0,0,0,0,0,0,
                    0,(-1/YH)*

(ng*muH*(SO/(KOH+SO))*(SNO/(KOH+SNO))*(SNH/(KNHH*SNH))*(KH2SH/(KH2SH+SH2S))
*XH),
                    0,0,(((iNSF/YH)-
iNBM)*ng*muH*(SF/(KSF+SF))*(SF/(SF+SA))*(SO/(KOH+SO))*(SNO/(KOH+SNO))*
                                (KH2SH/(KH2SH+SH2S))*XH),(-((1-
YH)/(2.86*YH)))*ng*muH*(SF/(KSF+SF))*(SF/(SF+SA))*

(SO/(KOH+SO))*(SNH/(KNHH*SNH))*(KH2SH/(KH2SH+SH2S))*XH,0,0,0,0,0,0,0,0,0,
                    (1-
(1/YH))*muH*(SA/(KSA+SA))*(SA/(SF+SA))*(SNH/(KNHH+SNH))*(KH2SH/(KH2SH+SH2S)
)*XH,0,
                    (-
1/YH)*(SNH/(KNHH+SNH))*(SO/(KOH+SO))*(KH2SH/(KH2SH+SH2S))*XH,0,
                    (-
iNBM)*muH*(SA/(KSA+SA))*(SA/(SF+SA))*(SO/(KOH+SO))*(KH2SH/(KH2SH+SH2S)),
                    0,0,0,0,0,0,0,0,0,0,
                    0,0,(-1/YH)*ng*muH*

(KOH/(KOH+SO))*(SNO/(KNOH+SNO))*(SNH/(KNHH+SNH))*(KH2SH/(KH2SH+SH2S))*XH,0,
                    (-iNBM)*ng*muH*

(SA/(KSA+SA))*(SA/(SF+SA))*(KOH/(KOH+SO))*(SNO/(KNOH+SNO))*(KH2SH/(KH2SH+SH
2S))*XH,
```

```
                    (-(1-YH)/(2.86*YH))*ng*muH*

(SA/(KSA+SA))*(SA/(SF+SA))*(KOH/(KOH+SO))*(SNH/(KNHH+SNH))*(KH2SH/(KH2SH+SH
2S))*XH,
                    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,
                    (-(4.57-
YA)/(YA))*muA*(SNH/(KNHA+SNH))*(KH2SA/(KH2SA+SH2S))*XA,0,0,0,
                    (-iNBM-
(1/YA))*muA*(SO/(KOA+SO))*(KH2SA/(KH2SA+SH2S)),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/YFB)*muFB*(KH2SFB/(KH2SFB+SH2S))*

(KOFB/(KOFB+SO))*(KNOFB/(KNOFB+SNO))*(SNH/(KNHFB+SNH))*XFB,0,0,
                    ((iNSF/YFB)-iNBM)*muFB*

(SF/(KSFB+SF))*(KH2SFB/(KH2SFB+SH2S))*(KOFB/(KOFB+SO))*(KNOFB/(KNOFB+SNO)),
                    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/YAMB)*muAMB*(KH2SAMB/(KH2SAMB+SH2S))*(KOAMB/(KOAMB+SO))*(KNOAMB/(KNOAMB+S
NO))*
                      (SNH/(KNHAMB+SNH))*XAMB,0,
                    (-
iNBM)*(SA/(KSAMB+SA))*(KH2SAMB/(KH2SAMB+SH2S))*(KOAMB/(KOAMB+SO))*

(KNOAMB/(KNOAMB+SNO))*(SNH/(KNHAMB+SNH))*XAMB,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/YASRB)*muASRB*(SSO4/(KSOASRB+SSO4))*(KH2SASRB/(KH2SASRB+SH2S))*

(KOASRB/(KOASRB+SO))*(KNOASRB/(KNOASRB+SNO))*(SNH/(KNHASRB+SNH))*XASRB,0,
                    (-
iNBM)*muASRB*(SA/(KSASRB+SA))*(SSO4/(KSOASRB+SSO4))*(KH2SASRB/(KH2SASRB+SH2
S))*
                      (KOASRB/(KOASRB+SO))*(KNOASRB/(KNOASRB+SNO))*XASRB,0,
                    (-(1-
YASRB)/(2*YASRB))*muASRB*(SA/(KSASRB+SA))*(KH2SASRB/(KH2SASRB+SH2S))*

(KOASRB/(KOASRB+SO))*(KNOASRB/(KNOASRB+SNO))*(SNH/(KNHASRB+SNH))*XASRB,
                    ((1-
YASRB)/(2*YASRB))*muASRB*(SA/(KSASRB+SA))*(SSO4/(KSOASRB+SSO4))*

(KOASRB/(KOASRB+SO))*(KNOASRB/(KNOASRB+SNO))*(SNH/(KNHASRB+SNH))*XASRB,
                    0,0,0,0,0,0,0,
                    0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
                    (-(2-
YSOB)/YSOB)*muSOB*(SH2S/(KSSOB+SH2S))*(SNH/(KNHSOB+SNH))*XSOB,0,0,0,
                    (-
iNBM)*muSOB*(SH2S/(KSSOB+SH2S))*(SO/(KOSOB+SO))*XSOB,0,0,
                    (-
1/YSOB)*muSOB*(SO/(KOSOB+SO))*(SNH/(KNHSOB+SNH))*XSOB,0,0,0,0,0,0,0,
                    0,0,0,0,(-
iNBM)*muSOB*nuSOB*(SH2S/(KSSOB+SH2S))*(SNO/(KNOSOB+SNO))*(KOSOB/(KOSOB+SO))
*XSOB,
                    (-(1-
YSOB)/(0.875*YSOB))*muSOB*nuSOB*(SH2S/(KSSOB+SH2S))*(KOSOB/(KOSOB+SO))*
                      (SNH/(KNHSOB+SNH))*XSOB,0,
                    (-
1/YSOB)*muSOB*nuSOB*(SNO/(KNOSOB+SNO))*(KOSOB/(KOSOB+SO))*(SNH/(KNHSOB+SNH)
)*XSOB,
```

```
                    0,0,0,0,0,0,0,0,
                    0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0),
                  nrow=17,byrow=TRUE)

Q_co_effs<-matrix(c(0,0,0,0,0,0,0,0,KX*(XH+XFB),0,nuh*XFB,0,0,0,0,0,
                    KOH,KSF,0,0,KNHH,0,0,0,0,0,0,0,0,0,0,0,
                    0,KSF,0,0,KNHH,KNOH,0,0,0,0,0,0,0,0,0,0,
                    KOH,0,KSA,0,KNHH,0,0,0,0,0,0,0,0,0,0,0,
                    0,0,KSA,0,KNHH,KNOH,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,
                    KOA,0,0,0,KNHA,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,KSFB,0,0,KNHFB,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,KSAMB,0,KNHAMB,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,KSASRB,0,KNHASRB,0,KSOASRB,KH2SASRB,0,0,0,0,0,0,0,0,
                    0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
                    KOSOB,0,0,0,KNHSOB,0,0,KSSOB,0,0,0,0,0,0,0,0,
                    0,0,0,0,KNHSOB,KNOSOB,0,KSSOB,0,0,0,0,0,0,0,0,
                    0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0),nrow=17,byrow=TRUE)

R1<-KX
R2<-SA
R3<-SA
R4<-SF
R5<-SF
T1<-XS+KX*XFB

SNO_Conc<-
c(0,0.054,0.1008,0.252,0.504,1.008,2.52,5.04,10.08,25.2,50.4,60.48,63,75.6)
NO_std_Conc<-50.4

SNO_3_O<-P_co_effs[3,6]*SNO_Conc/(Q_co_effs[3,6]+SNO_Conc)
SNO_3_M<-P_co_effs[3,6]*SNO_Conc/Q_co_effs[3,6]
SNO_3_T1<-(P_co_effs[3,6]*NO_std_Conc/(NO_std_Conc+Q_co_effs[3,6]))+

((P_co_effs[3,6]*Q_co_effs[3,6])/(NO_std_Conc+Q_co_effs[3,6])^2)*(SNO_Conc-
NO_std_Conc)
SNO_5_O<-P_co_effs[5,6]*SNO_Conc/(Q_co_effs[5,6]+SNO_Conc)
SNO_5_M<-P_co_effs[5,6]*SNO_Conc/Q_co_effs[5,6]
SNO_5_T1<-(P_co_effs[5,6]*NO_std_Conc/(NO_std_Conc+Q_co_effs[5,6]))+

((P_co_effs[5,6]*Q_co_effs[5,6])/(NO_std_Conc+Q_co_effs[5,6])^2)*(SNO_Conc-
NO_std_Conc)
SNO_16_O<-P_co_effs[16,6]*SNO_Conc/(Q_co_effs[16,6]+SNO_Conc)
SNO_16_M<-P_co_effs[16,6]*SNO_Conc/Q_co_effs[16,6]
SNO_16_T1<-(P_co_effs[16,6]*NO_std_Conc/(NO_std_Conc+Q_co_effs[16,6]))+

((P_co_effs[16,6]*Q_co_effs[16,6])/(NO_std_Conc+Q_co_effs[16,6])^2)*(SNO_Co
nc-NO_std_Conc)


Rate_SNO_3<-data.frame(Conc=c(SNO_Conc,SNO_Conc,SNH_Conc),
                       Rate=c(SNO_3_O,SNO_3_T1,SNO_3_M),
                       Eqn=c(rep('Original',times=length(SNO_Conc)),
                             rep("Taylor",times=length(SNO_Conc)),
                             rep("McLaurin",times=length(SNO_Conc))))

Rate_SNO_3_plot<-ggplot(data=Rate_SNO_3)+
```

```
                  geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
                  theme_bw()+
                  theme(legend.title = element_blank(),
                    text=element_text(family="Times New Roman"))+
                  ylab(expression(paste("Rate of degradation (mg
N/L.day)")))+
                  xlab(expression(paste("Concentration (mg N/L)")))
plot(Rate_SNO_3_plot)

Tay_SNO_3<-data.frame(Conc=c(SNO_Conc,SNO_Conc),
                      Rate=c(SNO_3_O,SNO_3_T1),
                      Eqn=c(rep('Original',times=length(SNO_Conc)),
                            rep("Taylor",times=length(SNO_Conc))))

Tay_SNO_3_plot<-ggplot(data=Tay_SNO_3)+
                geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
                scale_color_manual(values=c('#00BA38','#619CFF'))+
                ylab(expression(paste("Rate of degradation (mg
N/L.day)")))+
                xlab(expression(paste("Concentration (mg N/L)")))+
                theme_bw()+
                theme(legend.title = element_blank(),
                      text=element_text(family="Times New Roman"))
plot(Tay_SNO_3_plot)

Mc_SNO_3<-data.frame(Conc=c(SNO_Conc,SNO_Conc),
                     Rate=c(SNO_3_O,SNO_3_M),
                     Eqn=c(rep('Original',times=length(SNO_Conc)),
                           rep("McLaurin",times=length(SNO_Conc))))

Mc_SNO_3_plot<-ggplot(data=Mc_SNO_3)+
                geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
                scale_color_manual(values=c('#F8766D','#00BA38'))+
                ylab(expression(paste("Rate of degradation (mg
N/L.day)")))+
                xlab(expression(paste("Concentration (mg N/L)")))+
                theme_bw()+
                theme(legend.title = element_blank(),
                      text=element_text(family="Times New Roman"))
plot(Mc_SNO_3_plot)

Org_SNO_3<-data.frame(Conc=c(SNO_Conc),
                      Rate=c(SNO_3_O))

Org_SNO_3_plot<-ggplot(data=Org_SNO_3)+
                geom_line(aes(x=Conc,y=Rate),size=1.3,color='#00BA38')+
                ylab(expression(paste("Rate of degradation (mg
N/L.day)")))+
                xlab(expression(paste("Concentration (mg N/L)")))+
                theme_bw()+
                theme(legend.title = element_blank(),
                      text=element_text(family="Times New Roman"))
plot(Org_SNO_3_plot)


Rate_SNO_5<-data.frame(Conc=c(SNO_Conc,SNO_Conc,SNH_Conc),
                       Rate=c(SNO_5_O,SNO_5_T1,SNO_5_M),
                       Eqn=c(rep('Original',times=length(SNO_Conc)),
                             rep("Taylor",times=length(SNO_Conc)),
                             rep("McLaurin",times=length(SNO_Conc))))
```

```
Rate_SNO_5_plot<-ggplot(data=Rate_SNO_5)+
                  geom_line(aes(x=Conc,y=Rate,colour=Eqn))+
                  theme(legend.title = element_blank(),
                    text=element_text(family="Times New Roman"))+
                  ylab(expression(paste("Rate of degradation (mg
N/L.day)")))+
                  xlab(expression(paste("Concentration (mg N/L)")))+
                  theme_bw()
plot(Rate_SNO_5_plot)

Tay_SNO_5<-data.frame(Conc=c(SNO_Conc,SNO_Conc),
                      Rate=c(SNO_5_O,SNO_5_T1),
                      Eqn=c(rep('Original',times=length(SNO_Conc)),
                            rep("Taylor",times=length(SNO_Conc))))

Tay_SNO_5_plot<-ggplot(data=Tay_SNO_5)+
                geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
                scale_color_manual(values=c('#00BA38','#619CFF'))+
                ylab(expression(paste("Rate of degradation (mg
N/L.day)")))+
                xlab(expression(paste("Concentration (mg N/L)")))+
                theme_bw()+
                theme(legend.title = element_blank(),
                      text=element_text(family="Times New Roman"))
plot(Tay_SNO_5_plot)

Mc_SNO_5<-data.frame(Conc=c(SNO_Conc,SNO_Conc),
                     Rate=c(SNO_5_O,SNO_5_M),
                     Eqn=c(rep('Original',times=length(SNO_Conc)),
                           rep("McLaurin",times=length(SNO_Conc))))

Mc_SNO_5_plot<-ggplot(data=Mc_SNO_5)+
                geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
                scale_color_manual(values=c('#F8766D','#00BA38'))+
                ylab(expression(paste("Rate of degradation (mg
N/L.day)")))+
                xlab(expression(paste("Concentration (mg N/L)")))+
                theme_bw()+
                theme(legend.title = element_blank(),
                      text=element_text(family="Times New Roman"))
plot(Mc_SNO_5_plot)

Org_SNO_5<-data.frame(Conc=c(SNO_Conc),
                      Rate=c(SNO_5_O))

Org_SNO_5_plot<-ggplot(data=Org_SNO_5)+
                geom_line(aes(x=Conc,y=Rate),size=1.3,color='#00BA38')+
                ylab(expression(paste("Rate of degradation (mg
N/L.day)")))+
                xlab(expression(paste("Concentration (mg N/L)")))+
                theme_bw()+
                theme(legend.title = element_blank(),
                      text=element_text(family="Times New Roman"))
plot(Org_SNO_5_plot)


Rate_SNO_16<-data.frame(Conc=c(SNO_Conc,SNO_Conc,SNH_Conc),
                        Rate=c(SNO_16_O,SNO_16_T1,SNO_16_M),
                        Eqn=c(rep('Original',times=length(SNO_Conc)),
                              rep("Taylor",times=length(SNO_Conc)),
                              rep("McLaurin",times=length(SNO_Conc))))
```

```
Rate_SNO_16_plot<-ggplot(data=Rate_SNO_16)+
                  geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
                  theme_bw()+
                  theme(legend.title = element_blank(),
                    text=element_text(family="Times New Roman"))+
                  ylab(expression(paste("Rate of degradation (mg
N/L.day)")))+
                  xlab(expression(paste("Concentration (mg N/L)")))
plot(Rate_SNO_16_plot)

Tay_SNO_16<-data.frame(Conc=c(SNO_Conc,SNO_Conc),
                       Rate=c(SNO_16_O,SNO_16_T1),
                       Eqn=c(rep('Original',times=length(SNO_Conc)),
                             rep("Taylor",times=length(SNO_Conc))))

Tay_SNO_16_plot<-ggplot(data=Tay_SNO_16)+
                 geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
                 scale_color_manual(values=c('#00BA38','#619CFF'))+
                 ylab(expression(paste("Rate of degradation (mg
N/L.day)")))+
                 xlab(expression(paste("Concentration (mg N/L)")))+
                 theme_bw()+
                 theme(legend.title = element_blank(),
                       text=element_text(family="Times New Roman"))
plot(Tay_SNO_16_plot)

Mc_SNO_16<-data.frame(Conc=c(SNO_Conc,SNO_Conc),
                      Rate=c(SNO_16_O,SNO_16_M),
                      Eqn=c(rep('Original',times=length(SNO_Conc)),
                            rep("McLaurin",times=length(SNO_Conc))))

Mc_SNO_16_plot<-ggplot(data=Mc_SNO_16)+
                  geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
                  scale_color_manual(values=c('#F8766D','#00BA38'))+
                  ylab(expression(paste("Rate of degradation (mg
N/L.day)")))+
                  xlab(expression(paste("Concentration (mg N/L)")))+
                  theme_bw()+
                  theme(legend.title = element_blank(),
                        text=element_text(family="Times New Roman"))
plot(Mc_SNO_16_plot)

Org_SNO_16<-data.frame(Conc=c(SNO_Conc),
                               Rate=c(SNO_16_O))

Org_SNO_16_plot<-ggplot(data=Org_SNO_16)+
                  geom_line(aes(x=Conc,y=Rate),size=1.3,color='#00BA38')+
                  ylab(expression(paste("Rate of degradation (mg
N/L.day)")))+
                  xlab(expression(paste("Concentration (mg N/L)")))+
                  theme_bw()+
                  theme(legend.title = element_blank(),
                        text=element_text(family="Times New Roman"))
plot(Org_SNO_16_plot)
```

E.6 Sulphate sulphur

Growth of XASRB

Conc	Rate		
	Original	Taylor	McLaurin
0	0	-1.81E-08	0
0.035	-7.93E-11	-1.81E-08	-7.95E-11
0.07	-1.58E-10	-1.81E-08	-1.59E-10
0.175	-3.94E-10	-1.82E-08	-3.97E-10
0.35	-7.81E-10	-1.82E-08	-7.95E-10
0.7	-1.53E-09	-1.83E-08	-1.59E-09
1.75	-3.64E-09	-1.86E-08	-3.97E-09
3.5	-6.71E-09	-1.91E-08	-7.95E-09
7	-1.16E-08	-2.01E-08	-1.59E-08
17.5	-2.07E-08	-2.30E-08	-3.97E-08
35	-2.80E-08	-2.80E-08	-7.95E-08
42	-2.97E-08	-2.99E-08	-9.54E-08
43.75	-3.01E-08	-3.04E-08	-9.94E-08
52.5	-3.17E-08	-3.29E-08	-1.19E-07

The following code was used to generate the comparisons of the linearisation attempts and the original rates for sulphate sulphur

```
library(ggplot2)
library(ggthemes)
library(extrafont)
font_import()
loadfonts(device="win")

YH<-0.63;
YFB<-0.053;
YAMB<-0.032;
YASRB<-0.05;
YA<-0.24;
YSOB<-0.12;

KSA<-4;
KSF<-2;
KOH<-0.2;
KNHH<-0.05;
KH2SH<-140;
KNOH<-0.5;
KSFB<-28;
KH2SFB<-140;
KOFB<-0.2;
KNOFB<-0.5;
KNHFB<-0.01;
KSAMB<-56;
```

```
KH2SAMB<-140;
KOAMB<-0.0002;
KNOAMB<-0.0005;
KNHAMB<-0.01;
KSASRB<-24;
KSOASRB<-19;
KH2SASRB<-140;
KOASRB<-0.0002;
KNOASRB<-0.0005;
KNHASRB<-0.01;
kH<-3
KNHA<-0.5;
KH2SA<-140;
KOA<-1;
KSSOB<-0.24;
KOSOB<-0.2;
KNHSOB<-0.05;
KNOSOB<-0.5;
KX<-0.1;


muH<-6;
muA<-1;
muFB<-3;
muAMB<-0.085;
muASRB<-0.18;
muSOB<-5.28;
ng<-0.8; #not sure about this value, paper not clear
nuh<-0.1;
nuSOB<-0.7; #no value given, this is an approximation based on other rates

XH<-100;
XFB<-100;
XAMB<-1000;
XASRB<-340;
XS<-33;
XA<-100;
XSOB<-210;

SF<-170;
SO<-0.86;
SNH<-57;
SH2S<-34;
SNO<-50.4;
SA<-1;
SSO4<-35;

fHYDSI<-0.0;
fBMSF<-0.05;
fBMXI<-0.1;

iNXS<-0.04;
iNSF<-0.03;
iNSI<-0.01;
iNBM<-0.07;
iNXI<-0.03;

P_co_effs<-matrix(c(0,0,0,0,0,0,0,0,(-1)*(XH+nuh*XFB),0,kH*XS,0,0,0,0,0,
                    (1-(1/YH))*muH*

(SF/(KSF+SF))*(SF/(SF+SA))*(SNH/(KNHH*SNH))*(KH2SH/(KH2SH+SH2S))*XH,
```

```
                    (1/YH)*muH*

(SO/(KOH+SO))*(SNH/(KNHH*SNH))*(KH2SH/(KH2SH+SH2S))*XH,0,0,
                    ((iNSF/YH)-iNBM)*

(SF/(KSF+SF))*(SF/(SF+SA))*(SO/(KOH+SO))*(KH2SH/(KH2SH+SH2S))*XH,
                    0,0,0,0,0,0,0,0,0,0,
                    0,(-1/YH)*
                      (ng*muH*(SO/(KOH+SO))*

(SNO/(KOH+SNO))*(SNH/(KNHH*SNH))*(KH2SH/(KH2SH+SH2S))*XH),
                    0,0,(((iNSF/YH)-iNBM)*ng*muH*

(SF/(KSF+SF))*(SF/(SF+SA))*(SO/(KOH+SO))*(SNO/(KOH+SNO))*
                              (KH2SH/(KH2SH+SH2S))*XH),
                    (-((1-
YH)/(2.86*YH)))*ng*muH*(SF/(KSF+SF))*(SF/(SF+SA))*

(SO/(KOH+SO))*(SNH/(KNHH*SNH))*(KH2SH/(KH2SH+SH2S))*XH,0,0,0,0,0,0,0,0,0,
                    (1-(1/YH))*muH*

(SA/(KSA+SA))*(SA/(SF+SA))*(SNH/(KNHH+SNH))*(KH2SH/(KH2SH+SH2S))*XH,0,
                    (-
1/YH)*(SNH/(KNHH+SNH))*(SO/(KOH+SO))*(KH2SH/(KH2SH+SH2S))*XH,0,
                    (-
iNBM)*muH*(SA/(KSA+SA))*(SA/(SF+SA))*(SO/(KOH+SO))*(KH2SH/(KH2SH+SH2S)),
                    0,0,0,0,0,0,0,0,0,0,
                    0,0,(-1/YH)*ng*muH*

(KOH/(KOH+SO))*(SNO/(KNOH+SNO))*(SNH/(KNHH+SNH))*(KH2SH/(KH2SH+SH2S))*XH,0,
                    (-iNBM)*ng*muH*(SA/(KSA+SA))*

(SA/(SF+SA))*(KOH/(KOH+SO))*(SNO/(KNOH+SNO))*(KH2SH/(KH2SH+SH2S))*XH,
                    (-(1-YH)/(2.86*YH))*ng*muH*(SA/(KSA+SA))*

(SA/(SF+SA))*(KOH/(KOH+SO))*(SNH/(KNHH+SNH))*(KH2SH/(KH2SH+SH2S))*XH,
                    0,0,0,0,0,0,0,0,0,
                    0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
                    (-(4.57-
YA)/(YA))*muA*(SNH/(KNHA+SNH))*(KH2SA/(KH2SA+SH2S))*XA,0,0,0,
                    (-iNBM-
(1/YA))*muA*(SO/(KOA+SO))*(KH2SA/(KH2SA+SH2S)),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/YFB)*muFB*(KH2SFB/(KH2SFB+SH2S))*

(KOFB/(KOFB+SO))*(KNOFB/(KNOFB+SNO))*(SNH/(KNHFB+SNH))*XFB,0,0,
                    ((iNSF/YFB)-iNBM)*muFB*

(SF/(KSFB+SF))*(KH2SFB/(KH2SFB+SH2S))*(KOFB/(KOFB+SO))*(KNOFB/(KNOFB+SNO)),
                    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/YAMB)*muAMB*

(KH2SAMB/(KH2SAMB+SH2S))*(KOAMB/(KOAMB+SO))*(KNOAMB/(KNOAMB+SNO))*
                      (SNH/(KNHAMB+SNH))*XAMB,0,
                    (-
iNBM)*(SA/(KSAMB+SA))*(KH2SAMB/(KH2SAMB+SH2S))*(KOAMB/(KOAMB+SO))*

(KNOAMB/(KNOAMB+SNO))*(SNH/(KNHAMB+SNH))*XAMB,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/YASRB)*muASRB*(SSO4/(KSOASRB+SSO4))*(KH2SASRB/(KH2SASRB+SH2S))*

(KOASRB/(KOASRB+SO))*(KNOASRB/(KNOASRB+SNO))*(SNH/(KNHASRB+SNH))*XASRB,0,
                    (-iNBM)*muASRB*

(SA/(KSASRB+SA))*(SSO4/(KSOASRB+SSO4))*(KH2SASRB/(KH2SASRB+SH2S))*
                      (KOASRB/(KOASRB+SO))*(KNOASRB/(KNOASRB+SNO))*XASRB,0,
                    (-(1-
YASRB)/(2*YASRB))*muASRB*(SA/(KSASRB+SA))*(KH2SASRB/(KH2SASRB+SH2S))*

(KOASRB/(KOASRB+SO))*(KNOASRB/(KNOASRB+SNO))*(SNH/(KNHASRB+SNH))*XASRB,
                    ((1-
YASRB)/(2*YASRB))*muASRB*(SA/(KSASRB+SA))*(SSO4/(KSOASRB+SSO4))*

(KOASRB/(KOASRB+SO))*(KNOASRB/(KNOASRB+SNO))*(SNH/(KNHASRB+SNH))*XASRB,
                    0,0,0,0,0,0,0,0,
                    0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
                    (-(2-
YSOB)/YSOB)*muSOB*(SH2S/(KSSOB+SH2S))*(SNH/(KNHSOB+SNH))*XSOB,0,0,0,
                    (-
iNBM)*muSOB*(SH2S/(KSSOB+SH2S))*(SO/(KOSOB+SO))*XSOB,0,0,
                    (-
1/YSOB)*muSOB*(SO/(KOSOB+SO))*(SNH/(KNHSOB+SNH))*XSOB,0,0,0,0,0,0,0,
                    0,0,0,0,(-iNBM)*muSOB*nuSOB*

(SH2S/(KSSOB+SH2S))*(SNO/(KNOSOB+SNO))*(KOSOB/(KOSOB+SO))*XSOB,
                    (-(1-
YSOB)/(0.875*YSOB))*muSOB*nuSOB*(SH2S/(KSSOB+SH2S))*(KOSOB/(KOSOB+SO))*
                      (SNH/(KNHSOB+SNH))*XSOB,0,
                    (-1/YSOB)*muSOB*nuSOB*

(SNO/(KNOSOB+SNO))*(KOSOB/(KOSOB+SO))*(SNH/(KNHSOB+SNH))*XSOB,
                    0,0,0,0,0,0,0,0,
                    0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0),
                  nrow=17,byrow=TRUE)

Q_co_effs<-matrix(c(0,0,0,0,0,0,0,0,KX*(XH+XFB),0,nuh*XFB,0,0,0,0,0,
                    KOH,KSF,0,0,KNHH,0,0,0,0,0,0,0,0,0,0,0,
                    0,KSF,0,0,KNHH,KNOH,0,0,0,0,0,0,0,0,0,0,
                    KOH,0,KSA,0,KNHH,0,0,0,0,0,0,0,0,0,0,0,
                    0,0,KSA,0,KNHH,KNOH,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,
                    KOA,0,0,0,KNHA,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,KSFB,0,0,KNHFB,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,KSAMB,0,KNHAMB,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,KSASRB,0,KNHASRB,0,KSOASRB,KH2SASRB,0,0,0,0,0,0,0,0,
                    0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
                    KOSOB,0,0,0,KNHSOB,0,0,KSSOB,0,0,0,0,0,0,0,0,
                    0,0,0,0,KNHSOB,KNOSOB,0,KSSOB,0,0,0,0,0,0,0,0,
                    0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0),nrow=17,byrow=TRUE)

R1<-KX
R2<-SA
R3<-SA
R4<-SF
R5<-SF
```

```
T1<-XS+KX*XFB

SSO4_Conc<-c(0,0.035,0.07,0.175,0.35,0.7,1.75,3.5,7,17.5,35,42,43.75,52.5)
SO4_std_Conc<-35

SSO4_13_O<-P_co_effs[13,7]*SSO4_Conc/(Q_co_effs[13,7]+SSO4_Conc)
SSO4_13_M<-P_co_effs[13,7]*SSO4_Conc/Q_co_effs[13,7]
SSO4_13_T1<-(P_co_effs[13,7]*SO4_std_Conc/(SO4_std_Conc+Q_co_effs[13,7]))+

((P_co_effs[13,7]*Q_co_effs[13,7])/(SO4_std_Conc+Q_co_effs[13,7])^2)*
  (SSO4_Conc-SO4_std_Conc)

Rate_SSO4_13<-data.frame(Conc=c(SSO4_Conc,SSO4_Conc,SSO4_Conc),
                         Rate=c(SSO4_13_O,SSO4_13_T1,SSO4_13_M),
                         Eqn=c(rep('Original',times=length(SSO4_Conc)),
                               rep("Taylor",times=length(SSO4_Conc)),
                               rep("McLaurin",times=length(SSO4_Conc))))

Rate_SSO4_13_plot<-ggplot(data=Rate_SSO4_13)+
                    geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
                    theme_bw()+
                    theme(legend.title = element_blank(),
                      text=element_text(family="Times New Roman"))+
                    ylab(expression(paste("Rate of degradation (mg
S/L.day)")))+
                    xlab(expression(paste("Concentration (mg S/L)")))
plot(Rate_SSO4_13_plot)

Tay_SSO4_13<-data.frame(Conc=c(SSO4_Conc,SSO4_Conc),
                        Rate=c(SSO4_13_O,SSO4_13_T1),
                        Eqn=c(rep('Original',times=length(SSO4_Conc)),
                              rep("Taylor",times=length(SSO4_Conc))))

Tay_SSO4_13_plot<-ggplot(data=Tay_SSO4_13)+
                   geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
                   scale_color_manual(values=c('#00BA38','#619CFF'))+
                   ylab(expression(paste("Rate of degradation (mg
S/L.day)")))+
                   xlab(expression(paste("Concentration (mg S/L)")))+
                   theme_bw()+
                   theme(legend.title = element_blank(),
                         text=element_text(family="Times New Roman"))
plot(Tay_SSO4_13_plot)

Mc_SSO4_13<-data.frame(Conc=c(SSO4_Conc,SSO4_Conc),
                       Rate=c(SSO4_13_O,SSO4_13_M),
                       Eqn=c(rep('Original',times=length(SSO4_Conc)),
                             rep("McLaurin",times=length(SSO4_Conc))))

Mc_SSO4_13_plot<-ggplot(data=Mc_SSO4_13)+
                 geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
                 scale_color_manual(values=c('#F8766D','#00BA38'))+
                 ylab(expression(paste("Rate of production (mg S/L.day)")))+
                 xlab(expression(paste("Concentration (mg S/L)")))+
                 theme_bw()+
                 theme(legend.title = element_blank(),
                       text=element_text(family="Times New Roman"))
plot(Mc_SSO4_13_plot)

Org_SSO4_13<-data.frame(Conc=c(SSO4_Conc),
                        Rate=c(SSO4_13_O))
```

```
Org_SSO4_13_plot<-ggplot(data=Org_SSO4_13)+
                  geom_line(aes(x=Conc,y=Rate),size=1.3,color='#00BA38')+
                  ylab(expression(paste("Rate of degradation (mg
S/L.day)")))+
                  xlab(expression(paste("Concentration (mg S/L)")))+
                  theme_bw()+
                  theme(legend.title = element_blank(),
                        text=element_text(family="Times New Roman"))
plot(Org_SSO4_13_plot)
```

E.7 Dihydrogensulphide sulphur

Growth of XASRB

Conc	Rate		
	Original	Taylor	McLaurin
0	0	1.33E-09	0
0.034	8.44E-12	1.33E-09	8.44E-12
0.068	1.69E-11	1.34E-09	1.69E-11
0.17	4.22E-11	1.35E-09	4.22E-11
0.34	8.42E-11	1.38E-09	8.44E-11
0.68	1.68E-10	1.44E-09	1.69E-10
1.7	4.17E-10	1.60E-09	4.22E-10
3.4	8.24E-10	1.87E-09	8.44E-10
6.8	1.61E-09	2.42E-09	1.69E-09
17	3.76E-09	4.06E-09	4.22E-09
34	6.79E-09	6.79E-09	8.44E-09
40.8	7.84E-09	7.89E-09	1.01E-08
42.5	8.10E-09	8.16E-09	1.06E-08
51	9.28E-09	9.53E-09	1.27E-08

Aerobic growth of XSOB on SH2S

Conc	Rate		
	Original	Taylor	McLaurin
0	0	-7385.4	0
0.034	-929.42	-7385.45	-1061.09
0.068	-1653.64	-7385.51	-2122.18
0.17	-3105.62	-7385.66	-5305.44
0.34	-4390.71	-7385.92	-10610.9
0.68	-5536.11	-7386.44	-21221.8
1.7	-6563.43	-7388.01	-53054.4
3.4	-6996.19	-7390.61	-106109
6.8	-7234.69	-7395.83	-212218
17	-7385.76	-7411.47	-530544
34	-7437.53	-7437.53	-1061088
40.8	-7446.23	-7447.96	-1273306
42.5	-7447.97	-7450.57	-1326360
51	-7454.95	-7463.6	-1591632

Anoxic growth of XSOB on SH2S

Conc	Rate		
	Original	Taylor	McLaurin
0	0	-1190.46	0
0.034	-149.815	-1190.47	-171.038
0.068	-266.553	-1190.48	-342.077
0.17	-500.6	-1190.51	-855.192
0.34	-707.745	-1190.55	-1710.38
0.68	-892.375	-1190.63	-3420.77
1.7	-1057.97	-1190.88	-8551.92
3.4	-1127.73	-1191.3	-17103.8
6.8	-1166.17	-1192.15	-34207.7
17	-1190.52	-1194.67	-85519.2
34	-1198.87	-1198.87	-171038
40.8	-1200.27	-1200.55	-205246
42.5	-1200.55	-1200.97	-213798
51	-1201.68	-1203.07	-256558

The following code was used to generate the comparisons of the linearisation attempts and the original rates for dihydrogensulphide sulphur

```
library(ggplot2)
library(ggthemes)
library(extrafont)
font_import()
loadfonts(device="win")

YH<-0.63;
YFB<-0.053;
YAMB<-0.032;
YASRB<-0.05;
YA<-0.24;
YSOB<-0.12;

KSA<-4;
KSF<-2;
KOH<-0.2;
KNHH<-0.05;
KH2SH<-140;
KNOH<-0.5;
KSFB<-28;
KH2SFB<-140;
KOFB<-0.2;
KNOFB<-0.5;
KNHFB<-0.01;
KSAMB<-56;
KH2SAMB<-140;
KOAMB<-0.0002;
KNOAMB<-0.0005;
KNHAMB<-0.01;
```

```
KSASRB<-24;
KSOASRB<-19;
KH2SASRB<-140;
KOASRB<-0.0002;
KNOASRB<-0.0005;
KNHASRB<-0.01;
kH<-3
KNHA<-0.5;
KH2SA<-140;
KOA<-1;
KSSOB<-0.24;
KOSOB<-0.2;
KNHSOB<-0.05;
KNOSOB<-0.5;
KX<-0.1;


muH<-6;
muA<-1;
muFB<-3;
muAMB<-0.085;
muASRB<-0.18;
muSOB<-5.28;
ng<-0.8; #not sure about this value, paper not clear
nuh<-0.1;
nuSOB<-0.7; #no value given, this is an approximation based on other rates

XH<-100;
XFB<-100;
XAMB<-1000;
XASRB<-340;
XS<-33;
XA<-100;
XSOB<-210;

SF<-170;
SO<-0.86;
SNH<-57;
SH2S<-34;
SNO<-50.4;
SA<-1;
SSO4<-35;

fHYDSI<-0.0;
fBMSF<-0.05;
fBMXI<-0.1;

iNXS<-0.04;
iNSF<-0.03;
iNSI<-0.01;
iNBM<-0.07;
iNXI<-0.03;

P_co_effs<-matrix(c(0,0,0,0,0,0,0,0,(-1)*(XH+nuh*XFB),0,kH*XS,0,0,0,0,0,
                    (1-(1/YH))*muH*

(SF/(KSF+SF))*(SF/(SF+SA))*(SNH/(KNHH*SNH))*(KH2SH/(KH2SH+SH2S))*XH,
                    (1/YH)*muH*

(SO/(KOH+SO))*(SNH/(KNHH*SNH))*(KH2SH/(KH2SH+SH2S))*XH,0,0,
```

```
                        ((iNSF/YH)-
iNBM)*(SF/(KSF+SF))*(SF/(SF+SA))*(SO/(KOH+SO))*(KH2SH/(KH2SH+SH2S))*XH,
                        0,0,0,0,0,0,0,0,0,0,0,
                        0,(-1/YH)*

(ng*muH*(SO/(KOH+SO))*(SNO/(KOH+SNO))*(SNH/(KNHH*SNH))*(KH2SH/(KH2SH+SH2S))
*XH),
                        0,0,(((iNSF/YH)-
iNBM)*ng*muH*(SF/(KSF+SF))*(SF/(SF+SA))*(SO/(KOH+SO))*(SNO/(KOH+SNO))*
                                (KH2SH/(KH2SH+SH2S))*XH),(-((1-
YH)/(2.86*YH)))*ng*muH*(SF/(KSF+SF))*(SF/(SF+SA))*

(SO/(KOH+SO))*(SNH/(KNHH*SNH))*(KH2SH/(KH2SH+SH2S))*XH,0,0,0,0,0,0,0,0,0,0,
                        (1-
(1/YH))*muH*(SA/(KSA+SA))*(SA/(SF+SA))*(SNH/(KNHH+SNH))*(KH2SH/(KH2SH+SH2S)
)*XH,0,
                        (-
1/YH)*(SNH/(KNHH+SNH))*(SO/(KOH+SO))*(KH2SH/(KH2SH+SH2S))*XH,0,
                        (-
iNBM)*muH*(SA/(KSA+SA))*(SA/(SF+SA))*(SO/(KOH+SO))*(KH2SH/(KH2SH+SH2S)),
                        0,0,0,0,0,0,0,0,0,0,0,
                        0,0,(-1/YH)*ng*muH*

(KOH/(KOH+SO))*(SNO/(KNOH+SNO))*(SNH/(KNHH+SNH))*(KH2SH/(KH2SH+SH2S))*XH,0,
                        (-iNBM)*ng*muH*

(SA/(KSA+SA))*(SA/(SF+SA))*(KOH/(KOH+SO))*(SNO/(KNOH+SNO))*(KH2SH/(KH2SH+SH
2S))*XH,
                        (-(1-YH)/(2.86*YH))*ng*muH*

(SA/(KSA+SA))*(SA/(SF+SA))*(KOH/(KOH+SO))*(SNH/(KNHH+SNH))*(KH2SH/(KH2SH+SH
2S))*XH,
                        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,
                        (-(4.57-
YA)/(YA))*muA*(SNH/(KNHA+SNH))*(KH2SA/(KH2SA+SH2S))*XA,0,0,0,
                        (-iNBM-
(1/YA))*muA*(SO/(KOA+SO))*(KH2SA/(KH2SA+SH2S)),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/YFB)*muFB*(KH2SFB/(KH2SFB+SH2S))*

(KOFB/(KOFB+SO))*(KNOFB/(KNOFB+SNO))*(SNH/(KNHFB+SNH))*XFB,0,0,
                        ((iNSF/YFB)-iNBM)*muFB*

(SF/(KSFB+SF))*(KH2SFB/(KH2SFB+SH2S))*(KOFB/(KOFB+SO))*(KNOFB/(KNOFB+SNO)),
                        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/YAMB)*muAMB*

(KH2SAMB/(KH2SAMB+SH2S))*(KOAMB/(KOAMB+SO))*(KNOAMB/(KNOAMB+SNO))*
                          (SNH/(KNHAMB+SNH))*XAMB,0,
                        (-
iNBM)*(SA/(KSAMB+SA))*(KH2SAMB/(KH2SAMB+SH2S))*(KOAMB/(KOAMB+SO))*

(KNOAMB/(KNOAMB+SNO))*(SNH/(KNHAMB+SNH))*XAMB,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/YASRB)*muASRB*(SSO4/(KSOASRB+SSO4))*(KH2SASRB/(KH2SASRB+SH2S))*

(KOASRB/(KOASRB+SO))*(KNOASRB/(KNOASRB+SNO))*(SNH/(KNHASRB+SNH))*XASRB,0,
```

```
                    (-
iNBM)*muASRB*(SA/(KSASRB+SA))*(SSO4/(KSOASRB+SSO4))*(KH2SASRB/(KH2SASRB+SH2
S))*
                      (KOASRB/(KOASRB+SO))*(KNOASRB/(KNOASRB+SNO))*XASRB,0,
                    (-(1-
YASRB)/(2*YASRB))*muASRB*(SA/(KSASRB+SA))*(KH2SASRB/(KH2SASRB+SH2S))*

(KOASRB/(KOASRB+SO))*(KNOASRB/(KNOASRB+SNO))*(SNH/(KNHASRB+SNH))*XASRB,
                    ((1-
YASRB)/(2*YASRB))*muASRB*(SA/(KSASRB+SA))*(SSO4/(KSOASRB+SSO4))*

(KOASRB/(KOASRB+SO))*(KNOASRB/(KNOASRB+SNO))*(SNH/(KNHASRB+SNH))*XASRB,
                    0,0,0,0,0,0,0,0,
                    0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
                    (-(2-
YSOB)/YSOB)*muSOB*(SH2S/(KSSOB+SH2S))*(SNH/(KNHSOB+SNH))*XSOB,0,0,0,
                    (-
iNBM)*muSOB*(SH2S/(KSSOB+SH2S))*(SO/(KOSOB+SO))*XSOB,0,0,
                    (-
1/YSOB)*muSOB*(SO/(KOSOB+SO))*(SNH/(KNHSOB+SNH))*XSOB,0,0,0,0,0,0,0,0,
                    0,0,0,0,(-
iNBM)*muSOB*nuSOB*(SH2S/(KSSOB+SH2S))*(SNO/(KNOSOB+SNO))*(KOSOB/(KOSOB+SO))
*XSOB,
                    (-(1-
YSOB)/(0.875*YSOB))*muSOB*nuSOB*(SH2S/(KSSOB+SH2S))*(KOSOB/(KOSOB+SO))*
                      (SNH/(KNHSOB+SNH))*XSOB,0,
                    (-
1/YSOB)*muSOB*nuSOB*(SNO/(KNOSOB+SNO))*(KOSOB/(KOSOB+SO))*(SNH/(KNHSOB+SNH)
)*XSOB,
                    0,0,0,0,0,0,0,0,
                    0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0),
                  nrow=17,byrow=TRUE)

Q_co_effs<-matrix(c(0,0,0,0,0,0,0,0,KX*(XH+XFB),0,nuh*XFB,0,0,0,0,0,
                    KOH,KSF,0,0,KNHH,0,0,0,0,0,0,0,0,0,0,0,
                    0,KSF,0,0,KNHH,KNOH,0,0,0,0,0,0,0,0,0,0,
                    KOH,0,KSA,0,KNHH,0,0,0,0,0,0,0,0,0,0,0,
                    0,0,KSA,0,KNHH,KNOH,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,
                    KOA,0,0,0,KNHA,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,KSFB,0,0,KNHFB,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,KSAMB,0,KNHAMB,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,KSASRB,0,KNHASRB,0,KSOASRB,KH2SASRB,0,0,0,0,0,0,0,0,
                    0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
                    KOSOB,0,0,0,KNHSOB,0,0,KSSOB,0,0,0,0,0,0,0,0,
                    0,0,0,0,KNHSOB,KNOSOB,0,KSSOB,0,0,0,0,0,0,0,0,
                    0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0),nrow=17,byrow=TRUE)

R1<-KX
R2<-SA
R3<-SA
R4<-SF
R5<-SF
T1<-XS+KX*XFB

SH2S_Conc<-c(0,0.034,0.068,0.17,0.34,0.68,1.7,3.4,6.8,17,34,40.8,42.5,51)
H2S_std_Conc<-34
```

```
SH2S_13_O<-P_co_effs[13,8]*SH2S_Conc/(Q_co_effs[13,8]+SH2S_Conc)
SH2S_13_M<-P_co_effs[13,8]*SH2S_Conc/Q_co_effs[13,8]
SH2S_13_T1<-(P_co_effs[13,8]*H2S_std_Conc/(H2S_std_Conc+Q_co_effs[13,8]))+

((P_co_effs[13,8]*Q_co_effs[13,8])/(H2S_std_Conc+Q_co_effs[13,8])^2)*
              (SH2S_Conc-H2S_std_Conc)

SH2S_15_O<-P_co_effs[15,8]*SH2S_Conc/(Q_co_effs[15,8]+SH2S_Conc)
SH2S_15_M<-P_co_effs[15,8]*SH2S_Conc/Q_co_effs[15,8]
SH2S_15_T1<-(P_co_effs[15,8]*H2S_std_Conc/(H2S_std_Conc+Q_co_effs[15,8]))+

((P_co_effs[15,8]*Q_co_effs[15,8])/(H2S_std_Conc+Q_co_effs[15,8])^2)*
            (SH2S_Conc-H2S_std_Conc)

SH2S_16_O<-P_co_effs[16,8]*SH2S_Conc/(Q_co_effs[16,8]+SH2S_Conc)
SH2S_16_M<-P_co_effs[16,8]*SH2S_Conc/Q_co_effs[16,8]
SH2S_16_T1<-(P_co_effs[16,8]*H2S_std_Conc/(H2S_std_Conc+Q_co_effs[16,8]))+

((P_co_effs[16,8]*Q_co_effs[16,8])/(H2S_std_Conc+Q_co_effs[16,8])^2)*
              (SH2S_Conc-H2S_std_Conc)

Rate_SH2S_13<-data.frame(Conc=c(SH2S_Conc,SH2S_Conc,SH2S_Conc),
                         Rate=c(SH2S_13_O,SH2S_13_T1,SH2S_13_M),
                         Eqn=c(rep('Original',times=length(SH2S_Conc)),
                               rep("Taylor",times=length(SH2S_Conc)),
                               rep("McLaurin",times=length(SH2S_Conc))))

Rate_SH2S_13_plot<-ggplot(data=Rate_SH2S_13)+
                    geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
                    theme_bw()+
                    theme(legend.title = element_blank(),
                          text=element_text(family="Times New Roman"))+
                    ylab(expression(paste("Rate of degradation (mg
S/L.day)")))+
                    xlab(expression(paste("Concentration (mg S/L)")))
plot(Rate_SH2S_13_plot)

Tay_SH2S_13<-data.frame(Conc=c(SH2S_Conc,SH2S_Conc),
                        Rate=c(SH2S_13_O,SH2S_13_T1),
                        Eqn=c(rep('Original',times=length(SH2S_Conc)),
                              rep("Taylor",times=length(SH2S_Conc))))

Tay_SH2S_13_plot<-ggplot(data=Tay_SH2S_13)+
                  geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
                  scale_color_manual(values=c('#00BA38','#619CFF'))+
                  ylab(expression(paste("Rate of degradation (mg
S/L.day)")))+
                  xlab(expression(paste("Concentration (mg S/L)")))+
                  theme_bw()+
                  theme(legend.title = element_blank(),
                        text=element_text(family="Times New Roman"))
plot(Tay_SH2S_13_plot)

Mc_SH2S_13<-data.frame(Conc=c(SH2S_Conc,SH2S_Conc),
                       Rate=c(SH2S_13_O,SH2S_13_M),
                       Eqn=c(rep('Original',times=length(SH2S_Conc)),
                             rep("McLaurin",times=length(SH2S_Conc))))

Mc_SH2S_13_plot<-ggplot(data=Mc_SH2S_13)+
                  geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
```

```
                  scale_color_manual(values=c('#F8766D','#00BA38'))+
                  ylab(expression(paste("Rate of degradation (mg
S/L.day)")))+
                  xlab(expression(paste("Concentration (mg S/L)")))+
                  theme_bw()+
                  theme(legend.title = element_blank(),
                        text=element_text(family="Times New Roman"))
plot(Mc_SH2S_13_plot)

Org_SH2S_13<-data.frame(Conc=c(SH2S_Conc),
                        Rate=c(SH2S_13_O))

Org_SH2S_13_plot<-ggplot(data=Org_SH2S_13)+
                  geom_line(aes(x=Conc,y=Rate),size=1.3,color='#00BA38')+
                  ylab(expression(paste("Rate of degradation (mg
S/L.day)")))+
                  xlab(expression(paste("Concentration (mg S/L)")))+
                  theme_bw()+
                  theme(legend.title = element_blank(),
                        text=element_text(family="Times New Roman"))
plot(Org_SH2S_13_plot)

Rate_SH2S_15<-data.frame(Conc=c(SH2S_Conc,SH2S_Conc,SH2S_Conc),
                         Rate=c(SH2S_15_O,SH2S_15_T1,SH2S_15_M),
                         Eqn=c(rep('Original',times=length(SH2S_Conc)),
                               rep("Taylor",times=length(SH2S_Conc)),
                               rep("McLaurin",times=length(SH2S_Conc))))

Rate_SH2S_15_plot<-ggplot(data=Rate_SH2S_15)+
                   geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
                   theme_bw()+
                   theme(legend.title = element_blank(),
                     text=element_text(family="Times New Roman"))+
                   ylab(expression(paste("Rate of degradation (mg
S/L.day)")))+
                   xlab(expression(paste("Concentration (mg S/L)")))
plot(Rate_SH2S_15_plot)

Tay_SH2S_15<-data.frame(Conc=c(SH2S_Conc,SH2S_Conc),
                        Rate=c(SH2S_15_O,SH2S_15_T1),
                        Eqn=c(rep('Original',times=length(SH2S_Conc)),
                              rep("Taylor",times=length(SH2S_Conc))))

Tay_SH2S_15_plot<-ggplot(data=Tay_SH2S_15)+
                  geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
                  scale_color_manual(values=c('#00BA38','#619CFF'))+
                  ylab(expression(paste("Rate of degradation (mg
S/L.day)")))+
                  xlab(expression(paste("Concentration (mg S/L)")))+
                  theme_bw()+
                  theme(legend.title = element_blank(),
                        text=element_text(family="Times New Roman"))
plot(Tay_SH2S_15_plot)

Mc_SH2S_15<-data.frame(Conc=c(SH2S_Conc,SH2S_Conc),
                       Rate=c(SH2S_15_O,SH2S_15_M),
                       Eqn=c(rep('Original',times=length(SH2S_Conc)),
                             rep("McLaurin",times=length(SH2S_Conc))))

Mc_SH2S_15_plot<-ggplot(data=Mc_SH2S_15)+
                  geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
```

```
                  scale_color_manual(values=c('#F8766D','#00BA38'))+
                  ylab(expression(paste("Rate of degradation (mg
S/L.day)")))+
                  xlab(expression(paste("Concentration (mg S/L)")))+
                  theme_bw()+
                  theme(legend.title = element_blank(),
                        text=element_text(family="Times New Roman"))
plot(Mc_SH2S_15_plot)

Org_SH2S_15<-data.frame(Conc=c(SH2S_Conc),
                        Rate=c(SH2S_15_O))

Org_SH2S_15_plot<-ggplot(data=Org_SH2S_15)+
                  geom_line(aes(x=Conc,y=Rate),size=1.3,color='#00BA38')+
                  ylab(expression(paste("Rate of degradation (mg
S/L.day)")))+
                  xlab(expression(paste("Concentration (mg S/L)")))+
                  theme_bw()+
                  theme(legend.title = element_blank(),
                        text=element_text(family="Times New Roman"))
plot(Org_SH2S_15_plot)

Rate_SH2S_16<-data.frame(Conc=c(SH2S_Conc,SH2S_Conc,SH2S_Conc),
                         Rate=c(SH2S_16_O,SH2S_16_T1,SH2S_16_M),
                         Eqn=c(rep('Original',times=length(SH2S_Conc)),
                               rep("Taylor",times=length(SH2S_Conc)),
                               rep("McLaurin",times=length(SH2S_Conc))))

Rate_SH2S_16_plot<-ggplot(data=Rate_SH2S_16)+
                   geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
                   theme_bw()+
                   theme(legend.title = element_blank(),
                     text=element_text(family="Times New Roman"))+
                   ylab(expression(paste("Rate of degradation (mg
S/L.day)")))+
                   xlab(expression(paste("Concentration (mg S/L)")))
plot(Rate_SH2S_16_plot)

Tay_SH2S_16<-data.frame(Conc=c(SH2S_Conc,SH2S_Conc),
                        Rate=c(SH2S_16_O,SH2S_16_T1),
                        Eqn=c(rep('Original',times=length(SH2S_Conc)),
                              rep("Taylor",times=length(SH2S_Conc))))

Tay_SH2S_16_plot<-ggplot(data=Tay_SH2S_16)+
                  geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
                  scale_color_manual(values=c('#00BA38','#619CFF'))+
                  ylab(expression(paste("Rate of degradation (mg
S/L.day)")))+
                  xlab(expression(paste("Concentration (mg S/L)")))+
                  theme_bw()+
                  theme(legend.title = element_blank(),
                        text=element_text(family="Times New Roman"))
plot(Tay_SH2S_16_plot)

Mc_SH2S_16<-data.frame(Conc=c(SH2S_Conc,SH2S_Conc),
                       Rate=c(SH2S_16_O,SH2S_16_M),
                       Eqn=c(rep('Original',times=length(SH2S_Conc)),
                             rep("McLaurin",times=length(SH2S_Conc))))

Mc_SH2S_16_plot<-ggplot(data=Mc_SH2S_16)+
                  geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
```

```
                  scale_color_manual(values=c('#F8766D','#00BA38'))+
                  ylab(expression(paste("Rate of degradation (mg
S/L.day)")))+
                  xlab(expression(paste("Concentration (mg S/L)")))+
                  theme_bw()+
                  theme(legend.title = element_blank(),
                        text=element_text(family="Times New Roman"))
plot(Mc_SH2S_16_plot)

Org_SH2S_16<-data.frame(Conc=c(SH2S_Conc),
                        Rate=c(SH2S_16_O))

Org_SH2S_16_plot<-ggplot(data=Org_SH2S_15)+
                  geom_line(aes(x=Conc,y=Rate),size=1.3,color='#00BA38')+
                  ylab(expression(paste("Rate of degradation (mg
S/L.day)")))+
                  xlab(expression(paste("Concentration (mg S/L)")))+
                  theme_bw()+
                  theme(legend.title = element_blank(),
                        text=element_text(family="Times New Roman"))
plot(Org_SH2S_16_plot)
```

E.8 Slowly biodegradable particulate COD

Hydrolysis

Conc	Rate		
	Original	Taylor	McLaurin
0	0	-42.6451	0
0.033	-0.1812	-42.6709	-0.1815
0.066	-0.36181	-42.6968	-0.363
0.165	-0.90007	-42.7743	-0.9075
0.33	-1.78554	-42.9035	-1.815
0.66	-3.51404	-43.162	-3.63
1.65	-8.38337	-43.9373	-9.075
3.3	-15.5794	-45.2296	-18.15
6.6	-27.2932	-47.8142	-36.3
16.5	-49.726	-55.5678	-90.75
33	-68.4906	-68.4906	-181.5
39.5	-73.0252	-73.5813	-217.25
41.25	-74.0816	-74.9519	-226.875
49.5	-78.3453	-81.4133	-272.25

CODE

The following code was used to generate the comparisons of the linearisation attempts and the original rates for slowly biodegradable particulate COD

```
library(ggplot2)
library(ggthemes)
library(extrafont)
font_import()
loadfonts(device="win")

YH<-0.63;
YFB<-0.053;
YAMB<-0.032;
YASRB<-0.05;
YA<-0.24;
YSOB<-0.12;

KSA<-4;
KSF<-2;
KOH<-0.2;
KNHH<-0.05;
KH2SH<-140;
KNOH<-0.5;
KSFB<-28;
KH2SFB<-140;
KOFB<-0.2;
KNOFB<-0.5;
```

```
KNHFB<-0.01;
KSAMB<-56;
KH2SAMB<-140;
KOAMB<-0.0002;
KNOAMB<-0.0005;
KNHAMB<-0.01;
KSASRB<-24;
KSOASRB<-19;
KH2SASRB<-140;
KOASRB<-0.0002;
KNOASRB<-0.0005;
KNHASRB<-0.01;
kH<-3
KNHA<-0.5;
KH2SA<-140;
KOA<-1;
KSSOB<-0.24;
KOSOB<-0.2;
KNHSOB<-0.05;
KNOSOB<-0.5;
KX<-0.1;


muH<-6;
muA<-1;
muFB<-3;
muAMB<-0.085;
muASRB<-0.18;
muSOB<-5.28;
ng<-0.8; #not sure about this value, paper not clear
nuh<-0.1;
nuSOB<-0.7; #no value given, this is an approximation based on other rates

XH<-100;
XFB<-100;
XAMB<-1000;
XASRB<-340;
XS<-33;
XA<-100;
XSOB<-210;

SF<-170;
SO<-0.86;
SNH<-57;
SH2S<-34;
SNO<-50.4;
SA<-1;
SSO4<-35;

fHYDSI<-0.0;
fBMSF<-0.05;
fBMXI<-0.1;

iNXS<-0.04;
iNSF<-0.03;
iNSI<-0.01;
iNBM<-0.07;
iNXI<-0.03;

P_co_effs<-matrix(c(0,0,0,0,0,0,0,0,(-1)*(XH+nuh*XFB),0,kH*XS,0,0,0,0,0,
                    (1-(1/YH))*muH*
```

```
(SF/(KSF+SF))*(SF/(SF+SA))*(SNH/(KNHH*SNH))*(KH2SH/(KH2SH+SH2S))*XH,
                      (1/YH)*muH*

(SO/(KOH+SO))*(SNH/(KNHH*SNH))*(KH2SH/(KH2SH+SH2S))*XH,0,0,
                      ((iNSF/YH)-
iNBM)*(SF/(KSF+SF))*(SF/(SF+SA))*(SO/(KOH+SO))*(KH2SH/(KH2SH+SH2S))*XH,
                      0,0,0,0,0,0,0,0,0,0,
                      0,(-1/YH)*

(ng*muH*(SO/(KOH+SO))*(SNO/(KOH+SNO))*(SNH/(KNHH*SNH))*(KH2SH/(KH2SH+SH2S))
*XH),
                      0,0,(((iNSF/YH)-
iNBM)*ng*muH*(SF/(KSF+SF))*(SF/(SF+SA))*(SO/(KOH+SO))*(SNO/(KOH+SNO))*
                                (KH2SH/(KH2SH+SH2S))*XH),(-((1-
YH)/(2.86*YH)))*ng*muH*(SF/(KSF+SF))*(SF/(SF+SA))*

(SO/(KOH+SO))*(SNH/(KNHH*SNH))*(KH2SH/(KH2SH+SH2S))*XH,0,0,0,0,0,0,0,0,0,
                      (1-
(1/YH))*muH*(SA/(KSA+SA))*(SA/(SF+SA))*(SNH/(KNHH+SNH))*(KH2SH/(KH2SH+SH2S)
)*XH,0,
                      (-
1/YH)*(SNH/(KNHH+SNH))*(SO/(KOH+SO))*(KH2SH/(KH2SH+SH2S))*XH,0,
                      (-
iNBM)*muH*(SA/(KSA+SA))*(SA/(SF+SA))*(SO/(KOH+SO))*(KH2SH/(KH2SH+SH2S)),
                      0,0,0,0,0,0,0,0,0,0,
                      0,0,(-1/YH)*ng*muH*

(KOH/(KOH+SO))*(SNO/(KNOH+SNO))*(SNH/(KNHH+SNH))*(KH2SH/(KH2SH+SH2S))*XH,0,
                      (-iNBM)*ng*muH*

(SA/(KSA+SA))*(SA/(SF+SA))*(KOH/(KOH+SO))*(SNO/(KNOH+SNO))*(KH2SH/(KH2SH+SH
2S))*XH,
                      (-(1-YH)/(2.86*YH))*ng*muH*

(SA/(KSA+SA))*(SA/(SF+SA))*(KOH/(KOH+SO))*(SNH/(KNHH+SNH))*(KH2SH/(KH2SH+SH
2S))*XH,
                      0,0,0,0,0,0,0,0,0,
                      0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
                      (-(4.57-
YA)/(YA))*muA*(SNH/(KNHA+SNH))*(KH2SA/(KH2SA+SH2S))*XA,0,0,0,
                      (-iNBM-
(1/YA))*muA*(SO/(KOA+SO))*(KH2SA/(KH2SA+SH2S)),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/YFB)*muFB*(KH2SFB/(KH2SFB+SH2S))*

(KOFB/(KOFB+SO))*(KNOFB/(KNOFB+SNO))*(SNH/(KNHFB+SNH))*XFB,0,0,
                      ((iNSF/YFB)-iNBM)*muFB*

(SF/(KSFB+SF))*(KH2SFB/(KH2SFB+SH2S))*(KOFB/(KOFB+SO))*(KNOFB/(KNOFB+SNO)),
                      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/YAMB)*muAMB*(KH2SAMB/(KH2SAMB+SH2S))*(KOAMB/(KOAMB+SO))*(KNOAMB/(KNOAMB+S
NO))*
                        (SNH/(KNHAMB+SNH))*XAMB,0,
                      (-
iNBM)*(SA/(KSAMB+SA))*(KH2SAMB/(KH2SAMB+SH2S))*(KOAMB/(KOAMB+SO))*

(KNOAMB/(KNOAMB+SNO))*(SNH/(KNHAMB+SNH))*XAMB,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/YASRB)*muASRB*(SSO4/(KSOASRB+SSO4))*(KH2SASRB/(KH2SASRB+SH2S))*

(KOASRB/(KOASRB+SO))*(KNOASRB/(KNOASRB+SNO))*(SNH/(KNHASRB+SNH))*XASRB,0,
                    (-
iNBM)*muASRB*(SA/(KSASRB+SA))*(SSO4/(KSOASRB+SSO4))*(KH2SASRB/(KH2SASRB+SH2
S))*
                      (KOASRB/(KOASRB+SO))*(KNOASRB/(KNOASRB+SNO))*XASRB,0,
                    (-(1-
YASRB)/(2*YASRB))*muASRB*(SA/(KSASRB+SA))*(KH2SASRB/(KH2SASRB+SH2S))*

(KOASRB/(KOASRB+SO))*(KNOASRB/(KNOASRB+SNO))*(SNH/(KNHASRB+SNH))*XASRB,
                    ((1-
YASRB)/(2*YASRB))*muASRB*(SA/(KSASRB+SA))*(SSO4/(KSOASRB+SSO4))*

(KOASRB/(KOASRB+SO))*(KNOASRB/(KNOASRB+SNO))*(SNH/(KNHASRB+SNH))*XASRB,
                    0,0,0,0,0,0,0,0,
                    0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
                    (-(2-
YSOB)/YSOB)*muSOB*(SH2S/(KSSOB+SH2S))*(SNH/(KNHSOB+SNH))*XSOB,0,0,0,
                    (-
iNBM)*muSOB*(SH2S/(KSSOB+SH2S))*(SO/(KOSOB+SO))*XSOB,0,0,
                    (-
1/YSOB)*muSOB*(SO/(KOSOB+SO))*(SNH/(KNHSOB+SNH))*XSOB,0,0,0,0,0,0,0,
                    0,0,0,0,(-
iNBM)*muSOB*nuSOB*(SH2S/(KSSOB+SH2S))*(SNO/(KNOSOB+SNO))*(KOSOB/(KOSOB+SO))
*XSOB,
                    (-(1-
YSOB)/(0.875*YSOB))*muSOB*nuSOB*(SH2S/(KSSOB+SH2S))*(KOSOB/(KOSOB+SO))*
                      (SNH/(KNHSOB+SNH))*XSOB,0,
                    (-
1/YSOB)*muSOB*nuSOB*(SNO/(KNOSOB+SNO))*(KOSOB/(KOSOB+SO))*(SNH/(KNHSOB+SNH)
)*XSOB,
                    0,0,0,0,0,0,0,0,
                    0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0),
                  nrow=17,byrow=TRUE)

Q_co_effs<-matrix(c(0,0,0,0,0,0,0,0,KX*(XH+XFB),0,nuh*XFB,0,0,0,0,0,
                    KOH,KSF,0,0,KNHH,0,0,0,0,0,0,0,0,0,0,0,
                    0,KSF,0,0,KNHH,KNOH,0,0,0,0,0,0,0,0,0,0,
                    KOH,0,KSA,0,KNHH,0,0,0,0,0,0,0,0,0,0,0,
                    0,0,KSA,0,KNHH,KNOH,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,
                    KOA,0,0,0,KNHA,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,KSFB,0,0,KNHFB,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,KSAMB,0,KNHAMB,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,KSASRB,0,KNHASRB,0,KSOASRB,KH2SASRB,0,0,0,0,0,0,0,0,
                    0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
                    KOSOB,0,0,0,KNHSOB,0,0,KSSOB,0,0,0,0,0,0,0,0,
                    0,0,0,0,KNHSOB,KNOSOB,0,KSSOB,0,0,0,0,0,0,0,0,
                    0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0),nrow=17,byrow=TRUE)

R1<-KX
R2<-SA
R3<-SA
R4<-SF
R5<-SF
```

```
T1<-XS+KX*XFB

XS_Conc<-
c(0,0.033,0.066,0.165,0.33,0.66,1.65,3.3,6.6,16.5,33,39.5,41.25,49.5)
XS_std_Conc<-33

XS_1_O<-P_co_effs[1,9]*XS_Conc/(Q_co_effs[1,9]+XS_Conc)
XS_1_M<-P_co_effs[1,9]*XS_Conc/Q_co_effs[1,9]
XS_1_T1<-(P_co_effs[1,9]*XS_std_Conc/(XS_std_Conc+Q_co_effs[1,9]))+

((P_co_effs[1,9]*Q_co_effs[1,9])/(XS_std_Conc+Q_co_effs[1,9])^2)*
            (XS_Conc-XS_std_Conc)

Rate_XS_1<-data.frame(Conc=c(XS_Conc,XS_Conc,XS_Conc),
                      Rate=c(XS_1_O,XS_1_T1,XS_1_M),
                      Eqn=c(rep('Original',times=length(XS_Conc)),
                            rep("Taylor",times=length(XS_Conc)),
                            rep("McLaurin",times=length(XS_Conc))))

Rate_XS_1_plot<-ggplot(data=Rate_XS_1)+
                geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
                theme_bw()+
                theme(legend.title = element_blank(),
                  text=element_text(family="Times New Roman"))+
                ylab(expression(paste("Rate of degradation (mg
COD/L.day)")))+
                xlab(expression(paste("Concentration (mg COD/L)")))

plot(Rate_XS_1_plot)

Tay_XS_1<-data.frame(Conc=c(XS_Conc,XS_Conc),
                      Rate=c(XS_1_O,XS_1_T1),
                      Eqn=c(rep('Original',times=length(XS_Conc)),
                            rep("Taylor",times=length(XS_Conc))))

Tay_XS_1_plot<-ggplot(data=Tay_XS_1)+
                geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
                scale_color_manual(values=c('#00BA38','#619CFF'))+
                ylab(expression(paste("Rate of degradation (mg
COD/L.day)")))+
                xlab(expression(paste("Concentration (mg COD/L)")))+
                theme_bw()+
                theme(legend.title = element_blank(),
                      text=element_text(family="Times New Roman"))
plot(Tay_XS_1_plot)

Mc_XS_1<-data.frame(Conc=c(XS_Conc,XS_Conc),
                    Rate=c(XS_1_O,XS_1_M),
                    Eqn=c(rep('Original',times=length(XS_Conc)),
                          rep("McLaurin",times=length(XS_Conc))))

Mc_XS_1_plot<-ggplot(data=Mc_XS_1)+
              geom_line(aes(x=Conc,y=Rate,colour=Eqn),size=1.3)+
              scale_color_manual(values=c('#F8766D','#00BA38'))+
              ylab(expression(paste("Rate of degradation (mg
COD/L.day)")))+
              xlab(expression(paste("Concentration (mg COD/L)")))+
              theme_bw()+
              theme(legend.title = element_blank(),
                    text=element_text(family="Times New Roman"))
plot(Mc_XS_1_plot)
```

```
Org_XS_1<-data.frame(Conc=c(XS_Conc),
                     Rate=c(XS_1_O))

Org_XS_1_plot<-ggplot(data=Org_XS_1)+
                geom_line(aes(x=Conc,y=Rate),size=1.3,color='#00BA38')+
                ylab(expression(paste("Rate of degradation (mg
COD/L.day)")))+
                xlab(expression(paste("Concentration (mg COD/L)")))+
                theme_bw()+
                theme(legend.title = element_blank(),
                      text=element_text(family="Times New Roman"))
plot(Org_XS_1_plot)
```

Appendix F

Average concentration of uranine in the gravel columns, data used to generate Figure 7.2 and Figure 7.3

Sample number	Delta t (min)	Concentration (ppb)	Standard deviation
1	0	1.488	0.130108
2	4	1.393778	0.196894
3	8	1.353111	0.170315
4	12	1.448	0.183032
5	16	2.186333	0.443252
6	20	8.496556	4.725386
7	24	20.36256	8.631064
8	28	32.45133	8.93859
9	32	40.686	7.323525
10	36	46.20111	6.084521
11	40	47.17611	2.099869
12	44	46.50633	3.31044
13	48	44.84344	2.202558
14	52	41.34044	0.725535
15	56	35.11456	0.068507
16	60	32.85867	0.613723
17	64	29.85744	0.645439
18	68	26.13211	0.479887
19	72	23.73011	0.505402
20	76	21.37156	1.522698
21	80	20.33156	1.086039
22	84	18.59656	1.628267
23	88	16.64956	1.79489
24	92	14.82122	1.919856
25	96	14.10867	2.039444
26	100	13.34	1.398002
27	104	11.75567	0.88391
28	108	11.07911	0.802528
29	112	10.38889	0.865374
30	116	9.404667	0.704424
31	120	8.434222	0.587788
32	124	7.958222	0.586838
33	128	7.178222	0.495397
34	132	6.872778	0.58271
35	136	6.546778	0.368895

36	140	5.892889	0.701843
37	144	5.721222	0.518715
38	148	5.273667	0.434347
39	152	4.656111	0.400078
40	156	4.414556	0.457095
41	160	4.093222	0.360996
42	164	3.851889	0.10888
43	168	3.644556	0.314324
44	172	3.428556	0.042327
45	176	3.241	0.211322
46	180	3.029444	0.318102
47	184	3.065	0.262265
48	188	2.989667	0.257757
49	192	2.635889	0.377492
50	196	2.614556	0.189062
51	200	2.462889	0.215538
52	204	2.502444	0.244136
53	208	2.248	0.107778
54	212	2.131111	0.191851
55	216	2.105889	0.070386
56	220	1.970222	0.064114
57	224	1.886	0.074301
58	228	1.840667	0.122762
59	232	1.903111	0.104574
60	236	1.818111	0.116516
61	240	1.924889	0.389925
62	244	1.696126	0.216055
63	248	1.690668	0.134883
64	252	1.683103	0.102802
65	256	1.615696	0.154861
66	260	1.590107	0.149617
67	264	1.572328	0.134669
68	268	1.53454	0.147924
69	272	1.504033	0.151998
70	276	1.474172	0.155922
71	280	1.444942	0.15969
72	284	1.41633	0.163302
73	288	1.388321	0.166755
74	292	1.360903	0.17005
75	296	1.334061	0.173188
76	300	1.307785	0.176171
77	304	1.28206	0.178999
78	308	1.256874	0.181677
79	312	1.232217	0.184207
80	316	1.208075	0.186591

Source code for graph and hydraulic parameter

```
library(readr) #read csv files
library(suncalc)
library(readxl)
library(ggplot2)
library(TTR)
library(pracma)
library(stats)
library(extrafont)
font_import()
loadfonts(device="win")


getwd()
setwd("C:\\Users\\User\\OneDrive\\2019\\PhD 2019\\URBWAT\\Excel
spreadsheet")
Raw_data<-read_excel("Impulse mom method data.xlsx", na="n.a.")

#plots
Gravel<-data.frame(Time=c(as.numeric(Raw_data$Av_DT)),
                   Concentration=c(as.numeric((Raw_data$Av_Conc))),
                   SD=c(as.numeric((Raw_data$Av_SD_C))))

Gravel_plot<-ggplot(data=Gravel)+
  geom_jitter(aes(x=Time,y=Concentration))+
  geom_line(aes(x=Time,y=Concentration))+
  geom_ribbon(aes(ymin=Concentration-SD,
                  ymax=Concentration+SD,x=Time),
              alpha=0.2)+
  xlab("Time (minutes)")+ylab("Concentration (ppb)")+
  theme_bw()+
  theme(legend.position = 'none',
        text=element_text(family="Times New Roman"))

plot(Gravel_plot)
```

Original data from all the three individual gravel columns

Gravel column 1

Delta t (min)	Concentration measured (ppb)				Standard deviation
	1	2	3	Average	
0	1.58	1.58	1.58	1.58	0
4	1.565	1.565	1.565	1.565	2.22E-16
8	1.473	1.473	1.458	1.468	0.007071
12	1.458	1.458	1.458	1.458	0
16	1.764	1.764	1.764	1.764	0
20	4.85	4.85	4.85	4.85	0

24	12.23	12.23	12.23	12.23	1.78E-15
28	22.269	22.269	22.269	22.269	3.55E-15
32	31.758	31.758	31.758	31.758	0
36	37.611	37.595	37.595	37.60033	0.007542
40	44.227	44.212	44.181	44.20667	0.019154
44	43.631	43.631	43.631	43.631	0
48	43.738	43.723	43.738	43.733	0.007071
52	42.027	42.011	41.996	42.01133	0.012658
56	35.044	35.044	35.044	35.044	0
60	33.225	33.179	33.179	33.19433	0.021685
64	30.383	30.368	30.368	30.373	0.007071
68	26.456	26.426	26.441	26.441	0.012247
72	23.232	23.232	23.217	23.227	0.007071
76	20.741	20.726	20.726	20.731	0.007071
80	20.1	20.13	20.115	20.115	0.012247
84	18.617	18.617	18.602	18.612	0.007071
88	16.9	16.937	16.937	16.92467	0.017442
92	15.225	15.225	15.21	15.22	0.007071
96	14.186	14.217	14.202	14.20167	0.012658
100	13.544	13.529	13.544	13.539	0.007071
104	12.032	12.016	12.016	12.02133	0.007542
108	11.359	11.512	11.543	11.47133	0.080434
112	10.58	10.58	10.595	10.585	0.007071
116	10.168	10.137	10.122	10.14233	0.019154
120	9.113	9.129	9.144	9.128667	0.012658
124	8.502	8.502	8.517	8.507	0.007071
128	7.845	7.891	7.891	7.875667	0.021685
132	7.585	7.585	7.585	7.585	0
136	7.05	7.05	7.05	7.05	0
140	6.882	6.882	6.852	6.872	0.014142
144	6.455	6.455	6.439	6.449667	0.007542
148	5.813	5.813	5.828	5.818	0.007071
152	5.202	5.202	5.202	5.202	0
156	5.064	5.064	5.033	5.053667	0.014614
160	4.59	4.606	4.606	4.600667	0.007542
164	3.994	3.979	3.979	3.984	0.007071
168	4.071	4.071	4.071	4.071	0
172	3.811	3.811	2.826	3.482667	0.464333
176	3.521	3.521	3.505	3.515667	0.007542
180	3.444	3.444	3.46	3.449333	0.007542
184	3.429	3.429	3.429	3.429	0
188	3.292	3.276	3.261	3.276333	0.012658
192	3.108	3.108	3.108	3.108	0
196	2.833	2.833	2.848	2.838	0.007071
200	2.757	2.757	2.741	2.751667	0.007542
204	2.818	2.818	2.818	2.818	0

208	2.375	2.375	2.39	2.38	0.007071
212	2.344	2.344	2.344	2.344	0
216	2.191	2.176	2.191	2.186	0.007071
220	2.039	2.039	2.039	2.039	0
224	1.886	1.886	1.886	1.886	0
228	1.977	1.962	1.977	1.972	0.007071
232	1.977	1.962	1.977	1.972	0.007071
236	1.916	1.886	1.901	1.901	0.012247
240	2.497	2.451	2.451	2.466333	0.021685

Gravel column 2

Delta t (min)	**Concentration measured (ppb)**				**Standard deviation**
	1	2	3	Average	
0	1.304	1.304	1.304	1.304	0
4	1.118	1.118	1.118	1.118	0
8	1.101	1.118	1.118	1.112333	0.008014
12	1.219	1.219	1.219	1.219	0
16	2.81	2.793	2.793	2.798667	0.008014
20	15.181	15.164	15.164	15.16967	0.008014
24	32.284	32.334	32.317	32.31167	0.020758
28	44.205	43.934	43.951	44.03	0.123938
32	49.691	49.69	49.708	49.69633	0.00826
36	50.741	50.724	50.724	50.72967	0.008014
40	48.675	48.709	48.692	48.692	0.01388
44	44.763	44.73	44.74	44.74433	0.013816
48	42.952	42.85	42.833	42.87833	0.052551
52	40.344	40.327	40.327	40.33267	0.008014
56	35.213	35.213	35.196	35.20733	0.008014
60	33.401	33.384	33.367	33.384	0.01388
64	30.252	30.252	30.252	30.252	0
68	25.443	25.46	25.46	25.45433	0.008014
72	24.41	24.427	24.427	24.42133	0.008014
76	23.461	23.478	23.478	23.47233	0.008014
80	21.768	21.751	21.751	21.75667	0.008014
84	20.583	20.583	20.583	20.583	0
88	18.703	18.703	18.686	18.69733	0.008014
92	16.942	16.942	16.959	16.94767	0.008014
96	16.57	16.553	16.553	16.55867	0.008014
100	14.944	14.944	14.944	14.944	0
104	12.692	12.675	12.675	12.68067	0.008014

108	11.811	11.794	11.811	11.80533	0.008014
112	11.337	11.337	11.337	11.337	1.78E-15
116	9.61	9.627	9.61	9.615667	0.008014
120	8.477	8.494	8.477	8.482667	0.008014
124	8.223	8.223	8.223	8.223	0
128	6.887	6.887	6.887	6.887	0
132	6.87	6.87	6.887	6.875667	0.008014
136	6.176	6.176	6.176	6.176	8.88E-16
140	5.55	5.533	5.55	5.544333	0.008014
144	5.432	5.432	5.432	5.432	8.88E-16
148	4.755	4.755	4.755	4.755	0
152	4.231	4.248	4.284	4.254333	0.022096
156	4.011	4.011	4.011	4.011	0
160	3.791	3.791	3.791	3.791	0
164	3.723	3.706	3.723	3.717333	0.008014
168	3.334	3.317	3.317	3.322667	0.008014
172	3.368	3.385	3.385	3.379333	0.008014
176	3.013	2.996	2.996	3.001667	0.008014
180	2.674	2.691	2.674	2.679667	0.008014
184	2.81	2.827	2.827	2.821333	0.008014
188	2.657	2.657	2.64	2.651333	0.008014
192	2.184	2.184	2.184	2.184	0
196	2.37	2.387	2.37	2.375667	0.008014
200	2.234	2.234	2.234	2.234	0
204	2.234	2.218	2.218	2.223333	0.007542
208	2.116	2.116	2.116	2.116	0
212	1.879	1.879	1.879	1.879	2.22E-16
216	2.031	2.015	1.998	2.014667	0.013474
220	1.896	1.879	1.879	1.884667	0.008014
224	1.795	1.795	1.795	1.795	0
228	1.676	1.676	1.678	1.676667	0.000943
232	1.761	1.761	1.744	1.755333	0.008014
236	1.659	1.659	1.642	1.653333	0.008014
240	1.558	1.575	1.558	1.563667	0.008014
244	1.389	1.406	1.389	1.394667	0.008014
248	1.49	1.507	1.507	1.501333	0.008014
252	1.541	1.541	1.541	1.541	2.22E-16
256	1.456	1.372	1.372	1.4	0.039598
260	1.372	1.389	1.389	1.383333	0.008014
264	1.389	1.389	1.389	1.389	0

Gravel column 3

Delta t (min)	**Concentration measured (ppb)**	**Standard deviation**

	1	2	3	Average	
0	1.58	1.58	1.58	1.58	0
4	1.508	1.508	1.479	1.498333	0.013671
8	1.479	1.479	1.479	1.479	0
12	1.667	1.667	1.667	1.667	0
16	2.001	2.001	1.987	1.996333	0.0066
20	5.47	5.47	5.47	5.47	0
24	16.541	16.556	16.541	16.546	0.007071
28	31.031	31.06	31.074	31.055	0.017907
32	40.618	40.604	40.589	40.60367	0.011842
36	50.264	50.278	50.278	50.27333	0.0066
40	48.596	48.654	48.639	48.62967	0.024581
44	51.134	51.134	51.163	51.14367	0.013671
48	47.914	47.914	47.929	47.919	0.007071
52	41.721	41.663	41.648	41.67733	0.031478
56	35.107	35.078	35.092	35.09233	0.011842
60	32.017	31.988	31.988	31.99767	0.013671
64	28.957	28.957	28.928	28.94733	0.013671
68	26.506	26.506	26.491	26.501	0.007071
72	23.547	23.532	23.547	23.542	0.007071
76	19.921	19.921	19.892	19.91133	0.013671
80	19.123	19.123	19.123	19.123	0
84	16.614	16.585	16.585	16.59467	0.013671
88	14.336	14.322	14.322	14.32667	0.0066
92	12.291	12.291	12.306	12.296	0.007071
96	11.551	11.566	11.58	11.56567	0.011842
100	11.566	11.537	11.508	11.537	0.023678
104	10.449	10.623	10.623	10.565	0.082024
108	9.927	9.97	9.985	9.960667	0.024581
112	9.259	9.245	9.23	9.244667	0.011842
116	8.461	8.446	8.461	8.456	0.007071
120	7.706	7.677	7.691	7.691333	0.011842
124	7.154	7.14	7.14	7.144667	0.0066
128	6.777	6.777	6.762	6.772	0.007071
132	6.167	6.153	6.153	6.157667	0.0066
136	6.429	6.4	6.414	6.414333	0.011842
140	5.267	5.267	5.253	5.262333	0.0066
144	5.282	5.282	5.282	5.282	0
148	5.195	5.267	5.282	5.248	0.037974
152	4.512	4.512	4.512	4.512	0
156	4.179	4.179	4.179	4.179	0
160	3.888	3.888	3.888	3.888	0
164	3.859	3.859	3.845	3.854333	0.0066
168	3.54	3.54	3.54	3.54	4.44E-16
172	3.438	3.424	3.409	3.423667	0.011842
176	3.177	3.22	3.22	3.205667	0.02027

180	2.959	2.945	2.974	2.959333	0.011842
184	2.93	2.945	2.959	2.944667	0.011842
188	3.046	3.046	3.032	3.041333	0.0066
192	2.625	2.611	2.611	2.615667	0.0066
196	2.64	2.625	2.625	2.63	0.007071
200	2.393	2.408	2.408	2.403	0.007071
204	2.466	2.466	2.466	2.466	0
208	2.248	2.248	2.248	2.248	0
212	2.175	2.175	2.161	2.170333	0.0066
216	2.117	2.117	2.117	2.117	0
220	1.987	1.987	1.987	1.987	0
224	1.987	1.972	1.972	1.977	0.007071
228	1.88	1.87	1.87	1.873333	0.004714
232	1.987	1.972	1.987	1.982	0.007071
236	1.9	1.9	1.9	1.9	2.22E-16
240	1.754	1.74	1.74	1.744667	0.0066
244	1.9	1.885	1.885	1.89	0.007071
248	1.49	1.507	1.507	1.501333	0.008014
252	1.541	1.541	1.541	1.541	2.22E-16
256	1.456	1.372	1.372	1.4	0.039598
260	1.372	1.389	1.389	1.383333	0.008014
264	1.389	1.389	1.389	1.389	0

Appendix G

Residence time distribution data for gravel columns, E(t), which was used to generate Figure 7.2

Sample number	Delta t (min)	Et	Standard deviation
1	0	0.000471	5.95E-05
2	4	0.000441	7.92E-05
3	8	0.000428	7.00E-05
4	12	0.000458	7.24E-05
5	16	0.000692	0.000108
6	20	0.002689	0.001345
7	24	0.006443	0.002402
8	28	0.010269	0.002377
9	32	0.012874	0.001803
10	36	0.01462	0.001621
11	40	0.014928	0.000542
12	44	0.014716	0.001314
13	48	0.01419	0.001095
14	52	0.013082	0.00077
15	56	0.011111	0.000443
16	60	0.010398	0.000397
17	64	0.009448	0.000404
18	68	0.008269	0.00049
19	72	0.007509	0.000158
20	76	0.006763	0.000243
21	80	0.006434	0.00019
22	84	0.005885	0.000368
23	88	0.005268	0.00045
24	92	0.00469	0.000503
25	96	0.004464	0.000519
26	100	0.004221	0.000347
27	104	0.00372	0.000229
28	108	0.003506	0.00023
29	112	0.003287	0.000217
30	116	0.002976	0.000261
31	120	0.002669	0.000236
32	124	0.002518	0.000207
33	128	0.002271	0.000229
34	132	0.002175	0.000227
35	136	0.002072	0.000195
36	140	0.001865	0.000277
37	144	0.00181	0.00022
38	148	0.001669	0.000203

39	152	0.001473	0.000181
40	156	0.001397	0.000194
41	160	0.001295	0.00016
42	164	0.001219	8.39E-05
43	168	0.001153	0.000143
44	172	0.001085	5.77E-05
45	176	0.001026	0.000107
46	180	0.000959	0.000137
47	184	0.00097	0.000118
48	188	0.000946	0.000119
49	192	0.000834	0.000152
50	196	0.000827	9.28E-05
51	200	0.000779	9.77E-05
52	204	0.000792	0.000108
53	208	0.000711	6.26E-05
54	212	0.000674	8.76E-05
55	216	0.000666	4.94E-05
56	220	0.000623	4.58E-05
57	224	0.000597	4.47E-05
58	228	0.000582	6.23E-05
59	232	0.000602	5.69E-05
60	236	0.000575	5.96E-05
61	240	0.000609	0.000145
62	244	0.000537	8.78E-05
63	248	0.000535	6.31E-05
64	252	0.000533	5.27E-05
65	256	0.000511	6.79E-05
66	260	0.000503	6.58E-05
67	264	0.000498	6.06E-05
68	268	0.000486	6.42E-05
69	272	0.000476	6.49E-05
70	276	0.000466	6.56E-05
71	280	0.000457	6.63E-05
72	284	0.000448	6.69E-05
73	288	0.000439	6.75E-05
74	292	0.000431	6.81E-05
75	296	0.000422	6.86E-05
76	300	0.000414	6.92E-05
77	304	0.000406	6.97E-05
78	308	0.000398	7.01E-05
79	312	0.00039	7.05E-05
80	316	0.000382	7.09E-05

Table used to generate the 5 groups in figure 7.2

Time (min)	E(t)	Group
0	0.000471	1
4	0.000441	1
8	0.000428	1
12	0.000458	1
16	0.000692	1
20	0.002689	1
24	0.006443	1
28	0.010269	1
32	0.012874	1
36	0.01462	1
40	0.014928	1
40	0	1
0	0	1
0	0.000471	1
40	0.014928	2
44	0.014716	2
48	0.01419	2
52	0.013082	2
52	0	2
40	0	2
40	0.014928	2
52	0.013082	3
56	0.011111	3
60	0.010398	3
64	0.009448	3
68	0.008269	3
72	0.007509	3
72	0	3
52	0	3
52	0.007509	3
72	0.007509	4
76	0.006763	4
80	0.006434	4
84	0.005885	4
88	0.005268	4
92	0.00469	4
96	0.004464	4
100	0.004221	4
104	0.00372	4
108	0.003506	4
112	0.003287	4
112	0	4
72	0	4
72	0.007509	4

112	0.003287	5
116	0.002976	5
120	0.002669	5
124	0.002518	5
128	0.002271	5
132	0.002175	5
136	0.002072	5
140	0.001865	5
144	0.00181	5
148	0.001669	5
152	0.001473	5
156	0.001397	5
160	0.001295	5
164	0.001219	5
168	0.001153	5
172	0.001085	5
176	0.001026	5
180	0.000959	5
184	0.00097	5
188	0.000946	5
192	0.000834	5
196	0.000827	5
200	0.000779	5
204	0.000792	5
208	0.000711	5
212	0.000674	5
216	0.000666	5
220	0.000623	5
224	0.000597	5
228	0.000582	5
232	0.000602	5
236	0.000575	5
240	0.000609	5
244	0.000537	5
248	0.000535	5
252	0.000533	5
256	0.000511	5
260	0.000503	5
264	0.000498	5
268	0.000486	5
272	0.000476	5
276	0.000466	5
280	0.000457	5
284	0.000448	5
288	0.000439	5
292	0.000431	5

296	0.000422	5
300	0.000414	5
304	0.000406	5
308	0.000398	5
312	0.00039	5
316	0.000382	5
316	0	5
112	0	5
112	0.003287	5

Code to generate Figure 7.2 and determine hydraulic parameters of each group

```
library(readr) #read csv files
library(suncalc)
library(readxl)
library(ggplot2)
library(TTR)
library(pracma)
library(stats)
library(extrafont)
font_import()
loadfonts(device="win")


getwd()
setwd("C:\\Users\\User\\OneDrive\\2019\\PhD 2019\\URBWAT\\Excel
spreadsheet")
Raw_data<-read_excel("Impulse mom method data.xlsx", na="n.a.")

#plots
t1_Gravel<-trapz((as.numeric(Raw_data$Av_DT[1:11])),
                 (as.numeric(Raw_data$Av_DT[1:11])*Et_Gravel[1:11]))/
  trapz((as.numeric(Raw_data$Av_DT[1:11])),(Et_Gravel[1:11]))

g1_Gravel<-trapz((as.numeric(Raw_data$Av_DT[1:11])),
                 ((Et_Gravel[1:11])))

var1_Gravel<-trapz((as.numeric(Raw_data$Av_DT[1:11])),
                   (((as.numeric(Raw_data$Av_DT[1:11])-t1_Gravel)^2)*
                      Et_Gravel[1:11]))


t2_Gravel<-trapz((as.numeric(Raw_data$Av_DT[11:14])),
                 (as.numeric(Raw_data$Av_DT[11:14])*Et_Gravel[11:14]))/
  trapz((as.numeric(Raw_data$Av_DT[11:14])),(Et_Gravel[11:14]))

g2_Gravel<-trapz((as.numeric(Raw_data$Av_DT[11:14])),
                 ((Et_Gravel[11:14])))

var2_Gravel<-trapz((as.numeric(Raw_data$Av_DT[11:14])),
                   (((as.numeric(Raw_data$Av_DT[11:14])-t2_Gravel)^2)*
                      Et_Gravel[11:14]))

t3_Gravel<-trapz((as.numeric(Raw_data$Av_DT[14:19])),
                 (as.numeric(Raw_data$Av_DT[14:19])*Et_Gravel[14:19]))/
  trapz((as.numeric(Raw_data$Av_DT[14:19])),(Et_Gravel[14:19]))
```

```
g3_Gravel<-trapz((as.numeric(Raw_data$Av_DT[14:19])),
                 ((Et_Gravel[14:19])))

var3_Gravel<-trapz((as.numeric(Raw_data$Av_DT[14:19])),
                   (((as.numeric(Raw_data$Av_DT[14:19])-t3_Gravel)^2)*
                      Et_Gravel[14:19]))


t4_Gravel<-trapz((as.numeric(Raw_data$Av_DT[19:29])),
                 (as.numeric(Raw_data$Av_DT[19:29])*Et_Gravel[19:29]))/
  trapz((as.numeric(Raw_data$Av_DT[19:29])),(Et_Gravel[19:29]))

g4_Gravel<-trapz((as.numeric(Raw_data$Av_DT[19:29])),
                 ((Et_Gravel[19:29])))

var4_Gravel<-trapz((as.numeric(Raw_data$Av_DT[19:29])),
                   (((as.numeric(Raw_data$Av_DT[19:29])-t4_Gravel)^2)*
                      Et_Gravel[19:29]))

t5_Gravel<-trapz((as.numeric(Raw_data$Av_DT[29:80])),
                 (as.numeric(Raw_data$Av_DT[29:80])*Et_Gravel[29:80]))/
  trapz((as.numeric(Raw_data$Av_DT[29:80])),(Et_Gravel[29:80]))

g5_Gravel<-trapz((as.numeric(Raw_data$Av_DT[29:80])),
                 ((Et_Gravel[29:80])))

var5_Gravel<-trapz((as.numeric(Raw_data$Av_DT[29:80])),
                   (((as.numeric(Raw_data$Av_DT[29:80])-t5_Gravel)^2)*
                      Et_Gravel[29:80]))


Gravel_Et<-data.frame(Time=c(as.numeric(Raw_data$Av_DT)),
                      Et=c(Et_Gravel),
                      SD=c(as.numeric(Raw_data$Av_SD_E)))

write.table(Gravel_Et,file='Gravel Et.txt',sep='\t')

Gravel_fill<-
data.frame(Time=c(as.numeric(Raw_data$Av_DT[1:11]),as.numeric(Raw_data$Av_D
T[11]),

as.numeric(Raw_data$Av_DT[1]),as.numeric(Raw_data$Av_DT[1]),

as.numeric(Raw_data$Av_DT[11:14]),as.numeric(Raw_data$Av_DT[14]),

as.numeric(Raw_data$Av_DT[11]),as.numeric(Raw_data$Av_DT[11]),

as.numeric(Raw_data$Av_DT[14:19]),as.numeric(Raw_data$Av_DT[19]),

as.numeric(Raw_data$Av_DT[14]),as.numeric(Raw_data$Av_DT[14]),

as.numeric(Raw_data$Av_DT[19:29]),as.numeric(Raw_data$Av_DT[29]),

as.numeric(Raw_data$Av_DT[19]),as.numeric(Raw_data$Av_DT[19]),

as.numeric(Raw_data$Av_DT[29:80]),as.numeric(Raw_data$Av_DT[80]),

as.numeric(Raw_data$Av_DT[29]),as.numeric(Raw_data$Av_DT[29])),

Et=c(Et_Gravel[1:11],0,0,Et_Gravel[1],Et_Gravel[11:14],0,0,Et_Gravel[11],
```

```
Et_Gravel[14:19],0,0,Et_Gravel[19],Et_Gravel[19:29],0,0,Et_Gravel[19],
                                Et_Gravel[29:80],0,0,Et_Gravel[29]),

Group=c(rep('1',times=14),rep('2',times=7),rep('3',times=9),
                                    rep('4',times=14),rep('5',times=55)))

write.table(Gravel_fill,file='Gravel fill.txt',sep='\t')


Gravel_groups<-ggplot()+
  geom_polygon(data=Gravel_fill,aes(x=Time,y=Et,fill=Group,color=Group),
               alpha=0.7,size=0.1)+
  scale_color_brewer(palette="Greens")+
  scale_fill_brewer(palette="Greens")+
  geom_jitter(data=Gravel_Et,aes(x=Time,y=Et),color='grey12')+
  geom_line(data=Gravel_Et,aes(x=Time,y=Et),color='grey12')+
  theme_bw()+
  theme(legend.position = 'none',
        text=element_text(family="Times New Roman"))+
  xlab('Time (minutes)')+
  ylab('E(t) (-)')

plot(Gravel_groups)
```

Appendix H

Data used to determine hydraulic parameters and generate graphs in section 7.2

Column1	Column2	Column3	Colun	Columı	Column6	Colun	Colun	Column9	Columr	Column11	Column12	Colun	Column1	Column15
A	27:04:18	8:00:00 AM	A	1	27399		7	34130		215	30595		21	4872
A	27:04:18	8:03:00 AM	A	1	27450		6	23541		215	31464		21	6114
A	27:04:18	8:06:00 AM	A	1	27471		6	18321		215	33866		21	4639
A	27:04:18	8:09:00 AM	A	1	27402		6	35234		215	34836		20	26422
A	27:04:18	8:12:00 AM	A	1	27351		6	19048		215	35655		20	1880
A	27:04:18	8:15:00 AM	A	1	27325		6	26682		215	35091		19	58062
A	27:04:18	8:18:00 AM	A	1	26550		6	38731		215	35887		19	47009
A	27:04:18	8:21:00 AM	A	1	27398		6	37366		215	36666		19	42187
A	27:04:18	8:24:00 AM	A	1	27347		6	36645		215	37486		19	40413
A	27:04:18	8:27:00 AM	A	1	27443		6	37988		215	37903		19	38934
A	27:04:18	8:30:00 AM	A	1	27399		6	41940		215	38116		19	34310
A	27:04:18	8:33:00 AM	A	1	27580		6	44119		215	37994		19	26802
A	27:04:18	8:36:00 AM	A	1	27366		6	44471		215	38212		19	26719
A	27:04:18	8:39:00 AM	A	1	27178		6	46142		215	37678		19	26687
A	27:04:18	8:41:00 AM	A	1	27444		6	46398		215	36298		19	22827
A	27:04:18	8:42:00 AM	A	1	27416		6	47075		215	36077		19	23173
A	27:04:18	8:45:00 AM	A	1	27247		6	45690		215	35914		19	26576
A	27:04:18	8:48:00 AM	A	1	27535		6	47364		215	36443		19	28265
A	27:04:18	8:51:00 AM	A	1	27371		6	50079		215	35831		19	21905
A	27:04:18	8:54:00 AM	A	1	27425		6	48797		215	35493		19	15142
A	27:04:18	8:57:00 AM	A	1	27392		6	49638		215	35500		19	6181
A	27:04:18	9:00:00 AM	A	1	27422		6	45243		215	34942		19	2503
A	27:04:18	9:03:00 AM	A	1	27065		6	38103		215	35206		18	64960
A	27:04:18	9:06:00 AM	A	1	27360		6	35745		215	32839		18	63704
A	27:04:18	9:09:00 AM	A	1	27452		6	30893		215	32320		19	2061
A	27:04:18	9:12:00 AM	A	1	27558		6	29236		215	32626		19	9633
A	27:04:18	9:15:00 AM	A	1	27305		6	30486		215	32156		19	15236
A	27:04:18	9:18:00 AM	A	1	27435		6	31369		215	31401		19	17773
A	27:04:18	9:21:00 AM	A	1	27587		6	32726		215	31084		19	22793
A	27:04:18	9:24:00 AM	A	1	27362		6	36387		215	30654		19	38676
A	27:04:18	9:27:00 AM	A	1	27432		6	40487		215	30079		19	62324
A	27:04:18	9:30:00 AM	A	1	27494		6	43833		215	29220		20	12398
A	27:04:18	9:33:00 AM	A	1	27478		6	48471		215	26934		20	25833
A	27:04:18	9:36:00 AM	A	1	27672		6	58438		215	27421		20	35873
A	27:04:18	9:39:00 AM	A	1	27399		6	56483		215	27199		20	45400
A	27:04:18	9:42:00 AM	A	1	27233		6	54212		215	27295		20	61841
A	27:04:18	9:45:00 AM	A	1	27419		6	54198		215	27410		21	9356
A	27:04:18	9:48:00 AM	A	1	27251		6	56341		215	27728		21	18120
A	27:04:18	9:51:00 AM	A	1	27461		6	51994		215	27792		21	31437
A	27:04:18	9:54:00 AM	A	1	27433		6	47807		215	28205		21	41830
A	27:04:18	9:57:00 AM	A	1	27516		6	48801		215	26526		21	49275

A	27:04:18	10:03:00 AM	A	1	27402		6	53295		215	27729		21	51588
A	27:04:18	10:06:00 AM	A	1	27565		6	53891		215	27656		21	16637
A	27:04:18	10:09:00 AM	A	1	27386		6	55257		215	28282		21	26989
A	27:04:18	10:12:00 AM	A	1	27616		6	59330		215	27573		21	15231
A	27:04:18	10:15:00 AM	A	1	27314		6	62287		215	27588		21	22818
A	27:04:18	10:18:00 AM	A	1	27544		6	63842		215	27125		21	49783
A	27:04:18	10:21:00 AM	A	1	27263		6	65487		215	26752		22	1901
A	27:04:18	10:24:00 AM	A	1	27060		7	8413		215	25183		22	17307
A	27:04:18	10:27:00 AM	A	1	27459		7	37083		215	25907		22	18154
A	27:04:18	10:30:00 AM	A	1	27341		7	61891		215	25739		21	54946
A	27:04:18	10:33:00 AM	A	1	27358		8	21116		215	25298		21	47396
A	27:04:18	10:36:00 AM	A	1	27308		8	27773		215	24890		21	55504
A	27:04:18	10:39:00 AM	A	1	27438		8	18764		215	24602		21	54638
A	27:04:18	10:42:00 AM	A	1	27432		8	23464		215	24281		21	51079
A	27:04:18	10:45:00 AM	A	1	27514		8	36144		215	23129		21	52068
A	27:04:18	10:48:00 AM	A	1	27367		8	48685		215	20987		21	54902
A	27:04:18	10:51:00 AM	A	1	27356		9	6522		215	20110		21	65384
A	27:04:18	10:54:00 AM	A	1	27536		9	32120		215	19587		22	23086
A	27:04:18	10:57:00 AM	A	1	27621		10	331		215	18864		22	41472
A	27:04:18	11:00:00 AM	A	1	27286		10	45149		215	18493		22	52792
A	27:04:18	11:03:00 AM	A	1	27501		11	28831		215	17886		22	57337
A	27:04:18	11:06:00 AM	A	1	27421		12	40150		215	17192		22	62157
A	27:04:18	11:09:00 AM	A	1	27511		12	64247		215	16786		23	6669
A	27:04:18	11:12:00 AM	A	1	27441		12	50626		215	16397		23	11442
A	27:04:18	11:15:00 AM	A	1	27378		12	35014		215	14342		23	14789
A	27:04:18	11:18:00 AM	A	1	27468		12	25623		215	13780		23	22916
A	27:04:18	11:21:00 AM	A	1	27662		12	15065		215	14253		23	21955
A	27:04:18	11:24:00 AM	A	1	27448		12	22137		215	13593		22	61167
A	27:04:18	11:27:00 AM	A	1	27388		12	31884		215	13713		22	41129
A	27:04:18	11:30:00 AM	A	1	27447		12	28553		215	13193		22	35423
A	27:04:18	11:33:00 AM	A	1	27346		12	13283		215	12589		22	33346
A	27:04:18	11:36:00 AM	A	1	27459		12	11372		215	12168		22	32482
A	27:04:18	11:39:00 AM	A	1	27412		12	50074		215	11484		22	30308
A	27:04:18	11:42:00 AM	A	1	27426		12	64599		215	9068		22	50210
A	27:04:18	11:45:00 AM	A	1	27277		12	65027		215	8396		22	64700
A	27:04:18	11:48:00 AM	A	1	27277		13	36761		215	7315		23	5266
A	27:04:18	11:51:00 AM	A	1	26394		15	7435		215	7084		23	10748
A	27:04:18	11:54:00 AM	A	1	28611		16	14137		215	6681		23	16572
A	27:04:18	11:57:00 AM	A	1	27332		17	136		215	5808		23	19431
A	27:04:18	12:00:00 PM	A	1	27292		17	7522		215	5771		23	21699
A	27:04:18	12:03:00 PM	A	1	27453		16	53945		215	4941		23	29007
A	27:04:18	12:06:00 PM	A	1	27484		17	15194		215	4165		23	33394

A	27:04:18	12:09:00 PM	A	1	27402		16	64062		215	1592		23	34562
A	27:04:18	12:12:00 PM	A	1	27446		17	3766		215	1311		23	38128
A	27:04:18	12:15:00 PM	A	1	27347		16	60124		215	1347		23	39949
A	27:04:18	12:18:00 PM	A	1	27395		22	12462		215	548		23	41041
A	27:04:18	12:21:00 PM	A	1	27306		27	33847		215	650		23	43367
A	27:04:18	12:24:00 PM	A	1	27250		27	51760		215	395		23	43747
A	27:04:18	12:27:00 PM	A	1	27341		26	33291		215	127		23	41901
A	27:04:18	12:30:00 PM	A	1	27329		25	14860		214	65146		23	44723
A	27:04:18	12:33:00 PM	A	1	27276		24	28814		214	64272		23	47531
A	27:04:18	12:36:00 PM	A	1	27336		23	61019		214	62004		23	41428
A	27:04:18	12:39:00 PM	A	1	27231		23	26614		214	61230		23	45953
A	27:04:18	12:42:00 PM	A	1	27284		22	51136		214	61204		23	50166
A	27:04:18	12:45:00 PM	A	1	27343		22	22033		214	60779		23	50799
A	27:04:18	12:48:00 PM	A	1	27269		22	4623		214	60236		23	52039
A	27:04:18	12:51:00 PM	A	1	27360		21	41350		214	59504		23	54931
A	27:04:18	12:54:00 PM	A	1	27480		20	55423		214	58579		23	54657
A	27:04:18	12:57:00 PM	A	1	27365		18	28655		214	58122		23	57565
A	27:04:18	1:00:00 PM	A	1	27516		17	58448		214	57512		23	62546
A	27:04:18	1:03:00 PM	A	1	27466		17	18274		214	55191		23	63041
A	27:04:18	1:06:00 PM	A	1	27262		18	36517		214	54608		23	64256
A	27:04:18	1:09:00 PM	A	1	27362		20	62619		214	53999		24	1691
A	27:04:18	1:12:00 PM	A	1	27366		24	49090		214	53334		24	1719
A	27:04:18	1:15:00 PM	A	1	27390		24	54866		214	52639		24	2719
A	27:04:18	1:18:00 PM	A	1	27292		24	17540		214	52054		24	3424
A	27:04:18	1:21:00 PM	A	1	27339		23	53320		214	51471		24	4389
A	27:04:18	1:24:00 PM	A	1	27206		23	41780		214	50562		24	5098
A	27:04:18	1:27:00 PM	A	1	27360		23	46979		214	50312		24	7114
A	27:04:18	1:30:00 PM	A	1	27356		23	58207		214	47248		24	8215
A	27:04:18	1:33:00 PM	A	1	27379		24	2582		214	46662		24	6528
A	27:04:18	1:36:00 PM	A	1	27336		24	7899		214	46357		24	8890
A	27:04:18	1:39:00 PM	A	1	27427		24	8582		214	45786		24	10900
A	27:04:18	1:42:00 PM	A	1	27372		24	5870		214	45017		24	10576
A	27:04:18	1:45:00 PM	A	1	27419		23	20805		214	44589		24	11705
A	27:04:18	1:48:00 PM	A	1	27158		22	2882		214	43426		24	13456
A	27:04:18	1:51:00 PM	A	1	27408		21	22050		214	42986		24	11806
A	27:04:18	1:54:00 PM	A	1	27333		20	56914		214	42132		24	10105
A	27:04:18	1:57:00 PM	A	1	27238		20	33325		214	39585		24	8229
A	27:04:18	2:00:00 PM	A	1	27281		18	52414		214	39313		24	8102
A	27:04:18	2:03:00 PM	A	1	27222		15	36880		214	38775		24	7890
A	27:04:18	2:06:00 PM	A	1	27336		14	44221		214	37839		24	8909
A	27:04:18	2:09:00 PM	A	1	27332		16	9397		214	37068		24	9183
A	27:04:18	2:12:00 PM	A	1	27361		16	58870		214	36194		24	8998

A	27:04:18	2:15:00 PM	A	1	27411		17	10595		214	35626		24	10075
A	27:04:18	2:18:00 PM	A	1	27339		17	15942		214	34962		24	10942
A	27:04:18	2:21:00 PM	A	1	27421		17	16553		214	34269		24	10259
A	27:04:18	2:24:00 PM	A	1	27317		17	18737		214	32021		23	61170
A	27:04:18	2:27:00 PM	A	1	27237		17	20151		214	31706		23	30916
A	27:04:18	2:30:00 PM	A	1	27247		18	25039		214	30681		23	13360
A	27:04:18	2:33:00 PM	A	1	27376		17	61640		214	30216		23	3992
A	27:04:18	2:36:00 PM	A	1	27342		17	27424		214	29644		22	64123
A	27:04:18	2:39:00 PM	A	1	27119		17	23627		214	28209		23	6726
A	27:04:18	2:42:00 PM	A	1	27278		17	25223		214	27307		23	21960
A	27:04:18	2:45:00 PM	A	1	27596		17	21633		214	26366		23	29431
A	27:04:18	2:48:00 PM	A	1	27418		17	24318		214	25410		23	34390
A	27:04:18	2:51:00 PM	A	1	27245		17	27987		214	21891		23	38424
A	27:04:18	2:54:00 PM	A	1	27249		17	38981		214	21420		23	41553
A	27:04:18	2:57:00 PM	A	1	27124		17	48751		214	20594		23	43652
A	27:04:18	3:00:00 PM	A	1	27257		17	47952		214	20035		23	45729
A	27:04:18	3:03:00 PM	A	1	27302		17	24726		214	19037		23	48627
A	27:04:18	3:06:00 PM	A	1	27436		14	63246		214	17904		23	52562
A	27:04:18	3:09:00 PM	A	1	27612		12	46281		214	16773		23	55204
A	27:04:18	3:12:00 PM	A	1	27453		13	40533		214	16432		23	57708
A	27:04:18	3:18:00 PM	A	1	27326		15	38657		214	12893		23	61354
A	27:04:18	3:21:00 PM	A	1	27340		16	13801		214	12180		23	63135
A	27:04:18	3:24:00 PM	A	1	27355		16	29443		214	11185		23	64950
A	27:04:18	3:27:00 PM	A	1	27376		16	37031		214	10620		24	1204
A	27:04:18	3:30:00 PM	A	1	27387		16	40274		214	9853		24	2392
A	27:04:18	3:33:00 PM	A	1	27332		16	40537		214	8723		24	4462
A	27:04:18	3:36:00 PM	A	1	27290		16	35596		214	8253		24	6938
A	27:04:18	3:39:00 PM	A	1	27454		16	32141		214	7267		24	9156
A	27:04:18	3:42:00 PM	A	1	27252		16	26222		214	6418		24	10604
A	27:04:18	3:45:00 PM	A	1	27328		16	21186		214	3769		24	12638
A	27:04:18	3:48:00 PM	A	1	27476		16	16885		214	3038		24	14868
A	27:04:18	3:51:00 PM	A	1	27334		16	11371		214	2168		24	17350
A	27:04:18	3:54:00 PM	A	1	27322		16	5075		214	1857		24	19736
A	27:04:18	3:57:00 PM	A	1	27400		15	64859		214	749		24	21526
A	27:04:18	4:00:00 PM	A	1	27386		15	53910		214	85		24	22833
A	27:04:18	4:03:00 PM	A	1	27333		15	54500		213	64801		24	22598
A	27:04:18	4:06:00 PM	A	1	27362		15	40755		213	63892		24	24389
A	27:04:18	4:09:00 PM	A	1	27330		15	33695		213	62688		24	26406
A	27:04:18	4:12:00 PM	A	1	27342		15	27384		213	60578		24	28140
A	27:04:18	4:15:00 PM	A	1	27289		15	17946		213	59232		24	28187
A	27:04:18	4:18:00 PM	A	1	27323		15	7609		213	58502		24	27531
A	27:04:18	4:21:00 PM	A	1	27435		14	65203		213	57855		24	29539

A	27:04:18	4:24:00 PM	A	1	27222		14	55394		213	57149		24	32182
A	27:04:18	4:27:00 PM	A	1	27487		14	47392		213	55939		24	33574
A	27:04:18	4:30:00 PM	A	1	27278		14	36743		213	55040		24	35047
A	27:04:18	4:33:00 PM	A	1	27458		14	27928		213	54561		24	36014
A	27:04:18	4:36:00 PM	A	1	27409		14	18707		213	53315		24	34081
A	27:04:18	4:39:00 PM	A	1	27515		14	10377		213	50558		24	32799
A	27:04:18	4:42:00 PM	A	1	27486		14	4085		213	49458		24	33892
A	27:04:18	4:45:00 PM	A	1	27353		13	61738		213	49002		24	35765
A	27:04:18	4:48:00 PM	A	1	27445		13	54094		213	48432		24	36927
A	27:04:18	4:51:00 PM	A	1	27539		13	45350		213	47469		24	37862
A	27:04:18	4:54:00 PM	A	1	27326		13	35652		213	46419		24	39128
A	27:04:18	4:57:00 PM	A	1	27196		13	25279		213	45609		24	40709
A	27:04:18	5:00:00 PM	A	1	27071		13	15920		213	44272		24	41545
A	27:04:18	5:00:03 PM	A	1	27329		13	15458		213	44332		24	41541
A	27:04:18	5:00:06 PM	A	1	27345		13	15469		213	44174		24	41551
A	27:04:18	5:00:09 PM	A	1	27336		13	15432		213	44381		24	41596
A	27:04:18	5:00:12 PM	A	1	27396		13	15229		213	44538		24	41604
A	27:04:18	5:00:15 PM	A	1	27499		13	15297		213	44450		24	41643
A	27:04:18	5:00:18 PM	A	1	27355		13	15192		213	44398		24	41653
A	27:04:18	5:00:21 PM	A	1	27410		13	15091		213	44078		24	41655
A	27:04:18	5:00:24 PM	A	1	27411		13	14983		213	44047		24	41651
A	27:04:18	5:00:27 PM	A	1	27396		13	14450		213	44137		24	41697
A	27:04:18	5:00:30 PM	A	1	27398		13	14468		213	44463		24	41672
A	27:04:18	5:00:33 PM	A	1	27393		13	14280		213	44361		24	41719
A	27:04:18	5:00:36 PM	A	1	27315		13	14173		213	44360		24	41720
A	27:04:18	5:00:39 PM	A	1	27164		13	14114		213	44290		24	41738
A	27:04:18	5:00:42 PM	A	1	27652		13	13994		213	44008		24	41773
A	27:04:18	5:00:45 PM	A	1	27397		13	13654		213	44384		24	41775
A	27:04:18	5:00:48 PM	A	1	27408		13	13143		213	44286		24	41827
A	27:04:18	5:00:51 PM	A	1	27333		13	13440		213	44194		24	41840
A	27:04:18	5:00:54 PM	A	1	27430		13	13647		213	44298		24	41847
A	27:04:18	5:00:57 PM	A	1	27428		13	13490		213	44032		24	41888
A	27:04:18	5:01:00 PM	A	1	27465		13	13381		213	43823		24	41886
A	27:04:18	5:01:03 PM	A	1	27496		13	12878		213	43892		24	41913
A	27:04:18	5:01:06 PM	A	1	27589		13	12512		213	44074		24	41912
A	27:04:18	5:01:09 PM	A	1	27368		13	12911		213	44136		24	41975
A	27:04:18	5:01:12 PM	A	1	27356		13	11964		213	44090		24	41967
A	27:04:18	5:01:15 PM	A	1	27638		13	12140		213	43845		24	42013
A	27:04:18	5:01:18 PM	A	1	27276		13	11763		213	43916		24	42009
A	27:04:18	5:01:21 PM	A	1	27467		13	11822		213	44101		24	42041
A	27:04:18	5:01:24 PM	A	1	27322		13	11907		213	43972		24	42039
A	27:04:18	5:01:27 PM	A	1	27428		13	11819		213	44132		24	42068

A	27:04:18	5:01:30 PM	A	1	27189		13	11755		213	43794		24	42107
A	27:04:18	5:01:33 PM	A	1	27253		13	11695		213	43694		24	42134
A	27:04:18	5:01:36 PM	A	1	27390		13	11307		213	44062		24	42166
A	27:04:18	5:01:39 PM	A	1	27421		13	11127		213	44073		24	42177
A	27:04:18	5:01:42 PM	A	1	27594		13	11041		213	43777		24	42179
A	27:04:18	5:01:45 PM	A	1	27291		13	11210		213	43833		24	42226
A	27:04:18	5:01:48 PM	A	1	27310		13	10879		213	43752		24	42237
A	27:04:18	5:01:51 PM	A	1	27335		13	10794		213	43779		24	42294
A	27:04:18	5:01:54 PM	A	1	27422		13	11184		213	43798		24	42298
A	27:04:18	5:01:57 PM	A	1	27542		13	10897		213	43951		24	42299
A	27:04:18	5:02:00 PM	A	1	27273		13	10742		213	43707		24	42336
A	27:04:18	5:02:03 PM	A	1	27366		13	10117		213	43613		24	42318
A	27:04:18	5:02:06 PM	A	1	27402		13	9933		213	43886		24	42394
A	27:04:18	5:02:09 PM	A	1	27411		13	9761		213	43846		24	42399
A	27:04:18	5:02:12 PM	A	1	27465		13	8159		213	43864		24	42455
A	27:04:18	5:02:15 PM	A	1	27359		13	7074		213	43509		24	42456
A	27:04:18	5:02:18 PM	A	1	27310		13	6464		213	43738		24	42466
A	27:04:18	5:02:21 PM	A	1	27373		13	5472		213	43992		24	42516
A	27:04:18	5:02:24 PM	A	1	27376		13	5954		213	43869		24	42502
A	27:04:18	5:02:27 PM	A	1	27424		13	3932		213	43520		24	42517
A	27:04:18	5:02:30 PM	A	1	27546		13	4083		213	43374		24	42546
A	27:04:18	5:02:33 PM	A	1	27427		13	3998		213	43476		24	42579
A	27:04:18	5:02:36 PM	A	1	27505		13	3804		213	43667		24	42581
A	27:04:18	5:02:39 PM	A	1	27370		13	4353		213	43999		24	42628
A	27:04:18	5:02:42 PM	A	1	27364		13	3549		213	43656		24	42660
A	27:04:18	5:02:45 PM	A	1	27300		13	3643		213	43478		24	42681
A	27:04:18	5:02:48 PM	A	1	27446		13	3947		213	43499		24	42696
A	27:04:18	5:02:51 PM	A	1	27128		13	3406		213	43297		24	42704
A	27:04:18	5:02:54 PM	A	1	27341		13	3690		213	43252		24	42749
A	27:04:18	5:02:57 PM	A	1	27467		13	3364		213	43110		24	42756
A	27:04:18	5:03:00 PM	A	1	27306		13	3285		213	43484		24	42757
A	27:04:18	5:03:03 PM	A	1	27306		13	3075		213	43444		24	42776
A	27:04:18	5:03:06 PM	A	1	27545		13	3226		213	43264		24	42814
A	27:04:18	5:03:09 PM	A	1	27372		13	3246		213	43293		24	42826
A	27:04:18	5:03:12 PM	A	1	27276		13	3119		213	43219		24	42847
A	27:04:18	5:03:15 PM	A	1	27103		13	3288		213	43314		24	42854
A	27:04:18	5:03:18 PM	A	1	27400		13	3322		213	43396		24	42893
A	27:04:18	5:03:21 PM	A	1	27455		13	3499		213	43245		24	42893
A	27:04:18	5:03:24 PM	A	1	27232		13	3349		213	43221		24	42912
A	27:04:18	5:03:27 PM	A	1	27381		13	3779		213	43230		24	42959
A	27:04:18	5:03:30 PM	A	1	27210		13	3940		213	43145		24	42950
A	27:04:18	5:03:33 PM	A	1	27355		13	4156		213	43391		24	42977

A	27:04:18	5:03:36 PM	A	1	27275		13	3885		213	43420		24	42999
A	27:04:18	5:03:39 PM	A	1	27351		13	3925		213	43147		24	43007
A	27:04:18	5:03:42 PM	A	1	27222		13	4529		213	43374		24	43027
A	27:04:18	5:03:45 PM	A	1	27292		13	4881		213	43099		24	43053
A	27:04:18	5:03:48 PM	A	1	27248		13	4572		213	43211		24	43085
A	27:04:18	5:03:51 PM	A	1	27421		13	4632		213	43125		24	43127
A	27:04:18	5:03:54 PM	A	1	27353		13	4713		213	43378		24	43166
A	27:04:18	5:03:57 PM	A	1	27509		13	4939		213	43364		24	43181
A	27:04:18	5:04:00 PM	A	1	27451		13	5022		213	43190		24	43204
A	27:04:18	5:04:03 PM	A	1	27432		13	5022		213	43054		24	43205
A	27:04:18	5:04:06 PM	A	1	27432		13	4990		213	43196		24	43237
A	27:04:18	5:04:09 PM	A	1	27356		13	4997		213	43028		24	43268
A	27:04:18	5:04:12 PM	A	1	27368		13	5104		213	43072		24	43336
A	27:04:18	5:04:15 PM	A	1	27470		13	5456		213	42746		24	43323
A	27:04:18	5:04:18 PM	A	1	27309		13	5585		213	42918		24	43350
A	27:04:18	5:04:21 PM	A	1	27364		13	5723		213	43094		24	43391
A	27:04:18	5:04:24 PM	A	1	27439		13	6021		213	43205		24	43405
A	27:04:18	5:04:27 PM	A	1	27200		13	6401		213	43114		24	43424
A	27:04:18	5:04:30 PM	A	1	27306		13	6252		213	43033		24	43458
A	27:04:18	5:04:33 PM	A	1	27315		13	5973		213	42791		24	43476
A	27:04:18	5:04:36 PM	A	1	27426		13	6360		213	42899		24	43506
A	27:04:18	5:04:39 PM	A	1	27433		13	6359		213	42842		24	43515
A	27:04:18	5:04:42 PM	A	1	27464		13	6641		213	43169		24	43565
A	27:04:18	5:04:45 PM	A	1	27350		13	6534		213	42877		24	43567
A	27:04:18	5:04:48 PM	A	1	27450		13	6517		213	42997		24	43574
A	27:04:18	5:04:51 PM	A	1	27310		13	6413		213	42931		24	43627
A	27:04:18	5:04:54 PM	A	1	27301		13	6407		213	42619		24	43646
A	27:04:18	5:04:57 PM	A	1	27401		13	6610		213	42952		24	43671
A	27:04:18	5:05:00 PM	A	1	27356		13	5922		213	42856		24	43670
A	27:04:18	5:05:03 PM	A	1	27319		13	6592		213	42806		24	43686
A	27:04:18	5:05:06 PM	A	1	27354		13	6580		213	42725		24	43715
A	27:04:18	5:05:09 PM	A	1	27428		13	6418		213	42689		24	43750
A	27:04:18	5:05:12 PM	A	1	27318		13	6242		213	42789		24	43770
A	27:04:18	5:05:15 PM	A	1	27231		13	6067		213	40922		24	43784
A	27:04:18	5:05:18 PM	A	1	27390		13	6012		213	42661		24	43787
A	27:04:18	5:05:21 PM	A	1	27296		13	6191		213	42599		24	43819
A	27:04:18	5:05:24 PM	A	1	27437		13	5863		213	40448		24	43839
A	27:04:18	5:05:27 PM	A	1	27204		13	5828		213	42389		24	43867
A	27:04:18	5:05:30 PM	A	1	27352		13	5460		213	40724		24	43870
A	27:04:18	5:05:33 PM	A	1	27204		13	5483		213	40261		24	43925
A	27:04:18	5:05:36 PM	A	1	27095		13	5257		213	40907		24	43936
A	27:04:18	5:05:39 PM	A	1	27469		13	4851		213	40750		24	43975

A	27:04:18	5:05:42 PM	A	1	27523		13	5178		213	42602		24	43956
A	27:04:18	5:05:45 PM	A	1	26770		13	4607		213	40591		24	44001
A	27:04:18	5:05:48 PM	A	1	27172		13	4567		213	40590		24	44012
A	27:04:18	5:05:51 PM	A	1	27413		13	4361		213	40573		24	44022
A	27:04:18	5:05:54 PM	A	1	27466		13	4234		213	40627		24	44081
A	27:04:18	5:05:57 PM	A	1	27357		13	4302		213	40259		24	44095
A	27:04:18	5:06:00 PM	A	1	27468		13	4163		213	40407		24	44122
A	27:04:18	5:06:03 PM	A	1	27439		13	3687		213	40168		24	44156
A	27:04:18	5:06:06 PM	A	1	27462		13	3716		213	40655		24	44179
A	27:04:18	5:06:09 PM	A	1	27370		13	2900		213	40504		24	44212
A	27:04:18	5:06:12 PM	A	1	27312		13	2703		213	40505		24	44242
A	27:04:18	5:06:15 PM	A	1	27222		13	2709		213	40291		24	44251
A	27:04:18	5:06:18 PM	A	1	27258		13	2468		213	40116		24	44271
A	27:04:18	5:06:21 PM	A	1	27272		13	2731		213	40525		24	44287
A	27:04:18	5:06:24 PM	A	1	27475		13	1919		213	40635		24	44360
A	27:04:18	5:06:27 PM	A	1	27418		13	1914		213	40647		24	44351
A	27:04:18	5:06:30 PM	A	1	27072		13	1114		213	40226		24	44353
A	27:04:18	5:06:33 PM	A	1	27499		13	297		213	40458		24	44439
A	27:04:18	5:06:36 PM	A	1	27284		13	942		213	40061		24	44430
A	27:04:18	5:06:39 PM	A	1	27378		13	748		213	40014		24	44472
A	27:04:18	5:06:42 PM	A	1	27469		13	765		213	40052		24	44494
A	27:04:18	5:06:45 PM	A	1	27281		13	1026		213	40470		24	44498
A	27:04:18	5:06:48 PM	A	1	27468		13	103		213	40435		24	44538
A	27:04:18	5:06:51 PM	A	1	27250		13	258		213	40728		24	44591
A	27:04:18	5:06:54 PM	A	1	27544		12	64952		213	40057		24	44593
A	27:04:18	5:06:57 PM	A	1	27398		12	64835		213	40073		24	44633
A	27:04:18	5:07:00 PM	A	1	27327		12	64825		213	40671		24	44664
A	27:04:18	5:07:03 PM	A	1	27400		12	64450		213	40574		24	44698
A	27:04:18	5:07:06 PM	A	1	27272		12	64505		213	40550		24	44726
A	27:04:18	5:07:09 PM	A	1	27477		12	64136		213	40170		24	44739
A	27:04:18	5:07:12 PM	A	1	27466		12	64173		213	40041		24	44809
A	27:04:18	5:07:15 PM	A	1	27735		12	62596		213	40109		24	44799
A	27:04:18	5:07:18 PM	A	1	27375		12	62267		213	39919		24	44861
A	27:04:18	5:07:21 PM	A	1	27257		12	63935		213	40050		24	44871
A	27:04:18	5:07:24 PM	A	1	27419		12	63389		213	40017		24	44929
A	27:04:18	5:07:27 PM	A	1	27376		12	62899		213	40538		24	44956
A	27:04:18	5:07:30 PM	A	1	27548		12	63334		213	40367		24	44962
A	27:04:18	5:07:33 PM	A	1	27500		12	62485		213	39884		24	44959
A	27:04:18	5:07:36 PM	A	1	27681		12	62845		213	40383		24	45034
A	27:04:18	5:07:39 PM	A	1	27429		12	62052		213	40327		24	45032
A	27:04:18	5:07:42 PM	A	1	27424		12	61807		213	40188		24	45042
A	27:04:18	5:07:45 PM	A	1	27074		12	61899		213	39816		24	45086

A	27:04:18	5:07:48 PM	A	1	26986		12	61452		213	40339		24	45099
A	27:04:18	5:07:51 PM	A	1	27469		12	61789		213	40450		24	45117
A	27:04:18	5:07:54 PM	A	1	27329		12	61534		213	40291		24	45181
A	27:04:18	5:07:57 PM	A	1	27432		12	61780		213	39980		24	45187
A	27:04:18	5:08:00 PM	A	1	27099		12	61892		213	39738		24	45227
A	27:04:18	5:08:03 PM	A	1	27379		12	60936		213	40387		24	45247
A	27:04:18	5:08:06 PM	A	1	27360		12	61443		213	40359		24	45264
A	27:04:18	5:08:09 PM	A	1	27118		12	61141		213	40276		24	45305
A	27:04:18	5:08:12 PM	A	1	27463		12	60469		213	40001		24	45292
A	27:04:18	5:08:15 PM	A	1	27391		12	60304		213	40311		24	45351
A	27:04:18	5:08:18 PM	A	1	27401		12	60307		213	40169		24	45348
A	27:04:18	5:08:21 PM	A	1	27331		12	59778		213	39787		24	45371
A	27:04:18	5:08:24 PM	A	1	27324		12	59770		213	40235		24	45400
A	27:04:18	5:08:27 PM	A	1	27110		12	59213		213	40123		24	45408
A	27:04:18	5:08:30 PM	A	1	27336		12	59240		213	40222		24	45463
A	27:04:18	5:08:33 PM	A	1	27445		12	58812		213	40150		24	45496
A	27:04:18	5:08:36 PM	A	1	27350		12	58811		213	39396		24	45505
A	27:04:18	5:08:39 PM	A	1	27342		12	58932		213	40146		24	45485
A	27:04:18	5:08:42 PM	A	1	27322		12	58858		213	39918		24	45507
A	27:04:18	5:08:45 PM	A	1	27471		12	59038		213	40100		24	45541
A	27:04:18	5:08:48 PM	A	1	27353		12	58673		213	39998		24	45543
A	27:04:18	5:08:51 PM	A	1	27252		12	58902		213	40069		24	45565
A	27:04:18	5:08:54 PM	A	1	27302		12	58423		213	40083		24	45561
A	27:04:18	5:08:57 PM	A	1	27350		12	58627		213	39878		24	45618
A	27:04:18	5:09:00 PM	A	1	27266		12	58715		213	39546		24	45619
A	27:04:18	5:09:03 PM	A	1	27535		12	58913		213	39487		24	45660
A	27:04:18	5:09:06 PM	A	1	27376		12	58467		213	40001		24	45649
A	27:04:18	5:09:09 PM	A	1	27189		12	58450		213	40033		24	45641
A	27:04:18	5:09:12 PM	A	1	27313		12	58375		213	39760		24	45669
A	27:04:18	5:09:15 PM	A	1	27328		12	59100		213	39994		24	45675
A	27:04:18	5:09:18 PM	A	1	27436		12	58196		213	39647		24	45702
A	27:04:18	5:09:21 PM	A	1	27425		12	58135		213	39682		24	45718
A	27:04:18	5:09:24 PM	A	1	27435		12	57875		213	39836		24	45687
A	27:04:18	5:09:27 PM	A	1	27275		12	57419		213	39301		24	45709
A	27:04:18	5:09:30 PM	A	1	27211		12	57154		213	39333		24	45722
A	27:04:18	5:09:33 PM	A	1	27174		12	57172		213	39128		24	45705
A	27:04:18	5:09:36 PM	A	1	27460		12	56899		213	39375		24	45705
A	27:04:18	5:09:39 PM	A	1	27386		12	57351		213	39403		24	45735
A	27:04:18	5:09:42 PM	A	1	27264		12	58283		213	39275		24	45737
A	27:04:18	5:09:45 PM	A	1	27491		12	56995		213	39790		24	45777
A	27:04:18	5:09:48 PM	A	1	27229		12	57063		213	39677		24	45752
A	27:04:18	5:09:51 PM	A	1	27394		12	57015		213	39554		24	45771

A	27:04:18	5:09:54 PM	A	1	27422		12	57230		213	39625		24	45773
A	27:04:18	5:09:57 PM	A	1	27353		12	56858		213	39318		24	45772
A	27:04:18	5:10:00 PM	A	1	27470		12	56763		213	39650		24	45784
A	27:04:18	5:10:03 PM	A	1	27515		12	56680		213	39320		24	45784
A	27:04:18	5:10:06 PM	A	1	27338		12	56346		213	39329		24	45791
A	27:04:18	5:10:09 PM	A	1	27448		12	56409		213	39300		24	45812
A	27:04:18	5:10:12 PM	A	1	27301		12	56401		213	39134		24	45818
A	27:04:18	5:10:15 PM	A	1	27413		12	56372		213	39617		24	45804
A	27:04:18	5:10:18 PM	A	1	27401		12	56224		213	39555		24	45840
A	27:04:18	5:10:21 PM	A	1	27302		12	55996		213	39077		24	45826
A	27:04:18	5:10:24 PM	A	1	27260		12	55872		213	39283		24	45824
A	27:04:18	5:10:27 PM	A	1	27414		12	55266		213	39094		24	45829
A	27:04:18	5:10:30 PM	A	1	27384		12	55382		213	39429		24	45856
A	27:04:18	5:10:33 PM	A	1	27229		12	55790		213	39551		24	45860
A	27:04:18	5:10:36 PM	A	1	27490		12	55001		213	39482		24	45814
A	27:04:18	5:10:39 PM	A	1	27394		12	55109		213	39518		24	45821
A	27:04:18	5:10:42 PM	A	1	27305		12	54786		213	38931		24	45865
A	27:04:18	5:10:45 PM	A	1	27424		12	54974		213	39067		24	45832
A	27:04:18	5:10:48 PM	A	1	27379		12	54688		213	39144		24	45855
A	27:04:18	5:10:51 PM	A	1	27412		12	54491		213	39333		24	45800
A	27:04:18	5:10:54 PM	A	1	27365		12	54125		213	39482		24	45845
A	27:04:18	5:10:57 PM	A	1	27523		12	53256		213	39325		24	45843
A	27:04:18	5:11:00 PM	A	1	27312		12	53528		213	39320		24	45866
A	27:04:18	5:11:03 PM	A	1	27365		12	53865		213	39139		24	45878
A	27:04:18	5:11:06 PM	A	1	27271		12	53977		213	38918		24	45863
A	27:04:18	5:11:09 PM	A	1	27381		12	54207		213	38960		24	45835
A	27:04:18	5:11:12 PM	A	1	27477		12	53738		213	39356		24	45861
A	27:04:18	5:11:15 PM	A	1	27379		12	53703		213	39264		24	45846
A	27:04:18	5:11:18 PM	A	1	27444		12	53597		213	39244		24	45856
A	27:04:18	5:11:21 PM	A	1	27401		12	53307		213	38973		24	45856
A	27:04:18	5:11:24 PM	A	1	27418		12	53540		213	39259		24	45854
A	27:04:18	5:11:27 PM	A	1	27312		12	53412		213	39163		24	45812
A	27:04:18	5:11:30 PM	A	1	27351		12	53065		213	38775		24	45847
A	27:04:18	5:11:33 PM	A	1	27436		12	53032		213	38771		24	45833
A	27:04:18	5:11:36 PM	A	1	27419		12	52745		213	38722		24	45844
A	27:04:18	5:11:39 PM	A	1	27640		12	52717		213	39331		24	45789
A	27:04:18	5:11:42 PM	A	1	27436		12	52536		213	39289		24	45831
A	27:04:18	5:11:45 PM	A	1	27345		12	52433		213	38904		24	45841
A	27:04:18	5:11:48 PM	A	1	27307		12	52459		213	38791		24	45805
A	27:04:18	5:11:51 PM	A	1	27475		12	52391		213	38850		24	45809
A	27:04:18	5:11:54 PM	A	1	27427		12	52199		213	39009		24	45799
A	27:04:18	5:11:57 PM	A	1	27618		12	52055		213	39150		24	45790

A	27:04:18	5:12:00 PM	A	1	27485		12	52019		213	39023		24	45807
A	27:04:18	5:12:03 PM	A	1	27329		12	51985		213	38871		24	45811
A	27:04:18	5:12:06 PM	A	1	27287		12	51740		213	39120		24	45806
A	27:04:18	5:12:09 PM	A	1	27398		12	51514		213	38617		24	45783
A	27:04:18	5:12:12 PM	A	1	27306		12	51402		213	39012		24	45771
A	27:04:18	5:12:15 PM	A	1	27338		12	51096		213	39124		24	45780
A	27:04:18	5:12:18 PM	A	1	27319		12	51482		213	38581		24	45782
A	27:04:18	5:12:21 PM	A	1	27412		12	51087		213	38714		24	45790
A	27:04:18	5:12:24 PM	A	1	27615		12	50744		213	38482		24	45776
A	27:04:18	5:12:27 PM	A	1	27461		12	50282		213	38543		24	45776
A	27:04:18	5:12:30 PM	A	1	27294		12	50239		213	38918		24	45760
A	27:04:18	5:12:33 PM	A	1	27446		12	50075		213	38680		24	45771
A	27:04:18	5:12:36 PM	A	1	27453		12	49351		213	38549		24	45749
A	27:04:18	5:12:39 PM	A	1	27444		12	49230		213	38854		24	45769
A	27:04:18	5:12:42 PM	A	1	27423		12	49543		213	38977		24	45748
A	27:04:18	5:12:45 PM	A	1	27488		12	49333		213	38933		24	45735
A	27:04:18	5:12:48 PM	A	1	27312		12	50228		213	38628		24	45735
A	27:04:18	5:12:51 PM	A	1	27143		12	50040		213	38486		24	45689
A	27:04:18	5:12:54 PM	A	1	27310		12	49818		213	38509		24	45750
A	27:04:18	5:12:57 PM	A	1	27312		12	49656		213	39061		24	45732
A	27:04:18	5:13:00 PM	A	1	27351		12	49536		213	38864		24	45760
A	27:04:18	5:13:03 PM	A	1	27341		12	49449		213	39001		24	45731
A	27:04:18	5:13:06 PM	A	1	27390		12	49262		213	38837		24	45711
A	27:04:18	5:13:09 PM	A	1	27422		12	49131		213	38819		24	45731
A	27:04:18	5:13:12 PM	A	1	27270		12	49469		213	38594		24	45715
A	27:04:18	5:13:15 PM	A	1	27387		12	49127		213	38448		24	45721
A	27:04:18	5:13:18 PM	A	1	27486		12	49101		213	38407		24	45721
A	27:04:18	5:13:21 PM	A	1	27474		12	49023		213	38741		24	45683
A	27:04:18	5:13:24 PM	A	1	27392		12	48924		213	38725		24	45683
A	27:04:18	5:13:27 PM	A	1	27531		12	48690		213	38824		24	45689
A	27:04:18	5:13:30 PM	A	1	27323		12	48178		213	38436		24	45683
A	27:04:18	5:13:33 PM	A	1	27397		12	47479		213	38714		24	45689
A	27:04:18	5:13:36 PM	A	1	27388		12	48147		213	38818		24	45691
A	27:04:18	5:13:39 PM	A	1	27399		12	48748		213	38277		24	45677
A	27:04:18	5:13:42 PM	A	1	27345		12	48718		213	38430		24	45686
A	27:04:18	5:13:45 PM	A	1	27262		12	48102		213	38246		24	45663
A	27:04:18	5:13:48 PM	A	1	27356		12	47745		213	38789		24	45681
A	27:04:18	5:13:51 PM	A	1	27243		12	47786		213	38578		24	45655
A	27:04:18	5:13:54 PM	A	1	27359		12	47600		213	38440		24	45658
A	27:04:18	5:13:57 PM	A	1	27489		12	47598		213	38347		24	45674
A	27:04:18	5:14:00 PM	A	1	27620		12	47564		213	38116		24	45617
A	27:04:18	5:14:03 PM	A	1	27326		12	47374		213	38024		24	45621

A	27:04:18	5:14:06 PM	A	1	27292		12	46928		213	38126		24	45649
A	27:04:18	5:14:09 PM	A	1	27371		12	47239		213	38539		24	45644
A	27:04:18	5:14:12 PM	A	1	27438		12	47182		213	38427		24	45623
A	27:04:18	5:14:15 PM	A	1	27404		12	46805		213	38603		24	45632
A	27:04:18	5:14:18 PM	A	1	27426		12	46478		213	38457		24	45594
A	27:04:18	5:14:21 PM	A	1	27449		12	45220		213	38280		24	45616
A	27:04:18	5:14:24 PM	A	1	27459		12	45896		213	38152		24	45614
A	27:04:18	5:14:27 PM	A	1	27400		12	46966		213	38175		24	45593
A	27:04:18	5:14:30 PM	A	1	27348		12	46111		213	37810		24	45606
A	27:04:18	5:14:33 PM	A	1	27358		12	45739		213	38035		24	45602
A	27:04:18	5:14:36 PM	A	1	27291		12	45879		213	38408		24	45561
A	27:04:18	5:14:39 PM	A	1	27441		12	45331		213	38255		24	45584
A	27:04:18	5:14:42 PM	A	1	27395		12	45254		213	38351		24	45569
A	27:04:18	5:14:45 PM	A	1	27400		12	44504		213	37889		24	45585
A	27:04:18	5:14:48 PM	A	1	27345		12	43961		213	38075		24	45572
A	27:04:18	5:14:51 PM	A	1	27469		12	43820		213	38016		24	45572
A	27:04:18	5:14:54 PM	A	1	27358		12	43510		213	37835		24	45562
A	27:04:18	5:14:57 PM	A	1	27384		12	44163		213	37820		24	45527
A	27:04:18	5:15:00 PM	A	1	27544		12	43131		213	38302		24	45548
A	27:04:18	5:15:03 PM	A	1	27252		12	42809		213	38223		24	45520
A	27:04:18	5:15:06 PM	A	1	27297		12	42386		213	38215		24	45518
A	27:04:18	5:15:09 PM	A	1	27396		12	42866		213	37826		24	45505
A	27:04:18	5:15:12 PM	A	1	27427		12	43075		213	38043		24	45505
A	27:04:18	5:15:15 PM	A	1	27465		12	43165		213	37895		24	45536
A	27:04:18	5:15:18 PM	A	1	27444		12	42880		213	38105		24	45511
A	27:04:18	5:15:21 PM	A	1	27148		12	43116		213	37952		24	45455
A	27:04:18	5:15:24 PM	A	1	27154		12	42687		213	37689		24	45497
A	27:04:18	5:15:27 PM	A	1	27500		12	42430		213	37743		24	45483
A	27:04:18	5:15:30 PM	A	1	27408		12	42384		213	37771		24	45504
A	27:04:18	5:15:33 PM	A	1	27340		12	41790		213	38012		24	45465
A	27:04:18	5:15:36 PM	A	1	27397		12	41762		213	37986		24	45491
A	27:04:18	5:15:39 PM	A	1	27293		12	41645		213	38131		24	45476
A	27:04:18	5:15:42 PM	A	1	27417		12	41407		213	37869		24	45474
A	27:04:18	5:15:45 PM	A	1	27403		12	41265		213	38133		24	45493
A	27:04:18	5:15:48 PM	A	1	27456		12	40686		213	37630		24	45518
A	27:04:18	5:15:51 PM	A	1	27417		12	41537		213	37958		24	45466
A	27:04:18	5:15:54 PM	A	1	27427		12	41451		213	38131		24	45467
A	27:04:18	5:15:57 PM	A	1	27190		12	40579		213	37996		24	45453
A	27:04:18	5:16:00 PM	A	1	27442		12	41068		213	37704		24	45506
A	27:04:18	5:16:03 PM	A	1	27410		12	40707		213	37874		24	45481
A	27:04:18	5:16:06 PM	A	1	27393		12	40974		213	37905		24	45484
A	27:04:18	5:16:09 PM	A	1	27368		12	40775		213	37471		24	45454

A	27:04:18	5:16:12 PM	A	1	27242		12	40513		213	37948		24	45463
A	27:04:18	5:16:15 PM	A	1	27459		12	40581		213	38059		24	45496
A	27:04:18	5:16:18 PM	A	1	27500		12	39837		213	37880		24	45472
A	27:04:18	5:16:21 PM	A	1	27504		12	39872		213	37846		24	45485
A	27:04:18	5:16:24 PM	A	1	27289		12	39973		213	37966		24	45508
A	27:04:18	5:16:27 PM	A	1	27222		12	39704		213	37918		24	45516
A	27:04:18	5:16:30 PM	A	1	27444		12	39828		213	37574		24	45508
A	27:04:18	5:16:33 PM	A	1	27498		12	39642		213	37418		24	45523
A	27:04:18	5:16:36 PM	A	1	27459		12	39435		213	37502		24	45524
A	27:04:18	5:16:39 PM	A	1	27506		12	39411		213	37877		24	45483
A	27:04:18	5:16:42 PM	A	1	27335		12	39151		213	37786		24	45481
A	27:04:18	5:16:45 PM	A	1	27449		12	39364		213	37454		24	45566
A	27:04:18	5:16:48 PM	A	1	27495		12	38840		213	37645		24	45548
A	27:04:18	5:16:51 PM	A	1	27408		12	38826		213	37827		24	45540
A	27:04:18	5:16:54 PM	A	1	27270		12	38670		213	37775		24	45499
A	27:04:18	5:16:57 PM	A	1	27352		12	38289		213	37726		24	45565
A	27:04:18	5:17:00 PM	A	1	27402		12	38673		213	37387		24	45568
A	27:04:18	5:17:03 PM	A	1	27355		12	38063		213	37417		24	45535
A	27:04:18	5:17:06 PM	A	1	27365		12	37975		213	37359		24	45544
A	27:04:18	5:17:09 PM	A	1	27325		12	38262		213	37212		24	45524
A	27:04:18	5:17:12 PM	A	1	27345		12	37912		213	37151		24	45583
A	27:04:18	5:17:15 PM	A	1	27348		12	37966		213	37229		24	45586
A	27:04:18	5:17:18 PM	A	1	27375		12	37542		213	37502		24	45588
A	27:04:18	5:17:21 PM	A	1	27307		12	37137		213	37306		24	45591
A	27:04:18	5:17:24 PM	A	1	27345		12	37165		213	37408		24	45577
A	27:04:18	5:17:27 PM	A	1	27237		12	37053		213	37388		24	45581
A	27:04:18	5:17:30 PM	A	1	27299		12	37223		213	37029		24	45622
A	27:04:18	5:17:33 PM	A	1	27813		12	36514		213	37185		24	45611
A	27:04:18	5:17:36 PM	A	1	27399		12	36735		213	37237		24	45606
A	27:04:18	5:17:39 PM	A	1	27290		12	36795		213	37199		24	45606
A	27:04:18	5:17:42 PM	A	1	27476		12	35998		213	37033		24	45651
A	27:04:18	5:17:45 PM	A	1	27385		12	35127		213	37112		24	45679
A	27:04:18	5:17:48 PM	A	1	27428		12	35186		213	37410		24	45667
A	27:04:18	5:17:51 PM	A	1	27506		12	35760		213	37294		24	45669
A	27:04:18	5:17:54 PM	A	1	27472		12	35932		213	37264		24	45653
A	27:04:18	5:17:57 PM	A	1	27459		12	35332		213	37164		24	45696
A	27:04:18	5:18:00 PM	A	1	27410		12	35743		213	37160		24	45671
A	27:04:18	5:18:03 PM	A	1	27446		12	35366		213	36894		24	45676
A	27:04:18	5:18:06 PM	A	1	27354		12	35279		213	36869		24	45678
A	27:04:18	5:18:09 PM	A	1	27367		12	35612		213	37272		24	45710
A	27:04:18	5:18:12 PM	A	1	27425		12	35450		213	37210		24	45696
A	27:04:18	5:18:15 PM	A	1	27420		12	35330		213	37162		24	45718

A	27:04:18	5:18:18 PM	A	1	27257		12	35325		213	36819		24	45696
A	27:04:18	5:18:21 PM	A	1	27443		12	34914		213	37277		24	45720
A	27:04:18	5:18:24 PM	A	1	27263		12	34741		213	37329		24	45725
A	27:04:18	5:18:27 PM	A	1	27347		12	34471		213	37167		24	45760
A	27:04:18	5:18:30 PM	A	1	27276		12	34802		213	37024		24	45732
A	27:04:18	5:18:33 PM	A	1	27287		12	35260		213	37025		24	45760
A	27:04:18	5:18:36 PM	A	1	27334		12	34877		213	37006		24	45765
A	27:04:18	5:18:39 PM	A	1	27418		12	35037		213	36809		24	45783
A	27:04:18	5:18:42 PM	A	1	27290		12	34756		213	36958		24	45776
A	27:04:18	5:18:45 PM	A	1	27349		12	33901		213	37107		24	45804
A	27:04:18	5:18:48 PM	A	1	27326		12	34482		213	36952		24	45805
A	27:04:18	5:18:51 PM	A	1	27433		12	34550		213	36664		24	45813
A	27:04:18	5:18:54 PM	A	1	27489		12	34756		213	37103		24	45827
A	27:04:18	5:18:57 PM	A	1	27375		12	34228		213	36972		24	45847
A	27:04:18	5:19:00 PM	A	1	27335		12	33701		213	37032		24	45879
A	27:04:18	5:19:03 PM	A	1	27287		12	33718		213	36751		24	45848
A	27:04:18	5:19:06 PM	A	1	27385		12	33578		213	36575		24	45869
A	27:04:18	5:19:09 PM	A	1	27501		12	33983		213	36629		24	45842
A	27:04:18	5:19:12 PM	A	1	27563		12	33561		213	36820		24	45895
A	27:04:18	5:19:15 PM	A	1	27643		12	33470		213	36874		24	45899
A	27:04:18	5:19:18 PM	A	1	27384		12	33677		213	36389		24	45910
A	27:04:18	5:19:21 PM	A	1	27269		12	32981		213	36404		24	45890
A	27:04:18	5:19:24 PM	A	1	27326		12	32676		213	36805		24	45926
A	27:04:18	5:19:27 PM	A	1	27419		12	32619		213	37011		24	45969
A	27:04:18	5:19:30 PM	A	1	27292		12	32807		213	36580		24	45960
A	27:04:18	5:19:33 PM	A	1	27252		12	33109		213	36709		24	45951
A	27:04:18	5:19:36 PM	A	1	27329		12	32770		213	36521		24	45995
A	27:04:18	5:19:39 PM	A	1	27428		12	32512		213	36697		24	45986
A	27:04:18	5:19:42 PM	A	1	27423		12	32384		213	36852		24	46019
A	27:04:18	5:19:45 PM	A	1	27312		12	32538		213	36870		24	46061
A	27:04:18	5:19:48 PM	A	1	27244		12	32086		213	36438		24	46021
A	27:04:18	5:19:51 PM	A	1	27398		12	31933		213	36294		24	46018
A	27:04:18	5:19:54 PM	A	1	27325		12	32037		213	36862		24	46077
A	27:04:18	5:19:57 PM	A	1	27516		12	31881		213	36614		24	46103
A	27:04:18	5:20:00 PM	A	1	27299		12	31787		213	36601		24	46071
A	27:04:18	5:20:03 PM	A	1	27283		12	32012		213	36376		24	46109
A	27:04:18	5:20:06 PM	A	1	27357		12	31493		213	36456		24	46115
A	27:04:18	5:20:09 PM	A	1	27314		12	31515		213	36319		24	46108
A	27:04:18	5:20:12 PM	A	1	27446		12	31556		213	36392		24	46148
A	27:04:18	5:20:15 PM	A	1	27489		12	31448		213	36288		24	46163
A	27:04:18	5:20:18 PM	A	1	27369		12	31359		213	36573		24	46180
A	27:04:18	5:20:21 PM	A	1	27303		12	31235		213	36565		24	46176

A	27:04:18	5:20:24 PM	A	1	27546		12	30922		213	36333		24	46200
A	27:04:18	5:20:27 PM	A	1	27376		12	31086		213	36148		24	46213
A	27:04:18	5:20:30 PM	A	1	27333		12	30519		213	35972		24	46207
A	27:04:18	5:20:33 PM	A	1	27454		12	30643		213	36301		24	46217
A	27:04:18	5:20:36 PM	A	1	27330		12	30842		213	36402		24	46232
A	27:04:18	5:20:39 PM	A	1	27380		12	31033		213	36378		24	46239
A	27:04:18	5:20:42 PM	A	1	27252		12	31005		213	36021		24	46254
A	27:04:18	5:20:45 PM	A	1	27707		12	30681		213	36113		24	46244
A	27:04:18	5:20:48 PM	A	1	27426		12	30303		213	36009		24	46292
A	27:04:18	5:20:51 PM	A	1	27367		12	29931		213	35947		24	46290
A	27:04:18	5:20:54 PM	A	1	27364		12	29540		213	36109		24	46333
A	27:04:18	5:20:57 PM	A	1	27302		12	30101		213	35789		24	46351
A	27:04:18	5:21:00 PM	A	1	27347		12	29498		213	36342		24	46310
A	27:04:18	5:21:03 PM	A	1	27331		12	29939		213	36461		24	46381
A	27:04:18	5:21:06 PM	A	1	27308		12	30159		213	36132		24	46383
A	27:04:18	5:21:09 PM	A	1	27377		12	29884		213	36321		24	46351
A	27:04:18	5:21:12 PM	A	1	27313		12	29931		213	36255		24	46396
A	27:04:18	5:21:15 PM	A	1	27378		12	29502		213	36242		24	46394
A	27:04:18	5:21:18 PM	A	1	27290		12	29019		213	36055		24	46430
A	27:04:18	5:21:21 PM	A	1	27498		12	28649		213	35988		24	46407
A	27:04:18	5:21:24 PM	A	1	27265		12	29211		213	36276		24	46394
A	27:04:18	5:21:27 PM	A	1	27450		12	29767		213	36066		24	46419
A	27:04:18	5:21:30 PM	A	1	27282		12	29167		213	36143		24	46403
A	27:04:18	5:21:33 PM	A	1	27406		12	29088		213	36077		24	46427
A	27:04:18	5:21:36 PM	A	1	27520		12	28599		213	36313		24	46430
A	27:04:18	5:21:39 PM	A	1	27487		12	28801		213	36196		24	46456
A	27:04:18	5:21:42 PM	A	1	27321		12	29162		213	35990		24	46443
A	27:04:18	5:21:45 PM	A	1	27346		12	28452		213	35842		24	46455
A	27:04:18	5:21:48 PM	A	1	27360		12	28184		213	35923		24	46488
A	27:04:18	5:21:51 PM	A	1	27397		12	28352		213	35821		24	46448
A	27:04:18	5:21:54 PM	A	1	27377		12	27739		213	35781		24	46478
A	27:04:18	5:21:57 PM	A	1	27381		12	28321		213	35968		24	46440
A	27:04:18	5:22:00 PM	A	1	27270		12	28102		213	35927		24	46472
A	27:04:18	5:22:03 PM	A	1	27405		12	28306		213	35980		24	46487
A	27:04:18	5:22:06 PM	A	1	27363		12	28130		213	36051		24	46471
A	27:04:18	5:22:09 PM	A	1	27373		12	27802		213	36152		24	46486
A	27:04:18	5:22:12 PM	A	1	27314		12	27558		213	36004		24	46490
A	27:04:18	5:22:15 PM	A	1	27471		12	27156		213	35849		24	46478
A	27:04:18	5:22:18 PM	A	1	27272		12	26722		213	35987		24	46479
A	27:04:18	5:22:21 PM	A	1	27395		12	27018		213	35985		24	46530
A	27:04:18	5:22:24 PM	A	1	27319		12	26480		213	35917		24	46545
A	27:04:18	5:22:27 PM	A	1	27260		12	26589		213	35824		24	46511

A	27:04:18	5:22:30 PM	A	1	27335		12	26499		213	36111		24	46531
A	27:04:18	5:22:33 PM	A	1	27451		12	26211		213	35952		24	46527
A	27:04:18	5:22:36 PM	A	1	27298		12	26372		213	35927		24	46523
A	27:04:18	5:22:39 PM	A	1	27379		12	26167		213	35606		24	46519
A	27:04:18	5:22:42 PM	A	1	27298		12	26607		213	36038		24	46532
A	27:04:18	5:22:45 PM	A	1	27517		12	26546		213	35865		24	46514
A	27:04:18	5:22:48 PM	A	1	27450		12	26442		213	35365		24	46485
A	27:04:18	5:22:51 PM	A	1	27388		12	26017		213	35455		24	46502
A	27:04:18	5:22:54 PM	A	1	27380		12	25233		213	35510		24	46503
A	27:04:18	5:22:57 PM	A	1	27523		12	25744		213	35448		24	46552
A	27:04:18	5:23:00 PM	A	1	27233		12	25921		213	35357		24	46493
A	27:04:18	5:23:03 PM	A	1	27274		12	25744		213	35643		24	46492
A	27:04:18	5:23:06 PM	A	1	27202		12	25462		213	35648		24	46502
A	27:04:18	5:23:09 PM	A	1	27372		12	25528		213	35603		24	46479
A	27:04:18	5:23:12 PM	A	1	27241		12	24726		213	35381		24	46480
A	27:04:18	5:23:15 PM	A	1	27396		12	24766		213	35488		24	46495
A	27:04:18	5:23:18 PM	A	1	27521		12	24297		213	35363		24	46497
A	27:04:18	5:23:21 PM	A	1	27131		12	23533		213	35635		24	46472
A	27:04:18	5:23:24 PM	A	1	27566		12	23912		213	35611		24	46450
A	27:04:18	5:23:27 PM	A	1	27663		12	24343		213	35363		24	46471
A	27:04:18	5:23:30 PM	A	1	27438		12	24871		213	35318		24	46496
A	27:04:18	5:23:33 PM	A	1	27477		12	24539		213	35428		24	46464
A	27:04:18	5:23:36 PM	A	1	27491		12	25042		213	35197		24	46476
A	27:04:18	5:23:39 PM	A	1	27293		12	24646		213	35246		24	46479
A	27:04:18	5:23:42 PM	A	1	27346		12	24088		213	35476		24	46458
A	27:04:18	5:23:45 PM	A	1	27547		12	23703		213	35537		24	46441
A	27:04:18	5:23:48 PM	A	1	27440		12	23247		213	35548		24	46442
A	27:04:18	5:23:51 PM	A	1	27647		12	23903		213	35432		24	46418
A	27:04:18	5:23:54 PM	A	1	27378		12	24134		213	35122		24	46433
A	27:04:18	5:23:57 PM	A	1	27331		12	23905		213	35115		24	46405
A	27:04:18	5:24:00 PM	A	1	27343		12	23915		213	35087		24	46411
A	27:04:18	5:24:03 PM	A	1	27663		12	23490		213	34941		24	46393
A	27:04:18	5:24:06 PM	A	1	27286		12	23826		213	35455		24	46359
A	27:04:18	5:24:09 PM	A	1	27340		12	23702		213	35264		24	46373
A	27:04:18	5:24:12 PM	A	1	27310		12	23382		213	35047		24	46409
A	27:04:18	5:24:15 PM	A	1	27523		12	22843		213	35306		24	46353
A	27:04:18	5:24:18 PM	A	1	27256		12	22468		213	35035		24	46363
A	27:04:18	5:24:21 PM	A	1	27337		12	22463		213	35134		24	46344
A	27:04:18	5:24:24 PM	A	1	27277		12	22322		213	35020		24	46341
A	27:04:18	5:24:27 PM	A	1	27484		12	21947		213	35371		24	46313
A	27:04:18	5:24:30 PM	A	1	27536		12	22018		213	35186		24	46281
A	27:04:18	5:24:33 PM	A	1	27427		12	21911		213	35214		24	46302

A	27:04:18	5:24:36 PM	A	1	27463		12	22290		213	35091		24	46332
A	27:04:18	5:24:39 PM	A	1	27342		12	22200		213	35218		24	46301
A	27:04:18	5:24:42 PM	A	1	27438		12	21978		213	34998		24	46293
A	27:04:18	5:24:45 PM	A	1	27472		12	21946		213	34593		24	46238
A	27:04:18	5:24:48 PM	A	1	27309		12	21743		213	34828		24	46258
A	27:04:18	5:24:51 PM	A	1	27490		12	21809		213	34939		24	46259
A	27:04:18	5:24:54 PM	A	1	27277		12	21632		213	34663		24	46236
A	27:04:18	5:24:57 PM	A	1	27057		12	21251		213	34698		24	46232
A	27:04:18	5:25:00 PM	A	1	27223		12	21130		213	34569		24	46213
A	27:04:18	5:25:03 PM	A	1	27274		12	21015		213	34841		24	46213
A	27:04:18	5:25:06 PM	A	1	27384		12	20888		213	34851		24	46215
A	27:04:18	5:25:09 PM	A	1	27407		12	21027		213	34886		24	46217
A	27:04:18	5:25:12 PM	A	1	27379		12	21050		213	34734		24	46185
A	27:04:18	5:25:15 PM	A	1	27471		12	21027		213	34543		24	46186
A	27:04:18	5:25:18 PM	A	1	27418		12	20878		213	34972		24	46191
A	27:04:18	5:25:21 PM	A	1	27280		12	20859		213	34828		24	46190
A	27:04:18	5:25:24 PM	A	1	27324		12	20915		213	34680		24	46172
A	27:04:18	5:25:27 PM	A	1	27369		12	20584		213	34797		24	46143
A	27:04:18	5:25:30 PM	A	1	27330		12	20746		213	34683		24	46168
A	27:04:18	5:25:33 PM	A	1	27248		12	20393		213	34936		24	46134
A	27:04:18	5:25:36 PM	A	1	27553		12	20467		213	34680		24	46152
A	27:04:18	5:25:39 PM	A	1	27331		12	20400		213	34464		24	46121
A	27:04:18	5:25:42 PM	A	1	27416		12	20116		213	34740		24	46153
A	27:04:18	5:25:45 PM	A	1	27436		12	20080		213	34782		24	46131
A	27:04:18	5:25:48 PM	A	1	27216		12	19745		213	34646		24	46136
A	27:04:18	5:25:51 PM	A	1	27496		12	19893		213	34582		24	46137
A	27:04:18	5:25:54 PM	A	1	27390		12	20106		213	34715		24	46149
A	27:04:18	5:25:57 PM	A	1	27424		12	19698		213	34338		24	46084
A	27:04:18	5:26:00 PM	A	1	27457		12	19889		213	34482		24	46147
A	27:04:18	5:26:03 PM	A	1	27285		12	19568		213	34451		24	46101
A	27:04:18	5:26:06 PM	A	1	27357		12	19431		213	34531		24	46101
A	27:04:18	5:26:09 PM	A	1	27462		12	19403		213	34519		24	46130
A	27:04:18	5:26:12 PM	A	1	27512		12	18787		213	34175		24	46103
A	27:04:18	5:26:15 PM	A	1	27342		12	18967		213	34540		24	46084
A	27:04:18	5:26:18 PM	A	1	27420		12	18745		213	34512		24	46075
A	27:04:18	5:26:21 PM	A	1	27658		12	18746		213	34505		24	46125
A	27:04:18	5:26:24 PM	A	1	27609		12	18632		213	34680		24	46104
A	27:04:18	5:26:27 PM	A	1	27394		12	18412		213	34636		24	46115
A	27:04:18	5:26:30 PM	A	1	27403		12	18679		213	34552		24	46127
A	27:04:18	5:26:33 PM	A	1	27220		12	18895		213	34536		24	46091
A	27:04:18	5:26:36 PM	A	1	27354		12	18967		213	34192		24	46103
A	27:04:18	5:26:39 PM	A	1	27391		12	18611		213	34031		24	46132

A	27:04:18	5:26:42 PM	A	1	27361		12	18008		213	34448		24	46110
A	27:04:18	5:26:45 PM	A	1	27565		12	17901		213	34226		24	46121
A	27:04:18	5:26:48 PM	A	1	27390		12	17302		213	34251		24	46106
A	27:04:18	5:26:51 PM	A	1	27363		12	17693		213	34253		24	46156
A	27:04:18	5:26:54 PM	A	1	27389		12	17913		213	34208		24	46148
A	27:04:18	5:26:57 PM	A	1	27359		12	17441		213	34256		24	46125
A	27:04:18	5:27:00 PM	A	1	27179		12	17502		213	34457		24	46167
A	27:04:18	5:27:03 PM	A	1	27435		12	17816		213	34325		24	46192
A	27:04:18	5:27:06 PM	A	1	27420		12	17094		213	34342		24	46145
A	27:04:18	5:27:09 PM	A	1	27315		12	17210		213	34389		24	46168
A	27:04:18	5:27:12 PM	A	1	27200		12	17055		213	34349		24	46169
A	27:04:18	5:27:15 PM	A	1	27541		12	16806		213	34000		24	46179
A	27:04:18	5:27:18 PM	A	1	27254		12	16726		213	34058		24	46193
A	27:04:18	5:27:21 PM	A	1	27133		12	17013		213	33905		24	46198
A	27:04:18	5:27:24 PM	A	1	27384		12	16607		213	34055		24	46197
A	27:04:18	5:27:27 PM	A	1	27221		12	16456		213	33980		24	46257
A	27:04:18	5:27:30 PM	A	1	27507		12	16180		213	33955		24	46212
A	27:04:18	5:27:33 PM	A	1	27417		12	16237		213	34175		24	46247
A	27:04:18	5:27:36 PM	A	1	27494		12	15911		213	33993		24	46289
A	27:04:18	5:27:39 PM	A	1	27428		12	15719		213	34293		24	46279
A	27:04:18	5:27:42 PM	A	1	27381		12	14972		213	34243		24	46282
A	27:04:18	5:27:45 PM	A	1	27389		12	15094		213	34013		24	46308
A	27:04:18	5:27:48 PM	A	1	27441		12	15315		213	33887		24	46305
A	27:04:18	5:27:51 PM	A	1	27388		12	15492		213	34093		24	46327
A	27:04:18	5:27:54 PM	A	1	27197		12	15422		213	34038		24	46342
A	27:04:18	5:27:57 PM	A	1	27393		12	15310		213	33918		24	46349
A	27:04:18	5:28:00 PM	A	1	27466		12	15147		213	33881		24	46366
A	27:04:18	5:28:03 PM	A	1	27279		12	15237		213	33814		24	46355
A	27:04:18	5:28:06 PM	A	1	27361		12	14692		213	34011		24	46388
A	27:04:18	5:28:09 PM	A	1	27469		12	14403		213	34144		24	46403
A	27:04:18	5:28:12 PM	A	1	27375		12	14375		213	34176		24	46413
A	27:04:18	5:28:15 PM	A	1	27452		12	14183		213	33892		24	46444
A	27:04:18	5:28:18 PM	A	1	27265		12	14479		213	33623		24	46438
A	27:04:18	5:28:21 PM	A	1	27455		12	14540		213	33998		24	46467
A	27:04:18	5:28:24 PM	A	1	27253		12	14269		213	34136		24	46489
A	27:04:18	5:28:27 PM	A	1	27505		12	14426		213	33830		24	46511
A	27:04:18	5:28:30 PM	A	1	27365		12	14466		213	33850		24	46524
A	27:04:18	5:28:33 PM	A	1	27150		12	14159		213	33779		24	46538
A	27:04:18	5:28:36 PM	A	1	27304		12	14162		213	33773		24	46579
A	27:04:18	5:28:39 PM	A	1	27394		12	14111		213	33621		24	46590
A	27:04:18	5:28:42 PM	A	1	27512		12	14024		213	33501		24	46552
A	27:04:18	5:28:45 PM	A	1	27482		12	13712		213	33902		24	46616

A	27:04:18	5:28:48 PM	A	1	27502		12	13756		213	33669		24	46590
A	27:04:18	5:28:51 PM	A	1	27388		12	14004		213	33543		24	46630
A	27:04:18	5:28:54 PM	A	1	27427		12	13343		213	33708		24	46678
A	27:04:18	5:28:57 PM	A	1	27455		12	13433		213	33549		24	46695
A	27:04:18	5:29:00 PM	A	1	27424		12	13094		213	33353		24	46678
A	27:04:18	5:29:03 PM	A	1	27379		12	13030		213	33459		24	46738
A	27:04:18	5:29:06 PM	A	1	27343		12	12693		213	33525		24	46720
A	27:04:18	5:29:09 PM	A	1	27414		12	11938		213	33347		24	46754
A	27:04:18	5:29:12 PM	A	1	27399		12	12573		213	33447		24	46804
A	27:04:18	5:29:15 PM	A	1	27551		12	12556		213	33314		24	46811
A	27:04:18	5:29:18 PM	A	1	27364		12	12549		213	33578		24	46841
A	27:04:18	5:29:21 PM	A	1	27407		12	12357		213	33627		24	46843
A	27:04:18	5:29:24 PM	A	1	27370		12	11696		213	33480		24	46867
A	27:04:18	5:29:27 PM	A	1	27409		12	11748		213	33245		24	46906
A	27:04:18	5:29:30 PM	A	1	27307		12	11775		213	33515		24	46915
A	27:04:18	5:29:33 PM	A	1	27376		12	11692		213	33390		24	46947
A	27:04:18	5:29:36 PM	A	1	27433		12	11564		213	33197		24	46967
A	27:04:18	5:29:39 PM	A	1	27566		12	10989		213	33254		24	46932
A	27:04:18	5:29:42 PM	A	1	27186		12	11154		213	33538		24	46984
A	27:04:18	5:29:45 PM	A	1	27198		12	10814		213	33352		24	47036
A	27:04:18	5:29:48 PM	A	1	27405		12	10697		213	33333		24	47053
A	27:04:18	5:29:51 PM	A	1	27322		12	10664		213	33284		24	47092
A	27:04:18	5:29:54 PM	A	1	27446		12	10628		213	33329		24	47051
A	27:04:18	5:29:57 PM	A	1	27415		12	10297		213	33232		24	47121
A	27:04:18	5:30:00 PM	A	1	27428		12	10526		213	33151		24	47130
A	27:04:18	5:30:03 PM	A	1	27528		12	10476		213	33295		24	47183
A	27:04:18	5:30:06 PM	A	1	27467		12	10573		213	33340		24	47209
A	27:04:18	5:30:09 PM	A	1	27389		12	10428		213	33229		24	47204
A	27:04:18	5:30:12 PM	A	1	27335		12	10316		213	33184		24	47262
A	27:04:18	5:30:15 PM	A	1	27345		12	10330		213	33050		24	47268
A	27:04:18	5:30:18 PM	A	1	27328		12	10051		213	33023		24	47269
A	27:04:18	5:30:21 PM	A	1	27406		12	10139		213	33347		24	47297
A	27:04:18	5:30:24 PM	A	1	27348		12	10029		213	33365		24	47323
A	27:04:18	5:30:27 PM	A	1	27278		12	9851		213	33177		24	47355
A	27:04:18	5:30:30 PM	A	1	27497		12	9968		213	32791		24	47391
A	27:04:18	5:30:33 PM	A	1	27436		12	9664		213	32972		24	47393
A	27:04:18	5:30:36 PM	A	1	27231		12	9819		213	32859		24	47399
A	27:04:18	5:30:39 PM	A	1	27605		12	9573		213	33200		24	47448
A	27:04:18	5:30:42 PM	A	1	27058		12	8882		213	33216		24	47448
A	27:04:18	5:30:45 PM	A	1	27490		12	8886		213	32930		24	47485
A	27:04:18	5:30:48 PM	A	1	27367		12	8241		213	32743		24	47501
A	27:04:18	5:30:51 PM	A	1	27271		12	8233		213	32984		24	47533

A	27:04:18	5:30:54 PM	A	1	27440		12	7510		213	33043		24	47569
A	27:04:18	5:30:57 PM	A	1	27450		12	8703		213	33086		24	47588
A	27:04:18	5:31:00 PM	A	1	27558		12	8096		213	33031		24	47576
A	27:04:18	5:31:03 PM	A	1	27573		12	7434		213	32981		24	47649
A	27:04:18	5:31:06 PM	A	1	27395		12	8192		213	32901		24	47636
A	27:04:18	5:31:09 PM	A	1	27350		12	7959		213	32575		24	47640
A	27:04:18	5:31:12 PM	A	1	27240		12	7538		213	32667		24	47665
A	27:04:18	5:31:15 PM	A	1	27481		12	7937		213	32706		24	47705
A	27:04:18	5:31:18 PM	A	1	27277		12	7710		213	32607		24	47712
A	27:04:18	5:31:21 PM	A	1	27140		12	7687		213	32580		24	47738
A	27:04:18	5:31:24 PM	A	1	27305		12	7813		213	32849		24	47772
A	27:04:18	5:31:27 PM	A	1	27397		12	7731		213	32932		24	47800
A	27:04:18	5:31:30 PM	A	1	27519		12	7741		213	32944		24	47826
A	27:04:18	5:31:33 PM	A	1	27398		12	7403		213	32748		24	47858
A	27:04:18	5:31:36 PM	A	1	27299		12	7392		213	32390		24	47841
A	27:04:18	5:31:39 PM	A	1	27431		12	7525		213	32601		24	47867
A	27:04:18	5:31:42 PM	A	1	27572		12	7100		213	32809		24	47897
A	27:04:18	5:31:45 PM	A	1	27231		12	7091		213	32781		24	47931
A	27:04:18	5:31:48 PM	A	1	27398		12	6991		213	32735		24	47930
A	27:04:18	5:31:51 PM	A	1	27440		12	6749		213	32342		24	47955
A	27:04:18	5:31:54 PM	A	1	27390		12	6697		213	32481		24	47985
A	27:04:18	5:31:57 PM	A	1	27251		12	6109		213	32295		24	48021
A	27:04:18	5:32:00 PM	A	1	27307		12	6242		213	32760		24	48035
A	27:04:18	5:32:03 PM	A	1	27475		12	5885		213	32626		24	48042
A	27:04:18	5:32:06 PM	A	1	27288		12	6102		213	32351		24	48072
A	27:04:18	5:32:09 PM	A	1	27294		12	6108		213	32388		24	48085
A	27:04:18	5:32:12 PM	A	1	27394		12	5865		213	32287		24	48094
A	27:04:18	5:32:15 PM	A	1	27436		12	5816		213	32476		24	48127
A	27:04:18	5:32:18 PM	A	1	27417		12	5764		213	32594		24	48140
A	27:04:18	5:32:21 PM	A	1	27417		12	5875		213	32698		24	48189
A	27:04:18	5:32:24 PM	A	1	27308		12	6370		213	32394		24	48183
A	27:04:18	5:32:27 PM	A	1	27414		12	6192		213	32097		24	48204
A	27:04:18	5:32:30 PM	A	1	27459		12	6275		213	32206		24	48219
A	27:04:18	5:32:33 PM	A	1	27445		12	5983		213	32659		24	48254
A	27:04:18	5:32:36 PM	A	1	27377		12	5847		213	32263		24	48277
A	27:04:18	5:32:39 PM	A	1	27314		12	5898		213	30447		24	48285
A	27:04:18	5:32:42 PM	A	1	27386		12	5538		213	30078		24	48296
A	27:04:18	5:32:45 PM	A	1	27394		12	5661		213	32181		24	48324
A	27:04:18	5:32:48 PM	A	1	27420		12	5357		213	32131		24	48336
A	27:04:18	5:32:51 PM	A	1	27344		12	5407		213	32221		24	48370
A	27:04:18	5:32:54 PM	A	1	27484		12	5528		213	30493		24	48378
A	27:04:18	5:32:57 PM	A	1	27560		12	5348		213	30648		24	48396

A	27:04:18	5:33:00 PM	A	1	27379		12	5302		213	30480		24	48397
A	27:04:18	5:33:03 PM	A	1	27186		12	4950		213	32249		24	48379
A	27:04:18	5:33:06 PM	A	1	27280		12	4783		213	30334		24	48430
A	27:04:18	5:33:09 PM	A	1	27282		12	5098		213	30389		24	48440
A	27:04:18	5:33:12 PM	A	1	27188		12	4911		213	30417		24	48477
A	27:04:18	5:33:15 PM	A	1	27464		12	5021		213	29745		24	48448
A	27:04:18	5:33:18 PM	A	1	27332		12	4814		213	29848		24	48511
A	27:04:18	5:33:21 PM	A	1	27466		12	4315		213	30126		24	48526
A	27:04:18	5:33:24 PM	A	1	27180		12	4559		213	30310		24	48521
A	27:04:18	5:33:27 PM	A	1	27436		12	4322		213	30252		24	48541
A	27:04:18	5:33:30 PM	A	1	27463		12	4162		213	30342		24	48582
A	27:04:18	5:33:33 PM	A	1	27421		12	4487		213	29911		24	48552
A	27:04:18	5:33:36 PM	A	1	27387		12	3998		213	29870		24	48573
A	27:04:18	5:33:39 PM	A	1	27385		12	4093		213	30174		24	48591
A	27:04:18	5:33:42 PM	A	1	27478		12	3914		213	30297		24	48590
A	27:04:18	5:33:45 PM	A	1	27298		12	3822		213	30179		24	48591
A	27:04:18	5:33:48 PM	A	1	27468		12	3728		213	30081		24	48611
A	27:04:18	5:33:51 PM	A	1	27294		12	3269		213	29892		24	48639
A	27:04:18	5:33:54 PM	A	1	27246		12	3605		213	29767		24	48666
A	27:04:18	5:33:57 PM	A	1	27438		12	3099		213	29807		24	48660
A	27:04:18	5:34:00 PM	A	1	27439		12	3248		213	29752		24	48676
A	27:04:18	5:34:03 PM	A	1	27368		12	3393		213	30252		24	48678
A	27:04:18	5:34:06 PM	A	1	27323		12	3191		213	30248		24	48671
A	27:04:18	5:34:09 PM	A	1	27367		12	3084		213	30126		24	48686
A	27:04:18	5:34:12 PM	A	1	27387		12	2972		213	30062		24	48693
A	27:04:18	5:34:15 PM	A	1	27421		12	2815		213	29897		24	48715
A	27:04:18	5:34:18 PM	A	1	27405		12	2993		213	29983		24	48694
A	27:04:18	5:34:21 PM	A	1	27297		12	2486		213	29522		24	48712
A	27:04:18	5:34:24 PM	A	1	27303		12	2232		213	29598		24	48697
A	27:04:18	5:34:27 PM	A	1	27510		12	1126		213	30225		24	48723
A	27:04:18	5:34:30 PM	A	1	27399		12	1416		213	30034		24	48738
A	27:04:18	5:34:33 PM	A	1	27378		12	1068		213	29881		24	48692
A	27:04:18	5:34:36 PM	A	1	27332		12	1198		213	29717		24	48731
A	27:04:18	5:34:39 PM	A	1	27407		12	1627		213	30105		24	48713
A	27:04:18	5:34:42 PM	A	1	27393		12	1630		213	29859		24	48735
A	27:04:18	5:34:45 PM	A	1	27469		12	1369		213	30076		24	48733
A	27:04:18	5:34:48 PM	A	1	27562		12	1434		213	29567		24	48743
A	27:04:18	5:34:51 PM	A	1	27396		12	1123		213	29427		24	48743
A	27:04:18	5:34:54 PM	A	1	27386		12	1131		213	29269		24	48742
A	27:04:18	5:34:57 PM	A	1	27395		12	613		213	29769		24	48726
A	27:04:18	5:35:00 PM	A	1	27484		12	293		213	29831		24	48722
A	27:04:18	5:35:03 PM	A	1	27481		12	615		213	29592		24	48717

A	27:04:18	5:35:06 PM	A	1	27435		12	107		213	29757		24	48724
A	27:04:18	5:35:09 PM	A	1	27392		12	427		213	29776		24	48728
A	27:04:18	5:35:12 PM	A	1	27226		12	507		213	29828		24	48721
A	27:04:18	5:35:15 PM	A	1	27408		12	203		213	29149		24	48721
A	27:04:18	5:35:18 PM	A	1	27390		12	247		213	29281		24	48713
A	27:04:18	5:35:21 PM	A	1	27518		11	64892		213	29225		24	48688
A	27:04:18	5:35:24 PM	A	1	27438		11	63800		213	29633		24	48727
A	27:04:18	5:35:27 PM	A	1	27356		11	63766		213	29774		24	48689
A	27:04:18	5:35:30 PM	A	1	27410		11	64588		213	29534		24	48691
A	27:04:18	5:35:33 PM	A	1	27297		11	65054		213	29774		24	48694
A	27:04:18	5:35:36 PM	A	1	27361		11	64672		213	29815		24	48692
A	27:04:18	5:35:39 PM	A	1	27364		11	64271		213	29615		24	48697
A	27:04:18	5:35:42 PM	A	1	27420		11	64310		213	29692		24	48682
A	27:04:18	5:35:45 PM	A	1	27291		11	63709		213	29708		24	48703
A	27:04:18	5:35:48 PM	A	1	27328		11	64477		213	28923		24	48646
A	27:04:18	5:35:51 PM	A	1	27277		11	64285		213	29279		24	48630
A	27:04:18	5:35:54 PM	A	1	27323		11	64012		213	29822		24	48645
A	27:04:18	5:35:57 PM	A	1	27392		11	63837		213	29711		24	48643
A	27:04:18	5:36:00 PM	A	1	27433		11	63619		213	29659		24	48642
A	27:04:18	5:36:03 PM	A	1	27454		11	63227		213	29239		24	48630
A	27:04:18	5:36:06 PM	A	1	27383		11	62844		213	29280		24	48607
A	27:04:18	5:36:09 PM	A	1	27359		11	62483		213	29378		24	48597
A	27:04:18	5:36:12 PM	A	1	27342		11	64117		213	29065		24	48591
A	27:04:18	5:36:15 PM	A	1	27395		11	63036		213	29126		24	48581
A	27:04:18	5:36:18 PM	A	1	27402		11	63140		213	29214		24	48557
A	27:04:18	5:36:21 PM	A	1	27457		11	62657		213	29164		24	48555
A	27:04:18	5:36:24 PM	A	1	27418		11	62706		213	29087		24	48549
A	27:04:18	5:36:27 PM	A	1	27333		11	62801		213	29610		24	48530
A	27:04:18	5:36:30 PM	A	1	27350		11	61975		213	29421		24	48509
A	27:04:18	5:36:33 PM	A	1	27428		11	62021		213	29519		24	48495
A	27:04:18	5:36:36 PM	A	1	27470		11	61587		213	29519		24	48493
A	27:04:18	5:36:39 PM	A	1	27444		11	61782		213	29172		24	48467
A	27:04:18	5:36:42 PM	A	1	27229		11	62194		213	29505		24	48432
A	27:04:18	5:36:45 PM	A	1	27241		11	61991		213	29433		24	48442
A	27:04:18	5:36:48 PM	A	1	27367		11	61643		213	28922		24	48429
A	27:04:18	5:36:51 PM	A	1	27442		11	61192		213	29522		24	48402
A	27:04:18	5:36:54 PM	A	1	27310		11	61216		213	29613		24	48374
A	27:04:18	5:36:57 PM	A	1	27384		11	61690		213	29380		24	48376
A	27:04:18	5:37:00 PM	A	1	27383		11	61390		213	28923		24	48348
A	27:04:18	5:37:03 PM	A	1	27388		11	61570		213	29351		24	48313
A	27:04:18	5:37:06 PM	A	1	27529		11	61264		213	29355		24	48329
A	27:04:18	5:37:09 PM	A	1	27345		11	61040		213	29339		24	48289

A	27:04:18	5:37:12 PM	A	1	27364		11	61355		213	28830		24	48297
A	27:04:18	5:37:15 PM	A	1	27426		11	61027		213	28983		24	48269
A	27:04:18	5:37:18 PM	A	1	27386		11	60972		213	29173		24	48233
A	27:04:18	5:37:21 PM	A	1	27319		11	60853		213	29235		24	48242
A	27:04:18	5:37:24 PM	A	1	27351		11	60539		213	29160		24	48223
A	27:04:18	5:37:27 PM	A	1	27324		11	60628		213	29043		24	48162
A	27:04:18	5:37:30 PM	A	1	27316		11	60418		213	28936		24	48201
A	27:04:18	5:37:33 PM	A	1	27411		11	59949		213	29354		24	48165
A	27:04:18	5:37:36 PM	A	1	27505		11	59842		213	29042		24	48144
A	27:04:18	5:37:39 PM	A	1	27383		11	59034		213	28873		24	48130
A	27:04:18	5:37:42 PM	A	1	27401		11	59785		213	28863		24	48146
A	27:04:18	5:37:45 PM	A	1	27380		11	59639		213	28800		24	48102
A	27:04:18	5:37:48 PM	A	1	27303		11	59718		213	28706		24	48067
A	27:04:18	5:37:51 PM	A	1	27350		11	59720		213	29321		24	48039
A	27:04:18	5:37:54 PM	A	1	27239		11	59336		213	28776		24	48019
A	27:04:18	5:37:57 PM	A	1	27347		11	59579		213	28806		24	48011
A	27:04:18	5:38:00 PM	A	1	27390		11	59681		213	28666		24	48019
A	27:04:18	5:38:03 PM	A	1	27454		11	59564		213	29400		24	47920
A	27:04:18	5:38:06 PM	A	1	27393		11	59607		213	29066		24	47920
A	27:04:18	5:38:09 PM	A	1	27485		11	59183		213	28875		24	47953
A	27:04:18	5:38:12 PM	A	1	27349		11	59375		213	28568		24	47911
A	27:04:18	5:38:15 PM	A	1	27339		11	59253		213	28573		24	47902
A	27:04:18	5:38:18 PM	A	1	27267		11	59173		213	28562		24	47918
A	27:04:18	5:38:21 PM	A	1	27436		11	59009		213	28626		24	47893
A	27:04:18	5:38:24 PM	A	1	27260		11	58661		213	28601		24	47884
A	27:04:18	5:38:27 PM	A	1	27415		11	58632		213	28992		24	47838
A	27:04:18	5:38:30 PM	A	1	27497		11	58435		213	28866		24	47833
A	27:04:18	5:38:33 PM	A	1	27484		11	58147		213	29017		24	47798
A	27:04:18	5:38:36 PM	A	1	27449		11	58440		213	28518		24	47787
A	27:04:18	5:38:39 PM	A	1	27385		11	57897		213	28387		24	47770
A	27:04:18	5:38:42 PM	A	1	27315		11	57907		213	29035		24	47730
A	27:04:18	5:38:45 PM	A	1	27332		11	57879		213	28783		24	47711
A	27:04:18	5:38:48 PM	A	1	27284		11	57594		213	28799		24	47690
A	27:04:18	5:38:51 PM	A	1	27500		11	57911		213	28386		24	47699
A	27:04:18	5:38:54 PM	A	1	27311		11	57533		213	28555		24	47689
A	27:04:18	5:38:57 PM	A	1	27330		11	57966		213	28769		24	47681
A	27:04:18	5:39:00 PM	A	1	27334		11	57380		213	28516		24	47648
A	27:04:18	5:39:03 PM	A	1	27273		11	57369		213	28348		24	47661
A	27:04:18	5:39:06 PM	A	1	27080		11	57412		213	28545		24	47657
A	27:04:18	5:39:09 PM	A	1	27337		11	57193		213	28710		24	47622
A	27:04:18	5:39:12 PM	A	1	27351		11	57386		213	28947		24	47599
A	27:04:18	5:39:15 PM	A	1	27243		11	57302		213	28496		24	47595

A	27:04:18	5:39:18 PM	A	1	27297		11	56714		213	28839		24	47574
A	27:04:18	5:39:21 PM	A	1	27371		11	56265		213	28819		24	47572
A	27:04:18	5:39:24 PM	A	1	27138		11	56006		213	28621		24	47535
A	27:04:18	5:39:27 PM	A	1	27207		11	56167		213	28264		24	47557
A	27:04:18	5:39:30 PM	A	1	27387		11	56420		213	28563		24	47529
A	27:04:18	5:39:33 PM	A	1	27563		11	56026		213	28624		24	47529
A	27:04:18	5:39:36 PM	A	1	27485		11	55957		213	28208		24	47510
A	27:04:18	5:39:39 PM	A	1	27293		11	55552		213	27240		24	47526
A	27:04:18	5:39:42 PM	A	1	27487		11	55472		213	27155		24	47527
A	27:04:18	5:39:45 PM	A	1	27350		11	55685		213	28199		24	47510
A	27:04:18	5:39:48 PM	A	1	27295		11	55164		213	28452		24	47484
A	27:04:18	5:39:51 PM	A	1	27357		11	55503		213	28227		24	47446
A	27:04:18	5:39:54 PM	A	1	27408		11	55488		213	27933		24	47450
A	27:04:18	5:39:57 PM	A	1	27358		11	55243		213	27720		24	47457
A	27:04:18	5:40:00 PM	A	1	27338		11	55476		213	27806		24	47436
A	27:04:18	5:40:03 PM	A	1	27411		11	55230		213	27827		24	47431
A	27:04:18	5:40:06 PM	A	1	27421		11	55178		213	27795		24	47425
A	27:04:18	5:40:09 PM	A	1	27493		11	55135		213	27834		24	47445
A	27:04:18	5:40:12 PM	A	1	27382		11	54928		213	28111		24	47428
A	27:04:18	5:40:15 PM	A	1	27305		11	55048		213	28201		24	47408
A	27:04:18	5:40:18 PM	A	1	27417		11	54647		213	27844		24	47404
A	27:04:18	5:40:21 PM	A	1	27374		11	54621		213	27966		24	47395
A	27:04:18	5:40:24 PM	A	1	27330		11	53991		213	27741		24	47417
A	27:04:18	5:40:27 PM	A	1	27395		11	53861		213	28183		24	47400
A	27:04:18	5:40:30 PM	A	1	27403		11	54104		213	27846		24	47407
A	27:04:18	5:40:33 PM	A	1	27431		11	53343		213	27909		24	47380
A	27:04:18	5:40:36 PM	A	1	27282		11	53177		213	27726		24	47377
A	27:04:18	5:40:39 PM	A	1	27356		11	53441		213	27869		24	47387
A	27:04:18	5:40:42 PM	A	1	27367		11	53364		213	27818		24	47420
A	27:04:18	5:40:45 PM	A	1	27414		11	53626		213	28187		24	47404
A	27:04:18	5:40:48 PM	A	1	27268		11	53253		213	28204		24	47397
A	27:04:18	5:40:51 PM	A	1	27372		11	53344		213	27952		24	47402
A	27:04:18	5:40:54 PM	A	1	27389		11	53315		213	28397		24	47434
A	27:04:18	5:40:57 PM	A	1	27381		11	52952		213	27997		24	47419
A	27:04:18	5:41:00 PM	A	1	27311		11	53040		213	27991		24	47431
A	27:04:18	5:41:03 PM	A	1	27453		11	52721		213	28069		24	47435
A	27:04:18	5:41:06 PM	A	1	27460		11	52648		213	28057		24	47446
A	27:04:18	5:41:09 PM	A	1	27289		11	52756		213	27999		24	47461
A	27:04:18	5:41:12 PM	A	1	27369		11	52598		213	27576		24	47456
A	27:04:18	5:41:15 PM	A	1	27372		11	52460		213	27787		24	47455
A	27:04:18	5:41:18 PM	A	1	27469		11	52351		213	28106		24	47486
A	27:04:18	5:41:21 PM	A	1	27385		11	52015		213	28176		24	47455

A	27:04:18	5:41:24 PM	A	1	27377		11	52034		213	28143		24	47460
A	27:04:18	5:41:27 PM	A	1	27356		11	51613		213	28045		24	47457
A	27:04:18	5:41:30 PM	A	1	27230		11	51564		213	28067		24	47461
A	27:04:18	5:41:33 PM	A	1	27350		11	51089		213	28198		24	47463
A	27:04:18	5:41:36 PM	A	1	27478		11	51513		213	27964		24	47502
A	27:04:18	5:41:39 PM	A	1	27449		11	51568		213	27894		24	47483
A	27:04:18	5:41:42 PM	A	1	27262		11	51487		213	27691		24	47520
A	27:04:18	5:41:45 PM	A	1	27301		11	51492		213	27522		24	47518
A	27:04:18	5:41:48 PM	A	1	27444		11	51320		213	27571		24	47528
A	27:04:18	5:41:51 PM	A	1	27438		11	51000		213	27464		24	47537
A	27:04:18	5:41:54 PM	A	1	27292		11	51218		213	27850		24	47544
A	27:04:18	5:41:57 PM	A	1	27311		11	50716		213	27756		24	47541
A	27:04:18	5:42:00 PM	A	1	27327		11	50505		213	27694		24	47540
A	27:04:18	5:42:03 PM	A	1	27359		11	50556		213	27727		24	47576
A	27:04:18	5:42:06 PM	A	1	27370		11	50472		213	27633		24	47561
A	27:04:18	5:42:09 PM	A	1	27352		11	50715		213	27522		24	47598
A	27:04:18	5:42:12 PM	A	1	27267		11	50292		213	27760		24	47611
A	27:04:18	5:42:15 PM	A	1	27350		11	50375		213	27817		24	47623
A	27:04:18	5:42:18 PM	A	1	27282		11	50138		213	27840		24	47623
A	27:04:18	5:42:21 PM	A	1	27371		11	50155		213	27768		24	47621
A	27:04:18	5:42:24 PM	A	1	27541		11	50270		213	27785		24	47626
A	27:04:18	5:42:27 PM	A	1	27402		11	49967		213	27768		24	47680
A	27:04:18	5:42:30 PM	A	1	27358		11	49553		213	27590		24	47656
A	27:04:18	5:42:33 PM	A	1	27300		11	49628		213	27547		24	47656
A	27:04:18	5:42:36 PM	A	1	27515		11	49320		213	27656		24	47658
A	27:04:18	5:42:39 PM	A	1	27330		11	49110		213	27509		24	47697
A	27:04:18	5:42:42 PM	A	1	27412		11	49224		213	27331		24	47697
A	27:04:18	5:42:45 PM	A	1	27534		11	49048		213	27222		24	47756
A	27:04:18	5:42:48 PM	A	1	27590		11	49188		213	27129		24	47737
A	27:04:18	5:42:51 PM	A	1	27421		11	48915		213	27343		24	47742
A	27:04:18	5:42:54 PM	A	1	27375		11	48791		213	27629		24	47729
A	27:04:18	5:42:57 PM	A	1	27250		11	48326		213	27358		24	47772
A	27:04:18	5:43:00 PM	A	1	27390		11	47149		213	27105		24	47801
A	27:04:18	5:43:03 PM	A	1	27434		11	48547		213	27453		24	47782
A	27:04:18	5:43:06 PM	A	1	27526		11	48407		213	27500		24	47812
A	27:04:18	5:43:09 PM	A	1	27386		11	48241		213	27481		24	47839
A	27:04:18	5:43:12 PM	A	1	27287		11	48328		213	27564		24	47837
A	27:04:18	5:43:15 PM	A	1	27385		11	47616		213	27533		24	47840
A	27:04:18	5:43:18 PM	A	1	27359		11	47679		213	27540		24	47876
A	27:04:18	5:43:21 PM	A	1	27234		11	47083		213	27395		24	47875
A	27:04:18	5:43:24 PM	A	1	27393		11	45907		213	27132		24	47893
A	27:04:18	5:43:27 PM	A	1	27425		11	45798		213	27271		24	47932

A	27:04:18	5:43:30 PM	A	1	27240		11	46183		213	27304		24	47902
A	27:04:18	5:43:33 PM	A	1	27320		11	46654		213	27424		24	47955
A	27:04:18	5:43:36 PM	A	1	27520		11	46750		213	27454		24	47952
A	27:04:18	5:43:39 PM	A	1	27390		11	46731		213	27373		24	47956
A	27:04:18	5:43:42 PM	A	1	27343		11	46841		213	27296		24	47941
A	27:04:18	5:43:45 PM	A	1	27309		11	46183		213	27002		24	47940
A	27:04:18	5:43:48 PM	A	1	27430		11	46246		213	26959		24	48015
A	27:04:18	5:43:51 PM	A	1	27402		11	46051		213	27242		24	47997
A	27:04:18	5:43:54 PM	A	1	27321		11	46559		213	27191		24	48007
A	27:04:18	5:43:57 PM	A	1	27433		11	46488		213	26936		24	48032
A	27:04:18	5:44:00 PM	A	1	27303		11	46342		213	26946		24	48034
A	27:04:18	5:44:03 PM	A	1	27381		11	46224		213	27292		24	48077
A	27:04:18	5:44:06 PM	A	1	27389		11	46032		213	27355		24	48071
A	27:04:18	5:44:09 PM	A	1	27416		11	45688		213	27262		24	48104
A	27:04:18	5:44:12 PM	A	1	27339		11	45698		213	27312		24	48114
A	27:04:18	5:44:15 PM	A	1	27308		11	45640		213	26884		24	48104
A	27:04:18	5:44:18 PM	A	1	27480		11	45669		213	26675		24	48096
A	27:04:18	5:44:21 PM	A	1	27364		11	45672		213	26789		24	48138
A	27:04:18	5:44:24 PM	A	1	27321		11	45495		213	26786		24	47875
A	27:04:18	5:44:27 PM	A	1	27388		11	45622		213	26598		24	48162
A	27:04:18	5:44:30 PM	A	1	27339		11	45266		213	26651		24	48176
A	27:04:18	5:44:33 PM	A	1	27369		11	45236		213	26983		24	48159
A	27:04:18	5:44:36 PM	A	1	27410		11	45203		213	26946		24	48206
A	27:04:18	5:44:39 PM	A	1	27243		11	45018		213	26899		24	48232
A	27:04:18	5:44:42 PM	A	1	27384		11	44518		213	26980		24	48215
A	27:04:18	5:44:45 PM	A	1	27434		11	44931		213	26891		24	48227
A	27:04:18	5:44:48 PM	A	1	27357		11	44645		213	26895		24	48261
A	27:04:18	5:44:51 PM	A	1	27291		11	44630		213	27120		24	48240
A	27:04:18	5:44:54 PM	A	1	27451		11	44323		213	26658		24	48275
A	27:04:18	5:44:57 PM	A	1	27394		11	44636		213	26947		24	48277
A	27:04:18	5:45:00 PM	A	1	27312		11	44539		213	26782		24	48270
A	27:04:18	5:45:03 PM	A	1	27368		11	44364		213	26854		24	48338
A	27:04:18	5:45:06 PM	A	1	27366		11	44417		213	26534		24	48288
A	27:04:18	5:45:09 PM	A	1	27452		11	43666		213	26823		24	48327
A	27:04:18	5:45:12 PM	A	1	27504		11	42924		213	26839		24	48336
A	27:04:18	5:45:15 PM	A	1	27368		11	42591		213	26532		24	48361
A	27:04:18	5:45:18 PM	A	1	27379		11	42728		213	26568		24	48348
A	27:04:18	5:45:21 PM	A	1	27337		11	43015		213	26514		24	48355
A	27:04:18	5:45:24 PM	A	1	27410		11	42592		213	26485		24	48391
A	27:04:18	5:45:27 PM	A	1	27324		11	42242		213	26513		24	48382
A	27:04:18	5:45:30 PM	A	1	27311		11	42178		213	26832		24	48399
A	27:04:18	5:45:33 PM	A	1	27445		11	42116		213	26719		24	48413

A	27:04:18	5:45:36 PM	A	1	27473		11	42398		213	26388		24	48394
A	27:04:18	5:45:39 PM	A	1	27318		11	42862		213	26423		24	48417
A	27:04:18	5:45:42 PM	A	1	27395		11	42890		213	26702		24	48437
A	27:04:18	5:45:45 PM	A	1	27377		11	42818		213	26717		24	48448
A	27:04:18	5:45:48 PM	A	1	27344		11	42163		213	26832		24	48447
A	27:04:18	5:45:51 PM	A	1	27504		11	42907		213	26634		24	48440
A	27:04:18	5:45:54 PM	A	1	27468		11	42610		213	26437		24	48460
A	27:04:18	5:45:57 PM	A	1	27478		11	42522		213	26390		24	48453
A	27:04:18	5:46:00 PM	A	1	27408		11	42236		213	26475		24	48478
A	27:04:18	5:46:03 PM	A	1	27588		11	42414		213	26444		24	48477
A	27:04:18	5:46:06 PM	A	1	27372		11	42451		213	26410		24	48511
A	27:04:18	5:46:09 PM	A	1	27499		11	41988		213	26581		24	48512
A	27:04:18	5:46:12 PM	A	1	27364		11	41605		213	26324		24	48470
A	27:04:18	5:46:15 PM	A	1	27303		11	41384		213	26621		24	48522
A	27:04:18	5:46:18 PM	A	1	27331		11	41027		213	26558		24	48487
A	27:04:18	5:46:21 PM	A	1	27375		11	42134		213	26314		24	48506
A	27:04:18	5:46:24 PM	A	1	27232		11	41792		213	26515		24	48505
A	27:04:18	5:46:27 PM	A	1	27342		11	41709		213	26311		24	48485
A	27:04:18	5:46:30 PM	A	1	27419		11	41702		213	26188		24	48492
A	27:04:18	5:46:33 PM	A	1	27292		11	41511		213	26073		24	48487
A	27:04:18	5:46:36 PM	A	1	27459		11	41714		213	26245		24	48502
A	27:04:18	5:46:39 PM	A	1	27566		11	41633		213	26466		24	48520
A	27:04:18	5:46:42 PM	A	1	27449		11	41517		213	26395		24	48550
A	27:04:18	5:46:45 PM	A	1	27420		11	41589		213	26479		24	48506
A	27:04:18	5:46:48 PM	A	1	27463		11	41354		213	26239		24	48491
A	27:04:18	5:46:51 PM	A	1	27429		11	41439		213	26034		24	48484
A	27:04:18	5:46:54 PM	A	1	27352		11	41421		213	26032		24	48500
A	27:04:18	5:46:57 PM	A	1	27394		11	40757		213	26382		24	48511
A	27:04:18	5:47:00 PM	A	1	27410		11	40896		213	26201		24	48508
A	27:04:18	5:47:03 PM	A	1	27423		11	40746		213	25935		24	48489
A	27:04:18	5:47:06 PM	A	1	27402		11	40695		213	26293		24	48493
A	27:04:18	5:47:09 PM	A	1	27349		11	40187		213	26098		24	48475
A	27:04:18	5:47:12 PM	A	1	27364		11	40174		213	26205		24	48479
A	27:04:18	5:47:15 PM	A	1	27190		11	40270		213	25949		24	48469
A	27:04:18	5:47:18 PM	A	1	27371		11	40460		213	26007		24	48479
A	27:04:18	5:47:21 PM	A	1	27283		11	40009		213	26141		24	48448
A	27:04:18	5:47:24 PM	A	1	27422		11	40179		213	26071		24	48403
A	27:04:18	5:47:27 PM	A	1	27413		11	40152		213	26015		24	48421
A	27:04:18	5:47:30 PM	A	1	27380		11	40045		213	25890		24	48467
A	27:04:18	5:47:33 PM	A	1	27488		11	39622		213	26233		24	48422
A	27:04:18	5:47:36 PM	A	1	27424		11	39546		213	25977		24	48417
A	27:04:18	5:47:39 PM	A	1	27386		11	39612		213	26017		24	48400

A	27:04:18	5:47:42 PM	A	1	27312		11	39175		213	25836		24	48397
A	27:04:18	5:47:45 PM	A	1	27437		11	39269		213	25878		24	48396
A	27:04:18	5:47:48 PM	A	1	27356		11	38977		213	25598		24	48354
A	27:04:18	5:47:51 PM	A	1	27418		11	39012		213	25580		24	48351
A	27:04:18	5:47:54 PM	A	1	27431		11	39150		213	25590		24	48341
A	27:04:18	5:47:57 PM	A	1	27368		11	38643		213	25589		24	48303
A	27:04:18	5:48:00 PM	A	1	27344		11	38900		213	26112		24	48309
A	27:04:18	5:48:03 PM	A	1	27332		11	38620		213	25831		24	48297
A	27:04:18	5:48:06 PM	A	1	27366		11	38298		213	25839		24	48279
A	27:04:18	5:48:09 PM	A	1	27373		11	38218		213	25737		24	48259
A	27:04:18	5:48:12 PM	A	1	27299		11	37693		213	25819		24	48242
A	27:04:18	5:48:15 PM	A	1	27375		11	38133		213	25916		24	48229
A	27:04:18	5:48:18 PM	A	1	27392		11	37768		213	25734		24	48228
A	27:04:18	5:48:21 PM	A	1	27381		11	37662		213	25379		24	48209
A	27:04:18	5:48:24 PM	A	1	27375		11	37585		213	25560		24	48152
A	27:04:18	5:48:27 PM	A	1	27441		11	37511		213	25835		24	48172
A	27:04:18	5:48:30 PM	A	1	27431		11	37451		213	25706		24	48163
A	27:04:18	5:48:33 PM	A	1	27403		11	37247		213	25431		24	48150
A	27:04:18	5:48:36 PM	A	1	27449		11	37181		213	25590		24	48141
A	27:04:18	5:48:39 PM	A	1	27507		11	37023		213	25338		24	48105
A	27:04:18	5:48:42 PM	A	1	27458		11	36792		213	25679		24	48114
A	27:04:18	5:48:45 PM	A	1	27449		11	36836		213	25597		24	48096
A	27:04:18	5:48:48 PM	A	1	27387		11	36346		213	25518		24	48100
A	27:04:18	5:48:51 PM	A	1	27374		11	35686		213	25415		24	48064
A	27:04:18	5:48:54 PM	A	1	27236		11	36179		213	25111		24	48080
A	27:04:18	5:48:57 PM	A	1	27455		11	35856		213	25264		24	48003
A	27:04:18	5:49:00 PM	A	1	27429		11	36300		213	25059		24	48015
A	27:04:18	5:49:03 PM	A	1	27324		11	35935		213	25173		24	47987
A	27:04:18	5:49:06 PM	A	1	27360		11	35763		213	25190		24	47986
A	27:04:18	5:49:09 PM	A	1	27361		11	35794		213	25645		24	47963
A	27:04:18	5:49:12 PM	A	1	27355		11	35581		213	25302		24	47954
A	27:04:18	5:49:15 PM	A	1	27393		11	35277		213	25424		24	47956
A	27:04:18	5:49:18 PM	A	1	27357		11	34734		213	25300		24	47927
A	27:04:18	5:49:21 PM	A	1	27542		11	34217		213	25173		24	47897
A	27:04:18	5:49:24 PM	A	1	27435		11	34723		213	25467		24	47892
A	27:04:18	5:49:27 PM	A	1	27228		11	34994		213	25342		24	47871
A	27:04:18	5:49:30 PM	A	1	27431		11	34809		213	25438		24	47835
A	27:04:18	5:49:33 PM	A	1	27411		11	34455		213	25307		24	47848
A	27:04:18	5:49:36 PM	A	1	27369		11	34173		213	25096		24	47804
A	27:04:18	5:49:39 PM	A	1	27392		11	34286		213	25090		24	47820
A	27:04:18	5:49:42 PM	A	1	27362		11	33808		213	25438		24	47801
A	27:04:18	5:49:45 PM	A	1	27303		11	33895		213	25418		24	47774

A	27:04:18	5:49:48 PM	A	1	27477		11	34024		213	25144		24	47758
A	27:04:18	5:49:51 PM	A	1	27399		11	34036		213	25066		24	47735
A	27:04:18	5:49:54 PM	A	1	27386		11	34037		213	24976		24	47743
A	27:04:18	5:49:57 PM	A	1	27405		11	33685		213	25222		24	47713
A	27:04:18	5:50:00 PM	A	1	27391		11	33755		213	25298		24	47691
A	27:04:18	5:50:03 PM	A	1	27383		11	33873		213	24832		24	47667
A	27:04:18	5:50:06 PM	A	1	27364		11	33213		213	24977		24	47637
A	27:04:18	5:50:09 PM	A	1	27376		11	33091		213	24861		24	47632
A	27:04:18	5:50:12 PM	A	1	27352		11	32540		213	25365		24	47633
A	27:04:18	5:50:15 PM	A	1	27429		11	32773		213	25138		24	47600
A	27:04:18	5:50:18 PM	A	1	27383		11	32599		213	25014		24	47566
A	27:04:18	5:50:21 PM	A	1	27450		11	32347		213	24686		24	47591
A	27:04:18	5:50:24 PM	A	1	27466		11	32742		213	25018		24	47584
A	27:04:18	5:50:27 PM	A	1	27342		11	32840		213	25040		24	47541
A	27:04:18	5:50:30 PM	A	1	27466		11	32682		213	24755		24	47543
A	27:04:18	5:50:33 PM	A	1	27404		11	32579		213	24859		24	47548
A	27:04:18	5:50:36 PM	A	1	27391		11	32103		213	25135		24	47524
A	27:04:18	5:50:39 PM	A	1	27502		11	32071		213	24678		24	47515
A	27:04:18	5:50:42 PM	A	1	27340		11	32228		213	24743		24	47504
A	27:04:18	5:50:45 PM	A	1	27415		11	32238		213	24724		24	47467
A	27:04:18	5:50:48 PM	A	1	27384		11	31923		213	25105		24	47507
A	27:04:18	5:50:51 PM	A	1	27330		11	31436		213	24941		24	47453
A	27:04:18	5:50:54 PM	A	1	27372		11	31544		213	24910		24	47433
A	27:04:18	5:50:57 PM	A	1	27490		11	32646		213	24972		24	47459
A	27:04:18	5:51:00 PM	A	1	27414		11	31441		213	24503		24	47427
A	27:04:18	5:51:03 PM	A	1	27396		11	31578		213	24992		24	47460
A	27:04:18	5:51:06 PM	A	1	27434		11	31381		213	24968		24	47424
A	27:04:18	5:51:09 PM	A	1	27359		11	31266		213	24727		24	47435
A	27:04:18	5:51:12 PM	A	1	27327		11	30872		213	24737		24	47393
A	27:04:18	5:51:15 PM	A	1	27396		11	30823		213	24655		24	47405
A	27:04:18	5:51:18 PM	A	1	27424		11	30564		213	24688		24	47405
A	27:04:18	5:51:21 PM	A	1	27481		11	30199		213	24840		24	47356
A	27:04:18	5:51:24 PM	A	1	27353		11	30416		213	24675		24	47374
A	27:04:18	5:51:27 PM	A	1	27397		11	30324		213	24562		24	47364
A	27:04:18	5:51:30 PM	A	1	27443		11	30275		213	24885		24	47370
A	27:04:18	5:51:33 PM	A	1	27348		11	30534		213	24611		24	47331
A	27:04:18	5:51:36 PM	A	1	27354		11	30019		213	24449		24	47318
A	27:04:18	5:51:39 PM	A	1	27482		11	30614		213	24135		24	47325
A	27:04:18	5:51:42 PM	A	1	27466		11	29942		213	24569		24	47321
A	27:04:18	5:51:45 PM	A	1	27348		11	29167		213	24670		24	47309
A	27:04:18	5:51:48 PM	A	1	27378		11	29311		213	24770		24	47319
A	27:04:18	5:51:51 PM	A	1	27353		11	29417		213	24838		24	47322

A	27:04:18	5:51:54 PM	A	1	27421		11	29432		213	24499		24	47296
A	27:04:18	5:51:57 PM	A	1	27396		11	29465		213	24604		24	47265
A	27:04:18	5:52:00 PM	A	1	27438		11	28634		213	24533		24	47279
A	27:04:18	5:52:03 PM	A	1	27364		11	28487		213	24357		24	47288
A	27:04:18	5:52:06 PM	A	1	27454		11	28478		213	24465		24	47318
A	27:04:18	5:52:09 PM	A	1	27489		11	28104		213	24675		24	47294
A	27:04:18	5:52:12 PM	A	1	27278		11	28129		213	24520		24	47274
A	27:04:18	5:52:15 PM	A	1	27322		11	27868		213	24211		24	47277
A	27:04:18	5:52:18 PM	A	1	27234		11	28120		213	24221		24	47240
A	27:04:18	5:52:21 PM	A	1	27311		11	27856		213	24434		24	47296
A	27:04:18	5:52:24 PM	A	1	27408		11	28036		213	24466		24	47299
A	27:04:18	5:52:27 PM	A	1	27411		11	28026		213	24319		24	47281
A	27:04:18	5:52:30 PM	A	1	27371		11	27643		213	24322		24	47259
A	27:04:18	5:52:33 PM	A	1	27306		11	27217		213	24262		24	47261
A	27:04:18	5:52:36 PM	A	1	27372		11	27649		213	24240		24	47268
A	27:04:18	5:52:39 PM	A	1	27411		11	27506		213	24049		24	47294
A	27:04:18	5:52:42 PM	A	1	27275		11	27557		213	24494		24	47265
A	27:04:18	5:52:45 PM	A	1	27303		11	27314		213	24247		24	47277
A	27:04:18	5:52:48 PM	A	1	27448		11	27402		213	24521		24	47274
A	27:04:18	5:52:51 PM	A	1	27363		11	27245		213	24203		24	47271
A	27:04:18	5:52:54 PM	A	1	27367		11	27318		213	23986		24	47296
A	27:04:18	5:52:57 PM	A	1	27292		11	27303		213	23843		24	47314
A	27:04:18	5:53:00 PM	A	1	27294		11	26663		213	24511		24	47328
A	27:04:18	5:53:03 PM	A	1	27402		11	26659		213	24217		24	47303
A	27:04:18	5:53:06 PM	A	1	27436		11	26661		213	24053		24	47321
A	27:04:18	5:53:09 PM	A	1	27315		11	26357		213	23953		24	47295
A	27:04:18	5:53:12 PM	A	1	27334		11	25839		213	23841		24	47331
A	27:04:18	5:53:15 PM	A	1	27509		11	25967		213	24284		24	47341
A	27:04:18	5:53:18 PM	A	1	27321		11	26548		213	24147		24	47354
A	27:04:18	5:53:21 PM	A	1	27398		11	26625		213	24221		24	47340
A	27:04:18	5:53:24 PM	A	1	27385		11	26150		213	24025		24	47371
A	27:04:18	5:53:27 PM	A	1	27338		11	26217		213	23881		24	47392
A	27:04:18	5:53:30 PM	A	1	27464		11	26115		213	23878		24	47364
A	27:04:18	5:53:33 PM	A	1	27409		11	25897		213	24143		24	47355
A	27:04:18	5:53:36 PM	A	1	27507		11	25888		213	24199		24	47412
A	27:04:18	5:53:39 PM	A	1	27435		11	25468		213	23977		24	47412
A	27:04:18	5:53:42 PM	A	1	27262		11	25354		213	23911		24	47390
A	27:04:18	5:53:45 PM	A	1	27248		11	25962		213	24031		24	47422
A	27:04:18	5:53:48 PM	A	1	27451		11	25284		213	23904		24	47413
A	27:04:18	5:53:51 PM	A	1	27498		11	25388		213	23746		24	47440
A	27:04:18	5:53:54 PM	A	1	27336		11	24817		213	23641		24	47440
A	27:04:18	5:53:57 PM	A	1	27474		11	24742		213	23621		24	47465

A	27:04:18	5:54:00 PM	A	1	27370		11	24618		213	23755		24	47502
A	27:04:18	5:54:03 PM	A	1	27325		11	24472		213	23953		24	47491
A	27:04:18	5:54:06 PM	A	1	27376		11	24609		213	24024		24	47508
A	27:04:18	5:54:09 PM	A	1	27380		11	24198		213	23587		24	47489
A	27:04:18	5:54:12 PM	A	1	27369		11	24407		213	23710		24	47518
A	27:04:18	5:54:15 PM	A	1	27444		11	24116		213	23703		24	47551
A	27:04:18	5:54:18 PM	A	1	27451		11	23962		213	23552		24	47568
A	27:04:18	5:54:21 PM	A	1	27499		11	24030		213	23893		24	47588
A	27:04:18	5:54:24 PM	A	1	27453		11	23888		213	23852		24	47577
A	27:04:18	5:54:27 PM	A	1	27342		11	24718		213	23867		24	47578
A	27:04:18	5:54:30 PM	A	1	27572		11	24138		213	23615		24	47613
A	27:04:18	5:54:33 PM	A	1	27494		11	23656		213	23840		24	47597
A	27:04:18	5:54:36 PM	A	1	27356		11	23756		213	23753		24	47635
A	27:04:18	5:54:39 PM	A	1	27322		11	23533		213	23638		24	47606
A	27:04:18	5:54:42 PM	A	1	27461		11	23391		213	23434		24	47665
A	27:04:18	5:54:45 PM	A	1	27454		11	23776		213	23389		24	47651
A	27:04:18	5:54:48 PM	A	1	27368		11	23443		213	23648		24	47672
A	27:04:18	5:54:51 PM	A	1	27224		11	23796		213	23728		24	47688
A	27:04:18	5:54:54 PM	A	1	27434		11	23335		213	23603		24	47701
A	27:04:18	5:54:57 PM	A	1	27343		11	22962		213	23441		24	47704
A	27:04:18	5:55:00 PM	A	1	27428		11	22675		213	23326		24	47706
A	27:04:18	5:55:03 PM	A	1	27522		11	22203		213	23231		24	47726
A	27:04:18	5:55:06 PM	A	1	27403		11	22012		213	23363		24	47763
A	27:04:18	5:55:09 PM	A	1	27527		11	22015		213	23639		24	47783
A	27:04:18	5:55:12 PM	A	1	27390		11	21961		213	23544		24	47783
A	27:04:18	5:55:15 PM	A	1	27403		11	22090		213	23491		24	47803
A	27:04:18	5:55:18 PM	A	1	27261		11	21888		213	23289		24	47812
A	27:04:18	5:55:21 PM	A	1	27495		11	22098		213	23240		24	47847
A	27:04:18	5:55:24 PM	A	1	27285		11	22341		213	23181		24	47836
A	27:04:18	5:55:27 PM	A	1	27361		11	21698		213	23502		24	47851
A	27:04:18	5:55:30 PM	A	1	27325		11	22286		213	23426		24	47886
A	27:04:18	5:55:33 PM	A	1	27382		11	22060		213	23082		24	47919
A	27:04:18	5:55:36 PM	A	1	27454		11	21987		213	23406		24	47908
A	27:04:18	5:55:39 PM	A	1	27547		11	21678		213	23273		24	47938
A	27:04:18	5:55:42 PM	A	1	27380		11	21192		213	22964		24	47925
A	27:04:18	5:55:45 PM	A	1	27422		11	21566		213	23083		24	47922
A	27:04:18	5:55:48 PM	A	1	27365		11	21538		213	23040		24	47956
A	27:04:18	5:55:51 PM	A	1	27332		11	21168		213	22865		24	47965
A	27:04:18	5:55:54 PM	A	1	27378		11	21720		213	22847		24	47985
A	27:04:18	5:55:57 PM	A	1	27413		11	21363		213	22875		24	47969
A	27:04:18	5:56:00 PM	A	1	27406		11	21519		213	23024		24	47997
A	27:04:18	5:56:03 PM	A	1	27413		11	21355		213	23216		24	48018

A	27:04:18	5:56:06 PM	A	1	27389		11	20802		213	22978		24	48052
A	27:04:18	5:56:09 PM	A	1	27411		11	21078		213	23241		24	48056
A	27:04:18	5:56:12 PM	A	1	27258		11	21237		213	23018		24	48072
A	27:04:18	5:56:15 PM	A	1	27447		11	21275		213	23125		24	48074
A	27:04:18	5:56:18 PM	A	1	27535		11	20983		213	23108		24	48086
A	27:04:18	5:56:21 PM	A	1	27453		11	20285		213	23012		24	48111
A	27:04:18	5:56:24 PM	A	1	27499		11	20778		213	22786		24	48129
A	27:04:18	5:56:27 PM	A	1	27479		11	20894		213	22945		24	48124
A	27:04:18	5:56:30 PM	A	1	27274		11	20747		213	23196		24	48132
A	27:04:18	5:56:33 PM	A	1	27335		11	20466		213	23101		24	48146
A	27:04:18	5:56:36 PM	A	1	27270		11	20437		213	22958		24	48165
A	27:04:18	5:56:39 PM	A	1	27340		11	20772		213	23014		24	48199
A	27:04:18	5:56:42 PM	A	1	27392		11	20649		213	22832		24	48222
A	27:04:18	5:56:45 PM	A	1	27423		11	20542		213	22836		24	48207
A	27:04:18	5:56:48 PM	A	1	27367		11	20878		213	22991		24	48203
A	27:04:18	5:56:51 PM	A	1	27368		11	20789		213	22914		24	48216
A	27:04:18	5:56:54 PM	A	1	27367		11	20462		213	22943		24	48243
A	27:04:18	5:56:57 PM	A	1	27334		11	20686		213	22680		24	48230
A	27:04:18	5:57:00 PM	A	1	27353		11	20468		213	22621		24	48282
A	27:04:18	5:57:03 PM	A	1	27256		11	20357		213	22713		24	48283
A	27:04:18	5:57:06 PM	A	1	27341		11	20211		213	22857		24	48249
A	27:04:18	5:57:09 PM	A	1	27279		11	20079		213	22842		24	48244
A	27:04:18	5:57:12 PM	A	1	27488		11	19695		213	22809		24	48278
A	27:04:18	5:57:15 PM	A	1	27242		11	19633		213	22631		24	48293
A	27:04:18	5:57:18 PM	A	1	27391		11	19692		213	22540		24	48316
A	27:04:18	5:57:21 PM	A	1	27542		11	19579		213	22624		24	48331
A	27:04:18	5:57:24 PM	A	1	27351		11	19795		213	22497		24	48336
A	27:04:18	5:57:27 PM	A	1	27341		11	19461		213	22593		24	48329
A	27:04:18	5:57:30 PM	A	1	27564		11	18853		213	22839		24	48358
A	27:04:18	5:57:33 PM	A	1	27378		11	19006		213	22592		24	48354
A	27:04:18	5:57:36 PM	A	1	27368		11	19208		213	22326		24	48370
A	27:04:18	5:57:39 PM	A	1	27252		11	19369		213	22633		24	48360
A	27:04:18	5:57:42 PM	A	1	27302		11	19481		213	22589		24	48350
A	27:04:18	5:57:45 PM	A	1	27442		11	19208		213	22241		24	48382
A	27:04:18	5:57:48 PM	A	1	27343		11	19559		213	22174		24	48382
A	27:04:18	5:57:51 PM	A	1	27353		11	19280		213	22728		24	48383
A	27:04:18	5:57:54 PM	A	1	27452		11	19341		213	22542		24	48404
A	27:04:18	5:57:57 PM	A	1	27409		11	19430		213	22481		24	48432
A	27:04:18	5:58:00 PM	A	1	27406		11	18862		213	22127		24	48403
A	27:04:18	5:58:03 PM	A	1	27340		11	18898		213	22029		24	48431
A	27:04:18	5:58:06 PM	A	1	27249		11	18506		213	22590		24	48430
A	27:04:18	5:58:09 PM	A	1	27193		11	18598		213	22345		24	48425

A	27:04:18	5:58:12 PM	A	1	27478		11	18622		213	22458		24	48452
A	27:04:18	5:58:15 PM	A	1	27466		11	18664		213	22032		24	48457
A	27:04:18	5:58:18 PM	A	1	27406		11	18811		213	22433		24	48434
A	27:04:18	5:58:21 PM	A	1	27500		11	18408		213	22196		24	48456
A	27:04:18	5:58:24 PM	A	1	27347		11	18326		213	22014		24	48495
A	27:04:18	5:58:27 PM	A	1	27329		11	18265		213	22183		24	48489
A	27:04:18	5:58:30 PM	A	1	27105		11	17814		213	22103		24	48457
A	27:04:18	5:58:33 PM	A	1	27505		11	18349		213	22457		24	48508
A	27:04:18	5:58:36 PM	A	1	27406		11	17924		213	22216		24	48508
A	27:04:18	5:58:39 PM	A	1	27646		11	18100		213	22246		24	48515
A	27:04:18	5:58:42 PM	A	1	27481		11	17786		213	22037		24	48502
A	27:04:18	5:58:45 PM	A	1	27280		11	17286		213	22148		24	48516
A	27:04:18	5:58:48 PM	A	1	27275		11	17531		213	22201		24	48536
A	27:04:18	5:58:51 PM	A	1	27302		11	16611		213	21953		24	48552
A	27:04:18	5:58:54 PM	A	1	27312		11	16856		213	21866		24	48548
A	27:04:18	5:58:57 PM	A	1	27278		11	17315		213	22177		24	48554
A	27:04:18	5:59:00 PM	A	1	27377		11	17332		213	22266		24	48539
A	27:04:18	5:59:03 PM	A	1	27439		11	17370		213	21852		24	48528
A	27:04:18	5:59:06 PM	A	1	27510		11	17240		213	22208		24	48577
A	27:04:18	5:59:09 PM	A	1	27417		11	17026		213	22050		24	48548
A	27:04:18	5:59:12 PM	A	1	27335		11	17143		213	21988		24	48594
A	27:04:18	5:59:15 PM	A	1	27365		11	16930		213	22134		24	48587
A	27:04:18	5:59:18 PM	A	1	27422		11	16813		213	22266		24	48591
A	27:04:18	5:59:21 PM	A	1	27536		11	15890		213	21908		24	48607
A	27:04:18	5:59:24 PM	A	1	27302		11	15865		213	21866		24	48577
A	27:04:18	5:59:27 PM	A	1	27359		11	16426		213	21646		24	48610
A	27:04:18	5:59:30 PM	A	1	27517		11	16207		213	21648		24	48616
A	27:04:18	5:59:33 PM	A	1	27488		11	16538		213	21606		24	48601
A	27:04:18	5:59:36 PM	A	1	27632		11	16449		213	22161		24	48657
A	27:04:18	5:59:39 PM	A	1	27270		11	16237		213	21931		24	48656
A	27:04:18	5:59:42 PM	A	1	27316		11	16162		213	21673		24	48675
A	27:04:18	5:59:45 PM	A	1	27421		11	15554		213	21940		24	48669
A	27:04:18	5:59:48 PM	A	1	27508		11	15854		213	21918		24	48658
A	27:04:18	5:59:51 PM	A	1	27262		11	16088		213	21804		24	48645
A	27:04:18	5:59:54 PM	A	1	27239		11	15729		213	21842		24	48679
A	27:04:18	5:59:57 PM	A	1	27381		11	15668		213	21932		24	48701
A	27:04:18	6:00:00 PM	A	1	27273		11	15542		213	21749		24	48674
A	27:04:18	6:00:03 PM	A	1	27284		11	15610		213	19746		24	48694
A	27:04:18	6:00:06 PM	A	1	27454		11	15658		213	21511		24	48703
A	27:04:18	6:00:09 PM	A	1	27462		11	15428		213	20081		24	48700
A	27:04:18	6:00:12 PM	A	1	27351		11	15626		213	19816		24	48680
A	27:04:18	6:00:15 PM	A	1	27395		11	15208		213	19764		24	48682

A	27:04:18	6:00:18 PM	A	1	27472		11	15210		213	19709		24	48677
A	27:04:18	6:00:21 PM	A	1	27408		11	15036		213	21347		24	48694
A	27:04:18	6:00:24 PM	A	1	27364		11	14606		213	19209		24	48694
A	27:04:18	6:00:27 PM	A	1	27390		11	14825		213	19215		24	48725
A	27:04:18	6:00:30 PM	A	1	27552		11	14556		213	21100		24	48717
A	27:04:18	6:00:33 PM	A	1	27471		11	14656		213	19579		24	48746
A	27:04:18	6:00:36 PM	A	1	27314		11	14557		213	19383		24	48745
A	27:04:18	6:00:39 PM	A	1	27368		11	14349		213	19671		24	48776
A	27:04:18	6:00:42 PM	A	1	27392		11	14387		213	19161		24	48767
A	27:04:18	6:00:45 PM	A	1	27446		11	14168		213	19038		24	48761
A	27:04:18	6:00:48 PM	A	1	27511		11	13970		213	18912		24	48781
A	27:04:18	6:00:51 PM	A	1	27472		11	14154		213	18848		24	48767
A	27:04:18	6:00:54 PM	A	1	27504		11	13251		213	18988		24	48782
A	27:04:18	6:00:57 PM	A	1	27339		11	12938		213	19650		24	48791
A	27:04:18	6:01:00 PM	A	1	27383		11	13410		213	19575		24	48820
A	27:04:18	6:01:03 PM	A	1	27366		11	13212		213	19433		24	48812
A	27:04:18	6:01:06 PM	A	1	27459		11	12992		213	19562		24	48811
A	27:04:18	6:01:09 PM	A	1	27436		11	12418		213	19609		24	48812
A	27:04:18	6:01:12 PM	A	1	27383		11	12619		213	19445		24	48823
A	27:04:18	6:01:15 PM	A	1	27487		11	12634		213	19423		24	48835
A	27:04:18	6:01:18 PM	A	1	27439		11	12296		213	19473		24	48835
A	27:04:18	6:01:21 PM	A	1	27318		11	12322		213	19096		24	48842
A	27:04:18	6:01:24 PM	A	1	27368		11	11997		213	19510		24	48857
A	27:04:18	6:01:27 PM	A	1	27506		11	12054		213	19399		24	48873
A	27:04:18	6:01:30 PM	A	1	27429		11	11545		213	19206		24	48858
A	27:04:18	6:01:33 PM	A	1	27471		11	11289		213	19304		24	48857
A	27:04:18	6:01:36 PM	A	1	27441		11	11398		213	19256		24	48894
A	27:04:18	6:01:39 PM	A	1	27789		11	11234		213	19043		24	48859
A	27:04:18	6:01:42 PM	A	1	27367		11	11396		213	18738		24	48836
A	27:04:18	6:01:45 PM	A	1	27387		11	11314		213	19067		24	48839
A	27:04:18	6:01:48 PM	A	1	27439		11	11022		213	18795		24	48860
A	27:04:18	6:01:51 PM	A	1	27441		11	11202		213	19001		24	48868
A	27:04:18	6:01:54 PM	A	1	27485		11	10860		213	19269		24	48899
A	27:04:18	6:01:57 PM	A	1	27406		11	10958		213	19359		24	48894
A	27:04:18	6:02:00 PM	A	1	27567		11	10941		213	18966		24	48870
A	27:04:18	6:02:03 PM	A	1	27364		11	10672		213	18796		24	48910
A	27:04:18	6:02:06 PM	A	1	27353		11	10693		213	18983		24	48894
A	27:04:18	6:02:09 PM	A	1	27240		11	10062		213	18812		24	48912
A	27:04:18	6:02:12 PM	A	1	27409		11	9267		213	19142		24	48906
A	27:04:18	6:02:15 PM	A	1	27405		11	8464		213	19255		24	48922
A	27:04:18	6:02:18 PM	A	1	27390		11	8203		213	19029		24	48941
A	27:04:18	6:02:21 PM	A	1	27318		11	8357		213	19239		24	48897

A	27:04:18	6:02:24 PM	A	1	27406		11	6819		213	18914		24	48888
A	27:04:18	6:02:27 PM	A	1	27390		11	6493		213	18839		24	48934
A	27:04:18	6:02:30 PM	A	1	27460		11	6927		213	19146		24	48909
A	27:04:18	6:02:33 PM	A	1	27385		11	5479		213	18967		24	48897
A	27:04:18	6:02:36 PM	A	1	27455		11	6486		213	19072		24	48929
A	27:04:18	6:02:39 PM	A	1	27073		11	4551		213	18878		24	48944
A	27:04:18	6:02:42 PM	A	1	27541		11	3356		213	18821		24	48918
A	27:04:18	6:02:45 PM	A	1	27477		11	3874		213	18759		24	48930
A	27:04:18	6:02:48 PM	A	1	27445		11	3204		213	19242		24	48952
A	27:04:18	6:02:51 PM	A	1	27374		11	3854		213	18929		24	48956
A	27:04:18	6:02:54 PM	A	1	27430		11	3461		213	18984		24	48959
A	27:04:18	6:02:57 PM	A	1	27237		11	3532		213	18937		24	48968
A	27:04:18	6:03:00 PM	A	1	27337		11	4800		213	19060		24	48944
A	27:04:18	6:03:03 PM	A	1	27443		11	3698		213	18944		24	48989
A	27:04:18	6:03:06 PM	A	1	27304		11	4145		213	18605		24	48981
A	27:04:18	6:03:09 PM	A	1	27409		11	3663		213	18344		24	48964
A	27:04:18	6:03:12 PM	A	1	27379		11	3780		213	18573		24	48998
A	27:04:18	6:03:15 PM	A	1	27290		11	3863		213	18407		24	48976
A	27:04:18	6:03:18 PM	A	1	27370		11	3857		213	18810		24	49011
A	27:04:18	6:03:21 PM	A	1	27355		11	4102		213	18716		24	48983
A	27:04:18	6:03:24 PM	A	1	27364		11	4198		213	18558		24	49026
A	27:04:18	6:03:27 PM	A	1	27345		11	4186		213	18555		24	48977
A	27:04:18	6:03:30 PM	A	1	27321		11	4278		213	18435		24	49034
A	27:04:18	6:03:33 PM	A	1	27559		11	4481		213	18457		24	49031
A	27:04:18	6:03:36 PM	A	1	27482		11	4242		213	18294		24	49001
A	27:04:18	6:03:39 PM	A	1	27436		11	4009		213	18516		24	49034
A	27:04:18	6:03:42 PM	A	1	27330		11	4155		213	18248		24	48995
A	27:04:18	6:03:45 PM	A	1	27406		11	4783		213	18404		24	49041
A	27:04:18	6:03:48 PM	A	1	27478		11	5395		213	18370		24	49061
A	27:04:18	6:03:51 PM	A	1	27269		11	5009		213	18063		24	49063
A	27:04:18	6:03:54 PM	A	1	27527		11	5541		213	18713		24	49047
A	27:04:18	6:03:57 PM	A	1	27465		11	5789		213	18561		24	49049
A	27:04:18	6:04:00 PM	A	1	27385		11	5619		213	18712		24	49066
A	27:04:18	6:04:03 PM	A	1	27615		11	5987		213	18658		24	49049
A	27:04:18	6:04:06 PM	A	1	27093		11	5703		213	18637		24	49043
A	27:04:18	6:04:09 PM	A	1	27408		11	6756		213	18644		24	49049
A	27:04:18	6:04:12 PM	A	1	27566		11	6143		213	18317		24	49089
A	27:04:18	6:04:15 PM	A	1	27405		11	5612		213	18293		24	49069
A	27:04:18	6:04:18 PM	A	1	27431		11	6016		213	18145		24	49056
A	27:04:18	6:04:21 PM	A	1	27385		11	6085		213	18141		24	49042
A	27:04:18	6:04:24 PM	A	1	27297		11	6182		213	18109		24	49048
A	27:04:18	6:04:27 PM	A	1	27288		11	6325		213	18609		24	49049

A	27:04:18	6:04:30 PM	A	1	27458		11	6449		213	18351		24	49045
A	27:04:18	6:04:33 PM	A	1	27301		11	7330		213	18441		24	49032
A	27:04:18	6:04:36 PM	A	1	27188		11	7072		213	18315		24	49031
A	27:04:18	6:04:39 PM	A	1	27428		11	6658		213	18023		24	49025
A	27:04:18	6:04:42 PM	A	1	27311		11	6835		213	18251		24	49031
A	27:04:18	6:04:45 PM	A	1	27256		11	7053		213	18350		24	49044
A	27:04:18	6:04:48 PM	A	1	27430		11	7077		213	18473		24	49023
A	27:04:18	6:04:51 PM	A	1	27297		11	7007		213	18252		24	49007
A	27:04:18	6:04:54 PM	A	1	27393		11	7225		213	18311		24	49014
A	27:04:18	6:04:57 PM	A	1	27398		11	7100		213	18478		24	49025
A	27:04:18	6:05:00 PM	A	1	27430		11	7084		213	18365		24	48998
A	27:04:18	6:05:03 PM	A	1	27581		11	7377		213	17871		24	48989
A	27:04:18	6:05:06 PM	A	1	27343		11	7221		213	17861		24	48997
A	27:04:18	6:05:09 PM	A	1	27519		11	7225		213	17816		24	48935
A	27:04:18	6:05:12 PM	A	1	27515		11	6676		213	17940		24	48972
A	27:04:18	6:05:15 PM	A	1	27476		11	7092		213	17890		24	48962
A	27:04:18	6:05:18 PM	A	1	27368		11	6956		213	18003		24	48960
A	27:04:18	6:05:21 PM	A	1	27235		11	6953		213	17874		24	48926
A	27:04:18	6:05:24 PM	A	1	27410		11	6910		213	17853		24	48929
A	27:04:18	6:05:27 PM	A	1	27317		11	6687		213	17821		24	48956
A	27:04:18	6:05:30 PM	A	1	27377		11	6797		213	18449		24	48933
A	27:04:18	6:05:33 PM	A	1	27216		11	6696		213	18275		24	48923
A	27:04:18	6:05:36 PM	A	1	27371		11	6420		213	18054		24	48910
A	27:04:18	6:05:39 PM	A	1	27356		11	6474		213	17723		24	48896
A	27:04:18	6:05:42 PM	A	1	27367		11	6126		213	17832		24	48836
A	27:04:18	6:05:45 PM	A	1	27434		11	6100		213	18114		24	48841
A	27:04:18	6:05:48 PM	A	1	27357		11	6028		213	18122		24	48837
A	27:04:18	6:05:51 PM	A	1	27337		11	5861		213	18341		24	48824
A	27:04:18	6:05:54 PM	A	1	27369		11	6035		213	18298		24	48798
A	27:04:18	6:05:57 PM	A	1	27391		11	5478		213	18030		24	48788
A	27:04:18	6:06:00 PM	A	1	27339		11	5552		213	17699		24	48774
A	27:04:18	6:06:03 PM	A	1	27334		11	5461		213	17721		24	48768
A	27:04:18	6:06:06 PM	A	1	27445		11	5299		213	17634		24	48766
A	27:04:18	6:06:09 PM	A	1	27449		11	4874		213	18133		24	48752
A	27:04:18	6:06:12 PM	A	1	27588		11	4852		213	18205		24	48730
A	27:04:18	6:06:15 PM	A	1	27302		11	4765		213	18008		24	48690
A	27:04:18	6:06:18 PM	A	1	27361		11	5285		213	17740		24	48696
A	27:04:18	6:06:21 PM	A	1	27369		11	4860		213	18051		24	48666
A	27:04:18	6:06:24 PM	A	1	27315		11	4810		213	17762		24	48648
A	27:04:18	6:06:27 PM	A	1	27445		11	4743		213	18095		24	48619
A	27:04:18	6:06:30 PM	A	1	27509		11	4614		213	17647		24	48595
A	27:04:18	6:06:33 PM	A	1	27382		11	4641		213	17625		24	48585

A	27:04:18	6:06:36 PM	A	1	27437		11	4289		213	17681		24	48546
A	27:04:18	6:06:39 PM	A	1	27379		11	4232		213	17667		24	48527
A	27:04:18	6:06:42 PM	A	1	27564		11	3937		213	17625		24	48492
A	27:04:18	6:06:45 PM	A	1	27401		11	3488		213	17965		24	48477
A	27:04:18	6:06:48 PM	A	1	27322		11	3972		213	17967		24	48493
A	27:04:18	6:06:51 PM	A	1	27454		11	3116		213	17818		24	48425
A	27:04:18	6:06:54 PM	A	1	27478		11	3126		213	17470		24	48400
A	27:04:18	6:06:57 PM	A	1	27274		11	2663		213	17616		24	48394
A	27:04:18	6:07:00 PM	A	1	27604		11	2140		213	17305		24	48327
A	27:04:18	6:07:03 PM	A	1	27495		11	2473		213	17930		24	48323
A	27:04:18	6:07:06 PM	A	1	27474		11	1992		213	17775		24	48325
A	27:04:18	6:07:09 PM	A	1	27386		11	2028		213	17694		24	48281
A	27:04:18	6:07:12 PM	A	1	27385		11	1832		213	17512		24	48234
A	27:04:18	6:07:15 PM	A	1	27416		11	1293		213	17755		24	48257
A	27:04:18	6:07:18 PM	A	1	27383		11	1381		213	17311		24	48181
A	27:04:18	6:07:21 PM	A	1	27533		11	1089		213	17282		24	48190
A	27:04:18	6:07:24 PM	A	1	27529		11	583		213	17515		24	48167
A	27:04:18	6:07:27 PM	A	1	27353		11	617		213	17688		24	48166
A	27:04:18	6:07:30 PM	A	1	27416		10	65489		213	17371		24	48121
A	27:04:18	6:07:33 PM	A	1	27390		11	63		213	17172		24	48093
A	27:04:18	6:07:36 PM	A	1	27305		10	64927		213	17194		24	48056
A	27:04:18	6:07:39 PM	A	1	27345		10	64796		213	17297		24	48077
A	27:04:18	6:07:42 PM	A	1	27333		10	65116		213	17295		24	48058
A	27:04:18	6:07:45 PM	A	1	27633		10	64756		213	17219		24	48024
A	27:04:18	6:07:48 PM	A	1	27331		10	64863		213	17489		24	48018
A	27:04:18	6:07:51 PM	A	1	27280		10	64489		213	17221		24	47984
A	27:04:18	6:07:54 PM	A	1	27405		10	64470		213	17193		24	47959
A	27:04:18	6:07:57 PM	A	1	27277		10	64466		213	17600		24	47932
A	27:04:18	6:08:00 PM	A	1	27286		10	64314		213	17372		24	47941
A	27:04:18	6:08:03 PM	A	1	27222		10	64316		213	17482		24	47932
A	27:04:18	6:08:06 PM	A	1	27323		10	64151		213	17391		24	47895
A	27:04:18	6:08:09 PM	A	1	27292		10	63688		213	17188		24	47840
A	27:04:18	6:08:12 PM	A	1	27372		10	63764		213	17138		24	47796
A	27:04:18	6:08:15 PM	A	1	27389		10	63682		213	17063		24	47821
A	27:04:18	6:08:18 PM	A	1	27399		10	63897		213	16791		24	47787
A	27:04:18	6:08:21 PM	A	1	27266		10	64101		213	16797		24	47773
A	27:04:18	6:08:24 PM	A	1	27410		10	63993		213	16898		24	47766
A	27:04:18	6:08:27 PM	A	1	27451		10	63958		213	17299		24	47755
A	27:04:18	6:08:30 PM	A	1	27454		10	63933		213	17172		24	47711
A	27:04:18	6:08:33 PM	A	1	27265		10	63732		213	17138		24	47703
A	27:04:18	6:08:36 PM	A	1	27399		10	63538		213	16848		24	47698
A	27:04:18	6:08:39 PM	A	1	27405		10	63331		213	17368		24	47711

A	27:04:18	6:08:42 PM	A	1	27508		10	63667		213	17137		24	47665
A	27:04:18	6:08:45 PM	A	1	27285		10	63871		213	16979		24	47646
A	27:04:18	6:08:48 PM	A	1	27381		10	63745		213	16852		24	47643
A	27:04:18	6:08:51 PM	A	1	27294		10	63901		213	16959		24	47598
A	27:04:18	6:08:54 PM	A	1	27490		10	63710		213	17214		24	47614
A	27:04:18	6:08:57 PM	A	1	27461		10	63745		213	17154		24	47571
A	27:04:18	6:09:00 PM	A	1	27429		10	63760		213	16726		24	47582
A	27:04:18	6:09:03 PM	A	1	27574		10	63515		213	16712		24	47559
A	27:04:18	6:09:06 PM	A	1	27338		10	63456		213	17279		24	47538
A	27:04:18	6:09:09 PM	A	1	27357		10	63071		213	17097		24	47536
A	27:04:18	6:09:12 PM	A	1	27284		10	62917		213	17058		24	47560
A	27:04:18	6:09:15 PM	A	1	27442		10	62900		213	16587		24	47495
A	27:04:18	6:09:18 PM	A	1	27418		10	63052		213	17029		24	47488
A	27:04:18	6:09:21 PM	A	1	27367		10	62889		213	16884		24	47487
A	27:04:18	6:09:24 PM	A	1	27417		10	62727		213	16664		24	47492
A	27:04:18	6:09:27 PM	A	1	27323		10	62871		213	17124		24	47470
A	27:04:18	6:09:30 PM	A	1	27429		10	62737		213	16926		24	47455
A	27:04:18	6:09:33 PM	A	1	27535		10	62466		213	16597		24	47468
A	27:04:18	6:09:36 PM	A	1	27513		10	62768		213	16676		24	47455
A	27:04:18	6:09:39 PM	A	1	27291		10	63557		213	16481		24	47434
A	27:04:18	6:09:42 PM	A	1	27294		10	62175		213	16601		24	47461
A	27:04:18	6:09:45 PM	A	1	27484		10	61913		213	16564		24	47415
A	27:04:18	6:09:48 PM	A	1	27307		10	61512		213	16682		24	47408
A	27:04:18	6:09:51 PM	A	1	27519		10	61464		213	16953		24	47419
A	27:04:18	6:09:54 PM	A	1	27358		10	61060		213	16812		24	47444
A	27:04:18	6:09:57 PM	A	1	27342		10	61186		213	16991		24	47411
A	27:04:18	6:10:00 PM	A	1	27344		10	61176		213	16641		24	47409
A	27:04:18	6:10:03 PM	A	1	27469		10	60973		213	16666		24	47407
A	27:04:18	6:10:06 PM	A	1	27416		10	61201		213	16738		24	47413
A	27:04:18	6:10:09 PM	A	1	27558		10	60788		213	16560		24	47414
A	27:04:18	6:10:12 PM	A	1	27315		10	60705		213	16781		24	47380
A	27:04:18	6:10:15 PM	A	1	27326		10	60623		213	16344		24	47391
A	27:04:18	6:10:18 PM	A	1	27367		10	59674		213	16410		24	47387
A	27:04:18	6:10:21 PM	A	1	27363		10	59617		213	16900		24	47405
A	27:04:18	6:10:24 PM	A	1	27213		10	59445		213	16647		24	47379
A	27:04:18	6:10:27 PM	A	1	27350		10	59096		213	16770		24	47368
A	27:04:18	6:10:30 PM	A	1	27226		10	59293		213	16324		24	47368
A	27:04:18	6:10:33 PM	A	1	27317		10	59373		213	16303		24	47360
A	27:04:18	6:10:36 PM	A	1	27345		10	59765		213	16801		24	47365
A	27:04:18	6:10:39 PM	A	1	27363		10	59679		213	16521		24	47403
A	27:04:18	6:10:42 PM	A	1	27369		10	59600		213	16260		24	47352
A	27:04:18	6:10:45 PM	A	1	27336		10	59706		213	16288		24	47365

A	27:04:18	6:10:48 PM	A	1	27411		10	59486		213	16103		24	47366
A	27:04:18	6:10:51 PM	A	1	27452		10	59483		213	16343		24	47370
A	27:04:18	6:10:54 PM	A	1	27338		10	59349		213	16321		24	47338
A	27:04:18	6:10:57 PM	A	1	27462		10	59182		213	16150		24	47374
A	27:04:18	6:11:00 PM	A	1	27456		10	59145		213	16016		24	47374
A	27:04:18	6:11:03 PM	A	1	27310		10	59012		213	16290		24	47377
A	27:04:18	6:11:06 PM	A	1	27379		10	59288		213	16090		24	47329
A	27:04:18	6:11:09 PM	A	1	27439		10	58792		213	16050		24	47371
A	27:04:18	6:11:12 PM	A	1	27319		10	58651		213	16418		24	47399
A	27:04:18	6:11:15 PM	A	1	27367		10	58637		213	16484		24	47609
A	27:04:18	6:11:18 PM	A	1	27360		10	58245		213	16387		24	47376
A	27:04:18	6:11:21 PM	A	1	27406		10	58119		213	16252		24	47364
A	27:04:18	6:11:24 PM	A	1	27387		10	58068		213	16346		24	47354
A	27:04:18	6:11:27 PM	A	1	27456		10	57820		213	16398		24	47395
A	27:04:18	6:11:30 PM	A	1	27557		10	57663		213	16118		24	47392
A	27:04:18	6:11:33 PM	A	1	27373		10	57171		213	16045		24	47373
A	27:04:18	6:11:36 PM	A	1	27229		10	57510		213	16468		24	47383
A	27:04:18	6:11:39 PM	A	1	27377		10	57670		213	16251		24	47421
A	27:04:18	6:11:42 PM	A	1	27421		10	57384		213	16178		24	47404
A	27:04:18	6:11:45 PM	A	1	27304		10	57351		213	16433		24	47424
A	27:04:18	6:11:48 PM	A	1	27298		10	57158		213	16192		24	47435
A	27:04:18	6:11:51 PM	A	1	27435		10	57050		213	16104		24	47426
A	27:04:18	6:11:54 PM	A	1	27375		10	56852		213	15843		24	47421
A	27:04:18	6:11:57 PM	A	1	27420		10	56498		213	15913		24	47449
A	27:04:18	6:12:00 PM	A	1	27334		10	56084		213	15745		24	47426
A	27:04:18	6:12:03 PM	A	1	27438		10	56730		213	15853		24	47466
A	27:04:18	6:12:06 PM	A	1	27348		10	56757		213	15937		24	47418
A	27:04:18	6:12:09 PM	A	1	27424		10	56603		213	15804		24	47444
A	27:04:18	6:12:12 PM	A	1	27390		10	56325		213	16260		24	47476
A	27:04:18	6:12:15 PM	A	1	27341		10	56329		213	15998		24	47439
A	27:04:18	6:12:18 PM	A	1	27477		10	56423		213	16027		24	47458
A	27:04:18	6:12:21 PM	A	1	27388		10	56126		213	15747		24	47467
A	27:04:18	6:12:24 PM	A	1	27318		10	56262		213	16205		24	47464
A	27:04:18	6:12:27 PM	A	1	27349		10	55511		213	16035		24	47490
A	27:04:18	6:12:30 PM	A	1	27450		10	55830		213	15878		24	47502
A	27:04:18	6:12:33 PM	A	1	27274		10	55732		213	15966		24	47492
A	27:04:18	6:12:36 PM	A	1	27247		10	55803		213	15740		24	47497
A	27:04:18	6:12:39 PM	A	1	27406		10	55750		213	15661		24	47502
A	27:04:18	6:12:42 PM	A	1	27374		10	55374		213	15563		24	47522
A	27:04:18	6:12:45 PM	A	1	27389		10	55313		213	15540		24	47500
A	27:04:18	6:12:48 PM	A	1	27350		10	55223		213	15790		24	47521
A	27:04:18	6:12:51 PM	A	1	27310		10	54969		213	15780		24	47551

A	27:04:18	6:12:54 PM	A	1	27471		10	55034		213	15899		24	47532
A	27:04:18	6:12:57 PM	A	1	27385		10	54690		213	15627		24	47546
A	27:04:18	6:13:00 PM	A	1	27495		10	54450		213	15575		24	47552
A	27:04:18	6:13:03 PM	A	1	27437		10	54775		213	15473		24	47567
A	27:04:18	6:13:06 PM	A	1	27441		10	54747		213	15437		24	47565
A	27:04:18	6:13:09 PM	A	1	27420		10	54639		213	15932		24	47554
A	27:04:18	6:13:12 PM	A	1	27397		10	54515		213	15697		24	47542
A	27:04:18	6:13:15 PM	A	1	27454		10	54459		213	15802		24	47560
A	27:04:18	6:13:18 PM	A	1	27453		10	54382		213	15605		24	47563
A	27:04:18	6:13:21 PM	A	1	27367		10	54124		213	15490		24	47579
A	27:04:18	6:13:24 PM	A	1	27347		10	54226		213	15363		24	47588
A	27:04:18	6:13:27 PM	A	1	27231		10	53796		213	15801		24	47590
A	27:04:18	6:13:30 PM	A	1	27451		10	54025		213	15473		24	47584
A	27:04:18	6:13:33 PM	A	1	27294		10	53886		213	15699		24	47597
A	27:04:18	6:13:36 PM	A	1	27210		10	53834		213	15680		24	47591
A	27:04:18	6:13:39 PM	A	1	27175		10	53755		213	15462		24	47585
A	27:04:18	6:13:42 PM	A	1	27334		10	53899		213	15372		24	47592
A	27:04:18	6:13:45 PM	A	1	27413		10	53719		213	15711		24	47611
A	27:04:18	6:13:48 PM	A	1	27368		10	53582		213	15491		24	47630
A	27:04:18	6:13:51 PM	A	1	27507		10	53448		213	15427		24	47638
A	27:04:18	6:13:54 PM	A	1	27401		10	53533		213	15251		24	47631
A	27:04:18	6:13:57 PM	A	1	27404		10	53336		213	15327		24	47599
A	27:04:18	6:14:00 PM	A	1	27282		10	52990		213	15638		24	47637
A	27:04:18	6:14:03 PM	A	1	27455		10	53052		213	15381		24	47641
A	27:04:18	6:14:06 PM	A	1	27420		10	52693		213	15421		24	47681
A	27:04:18	6:14:09 PM	A	1	27494		10	52715		213	15029		24	47630
A	27:04:18	6:14:12 PM	A	1	27414		10	52214		213	15176		24	47673
A	27:04:18	6:14:15 PM	A	1	27383		10	52238		213	15178		24	47650
A	27:04:18	6:14:18 PM	A	1	27253		10	52575		213	15512		24	47639
A	27:04:18	6:14:21 PM	A	1	27129		10	52579		213	15622		24	47652
A	27:04:18	6:14:24 PM	A	1	27456		10	52213		213	15222		24	47684
A	27:04:18	6:14:27 PM	A	1	27398		10	52165		213	15082		24	47668
A	27:04:18	6:14:30 PM	A	1	27430		10	52057		213	15125		24	47666
A	27:04:18	6:14:33 PM	A	1	27398		10	52227		213	15187		24	47684
A	27:04:18	6:14:36 PM	A	1	27345		10	52227		213	15391		24	47696
A	27:04:18	6:14:39 PM	A	1	27542		10	52307		213	15237		24	47692
A	27:04:18	6:14:42 PM	A	1	27516		10	52124		213	15144		24	47697
A	27:04:18	6:14:45 PM	A	1	27315		10	52038		213	15024		24	47736
A	27:04:18	6:14:48 PM	A	1	27330		10	52165		213	14957		24	47704
A	27:04:18	6:14:51 PM	A	1	27489		10	51997		213	15177		24	47694
A	27:04:18	6:14:54 PM	A	1	27401		10	51978		213	15269		24	47720
A	27:04:18	6:14:57 PM	A	1	27340		10	51898		213	15312		24	47743

A	27:04:18	6:15:00 PM	A	1	27382		10	51397		213	14893		24	47744
A	27:04:18	6:15:03 PM	A	1	27329		10	51470		213	14920		24	47744
A	27:04:18	6:15:06 PM	A	1	27312		10	51445		213	14996		24	47735
A	27:04:18	6:15:09 PM	A	1	27366		10	51226		213	15137		24	47733
A	27:04:18	6:15:12 PM	A	1	27125		10	51596		213	14718		24	47753
A	27:04:18	6:15:15 PM	A	1	27417		10	51481		213	15260		24	47777
A	27:04:18	6:15:18 PM	A	1	27237		10	51792		213	15126		24	47759
A	27:04:18	6:15:21 PM	A	1	27407		10	51885		213	14889		24	47777
A	27:04:18	6:15:24 PM	A	1	27322		10	51319		213	15080		24	47779
A	27:04:18	6:15:27 PM	A	1	27500		10	51343		213	15053		24	47770
A	27:04:18	6:15:30 PM	A	1	27398		10	51095		213	14989		24	47796
A	27:04:18	6:15:33 PM	A	1	27397		10	51202		213	15118		24	47783
A	27:04:18	6:15:36 PM	A	1	27413		10	51104		213	14848		24	47786
A	27:04:18	6:15:39 PM	A	1	27294		10	50988		213	14717		24	47779
A	27:04:18	6:15:42 PM	A	1	27437		10	50998		213	14913		24	47791
A	27:04:18	6:15:45 PM	A	1	27337		10	50592		213	14980		24	47770
A	27:04:18	6:15:48 PM	A	1	27409		10	50947		213	14513		24	47786
A	27:04:18	6:15:51 PM	A	1	27175		10	50403		213	14916		24	47780
A	27:04:18	6:15:54 PM	A	1	27853		10	50455		213	14847		24	47746
A	27:04:18	6:15:57 PM	A	1	27422		10	51100		213	14541		24	47806
A	27:04:18	6:16:00 PM	A	1	27470		10	50280		213	14858		24	47770
A	27:04:18	6:16:03 PM	A	1	27405		10	50531		213	14908		24	47811
A	27:04:18	6:16:06 PM	A	1	27262		10	50545		213	14790		24	47785
A	27:04:18	6:16:09 PM	A	1	27297		10	50315		213	14598		24	47771
A	27:04:18	6:16:12 PM	A	1	27469		10	50376		213	14665		24	47802
A	27:04:18	6:16:15 PM	A	1	27375		10	50053		213	14527		24	47801
A	27:04:18	6:16:18 PM	A	1	27398		10	49704		213	14845		24	47805
A	27:04:18	6:16:21 PM	A	1	27434		10	49556		213	14797		24	47771
A	27:04:18	6:16:24 PM	A	1	27477		10	49580		213	14563		24	47820
A	27:04:18	6:16:27 PM	A	1	27381		10	49595		213	15012		24	47806
A	27:04:18	6:16:30 PM	A	1	27142		10	49489		213	14718		24	47775
A	27:04:18	6:16:33 PM	A	1	27395		10	49247		213	14596		24	47781
A	27:04:18	6:16:36 PM	A	1	27420		10	48982		213	14500		24	47767
A	27:04:18	6:16:39 PM	A	1	27296		10	49068		213	14565		24	47800
A	27:04:18	6:16:42 PM	A	1	27250		10	49083		213	14509		24	47786
A	27:04:18	6:16:45 PM	A	1	27442		10	48900		213	14144		24	47777
A	27:04:18	6:16:48 PM	A	1	27324		10	48783		213	14306		24	47812
A	27:04:18	6:16:51 PM	A	1	27393		10	48638		213	14283		24	47800
A	27:04:18	6:16:54 PM	A	1	27424		10	48460		213	14583		24	47783
A	27:04:18	6:16:57 PM	A	1	27508		10	48841		213	14387		24	47765
A	27:04:18	6:17:00 PM	A	1	27147		10	48648		213	14410		24	47781
A	27:04:18	6:17:03 PM	A	1	27435		10	48510		213	14423		24	47823

A	27:04:18	6:17:06 PM	A	1	27474		10	48402		213	14439		24	47808
A	27:04:18	6:17:09 PM	A	1	27544		10	48286		213	14418		24	47791
A	27:04:18	6:17:12 PM	A	1	27339		10	48211		213	14493		24	47771
A	27:04:18	6:17:15 PM	A	1	27376		10	48242		213	14228		24	47743
A	27:04:18	6:17:18 PM	A	1	27431		10	48254		213	14232		24	47773
A	27:04:18	6:17:21 PM	A	1	27396		10	47974		213	14515		24	47777
A	27:04:18	6:17:24 PM	A	1	27501		10	47667		213	14413		24	47784
A	27:04:18	6:17:27 PM	A	1	27445		10	48159		213	14383		24	47740
A	27:04:18	6:17:30 PM	A	1	27342		10	48040		213	14345		24	47791
A	27:04:18	6:17:33 PM	A	1	27481		10	48138		213	13966		24	47767
A	27:04:18	6:17:36 PM	A	1	27449		10	47986		213	14446		24	47794
A	27:04:18	6:17:39 PM	A	1	27475		10	47149		213	14358		24	47787
A	27:04:18	6:17:42 PM	A	1	27438		10	47108		213	14112		24	47755
A	27:04:18	6:17:45 PM	A	1	27363		10	47111		213	13964		24	47766
A	27:04:18	6:17:48 PM	A	1	27301		10	47537		213	13998		24	47771
A	27:04:18	6:17:51 PM	A	1	27457		10	47311		213	14185		24	47758
A	27:04:18	6:17:54 PM	A	1	27335		10	47580		213	14261		24	47773
A	27:04:18	6:17:57 PM	A	1	27448		10	47301		213	14095		24	47762
A	27:04:18	6:18:00 PM	A	1	27421		10	47247		213	13993		24	47761
A	27:04:18	6:18:03 PM	A	1	27360		10	47196		213	14054		24	47747
A	27:04:18	6:18:06 PM	A	1	27393		10	47292		213	14200		24	47757
A	27:04:18	6:18:09 PM	A	1	27287		10	46632		213	14314		24	47769
A	27:04:18	6:18:12 PM	A	1	27387		10	46715		213	13942		24	47776
A	27:04:18	6:18:15 PM	A	1	27881		10	46797		213	13875		24	47748
A	27:04:18	6:18:18 PM	A	1	27531		10	46652		213	13912		24	47793
A	27:04:18	6:18:21 PM	A	1	27544		10	47079		213	13785		24	47769
A	27:04:18	6:18:24 PM	A	1	27369		10	47304		213	13618		24	47760
A	27:04:18	6:18:27 PM	A	1	27457		10	47083		213	13898		24	47782
A	27:04:18	6:18:30 PM	A	1	27448		10	46671		213	13788		24	47771
A	27:04:18	6:18:33 PM	A	1	27503		10	46786		213	13742		24	47764
A	27:04:18	6:18:36 PM	A	1	27269		10	46594		213	13961		24	47772
A	27:04:18	6:18:39 PM	A	1	27427		10	46745		213	14009		24	47797
A	27:04:18	6:18:42 PM	A	1	27146		10	46707		213	13901		24	47762
A	27:04:18	6:18:45 PM	A	1	27457		10	46978		213	13751		24	47750
A	27:04:18	6:18:48 PM	A	1	27620		10	46620		213	13595		24	47743
A	27:04:18	6:18:51 PM	A	1	27595		10	46506		213	13489		24	47754
A	27:04:18	6:18:54 PM	A	1	27482		10	46381		213	13895		24	47713
A	27:04:18	6:18:57 PM	A	1	27433		10	46245		213	13797		24	47738
A	27:04:18	6:19:00 PM	A	1	27274		10	46299		213	13679		24	47751
A	27:04:18	6:19:03 PM	A	1	27315		10	45999		213	13627		24	47758
A	27:04:18	6:19:06 PM	A	1	27350		10	46038		213	13775		24	47750
A	27:04:18	6:19:09 PM	A	1	27291		10	46147		213	13697		24	47747

A	27:04:18	6:19:12 PM	A	1	27584		10	45437		213	13700		24	47743
A	27:04:18	6:19:15 PM	A	1	27246		10	46087		213	13423		24	47737
A	27:04:18	6:19:18 PM	A	1	27542		10	46193		213	13642		24	47740
A	27:04:18	6:19:21 PM	A	1	27268		10	45895		213	13645		24	47747
A	27:04:18	6:19:24 PM	A	1	27343		10	45517		213	13702		24	47727
A	27:04:18	6:19:27 PM	A	1	27443		10	45320		213	13420		24	47725
A	27:04:18	6:19:30 PM	A	1	27254		10	45256		213	13550		24	47723
A	27:04:18	6:19:33 PM	A	1	27221		10	45534		213	13698		24	47747
A	27:04:18	6:19:36 PM	A	1	27492		10	45539		213	13603		24	47729
A	27:04:18	6:19:39 PM	A	1	27403		10	45573		213	13425		24	47741
A	27:04:18	6:19:42 PM	A	1	27413		10	45429		213	13243		24	47720
A	27:04:18	6:19:45 PM	A	1	27426		10	45778		213	13616		24	47727
A	27:04:18	6:19:48 PM	A	1	27452		10	45254		213	13412		24	47720
A	27:04:18	6:19:51 PM	A	1	27486		10	44915		213	13227		24	47702
A	27:04:18	6:19:54 PM	A	1	27322		10	45154		213	13258		24	47686
A	27:04:18	6:19:57 PM	A	1	27421		10	45140		213	13449		24	47709
A	27:04:18	6:20:00 PM	A	1	27387		10	45201		213	13544		24	47688
A	27:04:18	6:20:03 PM	A	1	27435		10	45378		213	13405		24	47704
A	27:04:18	6:20:06 PM	A	1	27277		10	45094		213	13305		24	47696
A	27:04:18	6:20:09 PM	A	1	27519		10	44991		213	13148		24	47687
A	27:04:18	6:20:12 PM	A	1	27664		10	44984		213	13388		24	47704
A	27:04:18	6:20:15 PM	A	1	27297		10	44754		213	13444		24	47700
A	27:04:18	6:20:18 PM	A	1	27546		10	44701		213	13103		24	47710
A	27:04:18	6:20:21 PM	A	1	27406		10	44327		213	13187		24	47668
A	27:04:18	6:20:24 PM	A	1	27304		10	44276		213	13305		24	47727
A	27:04:18	6:20:27 PM	A	1	27512		10	43813		213	13269		24	47683
A	27:04:18	6:20:30 PM	A	1	27316		10	43868		213	12947		24	47656
A	27:04:18	6:20:33 PM	A	1	27518		10	43717		213	12974		24	47698
A	27:04:18	6:20:36 PM	A	1	27566		10	43435		213	13160		24	47701
A	27:04:18	6:20:39 PM	A	1	27428		10	43568		213	13079		24	47691
A	27:04:18	6:20:42 PM	A	1	27318		10	43322		213	13303		24	47633
A	27:04:18	6:20:45 PM	A	1	27366		10	43207		213	13299		24	47682
A	27:04:18	6:20:48 PM	A	1	27572		10	42888		213	13153		24	47616
A	27:04:18	6:20:51 PM	A	1	27444		10	42252		213	13104		24	47677
A	27:04:18	6:20:54 PM	A	1	27396		10	42472		213	12936		24	47684
A	27:04:18	6:20:57 PM	A	1	27307		10	42213		213	12957		24	47665
A	27:04:18	6:21:00 PM	A	1	27472		10	42099		213	13164		24	47647
A	27:04:18	6:21:03 PM	A	1	27303		10	42067		213	13145		24	47636
A	27:04:18	6:21:06 PM	A	1	27066		10	42156		213	13122		24	47657
A	27:04:18	6:21:09 PM	A	1	27515		10	42148		213	13008		24	47633
A	27:04:18	6:21:12 PM	A	1	27459		10	42034		213	12911		24	47668
A	27:04:18	6:21:15 PM	A	1	27445		10	41767		213	12774		24	47672

A	27:04:18	6:21:18 PM	A	1	27298		10	42164		213	12999		24	47632
A	27:04:18	6:21:21 PM	A	1	27392		10	41625		213	12881		24	47645
A	27:04:18	6:21:24 PM	A	1	27332		10	41484		213	12990		24	47649
A	27:04:18	6:21:27 PM	A	1	27454		10	41613		213	12758		24	47652
A	27:04:18	6:21:30 PM	A	1	27284		10	41386		213	12632		24	47646
A	27:04:18	6:21:33 PM	A	1	27290		10	41498		213	12802		24	47649
A	27:04:18	6:21:36 PM	A	1	27283		10	41422		213	12629		24	47637
A	27:04:18	6:21:39 PM	A	1	27231		10	41597		213	12618		24	47615
A	27:04:18	6:21:42 PM	A	1	27245		10	41557		213	12731		24	47621
A	27:04:18	6:21:45 PM	A	1	27465		10	41527		213	12646		24	47600
A	27:04:18	6:21:48 PM	A	1	27376		10	41557		213	12744		24	47596
A	27:04:18	6:21:51 PM	A	1	27411		10	41472		213	12547		24	47594
A	27:04:18	6:21:54 PM	A	1	27347		10	41248		213	12568		24	47588
A	27:04:18	6:21:57 PM	A	1	27466		10	41431		213	12584		24	47568
A	27:04:18	6:22:00 PM	A	1	27344		10	41220		213	12515		24	47581
A	27:04:18	6:22:03 PM	A	1	27211		10	41185		213	12580		24	47563
A	27:04:18	6:22:06 PM	A	1	27408		10	41142		213	12474		24	47549
A	27:04:18	6:22:09 PM	A	1	27328		10	41146		213	12476		24	47514
A	27:04:18	6:22:12 PM	A	1	27299		10	40805		213	12829		24	47515
A	27:04:18	6:22:15 PM	A	1	27207		10	40689		213	12762		24	47524
A	27:04:18	6:22:18 PM	A	1	27419		10	41348		213	12619		24	47512
A	27:04:18	6:22:21 PM	A	1	27339		10	40913		213	12402		24	47512
A	27:04:18	6:22:24 PM	A	1	27470		10	40518		213	12315		24	47528
A	27:04:18	6:22:27 PM	A	1	27241		10	40509		213	12572		24	47497
A	27:04:18	6:22:30 PM	A	1	27303		10	39870		213	12665		24	47501
A	27:04:18	6:22:33 PM	A	1	27440		10	40133		213	12324		24	47463
A	27:04:18	6:22:36 PM	A	1	27423		10	39831		213	12404		24	47490
A	27:04:18	6:22:39 PM	A	1	27217		10	39647		213	12345		24	47473
A	27:04:18	6:22:42 PM	A	1	27159		10	39463		213	12784		24	47463
A	27:04:18	6:22:45 PM	A	1	27381		10	39691		213	12580		24	47458
A	27:04:18	6:22:48 PM	A	1	27537		10	39900		213	12519		24	47420
A	27:04:18	6:22:51 PM	A	1	27182		10	39496		213	12230		24	47436
A	27:04:18	6:22:54 PM	A	1	27458		10	39313		213	12298		24	47410
A	27:04:18	6:22:57 PM	A	1	27262		10	38720		213	12587		24	47385
A	27:04:18	6:23:00 PM	A	1	27382		10	37546		213	12505		24	47404
A	27:04:18	6:23:03 PM	A	1	27360		10	35252		213	12325		24	47367
A	27:04:18	6:23:06 PM	A	1	27570		10	33461		213	12149		24	47345
A	27:04:18	6:23:09 PM	A	1	27345		10	33295		213	12191		24	47341
A	27:04:18	6:23:12 PM	A	1	27409		10	32743		213	12105		24	47363
A	27:04:18	6:23:15 PM	A	1	27277		10	31982		213	11996		24	47344
A	27:04:18	6:23:18 PM	A	1	27411		10	34834		213	12422		24	47330
A	27:04:18	6:23:21 PM	A	1	27446		10	37474		213	12265		24	47327

A	27:04:18	6:23:24 PM	A	1	27534		10	38377		213	12156		24	47338
A	27:04:18	6:23:27 PM	A	1	27388		10	37548		213	12027		24	47322
A	27:04:18	6:23:30 PM	A	1	27407		10	36697		213	12035		24	47316
A	27:04:18	6:23:33 PM	A	1	27403		10	37189		213	12151		24	47317
A	27:04:18	6:23:36 PM	A	1	27434		10	38417		213	12109		24	47317
A	27:04:18	6:23:39 PM	A	1	27412		10	38339		213	12004		24	47279
A	27:04:18	6:23:42 PM	A	1	27416		10	38876		213	11994		24	47289
A	27:04:18	6:23:45 PM	A	1	27387		10	38538		213	11999		24	47284
A	27:04:18	6:23:48 PM	A	1	27227		10	38287		213	12487		24	47280
A	27:04:18	6:23:51 PM	A	1	27334		10	38229		213	12246		24	47258
A	27:04:18	6:23:54 PM	A	1	27342		10	38281		213	11907		24	47253
A	27:04:18	6:23:57 PM	A	1	27251		10	38192		213	12020		24	47225
A	27:04:18	6:24:00 PM	A	1	27288		10	38077		213	11941		24	47214
A	27:04:18	6:24:03 PM	A	1	27322		10	37815		213	12028		24	47217
A	27:04:18	6:24:06 PM	A	1	27293		10	37898		213	11852		24	47196
A	27:04:18	6:24:09 PM	A	1	27672		10	37739		213	11766		24	47197
A	27:04:18	6:24:12 PM	A	1	27394		10	37854		213	11910		24	47170
A	27:04:18	6:24:15 PM	A	1	27476		10	37273		213	11786		24	47207
A	27:04:18	6:24:18 PM	A	1	27422		10	36607		213	11833		24	47167
A	27:04:18	6:24:21 PM	A	1	27514		10	36903		213	11853		24	47190
A	27:04:18	6:24:24 PM	A	1	27266		10	37197		213	11886		24	47162
A	27:04:18	6:24:27 PM	A	1	27169		10	37154		213	11743		24	47153
A	27:04:18	6:24:30 PM	A	1	27134		10	37295		213	12087		24	47168
A	27:04:18	6:24:33 PM	A	1	27368		10	36896		213	11984		24	47120
A	27:04:18	6:24:36 PM	A	1	27524		10	37144		213	11774		24	47114
A	27:04:18	6:24:39 PM	A	1	27209		10	37009		213	11579		24	47100
A	27:04:18	6:24:42 PM	A	1	27266		10	36980		213	11463		24	47097
A	27:04:18	6:24:45 PM	A	1	27477		10	36812		213	11714		24	47116
A	27:04:18	6:24:48 PM	A	1	27255		10	36628		213	11819		24	47088
A	27:04:18	6:24:51 PM	A	1	27457		10	36818		213	11724		24	47036
A	27:04:18	6:24:54 PM	A	1	27522		10	36652		213	11758		24	47072
A	27:04:18	6:24:57 PM	A	1	27488		10	36605		213	11822		24	47054
A	27:04:18	6:25:00 PM	A	1	27575		10	36565		213	11807		24	47051
A	27:04:18	6:25:03 PM	A	1	27406		10	36175		213	11447		24	46995
A	27:04:18	6:25:06 PM	A	1	27391		10	36136		213	11468		24	47044
A	27:04:18	6:25:09 PM	A	1	27387		10	35617		213	11827		24	47017
A	27:04:18	6:25:12 PM	A	1	27393		10	36044		213	11597		24	46977
A	27:04:18	6:25:15 PM	A	1	27366		10	36218		213	11670		24	46978
A	27:04:18	6:25:18 PM	A	1	27505		10	35654		213	11561		24	46954
A	27:04:18	6:25:21 PM	A	1	27336		10	36949		213	11547		24	46976
A	27:04:18	6:25:24 PM	A	1	27321		10	35482		213	11626		24	46983
A	27:04:18	6:25:27 PM	A	1	27653		10	35733		213	11587		24	46968

A	27:04:18	6:25:30 PM	A	1	27168		10	34738		213	11397		24	46986
A	27:04:18	6:25:33 PM	A	1	27402		10	33015		213	11398		24	46939
A	27:04:18	6:25:36 PM	A	1	27416		10	34152		213	11336		24	46947
A	27:04:18	6:25:39 PM	A	1	27673		10	35159		213	11368		24	46941
A	27:04:18	6:25:42 PM	A	1	27498		10	35209		213	11247		24	46932
A	27:04:18	6:25:45 PM	A	1	27514		10	35204		213	11365		24	46909
A	27:04:18	6:25:48 PM	A	1	27365		10	35272		213	11466		24	46942
A	27:04:18	6:25:51 PM	A	1	27239		10	35215		213	11360		24	46905
A	27:04:18	6:25:54 PM	A	1	27308		10	34908		213	11247		24	46870
A	27:04:18	6:25:57 PM	A	1	27536		10	34750		213	11518		24	46871
A	27:04:18	6:26:00 PM	A	1	27416		10	35056		213	11452		24	46902
A	27:04:18	6:26:03 PM	A	1	27544		10	34628		213	11098		24	46862
A	27:04:18	6:26:06 PM	A	1	27177		10	34691		213	10987		24	46846
A	27:04:18	6:26:09 PM	A	1	27399		10	33929		213	11284		24	46872
A	27:04:18	6:26:12 PM	A	1	27382		10	32899		213	11124		24	46836
A	27:04:18	6:26:15 PM	A	1	27314		10	32449		213	11065		24	46843
A	27:04:18	6:26:18 PM	A	1	27386		10	32588		213	11004		24	46847
A	27:04:18	6:26:21 PM	A	1	27368		10	33685		213	11124		24	46817
A	27:04:18	6:26:24 PM	A	1	27277		10	33824		213	11342		24	46824
A	27:04:18	6:26:27 PM	A	1	27365		10	34120		213	11234		24	46823
A	27:04:18	6:26:30 PM	A	1	27441		10	34375		213	11032		24	46792
A	27:04:18	6:26:33 PM	A	1	27473		10	33780		213	11036		24	46785
A	27:04:18	6:26:36 PM	A	1	27338		10	33944		213	11010		24	46770
A	27:04:18	6:26:39 PM	A	1	27432		10	33636		213	10793		24	46757
A	27:04:18	6:26:42 PM	A	1	27142		10	33575		213	10893		24	46811
A	27:04:18	6:26:45 PM	A	1	27492		10	33702		213	10760		24	46779
A	27:04:18	6:26:48 PM	A	1	27378		10	33734		213	10713		24	46757
A	27:04:18	6:26:51 PM	A	1	27233		10	33438		213	10714		24	46764
A	27:04:18	6:26:54 PM	A	1	27434		10	33373		213	10824		24	46779
A	27:04:18	6:26:57 PM	A	1	27316		10	32753		213	10957		24	46766
A	27:04:18	6:27:00 PM	A	1	27396		10	33024		213	11017		24	46737
A	27:04:18	6:27:03 PM	A	1	27468		10	32772		213	11042		24	46732
A	27:04:18	6:27:06 PM	A	1	27519		10	32774		213	10945		24	46742
A	27:04:18	6:27:09 PM	A	1	27391		10	32739		213	8478		24	46736
A	27:04:18	6:27:12 PM	A	1	27220		10	32739		213	10746		24	46679
A	27:04:18	6:27:15 PM	A	1	27302		10	32403		213	10758		24	46733
A	27:04:18	6:27:18 PM	A	1	27354		10	32610		213	10939		24	46696
A	27:04:18	6:27:21 PM	A	1	27214		10	32718		213	9132		24	46697
A	27:04:18	6:27:24 PM	A	1	27410		10	33136		213	10840		24	46695
A	27:04:18	6:27:27 PM	A	1	27444		10	32937		213	10755		24	46687
A	27:04:18	6:27:30 PM	A	1	27116		10	32631		213	9020		24	46683
A	27:04:18	6:27:33 PM	A	1	27396		10	32310		213	10890		24	46659

A	27:04:18	6:27:36 PM	A	1	27437		10	31647		213	10814		24	46677
A	27:04:18	6:27:39 PM	A	1	27374		10	31456		213	10626		24	46667
A	27:04:18	6:27:42 PM	A	1	27383		10	32164		213	8252		24	46659
A	27:04:18	6:27:45 PM	A	1	27449		10	32451		213	8662		24	46643
A	27:04:18	6:27:48 PM	A	1	27359		10	32425		213	8934		24	46666
A	27:04:18	6:27:51 PM	A	1	27375		10	32453		213	9063		24	46637
A	27:04:18	6:27:54 PM	A	1	27400		10	32333		213	8899		24	46664
A	27:04:18	6:27:57 PM	A	1	27291		10	31982		213	9020		24	46691
A	27:04:18	6:28:00 PM	A	1	27384		10	32232		213	10540		24	46644
A	27:04:18	6:28:03 PM	A	1	27314		10	32038		213	8581		24	46645
A	27:04:18	6:28:06 PM	A	1	27399		10	31688		213	8426		24	46652
A	27:04:18	6:28:09 PM	A	1	27326		10	31646		213	8445		24	46620
A	27:04:18	6:28:12 PM	A	1	27468		10	31395		213	8965		24	46647
A	27:04:18	6:28:15 PM	A	1	27371		10	30427		213	8372		24	46614
A	27:04:18	6:28:18 PM	A	1	27441		10	28377		213	8469		24	46654
A	27:04:18	6:28:21 PM	A	1	27325		10	29464		213	8291		24	46622
A	27:04:18	6:28:24 PM	A	1	27587		10	30238		213	8802		24	46621
A	27:04:18	6:28:27 PM	A	1	27237		10	31045		213	8703		24	46606
A	27:04:18	6:28:30 PM	A	1	27285		10	31217		213	8662		24	46615
A	27:04:18	6:28:33 PM	A	1	27449		10	30950		213	8294		24	46600
A	27:04:18	6:28:36 PM	A	1	27350		10	30827		213	8402		24	46594
A	27:04:18	6:28:39 PM	A	1	27368		10	30949		213	8353		24	46621
A	27:04:18	6:28:42 PM	A	1	27319		10	30903		213	8683		24	46609
A	27:04:18	6:28:45 PM	A	1	27155		10	30792		213	8489		24	46630
A	27:04:18	6:28:48 PM	A	1	27377		10	30489		213	8132		24	46580
A	27:04:18	6:28:51 PM	A	1	27406		10	30431		213	8215		24	46572
A	27:04:18	6:28:54 PM	A	1	27337		10	30487		213	8269		24	46581
A	27:04:18	6:28:57 PM	A	1	27181		10	30398		213	8340		24	46571
A	27:04:18	6:29:00 PM	A	1	27408		10	29861		213	8108		24	46569
A	27:04:18	6:29:03 PM	A	1	27117		10	29831		213	8632		24	46591
A	27:04:18	6:29:06 PM	A	1	27438		10	29741		213	8169		24	46564
A	27:04:18	6:29:09 PM	A	1	27443		10	30002		213	8637		24	46627
A	27:04:18	6:29:12 PM	A	1	27471		10	29799		213	8678		24	46566
A	27:04:18	6:29:15 PM	A	1	27439		10	29513		213	8164		24	46542
A	27:04:18	6:29:18 PM	A	1	27511		10	29514		213	8262		24	46592
A	27:04:18	6:29:21 PM	A	1	27358		10	29251		213	8566		24	46568
A	27:04:18	6:29:24 PM	A	1	27410		10	29089		213	8228		24	46556
A	27:04:18	6:29:27 PM	A	1	27372		10	28698		213	8556		24	46556
A	27:04:18	6:29:30 PM	A	1	27432		10	28896		213	8518		24	46562
A	27:04:18	6:29:33 PM	A	1	27435		10	29175		213	8284		24	46578
A	27:04:18	6:29:36 PM	A	1	27500		10	27496		213	8406		24	46552
A	27:04:18	6:29:39 PM	A	1	27355		10	27116		213	8263		24	46598

A	27:04:18	6:29:42 PM	A	1	27245		10	27778		213	7941		24	46579
A	27:04:18	6:29:45 PM	A	1	27547		10	27991		213	8010		24	46575
A	27:04:18	6:29:48 PM	A	1	27498		10	28263		213	8420		24	46596
A	27:04:18	6:29:51 PM	A	1	27467		10	28178		213	8300		24	46589
A	27:04:18	6:29:54 PM	A	1	27349		10	28079		213	8100		24	46570
A	27:04:18	6:29:57 PM	A	1	27321		10	28048		213	7712		24	46595
A	27:04:18	6:30:00 PM	A	1	27435		10	27872		213	7928		24	46591
A	27:04:18	6:30:03 PM	A	1	27452		10	27773		213	7685		24	46593
A	27:04:18	6:30:06 PM	A	1	27415		10	27778		213	7828		24	46604
A	27:04:18	6:30:09 PM	A	1	27320		10	27768		213	7571		24	46619
A	27:04:18	6:30:12 PM	A	1	27427		10	27864		213	8204		24	46587
A	27:04:18	6:30:15 PM	A	1	27451		10	27366		213	8207		24	46624
A	27:04:18	6:30:18 PM	A	1	27401		10	26538		213	8259		24	46628
A	27:04:18	6:30:21 PM	A	1	27403		10	26577		213	7554		24	46626
A	27:04:18	6:30:24 PM	A	1	27451		10	26831		213	7776		24	46621
A	27:04:18	6:30:27 PM	A	1	27445		10	27240		213	8051		24	46608
A	27:04:18	6:30:30 PM	A	1	27318		10	27138		213	8047		24	46642
A	27:04:18	6:30:33 PM	A	1	27428		10	27018		213	7909		24	46627
A	27:04:18	6:30:36 PM	A	1	27447		10	27357		213	8310		24	46610
A	27:04:18	6:30:39 PM	A	1	27320		10	27078		213	7959		24	46612
A	27:04:18	6:30:42 PM	A	1	27396		10	27058		213	8073		24	46638
A	27:04:18	6:30:45 PM	A	1	27428		10	26665		213	8106		24	46643
A	27:04:18	6:30:48 PM	A	1	27451		10	27045		213	7591		24	46654
A	27:04:18	6:30:51 PM	A	1	27290		10	26949		213	7822		24	46650
A	27:04:18	6:30:54 PM	A	1	27487		10	26703		213	7633		24	46626
A	27:04:18	6:30:57 PM	A	1	27307		10	26727		213	7654		24	46629
A	27:04:18	6:31:00 PM	A	1	27233		10	26211		213	7995		24	46671
A	27:04:18	6:31:03 PM	A	1	27437		10	26443		213	7831		24	46642
A	27:04:18	6:31:06 PM	A	1	27311		10	26479		213	8121		24	46657
A	27:04:18	6:31:09 PM	A	1	27420		10	26652		213	7644		24	46644
A	27:04:18	6:31:12 PM	A	1	27365		10	26526		213	7494		24	46610
A	27:04:18	6:31:15 PM	A	1	27419		10	26184		213	7991		24	46620
A	27:04:18	6:31:18 PM	A	1	27427		10	25958		213	7810		24	46610
A	27:04:18	6:31:21 PM	A	1	27447		10	26005		213	7494		24	46607
A	27:04:18	6:31:24 PM	A	1	27428		10	25308		213	7830		24	46602
A	27:04:18	6:31:27 PM	A	1	27350		10	21632		213	7875		24	46597
A	27:04:18	6:31:30 PM	A	1	27421		10	25610		213	7596		24	46576
A	27:04:18	6:31:33 PM	A	1	27486		10	25733		213	7327		24	46585
A	27:04:18	6:31:36 PM	A	1	27285		10	25490		213	7838		24	46573
A	27:04:18	6:31:39 PM	A	1	27322		10	25317		213	7905		24	46577
A	27:04:18	6:31:42 PM	A	1	27350		10	25511		213	7714		24	46593
A	27:04:18	6:31:45 PM	A	1	27397		10	25242		213	7742		24	46561

A	27:04:18	6:31:48 PM	A	1	27451		10	24919		213	7454		24	46567
A	27:04:18	6:31:51 PM	A	1	27421		10	24854		213	7429		24	46567
A	27:04:18	6:31:54 PM	A	1	27378		10	24551		213	7708		24	46565
A	27:04:18	6:31:57 PM	A	1	27342		10	24790		213	7304		24	46533
A	27:04:18	6:32:00 PM	A	1	27427		10	25045		213	7458		24	46552
A	27:04:18	6:32:03 PM	A	1	27375		10	24742		213	7808		24	46542
A	27:04:18	6:32:06 PM	A	1	27407		10	24884		213	7514		24	46510
A	27:04:18	6:32:09 PM	A	1	27355		10	24216		213	7509		24	46507
A	27:04:18	6:32:12 PM	A	1	27380		10	24354		213	7663		24	46486
A	27:04:18	6:32:15 PM	A	1	27349		10	24633		213	7389		24	46514
A	27:04:18	6:32:18 PM	A	1	27564		10	24664		213	7448		24	46488
A	27:04:18	6:32:21 PM	A	1	27529		10	24611		213	7132		24	46465
A	27:04:18	6:32:24 PM	A	1	27411		10	24531		213	7068		24	46500
A	27:04:18	6:32:27 PM	A	1	27406		10	24862		213	7241		24	46489
A	27:04:18	6:32:30 PM	A	1	27370		10	24592		213	7061		24	46476
A	27:04:18	6:32:33 PM	A	1	27330		10	24237		213	7076		24	46441
A	27:04:18	6:32:36 PM	A	1	27429		10	24515		213	6980		24	46449
A	27:04:18	6:32:39 PM	A	1	27550		10	24264		213	7482		24	46443
A	27:04:18	6:32:42 PM	A	1	27548		10	24375		213	7511		24	46424
A	27:04:18	6:32:45 PM	A	1	27420		10	24092		213	7344		24	46440
A	27:04:18	6:32:48 PM	A	1	27340		10	24105		213	6829		24	46398
A	27:04:18	6:32:51 PM	A	1	27465		10	24209		213	7185		24	46392
A	27:04:18	6:32:54 PM	A	1	27497		10	23997		213	6916		24	46404
A	27:04:18	6:32:57 PM	A	1	27452		10	24030		213	6654		24	46399
A	27:04:18	6:33:00 PM	A	1	27413		10	23940		213	6953		24	46384
A	27:04:18	6:33:03 PM	A	1	27224		10	23625		213	7293		24	46379
A	27:04:18	6:33:06 PM	A	1	27341		10	23601		213	7023		24	46373
A	27:04:18	6:33:09 PM	A	1	27534		10	23104		213	7190		24	46374
A	27:04:18	6:33:12 PM	A	1	27529		10	22931		213	7311		24	46335
A	27:04:18	6:33:15 PM	A	1	27398		10	22992		213	7198		24	46339
A	27:04:18	6:33:18 PM	A	1	27316		10	22775		213	7025		24	46338
A	27:04:18	6:33:21 PM	A	1	27322		10	22633		213	6654		24	46344
A	27:04:18	6:33:24 PM	A	1	27249		10	22685		213	6714		24	46320
A	27:04:18	6:33:27 PM	A	1	27491		10	22813		213	6837		24	46337
A	27:04:18	6:33:30 PM	A	1	27504		10	22604		213	6825		24	46298
A	27:04:18	6:33:33 PM	A	1	27513		10	22564		213	7189		24	46294
A	27:04:18	6:33:36 PM	A	1	27390		10	22235		213	7130		24	46275
A	27:04:18	6:33:39 PM	A	1	27652		10	21604		213	6586		24	46265
A	27:04:18	6:33:42 PM	A	1	27414		10	22067		213	6796		24	46257
A	27:04:18	6:33:45 PM	A	1	27330		10	22285		213	7226		24	46235
A	27:04:18	6:33:48 PM	A	1	27449		10	22237		213	7141		24	46259
A	27:04:18	6:33:51 PM	A	1	27572		10	22531		213	7036		24	46217

A	27:04:18	6:33:54 PM	A	1	27644		10	22346		213	7007		24	46211
A	27:04:18	6:33:57 PM	A	1	27433		10	21748		213	6741		24	46219
A	27:04:18	6:34:00 PM	A	1	27442		10	22287		213	6432		24	46237
A	27:04:18	6:34:03 PM	A	1	27635		10	22039		213	7123		24	46212
A	27:04:18	6:34:06 PM	A	1	27423		10	21957		213	7133		24	46226
A	27:04:18	6:34:09 PM	A	1	27642		10	21307		213	6655		24	46207
A	27:04:18	6:34:12 PM	A	1	27169		10	21083		213	6502		24	46160
A	27:04:18	6:34:15 PM	A	1	27409		10	21405		213	6725		24	46184
A	27:04:18	6:34:18 PM	A	1	27308		10	21422		213	7097		24	46165
A	27:04:18	6:34:21 PM	A	1	27686		10	21682		213	7036		24	46172
A	27:04:18	6:34:24 PM	A	1	27104		10	21421		213	6783		24	46202
A	27:04:18	6:34:27 PM	A	1	27379		10	21064		213	6677		24	46139
A	27:04:18	6:34:30 PM	A	1	27330		10	21202		213	6545		24	46151
A	27:04:18	6:34:33 PM	A	1	27224		10	20906		213	6969		24	46165
A	27:04:18	6:34:36 PM	A	1	27404		10	21194		213	6856		24	46152
A	27:04:18	6:34:39 PM	A	1	27296		10	21270		213	6431		24	46153
A	27:04:18	6:34:42 PM	A	1	27352		10	21331		213	6867		24	46136
A	27:04:18	6:34:45 PM	A	1	27404		10	21164		213	6607		24	46125
A	27:04:18	6:34:48 PM	A	1	27369		10	20969		213	6675		24	46127
A	27:04:18	6:34:51 PM	A	1	27354		10	21023		213	6729		24	46135
A	27:04:18	6:34:54 PM	A	1	27366		10	21039		213	6511		24	46107
A	27:04:18	6:34:57 PM	A	1	27503		10	20678		213	6851		24	46089
A	27:04:18	6:35:00 PM	A	1	27496		10	21047		213	6752		24	46144
A	27:04:18	6:35:03 PM	A	1	27436		10	20617		213	6711		24	46098
A	27:04:18	6:35:06 PM	A	1	27392		10	20390		213	6759		24	46065
A	27:04:18	6:35:09 PM	A	1	27338		10	20444		213	6663		24	46082
A	27:04:18	6:35:12 PM	A	1	27364		10	19955		213	6556		24	46072
A	27:04:18	6:35:15 PM	A	1	27351		10	20391		213	6185		24	46071
A	27:04:18	6:35:18 PM	A	1	27356		10	19866		213	6307		24	46091
A	27:04:18	6:35:21 PM	A	1	27370		10	19365		213	6182		24	46057
A	27:04:18	6:35:24 PM	A	1	27372		10	19773		213	6228		24	46043
A	27:04:18	6:35:27 PM	A	1	27439		10	19664		213	6264		24	46066
A	27:04:18	6:35:30 PM	A	1	27467		10	19792		213	6637		24	46056
A	27:04:18	6:35:33 PM	A	1	27200		10	19711		213	6599		24	46068
A	27:04:18	6:35:36 PM	A	1	27516		10	19500		213	6508		24	46027
A	27:04:18	6:35:39 PM	A	1	27324		10	19769		213	6177		24	46038
A	27:04:18	6:35:42 PM	A	1	27418		10	19587		213	6094		24	46048
A	27:04:18	6:35:45 PM	A	1	27429		10	19031		213	6064		24	46036
A	27:04:18	6:35:48 PM	A	1	27548		10	19254		213	6071		24	46065
A	27:04:18	6:35:51 PM	A	1	27406		10	18461		213	6164		24	46051
A	27:04:18	6:35:54 PM	A	1	27439		10	18705		213	6075		24	46014
A	27:04:18	6:35:57 PM	A	1	27338		10	18955		213	6428		24	46050

A	27:04:18	6:36:00 PM	A	1	27347		10	18686		213	6667		24	46028
A	27:04:18	6:36:03 PM	A	1	27383		10	18835		213	6268		24	46033
A	27:04:18	6:36:06 PM	A	1	27300		10	18781		213	6378		24	46000
A	27:04:18	6:36:09 PM	A	1	27442		10	18862		213	6356		24	45997
A	27:04:18	6:36:12 PM	A	1	27334		10	18582		213	6276		24	46038
A	27:04:18	6:36:15 PM	A	1	27593		10	18141		213	6129		24	46000
A	27:04:18	6:36:18 PM	A	1	27462		10	17711		213	6031		24	45994
A	27:04:18	6:36:21 PM	A	1	27467		10	18019		213	6162		24	46018
A	27:04:18	6:36:24 PM	A	1	27379		10	18361		213	5861		24	45987
A	27:04:18	6:36:27 PM	A	1	27203		10	18217		213	5966		24	46022
A	27:04:18	6:36:30 PM	A	1	27061		10	18164		213	6010		24	45967
A	27:04:18	6:36:33 PM	A	1	27433		10	18148		213	5939		24	45996
A	27:04:18	6:36:36 PM	A	1	27428		10	17861		213	5814		24	45975
A	27:04:18	6:36:39 PM	A	1	27455		10	18205		213	6186		24	46005
A	27:04:18	6:36:42 PM	A	1	27381		10	18015		213	6095		24	45985
A	27:04:18	6:36:45 PM	A	1	27418		10	17904		213	5947		24	45987
A	27:04:18	6:36:48 PM	A	1	27505		10	18011		213	6329		24	45963
A	27:04:18	6:36:51 PM	A	1	27504		10	17902		213	6345		24	45965
A	27:04:18	6:36:54 PM	A	1	27420		10	17583		213	6171		24	45967
A	27:04:18	6:36:57 PM	A	1	27419		10	17644		213	6186		24	45979
A	27:04:18	6:37:00 PM	A	1	27739		10	17490		213	6217		24	45971
A	27:04:18	6:37:03 PM	A	1	27448		10	17547		213	5619		24	45933
A	27:04:18	6:37:06 PM	A	1	27583		10	17140		213	5673		24	45939
A	27:04:18	6:37:09 PM	A	1	27496		10	17155		213	5671		24	45901
A	27:04:18	6:37:12 PM	A	1	27388		10	17335		213	5620		24	45892
A	27:04:18	6:37:15 PM	A	1	27350		10	17445		213	5677		24	45911
A	27:04:18	6:37:18 PM	A	1	27445		10	17244		213	6024		24	45932
A	27:04:18	6:37:21 PM	A	1	27258		10	17057		213	5984		24	45917
A	27:04:18	6:37:24 PM	A	1	27407		10	17206		213	5855		24	45897
A	27:04:18	6:37:27 PM	A	1	27443		10	17009		213	6134		24	45897
A	27:04:18	6:37:30 PM	A	1	27413		10	16807		213	6125		24	45924
A	27:04:18	6:37:33 PM	A	1	27428		10	16881		213	6031		24	45920
A	27:04:18	6:37:36 PM	A	1	27364		10	16603		213	5777		24	45880
A	27:04:18	6:37:39 PM	A	1	27313		10	17302		213	5926		24	45902
A	27:04:18	6:37:42 PM	A	1	27443		10	16748		213	5798		24	45863
A	27:04:18	6:37:45 PM	A	1	27407		10	16858		213	5853		24	45870
A	27:04:18	6:37:48 PM	A	1	27454		10	16667		213	5862		24	45864
A	27:04:18	6:37:51 PM	A	1	27375		10	16492		213	5653		24	45845
A	27:04:18	6:37:54 PM	A	1	27451		10	16334		213	5540		24	45848
A	27:04:18	6:37:57 PM	A	1	27428		10	16419		213	5679		24	45840
A	27:04:18	6:38:00 PM	A	1	27395		10	16293		213	5692		24	45820
A	27:04:18	6:38:03 PM	A	1	27403		10	16266		213	5581		24	45820

A	27:04:18	6:38:06 PM	A	1	27363		10	15986		213	5636		24	45824
A	27:04:18	6:38:09 PM	A	1	27428		10	15957		213	5904		24	45789
A	27:04:18	6:38:12 PM	A	1	27406		10	15980		213	5716		24	45788
A	27:04:18	6:38:15 PM	A	1	27271		10	16105		213	5601		24	45807
A	27:04:18	6:38:18 PM	A	1	27356		10	16119		213	5771		24	45777
A	27:04:18	6:38:21 PM	A	1	27568		10	16060		213	5364		24	45763
A	27:04:18	6:38:24 PM	A	1	27449		10	15940		213	5384		24	45785
A	27:04:18	6:38:27 PM	A	1	27446		10	15797		213	5757		24	45761
A	27:04:18	6:38:30 PM	A	1	27468		10	15694		213	5663		24	45765
A	27:04:18	6:38:33 PM	A	1	27483		10	15759		213	5440		24	45732
A	27:04:18	6:38:36 PM	A	1	27393		10	15253		213	5398		24	45725
A	27:04:18	6:38:39 PM	A	1	27321		10	15136		213	5786		24	45727
A	27:04:18	6:38:42 PM	A	1	27355		10	15327		213	5740		24	45712
A	27:04:18	6:38:45 PM	A	1	27456		10	15036		213	5650		24	45715
A	27:04:18	6:38:48 PM	A	1	27393		10	15099		213	5537		24	45681
A	27:04:18	6:38:51 PM	A	1	27390		10	14866		213	5349		24	45667
A	27:04:18	6:38:54 PM	A	1	27443		10	14680		213	5148		24	45674
A	27:04:18	6:38:57 PM	A	1	27446		10	15052		213	5226		24	45670
A	27:04:18	6:39:00 PM	A	1	27509		10	14871		213	4974		24	45642
A	27:04:18	6:39:03 PM	A	1	27430		10	14851		213	5167		24	45657
A	27:04:18	6:39:06 PM	A	1	27496		10	14651		213	5355		24	45613
A	27:04:18	6:39:09 PM	A	1	27365		10	14669		213	5552		24	45619
A	27:04:18	6:39:12 PM	A	1	27531		10	14587		213	5465		24	45658
A	27:04:18	6:39:15 PM	A	1	27420		10	13973		213	5392		24	45637
A	27:04:18	6:39:18 PM	A	1	27664		10	13839		213	5132		24	45605
A	27:04:18	6:39:21 PM	A	1	27246		10	13469		213	5147		24	45579
A	27:04:18	6:39:24 PM	A	1	27354		10	13752		213	5223		24	45604
A	27:04:18	6:39:27 PM	A	1	27447		10	13510		213	5128		24	45624
A	27:04:18	6:39:30 PM	A	1	27340		10	13947		213	5123		24	45587
A	27:04:18	6:39:33 PM	A	1	27395		10	14095		213	4926		24	45576
A	27:04:18	6:39:36 PM	A	1	27345		10	13619		213	5402		24	45562
A	27:04:18	6:39:39 PM	A	1	27382		10	13532		213	5238		24	45525
A	27:04:18	6:39:42 PM	A	1	27349		10	13519		213	4975		24	45538
A	27:04:18	6:39:45 PM	A	1	27582		10	13250		213	4650		24	45560
A	27:04:18	6:39:48 PM	A	1	27477		10	13215		213	5341		24	45526
A	27:04:18	6:39:51 PM	A	1	27404		10	13604		213	5316		24	45533
A	27:04:18	6:39:54 PM	A	1	27404		10	13482		213	5141		24	45532
A	27:04:18	6:39:57 PM	A	1	27684		10	13473		213	4899		24	45499
A	27:04:18	6:40:00 PM	A	1	27468		10	12878		213	5013		24	45507
A	27:04:18	6:40:03 PM	A	1	27324		10	13161		213	4795		24	45509
A	27:04:18	6:40:06 PM	A	1	27462		10	13278		213	4736		24	45507
A	27:04:18	6:40:09 PM	A	1	27492		10	13293		213	5126		24	45478

A	27:04:18	6:40:12 PM	A	1	27393		10	13273		213	4763		24	45474
A	27:04:18	6:40:15 PM	A	1	27346		10	13355		213	5123		24	45473
A	27:04:18	6:40:18 PM	A	1	27380		10	13052		213	5137		24	45493
A	27:04:18	6:40:21 PM	A	1	27583		10	13176		213	4989		24	45463
A	27:04:18	6:40:24 PM	A	1	27477		10	12462		213	4779		24	45448
A	27:04:18	6:40:27 PM	A	1	27334		10	12823		213	4935		24	45500
A	27:04:18	6:40:30 PM	A	1	27569		10	12613		213	4818		24	45444
A	27:04:18	6:40:33 PM	A	1	27530		10	12743		213	5067		24	45472
A	27:04:18	6:40:36 PM	A	1	27563		10	12595		213	4929		24	45425
A	27:04:18	6:40:39 PM	A	1	27260		10	12156		213	4877		24	45431
A	27:04:18	6:40:42 PM	A	1	27412		10	12412		213	4702		24	45427
A	27:04:18	6:40:45 PM	A	1	27428		10	12419		213	4598		24	45383
A	27:04:18	6:40:48 PM	A	1	27445		10	12439		213	4600		24	45408
A	27:04:18	6:40:51 PM	A	1	27296		10	12278		213	4507		24	45377
A	27:04:18	6:40:54 PM	A	1	27166		10	11691		213	4399		24	45370
A	27:04:18	6:40:57 PM	A	1	27298		10	12048		213	4275		24	45396
A	27:04:18	6:41:00 PM	A	1	27419		10	11575		213	4535		24	45370
A	27:04:18	6:41:03 PM	A	1	27431		10	11556		213	4521		24	45372
A	27:04:18	6:41:06 PM	A	1	27461		10	12103		213	4729		24	45384
A	27:04:18	6:41:09 PM	A	1	27244		10	11691		213	4714		24	45358
A	27:04:18	6:41:12 PM	A	1	27481		10	11415		213	4299		24	45353
A	27:04:18	6:41:15 PM	A	1	27393		10	11523		213	4560		24	45364
A	27:04:18	6:41:18 PM	A	1	27491		10	11315		213	4331		24	45355
A	27:04:18	6:41:21 PM	A	1	27370		10	11420		213	4779		24	45330
A	27:04:18	6:41:24 PM	A	1	27554		10	11151		213	4644		24	45325
A	27:04:18	6:41:27 PM	A	1	27378		10	10990		213	4586		24	45278
A	27:04:18	6:41:30 PM	A	1	27750		10	11174		213	4605		24	45293
A	27:04:18	6:41:33 PM	A	1	27328		10	10781		213	4176		24	45303
A	27:04:18	6:41:36 PM	A	1	27358		10	10732		213	4303		24	45288
A	27:04:18	6:41:39 PM	A	1	27429		10	10771		213	4571		24	45265
A	27:04:18	6:41:42 PM	A	1	27390		10	10488		213	4698		24	45301
A	27:04:18	6:41:45 PM	A	1	27415		10	10746		213	4564		24	45279
A	27:04:18	6:41:48 PM	A	1	27470		10	10370		213	4230		24	45281
A	27:04:18	6:41:51 PM	A	1	27552		10	10343		213	4693		24	45245
A	27:04:18	6:41:54 PM	A	1	27465		10	10200		213	4766		24	45286
A	27:04:18	6:41:57 PM	A	1	27209		10	10300		213	4590		24	45250
A	27:04:18	6:42:00 PM	A	1	27586		10	10436		213	4416		24	45234
A	27:04:18	6:42:03 PM	A	1	27325		10	10170		213	4396		24	45219
A	27:04:18	6:42:06 PM	A	1	27371		10	9853		213	4520		24	45234
A	27:04:18	6:42:09 PM	A	1	27245		10	10186		213	4465		24	45227
A	27:04:18	6:42:12 PM	A	1	27724		10	10027		213	4296		24	45207
A	27:04:18	6:42:15 PM	A	1	27390		10	9787		213	4077		24	45214

A	27:04:18	6:42:18 PM	A	1	27550		10	9344		213	4149		24	45176
A	27:04:18	6:42:21 PM	A	1	27602		10	9428		213	4095		24	45224
A	27:04:18	6:42:24 PM	A	1	27198		10	9732		213	4081		24	45216
A	27:04:18	6:42:27 PM	A	1	27525		10	9497		213	4414		24	45191
A	27:04:18	6:42:30 PM	A	1	27449		10	9250		213	4232		24	45165
A	27:04:18	6:42:33 PM	A	1	27391		10	8975		213	4311		24	45172
A	27:04:18	6:42:36 PM	A	1	27467		10	9065		213	4022		24	45184
A	27:04:18	6:42:39 PM	A	1	27560		10	9075		213	4093		24	45153
A	27:04:18	6:42:42 PM	A	1	27208		10	7299		213	4020		24	45156
A	27:04:18	6:42:45 PM	A	1	27254		10	7309		213	4085		24	45166
A	27:04:18	6:42:48 PM	A	1	26579		10	8640		213	4363		24	45150
A	27:04:18	6:42:51 PM	A	1	27353		10	9074		213	4155		24	45170
A	27:04:18	6:42:54 PM	A	1	27326		10	8890		213	3973		24	45141
A	27:04:18	6:42:57 PM	A	1	27492		10	8412		213	4142		24	45151
A	27:04:18	6:43:00 PM	A	1	27486		10	8703		213	3962		24	45128
A	27:04:18	6:43:03 PM	A	1	27417		10	8576		213	4199		24	45123
A	27:04:18	6:43:06 PM	A	1	27403		10	8640		213	4124		24	45112
A	27:04:18	6:43:09 PM	A	1	27462		10	8508		213	3950		24	45121
A	27:04:18	6:43:12 PM	A	1	27365		10	7862		213	3852		24	45130
A	27:04:18	6:43:15 PM	A	1	27435		10	7713		213	4226		24	45108
A	27:04:18	6:43:18 PM	A	1	27346		10	7465		213	4138		24	45084
A	27:04:18	6:43:21 PM	A	1	27390		10	7633		213	3980		24	45076
A	27:04:18	6:43:24 PM	A	1	27336		10	7848		213	3705		24	45088
A	27:04:18	6:43:27 PM	A	1	27345		10	7987		213	3593		24	45072
A	27:04:18	6:43:30 PM	A	1	27299		10	8009		213	3685		24	45030
A	27:04:18	6:43:33 PM	A	1	27386		10	7832		213	4058		24	45035
A	27:04:18	6:43:36 PM	A	1	27384		10	7828		213	3839		24	45072
A	27:04:18	6:43:39 PM	A	1	27412		10	7709		213	4027		24	45025
A	27:04:18	6:43:42 PM	A	1	27409		10	7560		213	3919		24	44992
A	27:04:18	6:43:45 PM	A	1	27419		10	7528		213	3737		24	44998
A	27:04:18	6:43:48 PM	A	1	27382		10	7538		213	3687		24	44987
A	27:04:18	6:43:51 PM	A	1	27489		10	7384		213	3825		24	44976
A	27:04:18	6:43:54 PM	A	1	27365		10	7542		213	4012		24	44977
A	27:04:18	6:43:57 PM	A	1	27386		10	7510		213	3787		24	45000
A	27:04:18	6:44:00 PM	A	1	27313		10	7244		213	3625		24	44939
A	27:04:18	6:44:03 PM	A	1	27341		10	7323		213	3466		24	44968
A	27:04:18	6:44:06 PM	A	1	27316		10	7253		213	3998		24	44959
A	27:04:18	6:44:09 PM	A	1	27314		10	7117		213	3748		24	44948
A	27:04:18	6:44:12 PM	A	1	27323		10	7078		213	3833		24	44935
A	27:04:18	6:44:15 PM	A	1	27281		10	6926		213	3516		24	44954
A	27:04:18	6:44:18 PM	A	1	27356		10	6892		213	3554		24	44925
A	27:04:18	6:44:21 PM	A	1	27408		10	6556		213	3497		24	44893

A	27:04:18	6:44:24 PM	A	1	27215		10	6722		213	3502		24	44902
A	27:04:18	6:44:27 PM	A	1	27399		10	6770		213	3521		24	44938
A	27:04:18	6:44:30 PM	A	1	27496		10	6732		213	3395		24	44919
A	27:04:18	6:44:33 PM	A	1	27359		10	6501		213	3525		24	44921
A	27:04:18	6:44:36 PM	A	1	27338		10	6433		213	3287		24	44900
A	27:04:18	6:44:39 PM	A	1	27365		10	6490		213	3419		24	44906
A	27:04:18	6:44:42 PM	A	1	27405		10	6495		213	3627		24	44871
A	27:04:18	6:44:45 PM	A	1	27438		10	6122		213	3528		24	44897
A	27:04:18	6:44:48 PM	A	1	27491		10	6364		213	3297		24	44856
A	27:04:18	6:44:51 PM	A	1	27360		10	5913		213	3247		24	44876
A	27:04:18	6:44:54 PM	A	1	27466		10	6153		213	3072		24	44866
A	27:04:18	6:44:57 PM	A	1	27097		10	5858		213	3595		24	44835
A	27:04:18	6:45:00 PM	A	1	27436		10	5600		213	3446		24	44856
A	27:04:18	6:45:03 PM	A	1	27335		10	5875		213	3353		24	44829
A	27:04:18	6:45:06 PM	A	1	27400		10	5708		213	3366		24	44781
A	27:04:18	6:45:09 PM	A	1	27382		10	5918		213	3305		24	44818
A	27:04:18	6:45:12 PM	A	1	27554		10	5578		213	3267		24	44821
A	27:04:18	6:45:15 PM	A	1	27377		10	5470		213	3137		24	44825
A	27:04:18	6:45:18 PM	A	1	27280		10	5595		213	2934		24	44804
A	27:04:18	6:45:21 PM	A	1	27389		10	5070		213	2988		24	44807
A	27:04:18	6:45:24 PM	A	1	27359		10	5146		213	2917		24	44788
A	27:04:18	6:45:27 PM	A	1	27352		10	5051		213	3059		24	44801
A	27:04:18	6:45:30 PM	A	1	27262		10	5229		213	2988		24	44788
A	27:04:18	6:45:33 PM	A	1	27354		10	5016		213	3480		24	44798
A	27:04:18	6:45:36 PM	A	1	27379		10	4789		213	3466		24	44803
A	27:04:18	6:45:39 PM	A	1	27496		10	4777		213	3194		24	44775
A	27:04:18	6:45:42 PM	A	1	27497		10	5001		213	3321		24	44765
A	27:04:18	6:45:45 PM	A	1	27397		10	4912		213	2962		24	44769
A	27:04:18	6:45:48 PM	A	1	27276		10	4838		213	2873		24	44755
A	27:04:18	6:45:51 PM	A	1	27378		10	4169		213	2961		24	44730
A	27:04:18	6:45:54 PM	A	1	27406		10	4032		213	2933		24	44747
A	27:04:18	6:45:57 PM	A	1	27413		10	4518		213	2930		24	44750
A	27:04:18	6:46:00 PM	A	1	27463		10	4418		213	3251		24	44746
A	27:04:18	6:46:03 PM	A	1	27430		10	4278		213	3107		24	44742
A	27:04:18	6:46:06 PM	A	1	27393		10	4462		213	3026		24	44719
A	27:04:18	6:46:09 PM	A	1	27344		10	4298		213	2845		24	44671
A	27:04:18	6:46:12 PM	A	1	27550		10	4317		213	2963		24	44697
A	27:04:18	6:46:15 PM	A	1	27285		10	4484		213	3097		24	44662
A	27:04:18	6:46:18 PM	A	1	27424		10	4667		213	3055		24	44712
A	27:04:18	6:46:21 PM	A	1	27347		10	4926		213	2617		24	44695
A	27:04:18	6:46:24 PM	A	1	27415		10	4850		213	2754		24	44695
A	27:04:18	6:46:27 PM	A	1	27408		10	5001		213	2925		24	44704

A	27:04:18	6:46:30 PM	A	1	27512		10	4813		213	3069		24	44688
A	27:04:18	6:46:33 PM	A	1	27174		10	4926		213	2949		24	44662
A	27:04:18	6:46:36 PM	A	1	27490		10	4681		213	2912		24	44666
A	27:04:18	6:46:39 PM	A	1	27274		10	4262		213	2939		24	44665
A	27:04:18	6:46:42 PM	A	1	27312		10	4181		213	2823		24	44689
A	27:04:18	6:46:45 PM	A	1	27178		10	4469		213	2824		24	44662
A	27:04:18	6:46:48 PM	A	1	27576		10	4383		213	2551		24	44644
A	27:04:18	6:46:51 PM	A	1	27450		10	4370		213	2461		24	44634
A	27:04:18	6:46:54 PM	A	1	27365		10	4420		213	2482		24	44621
A	27:04:18	6:46:57 PM	A	1	27380		10	4794		213	2779		24	44664
A	27:04:18	6:47:00 PM	A	1	27434		10	4408		213	2714		24	44657
A	27:04:18	6:47:03 PM	A	1	27421		10	4620		213	2522		24	44627
A	27:04:18	6:47:06 PM	A	1	27504		10	4114		213	2587		24	44628
A	27:04:18	6:47:09 PM	A	1	27309		10	3882		213	2407		24	44606
A	27:04:18	6:47:12 PM	A	1	27313		10	4113		213	2874		24	44605
A	27:04:18	6:47:15 PM	A	1	27534		10	4128		213	2632		24	44634
A	27:04:18	6:47:18 PM	A	1	27326		10	3632		213	2660		24	44614
A	27:04:18	6:47:21 PM	A	1	27375		10	3421		213	2602		24	44621
A	27:04:18	6:47:24 PM	A	1	27507		10	2853		213	2487		24	44623
A	27:04:18	6:47:27 PM	A	1	27434		10	3822		213	2510		24	44626
A	27:04:18	6:47:30 PM	A	1	27205		10	3716		213	2356		24	44608
A	27:04:18	6:47:33 PM	A	1	27536		10	3948		213	2372		24	44620
A	27:04:18	6:47:36 PM	A	1	27414		10	3774		213	2311		24	44576
A	27:04:18	6:47:39 PM	A	1	27369		10	3552		213	2250		24	44614
A	27:04:18	6:47:42 PM	A	1	27369		10	3774		213	2501		24	44570
A	27:04:18	6:47:45 PM	A	1	27321		10	3534		213	2576		24	44585
A	27:04:18	6:47:48 PM	A	1	27480		10	4547		213	2563		24	44588
A	27:04:18	6:47:51 PM	A	1	27339		10	3425		213	2394		24	44598
A	27:04:18	6:47:54 PM	A	1	27260		10	3280		213	2201		24	44577
A	27:04:18	6:47:57 PM	A	1	27438		10	3180		213	2358		24	44546
A	27:04:18	6:48:00 PM	A	1	27463		10	3073		213	2579		24	44566
A	27:04:18	6:48:03 PM	A	1	27290		10	3011		213	2266		24	44547
A	27:04:18	6:48:06 PM	A	1	27604		10	3090		213	2084		24	44560
A	27:04:18	6:48:09 PM	A	1	27318		10	2886		213	2337		24	44542
A	27:04:18	6:48:12 PM	A	1	27482		10	2817		213	2091		24	44532
A	27:04:18	6:48:15 PM	A	1	27435		10	2663		213	2127		24	44530
A	27:04:18	6:48:18 PM	A	1	27444		10	2532		213	1998		24	44492
A	27:04:18	6:48:21 PM	A	1	27322		10	2720		213	2115		24	44493
A	27:04:18	6:48:24 PM	A	1	27473		10	2256		213	1906		24	44466
A	27:04:18	6:48:27 PM	A	1	27361		10	2498		213	1778		24	44479
A	27:04:18	6:48:30 PM	A	1	27338		10	2327		213	2108		24	44498
A	27:04:18	6:48:33 PM	A	1	27256		10	2134		213	2146		24	44463

A	27:04:18	6:48:36 PM	A	1	27325		10	2144		213	2152		24	44490
A	27:04:18	6:48:39 PM	A	1	27425		10	1884		213	2064		24	44489
A	27:04:18	6:48:42 PM	A	1	27429		10	2067		213	2114		24	44462
A	27:04:18	6:48:45 PM	A	1	27307		10	1964		213	1749		24	44462
A	27:04:18	6:48:48 PM	A	1	27498		10	1700		213	2188		24	44477
A	27:04:18	6:48:51 PM	A	1	27353		10	1595		213	2187		24	44420
A	27:04:18	6:48:54 PM	A	1	27364		10	1514		213	2146		24	44447
A	27:04:18	6:48:57 PM	A	1	27241		10	1482		213	2006		24	44428
A	27:04:18	6:49:00 PM	A	1	27437		10	1486		213	2140		24	44397
A	27:04:18	6:49:03 PM	A	1	27423		10	1284		213	2149		24	44399
A	27:04:18	6:49:06 PM	A	1	27311		10	1483		213	2193		24	44389
A	27:04:18	6:49:09 PM	A	1	27284		10	1273		213	1941		24	44367
A	27:04:18	6:49:12 PM	A	1	27456		10	1267		213	1912		24	44396
A	27:04:18	6:49:15 PM	A	1	27310		10	1201		213	2265		24	44363
A	27:04:18	6:49:18 PM	A	1	27440		10	966		213	2246		24	44363
A	27:04:18	6:49:21 PM	A	1	27423		10	947		213	2099		24	44370
A	27:04:18	6:49:24 PM	A	1	27444		10	757		213	1884		24	44346
A	27:04:18	6:49:27 PM	A	1	27376		10	439		213	1818		24	44361
A	27:04:18	6:49:30 PM	A	1	27141		10	387		213	1660		24	44313
A	27:04:18	6:49:33 PM	A	1	27251		10	288		213	2057		24	44295
A	27:04:18	6:49:36 PM	A	1	27713		10	360		213	1979		24	44323
A	27:04:18	6:49:39 PM	A	1	27333		10	649		213	2026		24	44332
A	27:04:18	6:49:42 PM	A	1	27509		10	210		213	1760		24	44322
A	27:04:18	6:49:45 PM	A	1	27373		10	213		213	1706		24	44306
A	27:04:18	6:49:48 PM	A	1	27418		9	65338		213	1772		24	44302
A	27:04:18	6:49:51 PM	A	1	27485		10	84		213	2159		24	44287
A	27:04:18	6:49:54 PM	A	1	27448		9	65267		213	1967		24	44280
A	27:04:18	6:49:57 PM	A	1	27433		9	64896		213	1959		24	44263
A	27:04:18	6:50:00 PM	A	1	27493		9	65488		213	1525		24	44217
A	27:04:18	6:50:03 PM	A	1	27402		9	65396		213	1626		24	44263
A	27:04:18	6:50:06 PM	A	1	27451		9	65339		213	1614		24	44255
A	27:04:18	6:50:09 PM	A	1	27338		9	65276		213	1569		24	44239
A	27:04:18	6:50:12 PM	A	1	27633		9	65005		213	1838		24	44246
A	27:04:18	6:50:15 PM	A	1	27374		9	65241		213	1725		24	44215
A	27:04:18	6:50:18 PM	A	1	27397		9	65061		213	1790		24	44216
A	27:04:18	6:50:21 PM	A	1	27371		9	64949		213	1548		24	44191
A	27:04:18	6:50:24 PM	A	1	27397		9	65207		213	1730		24	44182
A	27:04:18	6:50:27 PM	A	1	27472		9	65052		213	1671		24	44174
A	27:04:18	6:50:30 PM	A	1	27310		9	65071		213	1641		24	44186
A	27:04:18	6:50:33 PM	A	1	27408		9	65118		213	1359		24	44139
A	27:04:18	6:50:36 PM	A	1	27398		9	65304		213	1551		24	44147
A	27:04:18	6:50:39 PM	A	1	27184		9	65205		213	1549		24	44141

A	27:04:18	6:50:42 PM	A	1	27486		9	65126		213	1542		24	44150
A	27:04:18	6:50:45 PM	A	1	27035		9	65129		213	1476		24	44148
A	27:04:18	6:50:48 PM	A	1	27495		9	65153		213	1464		24	44144
A	27:04:18	6:50:51 PM	A	1	27517		9	65069		213	1236		24	44146
A	27:04:18	6:50:54 PM	A	1	27480		9	64874		213	1315		24	44113
A	27:04:18	6:50:57 PM	A	1	27428		9	65020		213	1320		24	44100
A	27:04:18	6:51:00 PM	A	1	27324		9	64953		213	1295		24	44112
A	27:04:18	6:51:03 PM	A	1	27138		9	65045		213	1066		24	44116
A	27:04:18	6:51:06 PM	A	1	27178		9	64816		213	1433		24	44077
A	27:04:18	6:51:09 PM	A	1	27343		9	64830		213	1380		24	44075
A	27:04:18	6:51:12 PM	A	1	27488		9	64762		213	1452		24	44068
A	27:04:18	6:51:15 PM	A	1	27412		9	64641		213	1140		24	44113
A	27:04:18	6:51:18 PM	A	1	27434		9	64793		213	1209		24	44084
A	27:04:18	6:51:21 PM	A	1	27375		9	64472		213	1013		24	44090
A	27:04:18	6:51:24 PM	A	1	27271		9	64706		213	1293		24	44120
A	27:04:18	6:51:27 PM	A	1	27306		9	64416		213	1550		24	44088
A	27:04:18	6:51:30 PM	A	1	27357		9	64334		213	1222		24	44067
A	27:04:18	6:51:33 PM	A	1	27366		9	64339		213	1428		24	44046
A	27:04:18	6:51:36 PM	A	1	27303		9	64345		213	1341		24	44107
A	27:04:18	6:51:39 PM	A	1	27334		9	64333		213	1203		24	44087
A	27:04:18	6:51:42 PM	A	1	27332		9	64013		213	1324		24	44091
A	27:04:18	6:51:45 PM	A	1	27502		9	63868		213	1184		24	44100
A	27:04:18	6:51:48 PM	A	1	27362		9	64196		213	1276		24	44098
A	27:04:18	6:51:51 PM	A	1	27309		9	64123		213	1167		24	44083
A	27:04:18	6:51:54 PM	A	1	27464		9	64152		213	827		24	44060
A	27:04:18	6:51:57 PM	A	1	27444		9	64060		213	1166		24	44068
A	27:04:18	6:52:00 PM	A	1	27342		9	63938		213	1164		24	44094
A	27:04:18	6:52:03 PM	A	1	27317		9	63957		213	1172		24	44073
A	27:04:18	6:52:06 PM	A	1	27458		9	63511		213	1120		24	44077
A	27:04:18	6:52:09 PM	A	1	27316		9	63906		213	1169		24	44091
A	27:04:18	6:52:12 PM	A	1	27313		9	63454		213	1278		24	44106
A	27:04:18	6:52:15 PM	A	1	27379		9	63433		213	1109		24	44099
A	27:04:18	6:52:18 PM	A	1	27524		9	63335		213	912		24	44093
A	27:04:18	6:52:21 PM	A	1	27454		9	63177		213	986		24	44093
A	27:04:18	6:52:24 PM	A	1	27420		9	63493		213	867		24	44037
A	27:04:18	6:52:27 PM	A	1	27564		9	63553		213	1020		24	44068
A	27:04:18	6:52:30 PM	A	1	27396		9	63331		213	765		24	44074
A	27:04:18	6:52:33 PM	A	1	27376		9	62777		213	730		24	44084
A	27:04:18	6:52:36 PM	A	1	27600		9	62636		213	756		24	44086
A	27:04:18	6:52:39 PM	A	1	27512		9	63265		213	729		24	44079
A	27:04:18	6:52:42 PM	A	1	27401		9	63144		213	642		24	44058
A	27:04:18	6:52:45 PM	A	1	27750		9	63281		213	804		24	44042

A	27:04:18	6:52:48 PM	A	1	27381		9	62987		213	691		24	44049
A	27:04:18	6:52:51 PM	A	1	27353		9	62897		213	716		24	44085
A	27:04:18	6:52:54 PM	A	1	27359		9	63076		213	767		24	44045
A	27:04:18	6:52:57 PM	A	1	27432		9	62950		213	667		24	44092
A	27:04:18	6:53:00 PM	A	1	27421		9	62771		213	639		24	44038
A	27:04:18	6:53:03 PM	A	1	27552		9	62983		213	236		24	44072
A	27:04:18	6:53:06 PM	A	1	27328		9	62672		213	352		24	44083
A	27:04:18	6:53:09 PM	A	1	27315		9	62779		213	357		24	44078
A	27:04:18	6:53:12 PM	A	1	27374		9	62771		213	403		24	44081
A	27:04:18	6:53:15 PM	A	1	27412		9	62832		213	380		24	44088
A	27:04:18	6:53:18 PM	A	1	27411		9	62986		213	262		24	44079
A	27:04:18	6:53:21 PM	A	1	27231		9	62772		213	614		24	44076
A	27:04:18	6:53:24 PM	A	1	27416		9	62667		213	623		24	44056
A	27:04:18	6:53:27 PM	A	1	27299		9	62565		213	425		24	44077
A	27:04:18	6:53:30 PM	A	1	27375		9	62465		213	388		24	44052
A	27:04:18	6:53:33 PM	A	1	27488		9	62265		213	363		24	44062
A	27:04:18	6:53:36 PM	A	1	27367		9	61964		213	540		24	44041
A	27:04:18	6:53:39 PM	A	1	27419		9	61947		213	396		24	44048
A	27:04:18	6:53:42 PM	A	1	27449		9	62418		213	298		24	44058
A	27:04:18	6:53:45 PM	A	1	27406		9	62205		213	214		24	44054
A	27:04:18	6:53:48 PM	A	1	27202		9	62149		213	399		24	44033
A	27:04:18	6:53:51 PM	A	1	27329		9	62051		213	472		24	44015
A	27:04:18	6:53:54 PM	A	1	27281		9	61551		213	473		24	44051
A	27:04:18	6:53:57 PM	A	1	27454		9	61298		213	280		24	44062
A	27:04:18	6:54:00 PM	A	1	27251		9	61453		213	381		24	44051
A	27:04:18	6:54:03 PM	A	1	27327		9	61479		213	434		24	44034
A	27:04:18	6:54:06 PM	A	1	27512		9	61153		213	435		24	44046
A	27:04:18	6:54:09 PM	A	1	27438		9	61342		213	115		24	44037
A	27:04:18	6:54:12 PM	A	1	27459		9	61341		213	91		24	44037
A	27:04:18	6:54:15 PM	A	1	27347		9	61270		212	471		24	44012
A	27:04:18	6:54:18 PM	A	1	27355		9	61262		213	148		24	44000
A	27:04:18	6:54:21 PM	A	1	27538		9	61246		212	63680		24	43993
A	27:04:18	6:54:24 PM	A	1	27424		9	61081		213	148		24	43987
A	27:04:18	6:54:27 PM	A	1	27408		9	61013		212	398		24	43996
A	27:04:18	6:54:30 PM	A	1	27386		9	60993		212	274		24	43985
A	27:04:18	6:54:33 PM	A	1	27407		9	60933		213	386		24	43998
A	27:04:18	6:54:36 PM	A	1	27361		9	60917		212	26		24	43964
A	27:04:18	6:54:39 PM	A	1	27499		9	59585		212	39		24	43948
A	27:04:18	6:54:42 PM	A	1	27407		9	59880		212	285		24	43954
A	27:04:18	6:54:45 PM	A	1	27294		9	60369		212	63914		24	43939
A	27:04:18	6:54:48 PM	A	1	27366		9	60255		213	146		24	43954
A	27:04:18	6:54:51 PM	A	1	27309		9	60426		212	63794		24	43941

A	27:04:18	6:54:54 PM	A	1	27414		9	60365		212	65469		24	43942
A	27:04:18	6:54:57 PM	A	1	27411		9	60237		212	63253		24	43910
A	27:04:18	6:55:00 PM	A	1	27395		9	60163		212	63857		24	43915
A	27:04:18	6:55:03 PM	A	1	27361		9	60122		212	65359		24	43934
A	27:04:18	6:55:06 PM	A	1	27441		9	60255		212	63765		24	43880
A	27:04:18	6:55:09 PM	A	1	27447		9	59962		212	63623		24	43908
A	27:04:18	6:55:12 PM	A	1	27351		9	60048		212	63496		24	43909
A	27:04:18	6:55:15 PM	A	1	27508		9	59810		212	65493		24	43887
A	27:04:18	6:55:18 PM	A	1	27407		9	59986		212	63786		24	43862
A	27:04:18	6:55:21 PM	A	1	27331		9	59904		212	63829		24	43865
A	27:04:18	6:55:24 PM	A	1	27287		9	59793		212	63435		24	43824
A	27:04:18	6:55:27 PM	A	1	27328		9	59824		212	63228		24	43817
A	27:04:18	6:55:30 PM	A	1	27442		9	59823		212	63252		24	43810
A	27:04:18	6:55:33 PM	A	1	27364		9	59490		212	63306		24	43844
A	27:04:18	6:55:36 PM	A	1	27431		9	59408		212	63150		24	43822
A	27:04:18	6:55:39 PM	A	1	27318		9	59410		212	63168		24	43786
A	27:04:18	6:55:42 PM	A	1	27710		9	59533		212	63308		24	43807
A	27:04:18	6:55:45 PM	A	1	27237		9	59472		212	63199		24	43762
A	27:04:18	6:55:48 PM	A	1	27404		9	59526		212	62928		24	43766
A	27:04:18	6:55:51 PM	A	1	27381		9	59621		212	63449		24	43745
A	27:04:18	6:55:54 PM	A	1	27400		9	59159		212	63613		24	43748
A	27:04:18	6:55:57 PM	A	1	27482		9	58832		212	63060		24	43723
A	27:04:18	6:56:00 PM	A	1	27447		9	58791		212	63019		24	43746
A	27:04:18	6:56:03 PM	A	1	27408		9	59071		212	63077		24	43734
A	27:04:18	6:56:06 PM	A	1	27413		9	59200		212	63045		24	43710
A	27:04:18	6:56:09 PM	A	1	27362		9	59274		212	62951		24	43692
A	27:04:18	6:56:12 PM	A	1	27374		9	59137		212	62995		24	43666
A	27:04:18	6:56:15 PM	A	1	27390		9	59284		212	63413		24	43678
A	27:04:18	6:56:18 PM	A	1	27443		9	58995		212	63299		24	43683
A	27:04:18	6:56:21 PM	A	1	27430		9	58870		212	63387		24	43665
A	27:04:18	6:56:24 PM	A	1	27405		9	59083		212	62987		24	43661
A	27:04:18	6:56:27 PM	A	1	27405		9	58853		212	63365		24	43645
A	27:04:18	6:56:30 PM	A	1	27428		9	58849		212	63435		24	43629
A	27:04:18	6:56:33 PM	A	1	27433		9	57945		212	63122		24	43614
A	27:04:18	6:56:36 PM	A	1	27429		9	58326		212	63152		24	43595
A	27:04:18	6:56:39 PM	A	1	27458		9	58632		212	63000		24	43604
A	27:04:18	6:56:42 PM	A	1	27373		9	58795		212	63161		24	43568
A	27:04:18	6:56:45 PM	A	1	27359		9	58755		212	62789		24	43544
A	27:04:18	6:56:48 PM	A	1	27386		9	58517		212	63213		24	43560
A	27:04:18	6:56:51 PM	A	1	27186		9	58569		212	63166		24	43521
A	27:04:18	6:56:54 PM	A	1	27408		9	58304		212	63136		24	43514
A	27:04:18	6:56:57 PM	A	1	27533		9	58357		212	62807		24	43500

A	27:04:18	6:57:00 PM	A	1	27265		9	58393		212	63258		24	43488
A	27:04:18	6:57:03 PM	A	1	27448		9	58239		212	63204		24	43477
A	27:04:18	6:57:06 PM	A	1	27278		9	58123		212	63169		24	43432
A	27:04:18	6:57:09 PM	A	1	27536		9	58074		212	62893		24	43440
A	27:04:18	6:57:12 PM	A	1	27337		9	58001		212	62737		24	43416
A	27:04:18	6:57:15 PM	A	1	27370		9	58026		212	62773		24	43426
A	27:04:18	6:57:18 PM	A	1	27481		9	57938		212	63150		24	43393
A	27:04:18	6:57:21 PM	A	1	27310		9	58007		212	63131		24	43400
A	27:04:18	6:57:24 PM	A	1	27447		9	57925		212	63116		24	43378
A	27:04:18	6:57:27 PM	A	1	27351		9	57641		212	62623		24	43401
A	27:04:18	6:57:30 PM	A	1	27476		9	57813		212	63168		24	43361
A	27:04:18	6:57:33 PM	A	1	27355		9	57494		212	63118		24	43358
A	27:04:18	6:57:36 PM	A	1	27496		9	57528		212	62967		24	43341
A	27:04:18	6:57:39 PM	A	1	27268		9	57487		212	62719		24	43318
A	27:04:18	6:57:42 PM	A	1	27266		9	57496		212	62555		24	43304
A	27:04:18	6:57:45 PM	A	1	27312		9	57285		212	62589		24	43292
A	27:04:18	6:57:48 PM	A	1	27388		9	57292		212	62333		24	43296
A	27:04:18	6:57:51 PM	A	1	27306		9	57390		212	62526		24	43279
A	27:04:18	6:57:54 PM	A	1	27395		9	57194		212	62725		24	43245
A	27:04:18	6:57:57 PM	A	1	27488		9	56972		212	62706		24	43240
A	27:04:18	6:58:00 PM	A	1	27332		9	56939		212	62531		24	43240
A	27:04:18	6:58:03 PM	A	1	27315		9	56559		212	62962		24	43191
A	27:04:18	6:58:06 PM	A	1	27422		9	56602		212	62688		24	43205
A	27:04:18	6:58:09 PM	A	1	27530		9	56516		212	63080		24	43184
A	27:04:18	6:58:12 PM	A	1	27146		9	56381		212	63018		24	43164
A	27:04:18	6:58:15 PM	A	1	27507		9	56401		212	62375		24	43161
A	27:04:18	6:58:18 PM	A	1	27372		9	56308		212	63148		24	43151
A	27:04:18	6:58:21 PM	A	1	27406		9	56126		212	62975		24	43150
A	27:04:18	6:58:24 PM	A	1	27603		9	55415		212	62881		24	43126
A	27:04:18	6:58:27 PM	A	1	27533		9	53850		212	62602		24	43098
A	27:04:18	6:58:30 PM	A	1	27386		9	55797		212	62521		24	43108
A	27:04:18	6:58:33 PM	A	1	27338		9	56220		212	63098		24	43061
A	27:04:18	6:58:36 PM	A	1	27314		9	56520		212	62642		24	43081
A	27:04:18	6:58:39 PM	A	1	27437		9	56499		212	62397		24	43038
A	27:04:18	6:58:42 PM	A	1	27357		9	56325		212	62430		24	43004
A	27:04:18	6:58:45 PM	A	1	27348		9	55925		212	62756		24	43024
A	27:04:18	6:58:48 PM	A	1	27460		9	55885		212	62956		24	43038
A	27:04:18	6:58:51 PM	A	1	27447		9	56019		212	62868		24	42998
A	27:04:18	6:58:54 PM	A	1	27333		9	56249		212	62780		24	42991
A	27:04:18	6:58:57 PM	A	1	27378		9	56138		212	62855		24	42983
A	27:04:18	6:59:00 PM	A	1	27349		9	56150		212	62330		24	42965
A	27:04:18	6:59:03 PM	A	1	27395		9	56093		212	62412		24	42940

A	27:04:18	6:59:06 PM	A	1	27382		9	55693		212	62350		24	42931
A	27:04:18	6:59:09 PM	A	1	27405		9	55828		212	62343		24	42926
A	27:04:18	6:59:12 PM	A	1	27345		9	55850		212	62394		24	42890
A	27:04:18	6:59:15 PM	A	1	27367		9	56051		212	62545		24	42887
A	27:04:18	6:59:18 PM	A	1	27499		9	55987		212	62094		24	42893
A	27:04:18	6:59:21 PM	A	1	27400		9	55776		212	62149		24	42872
A	27:04:18	6:59:24 PM	A	1	27337		9	55471		212	62132		24	42880
A	27:04:18	6:59:27 PM	A	1	27400		9	55225		212	62146		24	42866
A	27:04:18	6:59:30 PM	A	1	27469		9	55276		212	62113		24	42816
A	27:04:18	6:59:33 PM	A	1	27442		9	55515		212	62118		24	42818
A	27:04:18	6:59:36 PM	A	1	27432		9	55534		212	62112		24	42780
A	27:04:18	6:59:39 PM	A	1	27306		9	55448		212	62353		24	42771
A	27:04:18	6:59:42 PM	A	1	27269		9	55156		212	62574		24	42763
A	27:04:18	6:59:45 PM	A	1	27322		9	54902		212	62595		24	42748
A	27:04:18	6:59:48 PM	A	1	27465		9	55082		212	62405		24	42727
A	27:04:18	6:59:51 PM	A	1	27429		9	54866		212	62300		24	42707
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A	27:04:18	6:59:57 PM	A	1	27320		9	55133		212	62092		24	42664
A	27:04:18	7:00:00 PM	A	1	27371		9	55020		212	61923		24	42641
A	27:04:18	7:00:03 PM	A	1	27413		9	54958		212	62014		24	42623
A	27:04:18	7:00:06 PM	A	1	27389		9	54689		212	62364		24	42595
A	27:04:18	7:00:09 PM	A	1	27367		9	54891		212	62294		24	42613
A	27:04:18	7:00:12 PM	A	1	27424		9	54546		212	62083		24	42584
A	27:04:18	7:00:15 PM	A	1	27364		9	54456		212	62427		24	42564
A	27:04:18	7:00:18 PM	A	1	27368		9	54683		212	62333		24	42554
A	27:04:18	7:00:21 PM	A	1	27396		9	54450		212	62119		24	42522
A	27:04:18	7:00:24 PM	A	1	27461		9	54580		212	62123		24	42529
A	27:04:18	7:00:27 PM	A	1	27433		9	54474		212	62439		24	42509
A	27:04:18	7:00:30 PM	A	1	27383		9	54445		212	62338		24	42513
A	27:04:18	7:00:33 PM	A	1	27386		9	54349		212	62279		24	42438
A	27:04:18	7:00:36 PM	A	1	27301		9	54015		212	62272		24	42447
A	27:04:18	7:00:39 PM	A	1	27362		9	54117		212	62062		24	42460
A	27:04:18	7:00:42 PM	A	1	27441		9	54011		212	62355		24	42453
A	27:04:18	7:00:45 PM	A	1	27362		9	53853		212	61806		24	42424
A	27:04:18	7:00:48 PM	A	1	27243		9	54027		212	61866		24	42429
A	27:04:18	7:00:51 PM	A	1	27217		9	53715		212	61880		24	42403
A	27:04:18	7:00:54 PM	A	1	27413		9	53652		212	61696		24	42408
A	27:04:18	7:00:57 PM	A	1	27394		9	53483		212	61742		24	42362
A	27:04:18	7:01:00 PM	A	1	27487		9	53197		212	61774		24	42361
A	27:04:18	7:01:03 PM	A	1	27407		9	53340		212	61713		24	42363
A	27:04:18	7:01:06 PM	A	1	27372		9	53309		212	62120		24	42352
A	27:04:18	7:01:09 PM	A	1	27449		9	53423		212	61906		24	42299

A	27:04:18	7:01:12 PM	A	1	27532		9	53522		212	62082		24	42297
A	27:04:18	7:01:15 PM	A	1	27406		9	53316		212	61809		24	42308
A	27:04:18	7:01:18 PM	A	1	27376		9	53744		212	61858		24	42280
A	27:04:18	7:01:21 PM	A	1	27420		9	53508		212	61770		24	42292
A	27:04:18	7:01:24 PM	A	1	27520		9	53193		212	61752		24	42246
A	27:04:18	7:01:27 PM	A	1	27339		9	52949		212	61534		24	42247
A	27:04:18	7:01:30 PM	A	1	27470		9	52630		212	61764		24	42238
A	27:04:18	7:01:33 PM	A	1	27365		9	52938		212	61480		24	42215
A	27:04:18	7:01:36 PM	A	1	27615		9	53029		212	62057		24	42212
A	27:04:18	7:01:39 PM	A	1	27173		9	53151		212	61794		24	42194
A	27:04:18	7:01:42 PM	A	1	27364		9	52968		212	61491		24	42171
A	27:04:18	7:01:45 PM	A	1	27368		9	52676		212	61597		24	42197
A	27:04:18	7:01:48 PM	A	1	27396		9	52421		212	61430		24	42190
A	27:04:18	7:01:51 PM	A	1	27339		9	52821		212	61447		24	42176
A	27:04:18	7:01:54 PM	A	1	27327		9	52574		212	61543		24	42162
A	27:04:18	7:01:57 PM	A	1	27406		9	52663		212	61944		24	42111
A	27:04:18	7:02:00 PM	A	1	27426		9	52525		212	61798		24	42109
A	27:04:18	7:02:03 PM	A	1	27328		9	52530		212	61797		24	42078
A	27:04:18	7:02:06 PM	A	1	27357		9	52573		212	61507		24	42108
A	27:04:18	7:02:09 PM	A	1	27529		9	51942		212	61249		24	42063
A	27:04:18	7:02:12 PM	A	1	27442		9	52273		212	61979		24	42071
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A	27:04:18	7:02:18 PM	A	1	27353		9	52403		212	61825		24	42029
A	27:04:18	7:02:21 PM	A	1	27639		9	52119		212	61219		24	41983
A	27:04:18	7:02:24 PM	A	1	27366		9	51883		212	61420		24	41951
A	27:04:18	7:02:27 PM	A	1	27493		9	51728		212	61580		24	41991
A	27:04:18	7:02:30 PM	A	1	27347		9	52113		212	61704		24	41957
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A	27:04:18	7:02:36 PM	A	1	27428		9	51887		212	61674		24	41907
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A	27:04:18	7:02:48 PM	A	1	27438		9	51668		212	61544		24	41843
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A	27:04:18	7:02:57 PM	A	1	27404		9	51151		212	61105		24	41867
A	27:04:18	7:03:00 PM	A	1	27334		9	51093		212	61142		24	41822
A	27:04:18	7:03:03 PM	A	1	27294		9	51220		212	61226		24	41776
A	27:04:18	7:03:06 PM	A	1	27295		9	51144		212	61093		24	41814
A	27:04:18	7:03:09 PM	A	1	27436		9	51157		212	61032		24	41765
A	27:04:18	7:03:12 PM	A	1	27360		9	51161		212	61100		24	41797
A	27:04:18	7:03:15 PM	A	1	27456		9	50776		212	60718		24	41748

A	27:04:18	7:03:18 PM	A	1	27395		9	50822		212	61100		24	41748
A	27:04:18	7:03:21 PM	A	1	27381		9	50939		212	61574		24	41745
A	27:04:18	7:03:24 PM	A	1	27416		9	50793		212	61272		24	41746
A	27:04:18	7:03:27 PM	A	1	27405		9	50759		212	61493		24	41714
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A	27:04:18	7:03:36 PM	A	1	27369		9	50485		212	61274		24	41693
A	27:04:18	7:03:39 PM	A	1	27278		9	50135		212	61052		24	41686
A	27:04:18	7:03:42 PM	A	1	27482		9	50157		212	61551		24	41659
A	27:04:18	7:03:45 PM	A	1	27491		9	50142		212	61455		24	41663
A	27:04:18	7:03:48 PM	A	1	27344		9	50005		212	61242		24	41644
A	27:04:18	7:03:51 PM	A	1	27326		9	50336		212	61242		24	41635
A	27:04:18	7:03:54 PM	A	1	27503		9	50215		212	60930		24	41594
A	27:04:18	7:03:57 PM	A	1	27540		9	50038		212	61274		24	41605
A	27:04:18	7:04:00 PM	A	1	27424		9	49723		212	61188		24	41585
A	27:04:18	7:04:03 PM	A	1	27425		9	49557		212	61137		24	41573
A	27:04:18	7:04:06 PM	A	1	27320		9	49282		212	60837		24	41597
A	27:04:18	7:04:09 PM	A	1	27384		9	49268		212	61173		24	41547
A	27:04:18	7:04:12 PM	A	1	27445		9	48764		212	61106		24	41544
A	27:04:18	7:04:15 PM	A	1	27433		9	48863		212	61294		24	41540
A	27:04:18	7:04:18 PM	A	1	27518		9	47927		212	61287		24	41545
A	27:04:18	7:04:21 PM	A	1	27378		9	47554		212	61088		24	41505
A	27:04:18	7:04:24 PM	A	1	27369		9	46751		212	60714		24	41514
A	27:04:18	7:04:27 PM	A	1	27410		9	46346		212	60757		24	41482
A	27:04:18	7:04:30 PM	A	1	27321		9	46047		212	61063		24	41484
A	27:04:18	7:04:33 PM	A	1	27351		9	44663		212	61182		24	41488
A	27:04:18	7:04:36 PM	A	1	27353		9	45232		212	60837		24	41464
A	27:04:18	7:04:39 PM	A	1	27330		9	43899		212	60798		24	41462
A	27:04:18	7:04:42 PM	A	1	27376		9	43505		212	60805		24	41436
A	27:04:18	7:04:45 PM	A	1	27335		9	43478		212	60626		24	41400
A	27:04:18	7:04:48 PM	A	1	27500		9	42055		212	60715		24	41412
A	27:04:18	7:04:51 PM	A	1	27361		9	42659		212	61014		24	41362
A	27:04:18	7:04:54 PM	A	1	27306		9	42294		212	60906		24	41364
A	27:04:18	7:04:57 PM	A	1	27335		9	42017		212	61034		24	41371
A	27:04:18	7:05:00 PM	A	1	27294		9	42133		212	60656		24	41330
A	27:04:18	7:05:03 PM	A	1	27525		9	41145		212	60637		24	41331
A	27:04:18	7:05:06 PM	A	1	27437		9	41336		212	60978		24	41338
A	27:04:18	7:05:09 PM	A	1	27449		9	40967		212	60752		24	41294
A	27:04:18	7:05:12 PM	A	1	27535		9	40812		212	60759		24	41311
A	27:04:18	7:05:15 PM	A	1	27506		9	41066		212	60625		24	41298
A	27:04:18	7:05:18 PM	A	1	27383		9	40671		212	60619		24	41268
A	27:04:18	7:05:21 PM	A	1	27378		9	41014		212	60384		24	41260

A	27:04:18	7:05:24 PM	A	1	27305		9	40999		212	60385		24	41284
A	27:04:18	7:05:27 PM	A	1	27390		9	40970		212	60238		24	41223
A	27:04:18	7:05:30 PM	A	1	27342		9	41307		212	60294		24	41242
A	27:04:18	7:05:33 PM	A	1	27483		9	41503		212	60602		24	41226
A	27:04:18	7:05:36 PM	A	1	27342		9	43866		212	60699		24	41190
A	27:04:18	7:05:39 PM	A	1	27435		9	42044		212	60650		24	41200
A	27:04:18	7:05:42 PM	A	1	27343		9	42306		212	60614		24	41212
A	27:04:18	7:05:45 PM	A	1	27231		9	41753		212	60266		24	41172
A	27:04:18	7:05:48 PM	A	1	27264		9	42442		212	60691		24	41150
A	27:04:18	7:05:51 PM	A	1	27417		9	42448		212	60560		24	41189
A	27:04:18	7:05:54 PM	A	1	27427		9	42649		212	60487		24	41176
A	27:04:18	7:05:57 PM	A	1	27562		9	42845		212	60735		24	41138
A	27:04:18	7:06:00 PM	A	1	27497		9	42728		212	60607		24	41116
A	27:04:18	7:06:03 PM	A	1	27398		9	43407		212	60732		24	41119
A	27:04:18	7:06:06 PM	A	1	27479		9	43586		212	60274		24	41124
A	27:04:18	7:06:09 PM	A	1	27484		9	43933		212	60685		24	41116
A	27:04:18	7:06:12 PM	A	1	27421		9	43829		212	60563		24	41070
A	27:04:18	7:06:15 PM	A	1	27426		9	43877		212	60452		24	41108
A	27:04:18	7:06:18 PM	A	1	27302		9	44283		212	60354		24	41066
A	27:04:18	7:06:21 PM	A	1	27511		9	44533		212	60698		24	41079
A	27:04:18	7:06:24 PM	A	1	27305		9	44485		212	60432		24	41050
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A	27:04:18	7:06:30 PM	A	1	27477		9	44320		212	60351		24	41008
A	27:04:18	7:06:33 PM	A	1	27335		9	44632		212	60161		24	41010
A	27:04:18	7:06:36 PM	A	1	27368		9	44774		212	60454		24	40992
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A	27:04:18	7:06:42 PM	A	1	27283		9	45314		212	59985		24	40973
A	27:04:18	7:06:45 PM	A	1	27266		9	45389		212	60101		24	40973
A	27:04:18	7:06:48 PM	A	1	27411		9	45706		212	60167		24	40920
A	27:04:18	7:06:51 PM	A	1	27436		9	46108		212	60073		24	40878
A	27:04:18	7:06:54 PM	A	1	27366		9	45946		212	60119		24	40880
A	27:04:18	7:06:57 PM	A	1	27557		9	45799		212	60308		24	40860
A	27:04:18	7:07:00 PM	A	1	27354		9	45955		212	60164		24	40862
A	27:04:18	7:07:03 PM	A	1	27398		9	46261		212	60023		24	40835
A	27:04:18	7:07:06 PM	A	1	27585		9	46194		212	60463		24	40844
A	27:04:18	7:07:09 PM	A	1	27333		9	46242		212	60301		24	40832
A	27:04:18	7:07:12 PM	A	1	27373		9	46709		212	60192		24	40771
A	27:04:18	7:07:15 PM	A	1	27454		9	46577		212	59870		24	40766
A	27:04:18	7:07:18 PM	A	1	27303		9	46871		212	60275		24	40734
A	27:04:18	7:07:21 PM	A	1	27380		9	46832		212	60185		24	40706
A	27:04:18	7:07:24 PM	A	1	27262		9	46888		212	60106		24	40704
A	27:04:18	7:07:27 PM	A	1	27329		9	46963		212	60335		24	40700

A	27:04:18	7:07:30 PM	A	1	27285		9	46985		212	60126		24	40678
A	27:04:18	7:07:33 PM	A	1	27479		9	47167		212	60039		24	40643
A	27:04:18	7:07:36 PM	A	1	27342		9	47065		212	59707		24	40602
A	27:04:18	7:07:39 PM	A	1	27395		9	47040		212	59785		24	40593
A	27:04:18	7:07:42 PM	A	1	27317		9	47054		212	59732		24	40564
A	27:04:18	7:07:45 PM	A	1	27304		9	46863		212	59710		24	40562
A	27:04:18	7:07:48 PM	A	1	27390		9	47036		212	59962		24	40547
A	27:04:18	7:07:51 PM	A	1	27527		9	46976		212	60048		24	40513
A	27:04:18	7:07:54 PM	A	1	27326		9	46788		212	59729		24	40474
A	27:04:18	7:07:57 PM	A	1	27423		9	46591		212	59601		24	40489
A	27:04:18	7:08:00 PM	A	1	27318		9	46334		212	59979		24	40446
A	27:04:18	7:08:03 PM	A	1	27253		9	46586		212	59928		24	40418
A	27:04:18	7:08:06 PM	A	1	27388		9	46510		212	59864		24	40426
A	27:04:18	7:08:09 PM	A	1	27485		9	46495		212	59664		24	40405
A	27:04:18	7:08:12 PM	A	1	27420		9	46398		212	59669		24	40362
A	27:04:18	7:08:15 PM	A	1	27293		9	45882		212	60164		24	40332
A	27:04:18	7:08:18 PM	A	1	27486		9	46066		212	59969		24	40323
A	27:04:18	7:08:21 PM	A	1	27499		9	45820		212	59657		24	40270
A	27:04:18	7:08:24 PM	A	1	27374		9	45988		212	59950		24	40278
A	27:04:18	7:08:27 PM	A	1	27401		9	45839		212	59673		24	40248
A	27:04:18	7:08:30 PM	A	1	27391		9	45699		212	59519		24	40222
A	27:04:18	7:08:33 PM	A	1	27327		9	45844		212	59648		24	40217
A	27:04:18	7:08:36 PM	A	1	27356		9	45690		212	59513		24	40219
A	27:04:18	7:08:39 PM	A	1	27379		9	45704		212	59992		24	40172
A	27:04:18	7:08:42 PM	A	1	27408		9	45161		212	59779		24	40172
A	27:04:18	7:08:45 PM	A	1	27389		9	45253		212	59925		24	40156
A	27:04:18	7:08:48 PM	A	1	27506		9	45017		212	59785		24	40143
A	27:04:18	7:08:51 PM	A	1	27341		9	44432		212	59802		24	40134
A	27:04:18	7:08:54 PM	A	1	27510		9	44629		212	59554		24	40116
A	27:04:18	7:08:57 PM	A	1	27445		9	45323		212	59464		24	40084
A	27:04:18	7:09:00 PM	A	1	27328		9	44901		212	59400		24	40084
A	27:04:18	7:09:03 PM	A	1	27426		9	45003		212	59331		24	40071
A	27:04:18	7:09:06 PM	A	1	27391		9	44931		212	59375		24	40035
A	27:04:18	7:09:09 PM	A	1	27477		9	44807		212	59317		24	40041
A	27:04:18	7:09:12 PM	A	1	27437		9	44653		212	59361		24	40002
A	27:04:18	7:09:15 PM	A	1	27438		9	44368		212	59423		24	39997
A	27:04:18	7:09:18 PM	A	1	27289		9	44182		212	59395		24	40020
A	27:04:18	7:09:21 PM	A	1	26850		9	44528		212	59219		24	39972
A	27:04:18	7:09:24 PM	A	1	27474		9	44625		212	59527		24	39972
A	27:04:18	7:09:27 PM	A	1	27420		9	44443		212	59620		24	39975
A	27:04:18	7:09:30 PM	A	1	27454		9	43935		212	59400		24	39927
A	27:04:18	7:09:33 PM	A	1	27321		9	44030		212	59142		24	39941

A	27:04:18	7:09:36 PM	A	1	27432		9	44000		212	59218		24	39896
A	27:04:18	7:09:39 PM	A	1	27455		9	43853		212	59188		24	39902
A	27:04:18	7:09:42 PM	A	1	27382		9	43683		212	59460		24	39898
A	27:04:18	7:09:45 PM	A	1	27431		9	43323		212	59283		24	39880
A	27:04:18	7:09:48 PM	A	1	27389		9	43518		212	59295		24	39843
A	27:04:18	7:09:51 PM	A	1	27274		9	43225		212	59276		24	39824
A	27:04:18	7:09:54 PM	A	1	27243		9	42979		212	59160		24	39810
A	27:04:18	7:09:57 PM	A	1	27455		9	43114		212	59472		24	39799
A	27:04:18	7:10:00 PM	A	1	27321		9	42800		212	59085		24	39760
A	27:04:18	7:10:03 PM	A	1	27443		9	42978		212	59276		24	39770
A	27:04:18	7:10:06 PM	A	1	27238		9	42725		212	59293		24	39708
A	27:04:18	7:10:09 PM	A	1	27496		9	42417		212	59227		24	39763
A	27:04:18	7:10:12 PM	A	1	27156		9	42482		212	59228		24	39720
A	27:04:18	7:10:15 PM	A	1	27294		9	42329		212	59207		24	39675
A	27:04:18	7:10:18 PM	A	1	27210		9	42494		212	58999		24	39679
A	27:04:18	7:10:21 PM	A	1	27367		9	41719		212	59446		24	39680
A	27:04:18	7:10:24 PM	A	1	27346		9	41031		212	59162		24	39624
A	27:04:18	7:10:27 PM	A	1	27336		9	41524		212	59040		24	39630
A	27:04:18	7:10:30 PM	A	1	27345		9	41546		212	58678		24	39623
A	27:04:18	7:10:33 PM	A	1	27551		9	41659		212	59029		24	39597
A	27:04:18	7:10:36 PM	A	1	27448		9	41463		212	59151		24	39570
A	27:04:18	7:10:39 PM	A	1	27508		9	40797		212	59067		24	39546
A	27:04:18	7:10:42 PM	A	1	27571		9	41232		212	58815		24	39569
A	27:04:18	7:10:45 PM	A	1	27383		9	41072		212	58923		24	39544
A	27:04:18	7:10:48 PM	A	1	27380		9	40281		212	58727		24	39537
A	27:04:18	7:10:51 PM	A	1	27221		9	40092		212	59067		24	39492
A	27:04:18	7:10:54 PM	A	1	27408		9	39855		212	59014		24	39468
A	27:04:18	7:10:57 PM	A	1	27311		9	40506		212	58825		24	39472
A	27:04:18	7:11:00 PM	A	1	27272		9	40612		212	58844		24	39441
A	27:04:18	7:11:03 PM	A	1	27449		9	40507		212	59030		24	39437
A	27:04:18	7:11:06 PM	A	1	27508		9	40577		212	58759		24	39403
A	27:04:18	7:11:09 PM	A	1	27434		9	40130		212	58923		24	39354
A	27:04:18	7:11:12 PM	A	1	27406		9	40152		212	58825		24	39388
A	27:04:18	7:11:15 PM	A	1	27294		9	39931		212	58780		24	39368
A	27:04:18	7:11:18 PM	A	1	27361		9	40283		212	58910		24	39338
A	27:04:18	7:11:21 PM	A	1	27399		9	40242		212	58992		24	39361
A	27:04:18	7:11:24 PM	A	1	27395		9	40223		212	58181		24	39341
A	27:04:18	7:11:27 PM	A	1	27415		9	40092		212	58587		24	39300
A	27:04:18	7:11:30 PM	A	1	27359		9	39776		212	58571		24	39265
A	27:04:18	7:11:33 PM	A	1	27391		9	39660		212	58792		24	39272
A	27:04:18	7:11:36 PM	A	1	27362		9	39871		212	58654		24	39238
A	27:04:18	7:11:39 PM	A	1	27476		9	39689		212	58627		24	39211

A	27:04:18	7:11:42 PM	A	1	27479		9	39889		212	58518		24	39221
A	27:04:18	7:11:45 PM	A	1	27510		9	39776		212	58487		24	39175
A	27:04:18	7:11:48 PM	A	1	27512		9	39910		212	58521		24	39161
A	27:04:18	7:11:51 PM	A	1	27477		9	39634		212	58467		24	39133
A	27:04:18	7:11:54 PM	A	1	27306		9	39673		212	58385		24	39124
A	27:04:18	7:11:57 PM	A	1	27358		9	39471		212	58660		24	39088
A	27:04:18	7:12:00 PM	A	1	27324		9	39598		212	58603		24	39057
A	27:04:18	7:12:03 PM	A	1	27416		9	39428		212	58747		24	39084
A	27:04:18	7:12:06 PM	A	1	27406		9	39488		212	58593		24	39039
A	27:04:18	7:12:09 PM	A	1	27403		9	39151		212	58270		24	38976
A	27:04:18	7:12:12 PM	A	1	27390		9	39252		212	58678		24	39030
A	27:04:18	7:12:15 PM	A	1	27428		9	39241		212	58668		24	38994
A	27:04:18	7:12:18 PM	A	1	27336		9	38887		212	58448		24	38957
A	27:04:18	7:12:21 PM	A	1	27240		9	39029		212	58399		24	38961
A	27:04:18	7:12:24 PM	A	1	27382		9	38971		212	58275		24	38928
A	27:04:18	7:12:27 PM	A	1	27374		9	39039		212	58087		24	38894
A	27:04:18	7:12:30 PM	A	1	27569		9	39143		212	58383		24	38892
A	27:04:18	7:12:33 PM	A	1	27558		9	39040		212	58210		24	38870
A	27:04:18	7:12:36 PM	A	1	27353		9	38795		212	58355		24	38837
A	27:04:18	7:12:39 PM	A	1	27336		9	38961		212	58174		24	38826
A	27:04:18	7:12:42 PM	A	1	27445		9	38821		212	58119		24	38817
A	27:04:18	7:12:45 PM	A	1	27411		9	38790		212	58291		24	38790
A	27:04:18	7:12:48 PM	A	1	27337		9	38765		212	58655		24	38789
A	27:04:18	7:12:51 PM	A	1	27322		9	38860		212	58407		24	38774
A	27:04:18	7:12:54 PM	A	1	27499		9	38663		212	58303		24	38732
A	27:04:18	7:12:57 PM	A	1	27500		9	38485		212	58076		24	38721
A	27:04:18	7:13:00 PM	A	1	27383		9	38797		212	57879		24	38717
A	27:04:18	7:13:03 PM	A	1	27269		9	38512		212	58197		24	38699
A	27:04:18	7:13:06 PM	A	1	27516		9	38585		212	58428		24	38665
A	27:04:18	7:13:09 PM	A	1	27342		9	38592		212	58229		24	38674
A	27:04:18	7:13:12 PM	A	1	27379		9	38441		212	58096		24	38607
A	27:04:18	7:13:15 PM	A	1	27253		9	38756		212	58013		24	38598
A	27:04:18	7:13:18 PM	A	1	27453		9	38599		212	57966		24	38593
A	27:04:18	7:13:21 PM	A	1	27398		9	38525		212	58131		24	38580
A	27:04:18	7:13:24 PM	A	1	27329		9	38462		212	58089		24	38570
A	27:04:18	7:13:27 PM	A	1	27154		9	38603		212	57831		24	38538
A	27:04:18	7:13:30 PM	A	1	27530		9	38456		212	57827		24	38507
A	27:04:18	7:13:33 PM	A	1	27356		9	38516		212	58140		24	38540
A	27:04:18	7:13:36 PM	A	1	27366		9	38463		212	58218		24	38484
A	27:04:18	7:13:39 PM	A	1	27329		9	38218		212	58026		24	38498
A	27:04:18	7:13:42 PM	A	1	27452		9	38223		212	57922		24	38468
A	27:04:18	7:13:45 PM	A	1	27340		9	38486		212	57946		24	38446

A	27:04:18	7:13:48 PM	A	1	27242		9	38255		212	57760		24	38423
A	27:04:18	7:13:51 PM	A	1	27390		9	38121		212	58185		24	38399
A	27:04:18	7:13:54 PM	A	1	27352		9	38430		212	58047		24	38393
A	27:04:18	7:13:57 PM	A	1	27568		9	38087		212	58065		24	38392
A	27:04:18	7:14:00 PM	A	1	27312		9	38152		212	57840		24	38370
A	27:04:18	7:14:03 PM	A	1	27477		9	38109		212	57654		24	38335
A	27:04:18	7:14:06 PM	A	1	27410		9	38054		212	57907		24	38313
A	27:04:18	7:14:09 PM	A	1	27394		9	37819		212	57668		24	38305
A	27:04:18	7:14:12 PM	A	1	27460		9	38060		212	57977		24	38244
A	27:04:18	7:14:15 PM	A	1	27313		9	37753		212	57957		24	38238
A	27:04:18	7:14:18 PM	A	1	27345		9	37648		212	57759		24	38207
A	27:04:18	7:14:21 PM	A	1	27381		9	37859		212	57764		24	38191
A	27:04:18	7:14:24 PM	A	1	27528		9	37944		212	57970		24	38154
A	27:04:18	7:14:27 PM	A	1	27465		9	37758		212	57786		24	38156
A	27:04:18	7:14:30 PM	A	1	27535		9	36872		212	57786		24	38126
A	27:04:18	7:14:33 PM	A	1	27227		9	37245		212	57771		24	38128
A	27:04:18	7:14:36 PM	A	1	27519		9	37349		212	57493		24	38111
A	27:04:18	7:14:39 PM	A	1	27251		9	37216		212	57520		24	38087
A	27:04:18	7:14:42 PM	A	1	27354		9	36990		212	57962		24	38065
A	27:04:18	7:14:45 PM	A	1	27574		9	37444		212	57684		24	38046
A	27:04:18	7:14:48 PM	A	1	27346		9	36953		212	57727		24	38023
A	27:04:18	7:14:51 PM	A	1	27434		9	36885		212	57515		24	38003
A	27:04:18	7:14:54 PM	A	1	27448		9	37021		212	57514		24	38005
A	27:04:18	7:14:57 PM	A	1	27275		9	36773		212	57362		24	37991
A	27:04:18	7:15:00 PM	A	1	27377		9	36794		212	57830		24	37962
A	27:04:18	7:15:03 PM	A	1	27429		9	36747		212	57765		24	37950
A	27:04:18	7:15:06 PM	A	1	27435		9	36547		212	57719		24	37944
A	27:04:18	7:15:09 PM	A	1	27330		9	36541		212	57327		24	37915
A	27:04:18	7:15:12 PM	A	1	27399		9	36252		212	57306		24	37926
A	27:04:18	7:15:15 PM	A	1	27562		9	36380		212	57385		24	37890
A	27:04:18	7:15:18 PM	A	1	27509		9	36194		212	57362		24	37889
A	27:04:18	7:15:21 PM	A	1	27386		9	35913		212	57385		24	37883
A	27:04:18	7:15:24 PM	A	1	27523		9	35698		212	57577		24	37835
A	27:04:18	7:15:27 PM	A	1	27379		9	35831		212	57745		24	37857
A	27:04:18	7:15:30 PM	A	1	27361		9	36043		212	57336		24	37801
A	27:04:18	7:15:33 PM	A	1	27488		9	35571		212	57662		24	37807
A	27:04:18	7:15:36 PM	A	1	27435		9	35596		212	57493		24	37771
A	27:04:18	7:15:39 PM	A	1	27375		9	35703		212	57574		24	37750
A	27:04:18	7:15:42 PM	A	1	27387		9	35798		212	57436		24	37751
A	27:04:18	7:15:45 PM	A	1	27358		9	35398		212	57330		24	37719
A	27:04:18	7:15:48 PM	A	1	27271		9	35362		212	57239		24	37708
A	27:04:18	7:15:51 PM	A	1	27209		9	35093		212	57454		24	37683

A	27:04:18	7:15:54 PM	A	1	27446		9	35000		212	57510		24	37684
A	27:04:18	7:15:57 PM	A	1	27332		9	35005		212	57345		24	37668
A	27:04:18	7:16:00 PM	A	1	27330		9	34919		212	57176		24	37638
A	27:04:18	7:16:03 PM	A	1	27470		9	34883		212	57214		24	37638
A	27:04:18	7:16:06 PM	A	1	27165		9	34775		212	57484		24	37576
A	27:04:18	7:16:09 PM	A	1	27422		9	34693		212	57348		24	37598
A	27:04:18	7:16:12 PM	A	1	27464		9	34399		212	57278		24	37555
A	27:04:18	7:16:15 PM	A	1	27758		9	33927		212	57069		24	37531
A	27:04:18	7:16:18 PM	A	1	27589		9	34213		212	56856		24	37510
A	27:04:18	7:16:21 PM	A	1	27343		9	34389		212	56964		24	37507
A	27:04:18	7:16:24 PM	A	1	27590		9	34219		212	57290		24	37471
A	27:04:18	7:16:27 PM	A	1	27430		9	34068		212	57175		24	37463
A	27:04:18	7:16:30 PM	A	1	27527		9	33888		212	57332		24	37437
A	27:04:18	7:16:33 PM	A	1	27586		9	34022		212	57385		24	37433
A	27:04:18	7:16:36 PM	A	1	27382		9	33393		212	57281		24	37446
A	27:04:18	7:16:39 PM	A	1	27419		9	33310		212	56906		24	37413
A	27:04:18	7:16:42 PM	A	1	27419		9	33239		212	57131		24	37375
A	27:04:18	7:16:45 PM	A	1	27343		9	33245		212	57088		24	37361
A	27:04:18	7:16:48 PM	A	1	27325		9	33552		212	57084		24	37351
A	27:04:18	7:16:51 PM	A	1	27367		9	33150		212	56850		24	37323
A	27:04:18	7:16:54 PM	A	1	27269		9	33079		212	56824		24	37326
A	27:04:18	7:16:57 PM	A	1	27395		9	33559		212	56726		24	37312
A	27:04:18	7:17:00 PM	A	1	27514		9	33650		212	56902		24	37315
A	27:04:18	7:17:03 PM	A	1	27306		9	33445		212	56931		24	37283
A	27:04:18	7:17:06 PM	A	1	27496		9	33401		212	56754		24	37283
A	27:04:18	7:17:09 PM	A	1	27577		9	33453		212	56866		24	37273
A	27:04:18	7:17:12 PM	A	1	27246		9	33428		212	56998		24	37233
A	27:04:18	7:17:15 PM	A	1	27313		9	33546		212	56661		24	37240
A	27:04:18	7:17:18 PM	A	1	27335		9	33698		212	56857		24	37221
A	27:04:18	7:17:21 PM	A	1	27586		9	33310		212	56736		24	37212
A	27:04:18	7:17:24 PM	A	1	27292		9	33401		212	56552		24	37191
A	27:04:18	7:17:27 PM	A	1	27392		9	33490		212	56604		24	37169
A	27:04:18	7:17:30 PM	A	1	27458		9	33345		212	56574		24	37193
A	27:04:18	7:17:33 PM	A	1	27407		9	33336		212	56606		24	37191
A	27:04:18	7:17:36 PM	A	1	27313		9	33409		212	56832		24	37154
A	27:04:18	7:17:39 PM	A	1	27267		9	33053		212	56757		24	37157
A	27:04:18	7:17:42 PM	A	1	27324		9	33307		212	56719		24	37120
A	27:04:18	7:17:45 PM	A	1	27542		9	33076		212	56958		24	37174
A	27:04:18	7:17:48 PM	A	1	27310		9	33144		212	56501		24	37104
A	27:04:18	7:17:51 PM	A	1	27473		9	32989		212	56331		24	37092
A	27:04:18	7:17:54 PM	A	1	27323		9	32801		212	56359		24	37080
A	27:04:18	7:17:57 PM	A	1	27306		9	32773		212	56260		24	37079

A	27:04:18	7:18:00 PM	A	1	27392		9	32564		212	56411		24	37049
A	27:04:18	7:18:03 PM	A	1	27587		9	32580		212	56771		24	37066
A	27:04:18	7:18:06 PM	A	1	27463		9	32662		212	56581		24	37006
A	27:04:18	7:18:09 PM	A	1	27083		9	32682		212	56649		24	36975
A	27:04:18	7:18:12 PM	A	1	27372		9	32539		212	56510		24	36997
A	27:04:18	7:18:15 PM	A	1	27290		9	32372		212	56364		24	36959
A	27:04:18	7:18:18 PM	A	1	27368		9	32643		212	56489		24	36947
A	27:04:18	7:18:21 PM	A	1	27369		9	32576		212	56400		24	36957
A	27:04:18	7:18:24 PM	A	1	27387		9	32314		212	56444		24	36906
A	27:04:18	7:18:27 PM	A	1	27345		9	31935		212	56638		24	36918
A	27:04:18	7:18:30 PM	A	1	27491		9	31742		212	56277		24	36859
A	27:04:18	7:18:33 PM	A	1	27617		9	31849		212	56273		24	36817
A	27:04:18	7:18:36 PM	A	1	27460		9	31897		212	56540		24	36847
A	27:04:18	7:18:39 PM	A	1	27308		9	31664		212	56377		24	36809
A	27:04:18	7:18:42 PM	A	1	27519		9	32129		212	56207		24	36774
A	27:04:18	7:18:45 PM	A	1	27298		9	31766		212	56213		24	36748
A	27:04:18	7:18:48 PM	A	1	27540		9	31515		212	56285		24	36759
A	27:04:18	7:18:51 PM	A	1	27311		9	31561		212	56326		24	36709
A	27:04:18	7:18:54 PM	A	1	27347		9	31339		212	56370		24	36720
A	27:04:18	7:18:57 PM	A	1	27425		9	30234		212	56263		24	36684
A	27:04:18	7:19:00 PM	A	1	27348		9	30795		212	56188		24	36649
A	27:04:18	7:19:03 PM	A	1	27438		9	31536		212	56084		24	36629
A	27:04:18	7:19:06 PM	A	1	27472		9	31882		212	56168		24	36588
A	27:04:18	7:19:09 PM	A	1	27215		9	31796		212	56099		24	36565
A	27:04:18	7:19:12 PM	A	1	27353		9	31902		212	56316		24	36557
A	27:04:18	7:19:15 PM	A	1	27370		9	31715		212	56404		24	36508
A	27:04:18	7:19:18 PM	A	1	27284		9	31748		212	56335		24	36520
A	27:04:18	7:19:21 PM	A	1	27441		9	31814		212	56009		24	36485
A	27:04:18	7:19:24 PM	A	1	27307		9	31841		212	56497		24	36446
A	27:04:18	7:19:27 PM	A	1	27385		9	31924		212	56304		24	36425
A	27:04:18	7:19:30 PM	A	1	27507		9	31799		212	56381		24	36417
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A	27:04:18	7:19:36 PM	A	1	27541		9	31718		212	56156		24	36351
A	27:04:18	7:19:39 PM	A	1	27280		9	31776		212	56109		24	36315
A	27:04:18	7:19:42 PM	A	1	27498		9	31957		212	55840		24	36267
A	27:04:18	7:19:45 PM	A	1	27600		9	31758		212	56254		24	36248
A	27:04:18	7:19:48 PM	A	1	27362		9	31627		212	56048		24	36206
A	27:04:18	7:19:51 PM	A	1	27463		9	31479		212	55938		24	36195
A	27:04:18	7:19:54 PM	A	1	27496		9	31531		212	55977		24	36196
A	27:04:18	7:19:57 PM	A	1	27451		9	31086		212	55902		24	36171
A	27:04:18	7:20:00 PM	A	1	27485		9	31104		212	55807		24	36147
A	27:04:18	7:20:03 PM	A	1	27317		9	30838		212	56118		24	36153

A	27:04:18	7:20:06 PM	A	1	27420		9	31517		212	55948		24	36060
A	27:04:18	7:20:09 PM	A	1	27281		9	30687		212	56058		24	36076
A	27:04:18	7:20:12 PM	A	1	27417		9	30774		212	56142		24	36051
A	27:04:18	7:20:15 PM	A	1	27341		9	30512		212	55975		24	36013
A	27:04:18	7:20:18 PM	A	1	27368		9	30166		212	55706		24	35962
A	27:04:18	7:20:21 PM	A	1	27409		9	30635		212	55676		24	35940
A	27:04:18	7:20:24 PM	A	1	27392		9	30178		212	55641		24	35894
A	27:04:18	7:20:27 PM	A	1	27516		9	29743		212	55995		24	35872
A	27:04:18	7:20:30 PM	A	1	27388		9	30453		212	55821		24	35818
A	27:04:18	7:20:33 PM	A	1	27420		9	30344		212	55870		24	35781
A	27:04:18	7:20:36 PM	A	1	27341		9	30227		212	55790		24	35792
A	27:04:18	7:20:39 PM	A	1	27329		9	29866		212	55617		24	35745
A	27:04:18	7:20:42 PM	A	1	27339		9	29650		212	55635		24	35721
A	27:04:18	7:20:45 PM	A	1	27303		9	29717		212	55980		24	35665
A	27:04:18	7:20:48 PM	A	1	27236		9	29856		212	55901		24	35674
A	27:04:18	7:20:51 PM	A	1	27443		9	29785		212	55573		24	35643
A	27:04:18	7:20:54 PM	A	1	27335		9	29717		212	55572		24	35595
A	27:04:18	7:20:57 PM	A	1	27470		9	29482		212	55458		24	35526
A	27:04:18	7:21:00 PM	A	1	27408		9	29759		212	55643		24	35535
A	27:04:18	7:21:03 PM	A	1	27521		9	29636		212	55572		24	35520
A	27:04:18	7:21:06 PM	A	1	27361		9	29633		212	55569		24	35460
A	27:04:18	7:21:09 PM	A	1	27387		9	29158		212	55607		24	35449
A	27:04:18	7:21:12 PM	A	1	27490		9	29298		212	55561		24	35419
A	27:04:18	7:21:15 PM	A	1	27432		9	29541		212	55583		24	35393
A	27:04:18	7:21:18 PM	A	1	27419		9	29571		212	55467		24	35366
A	27:04:18	7:21:21 PM	A	1	27293		9	29654		212	55405		24	35349
A	27:04:18	7:21:24 PM	A	1	27413		9	29602		212	55586		24	35276
A	27:04:18	7:21:27 PM	A	1	27440		9	29433		212	55559		24	35255
A	27:04:18	7:21:30 PM	A	1	27467		9	29501		212	55509		24	35237
A	27:04:18	7:21:33 PM	A	1	27375		9	29857		212	55290		24	35197
A	27:04:18	7:21:36 PM	A	1	27344		9	29810		212	55375		24	35164
A	27:04:18	7:21:39 PM	A	1	27303		9	29712		212	55405		24	35174
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A	27:04:18	7:21:48 PM	A	1	27540		9	29643		212	53179		24	35112
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A	27:04:18	7:21:54 PM	A	1	27446		9	29444		212	55063		24	35034
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A	27:04:18	7:22:00 PM	A	1	27379		9	29666		212	53574		24	34992
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A	27:04:18	7:22:06 PM	A	1	27540		9	29484		212	55307		24	34962
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A	27:04:18	7:22:27 PM	A	1	27384		9	29633		212	54757		24	34775
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A	27:04:18	7:22:39 PM	A	1	27312		9	28991		212	53437		24	34661
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A	27:04:18	7:22:45 PM	A	1	27311		9	28745		212	53422		24	34614
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A	27:04:18	7:23:09 PM	A	1	27292		9	28071		212	53006		24	34423
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A	27:04:18	7:23:24 PM	A	1	27332		9	27662		212	52838		24	34335
A	27:04:18	7:23:27 PM	A	1	27510		9	27410		212	53198		24	34330
A	27:04:18	7:23:30 PM	A	1	27410		9	27399		212	53232		24	34259
A	27:04:18	7:23:33 PM	A	1	27433		9	27107		212	52985		24	34261
A	27:04:18	7:23:36 PM	A	1	27197		9	26894		212	52775		24	34218
A	27:04:18	7:23:39 PM	A	1	27330		9	27205		212	52993		24	34194
A	27:04:18	7:23:42 PM	A	1	27384		9	26734		212	52996		24	34167
A	27:04:18	7:23:45 PM	A	1	27387		9	26680		212	53039		24	34181
A	27:04:18	7:23:48 PM	A	1	27404		9	26701		212	52781		24	34167
A	27:04:18	7:23:51 PM	A	1	27250		9	26649		212	52684		24	34117
A	27:04:18	7:23:54 PM	A	1	27468		9	26348		212	52283		24	34109
A	27:04:18	7:23:57 PM	A	1	27356		9	25992		212	53120		24	34089
A	27:04:18	7:24:00 PM	A	1	27493		9	25795		212	52719		24	34073
A	27:04:18	7:24:03 PM	A	1	27450		9	26081		212	53032		24	34058
A	27:04:18	7:24:06 PM	A	1	27389		9	26155		212	53116		24	34021
A	27:04:18	7:24:09 PM	A	1	27503		9	26278		212	53017		24	34002
A	27:04:18	7:24:12 PM	A	1	27392		9	26365		212	53047		24	34001
A	27:04:18	7:24:15 PM	A	1	27372		9	26016		212	53044		24	33969

A	27:04:18	7:24:18 PM	A	1	27414		9	25777		212	52742		24	33951
A	27:04:18	7:24:21 PM	A	1	27355		9	25546		212	52972		24	33905
A	27:04:18	7:24:24 PM	A	1	27254		9	26029		212	53027		24	33900
A	27:04:18	7:24:27 PM	A	1	27380		9	26050		212	52538		24	33891
A	27:04:18	7:24:30 PM	A	1	27466		9	26025		212	52900		24	33828
A	27:04:18	7:24:33 PM	A	1	27360		9	26092		212	52901		24	33860
A	27:04:18	7:24:36 PM	A	1	27472		9	26009		212	52862		24	33815
A	27:04:18	7:24:39 PM	A	1	27371		9	26233		212	52559		24	33825
A	27:04:18	7:24:42 PM	A	1	27348		9	25915		212	52405		24	33814
A	27:04:18	7:24:45 PM	A	1	27475		9	25769		212	52889		24	33801
A	27:04:18	7:24:48 PM	A	1	27308		9	26069		212	52922		24	33783
A	27:04:18	7:24:51 PM	A	1	27485		9	25820		212	52826		24	33775
A	27:04:18	7:24:54 PM	A	1	27497		9	25598		212	52275		24	33717
A	27:04:18	7:24:57 PM	A	1	27349		9	25736		212	52888		24	33706
A	27:04:18	7:25:00 PM	A	1	27342		9	25767		212	52674		24	33665
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A	27:04:18	7:25:06 PM	A	1	27300		9	25539		212	52485		24	33684
A	27:04:18	7:25:09 PM	A	1	27348		9	25413		212	52229		24	33635
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A	27:04:18	7:25:27 PM	A	1	27312		9	25127		212	52052		24	33498
A	27:04:18	7:25:30 PM	A	1	27380		9	25402		212	52295		24	33454
A	27:04:18	7:25:33 PM	A	1	27405		9	25086		212	52623		24	33447
A	27:04:18	7:25:36 PM	A	1	27303		9	25380		212	52568		24	33422
A	27:04:18	7:25:39 PM	A	1	27454		9	25193		212	52638		24	33414
A	27:04:18	7:25:42 PM	A	1	27407		9	25219		212	52096		24	33338
A	27:04:18	7:25:45 PM	A	1	27386		9	25214		212	52700		24	33354
A	27:04:18	7:25:48 PM	A	1	27310		9	25238		212	52261		24	33335
A	27:04:18	7:25:51 PM	A	1	27466		9	25120		212	52497		24	33328
A	27:04:18	7:25:54 PM	A	1	27402		9	25076		212	52150		24	33295
A	27:04:18	7:25:57 PM	A	1	27470		9	25492		212	51975		24	33257
A	27:04:18	7:26:00 PM	A	1	27463		9	25028		212	51989		24	33248
A	27:04:18	7:26:03 PM	A	1	27456		9	25184		212	52147		24	33214
A	27:04:18	7:26:06 PM	A	1	27234		9	25097		212	51942		24	33216
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A	27:04:18	7:26:12 PM	A	1	27381		9	25113		212	52034		24	33151
A	27:04:18	7:26:15 PM	A	1	27467		9	24847		212	51910		24	33128
A	27:04:18	7:26:18 PM	A	1	27332		9	24796		212	51971		24	33111
A	27:04:18	7:26:21 PM	A	1	27412		9	24763		212	52360		24	33068

A	27:04:18	7:26:24 PM	A	1	27413		9	24815		212	52435		24	33080
A	27:04:18	7:26:27 PM	A	1	27638		9	24745		212	52277		24	33058
A	27:04:18	7:26:30 PM	A	1	27238		9	24815		212	52323		24	33032
A	27:04:18	7:26:33 PM	A	1	27228		9	25086		212	51948		24	32991
A	27:04:18	7:26:36 PM	A	1	27491		9	24580		212	52394		24	32955
A	27:04:18	7:26:39 PM	A	1	27630		9	25053		212	52361		24	32933
A	27:04:18	7:26:42 PM	A	1	27387		9	25129		212	51934		24	32913
A	27:04:18	7:26:45 PM	A	1	27313		9	24630		212	52404		24	32899
A	27:04:18	7:26:48 PM	A	1	27413		9	24542		212	52273		24	32882
A	27:04:18	7:26:51 PM	A	1	27469		9	24913		212	51893		24	32843
A	27:04:18	7:26:54 PM	A	1	27435		9	24767		212	51759		24	32814
A	27:04:18	7:26:57 PM	A	1	27514		9	24534		212	52116		24	32788
A	27:04:18	7:27:00 PM	A	1	27444		9	24089		212	52257		24	32793
A	27:04:18	7:27:03 PM	A	1	27363		9	24414		212	51506		24	32770
A	27:04:18	7:27:06 PM	A	1	27361		9	24489		212	52273		24	32726
A	27:04:18	7:27:09 PM	A	1	27458		9	23752		212	52152		24	32690
A	27:04:18	7:27:12 PM	A	1	27519		9	23843		212	52055		24	32709
A	27:04:18	7:27:15 PM	A	1	27476		9	23637		212	52032		24	32643
A	27:04:18	7:27:18 PM	A	1	27298		9	23662		212	52156		24	32642
A	27:04:18	7:27:21 PM	A	1	27300		9	24110		212	52304		24	32622
A	27:04:18	7:27:24 PM	A	1	27410		9	23938		212	52126		24	32608
A	27:04:18	7:27:27 PM	A	1	27316		9	24229		212	51891		24	32586
A	27:04:18	7:27:30 PM	A	1	27300		9	23977		212	52200		24	32571
A	27:04:18	7:27:33 PM	A	1	27252		9	23708		212	51727		24	32553
A	27:04:18	7:27:36 PM	A	1	27379		9	23797		212	51857		24	32487
A	27:04:18	7:27:39 PM	A	1	27506		9	23908		212	52145		24	32475
A	27:04:18	7:27:42 PM	A	1	27306		9	23611		212	52107		24	32452
A	27:04:18	7:27:45 PM	A	1	27589		9	23570		212	51891		24	32428
A	27:04:18	7:27:48 PM	A	1	27437		9	23367		212	52033		24	32417
A	27:04:18	7:27:51 PM	A	1	27326		9	23386		212	51886		24	32411
A	27:04:18	7:27:54 PM	A	1	27423		9	22968		212	51792		24	32371
A	27:04:18	7:27:57 PM	A	1	27520		9	23324		212	51596		24	32315
A	27:04:18	7:28:00 PM	A	1	27298		9	23371		212	51568		24	32310
A	27:04:18	7:28:03 PM	A	1	27523		9	22887		212	51484		24	32301
A	27:04:18	7:28:06 PM	A	1	27137		9	23382		212	51551		24	32264
A	27:04:18	7:28:09 PM	A	1	27332		9	23060		212	51469		24	32244
A	27:04:18	7:28:12 PM	A	1	27660		9	23012		212	51295		24	32223
A	27:04:18	7:28:15 PM	A	1	27420		9	22799		212	51801		24	32181
A	27:04:18	7:28:18 PM	A	1	27437		9	22812		212	51790		24	32158
A	27:04:18	7:28:21 PM	A	1	27435		9	22882		212	51813		24	32162
A	27:04:18	7:28:24 PM	A	1	27454		9	22884		212	51362		24	32123
A	27:04:18	7:28:27 PM	A	1	27527		9	22613		212	51841		24	32091

A	27:04:18	7:28:30 PM	A	1	27386		9	22490		212	51845		24	32080
A	27:04:18	7:28:33 PM	A	1	27169		9	22896		212	51377		24	32052
A	27:04:18	7:28:36 PM	A	1	27851		9	21519		212	51388		24	31988
A	27:04:18	7:28:39 PM	A	1	27353		9	21664		212	51688		24	31984
A	27:04:18	7:28:42 PM	A	1	27395		9	22075		212	51353		24	31964
A	27:04:18	7:28:45 PM	A	1	27214		9	21724		212	51770		24	31949
A	27:04:18	7:28:48 PM	A	1	27274		9	21694		212	51891		24	31955
A	27:04:18	7:28:51 PM	A	1	27895		9	21468		212	51441		24	31895
A	27:04:18	7:28:54 PM	A	1	27801		9	21450		212	51876		24	31852
A	27:04:18	7:28:57 PM	A	1	27125		9	22203		212	51740		24	31857
A	27:04:18	7:29:00 PM	A	1	27543		9	21875		212	51693		24	31826
A	27:04:18	7:29:03 PM	A	1	27539		9	21777		212	51519		24	31759
A	27:04:18	7:29:06 PM	A	1	27196		9	21964		212	51222		24	31752
A	27:04:18	7:29:09 PM	A	1	27398		9	21697		212	51616		24	31744
A	27:04:18	7:29:12 PM	A	1	27637		9	21661		212	51664		24	31706
A	27:04:18	7:29:15 PM	A	1	27357		9	21660		212	51305		24	31664
A	27:04:18	7:29:18 PM	A	1	27458		9	21180		212	51576		24	31671
A	27:04:18	7:29:21 PM	A	1	27428		9	21254		212	51313		24	31613
A	27:04:18	7:29:24 PM	A	1	27468		9	21397		212	51259		24	31618
A	27:04:18	7:29:27 PM	A	1	27395		9	21494		212	51673		24	31542
A	27:04:18	7:29:30 PM	A	1	27382		9	21095		212	51548		24	31561
A	27:04:18	7:29:33 PM	A	1	27424		9	21227		212	51008		24	31527
A	27:04:18	7:29:36 PM	A	1	27444		9	21407		212	51477		24	31512
A	27:04:18	7:29:39 PM	A	1	27443		9	21203		212	51425		24	31485
A	27:04:18	7:29:42 PM	A	1	27436		9	20740		212	51417		24	31461
A	27:04:18	7:29:45 PM	A	1	27259		9	21028		212	51215		24	31422
A	27:04:18	7:29:48 PM	A	1	27344		9	21036		212	51108		24	31433
A	27:04:18	7:29:51 PM	A	1	27439		9	21147		212	51105		24	31426
A	27:04:18	7:29:54 PM	A	1	27457		9	21117		212	51529		24	31386
A	27:04:18	7:29:57 PM	A	1	27373		9	21236		212	51559		24	31369
A	27:04:18	7:30:00 PM	A	1	27393		9	20850		212	51296		24	31379
A	27:04:18	7:30:03 PM	A	1	27295		9	20981		212	50912		24	31324
A	27:04:18	7:30:06 PM	A	1	27118		9	20341		212	51069		24	31271
A	27:04:18	7:30:09 PM	A	1	27380		9	20238		212	51109		24	31275
A	27:04:18	7:30:12 PM	A	1	27356		9	20109		212	50973		24	31267
A	27:04:18	7:30:15 PM	A	1	27431		9	20261		212	50769		24	31262
A	27:04:18	7:30:18 PM	A	1	27470		9	20783		212	50893		24	31190
A	27:04:18	7:30:21 PM	A	1	27492		9	20578		212	50927		24	31215
A	27:04:18	7:30:24 PM	A	1	27329		9	20819		212	50838		24	31161
A	27:04:18	7:30:27 PM	A	1	27480		9	20646		212	50521		24	31127
A	27:04:18	7:30:30 PM	A	1	27338		9	20645		212	50867		24	31103
A	27:04:18	7:30:33 PM	A	1	27403		9	20406		212	50931		24	31074

A	27:04:18	7:30:36 PM	A	1	27354		9	20312		212	51199		24	31052
A	27:04:18	7:30:39 PM	A	1	27307		9	20403		212	51250		24	31038
A	27:04:18	7:30:42 PM	A	1	27492		9	20316		212	51137		24	31005
A	27:04:18	7:30:45 PM	A	1	27488		9	20116		212	50571		24	30982
A	27:04:18	7:30:48 PM	A	1	27430		9	20096		212	50897		24	30952
A	27:04:18	7:30:51 PM	A	1	27443		9	20088		212	50780		24	30923
A	27:04:18	7:30:54 PM	A	1	27543		9	19977		212	50838		24	30898
A	27:04:18	7:30:57 PM	A	1	27565		9	20280		212	50499		24	30873
A	27:04:18	7:31:00 PM	A	1	27707		9	20097		212	50762		24	30880
A	27:04:18	7:31:03 PM	A	1	27338		9	20061		212	50711		24	30836
A	27:04:18	7:31:06 PM	A	1	27447		9	20210		212	51172		24	30802
A	27:04:18	7:31:09 PM	A	1	27059		9	20010		212	50886		24	30740
A	27:04:18	7:31:12 PM	A	1	27441		9	20050		212	50853		24	30730
A	27:04:18	7:31:15 PM	A	1	27385		9	20225		212	50703		24	30715
A	27:04:18	7:31:18 PM	A	1	27323		9	19819		212	51182		24	30667
A	27:04:18	7:31:21 PM	A	1	27425		9	19713		212	51106		24	30671
A	27:04:18	7:31:24 PM	A	1	27373		9	19264		212	50637		24	30647
A	27:04:18	7:31:27 PM	A	1	27275		9	18282		212	50616		24	30584
A	27:04:18	7:31:30 PM	A	1	27398		9	18195		212	50684		24	30552
A	27:04:18	7:31:33 PM	A	1	27269		9	19330		212	50499		24	30537
A	27:04:18	7:31:36 PM	A	1	27360		9	19629		212	50809		24	30525
A	27:04:18	7:31:39 PM	A	1	27834		9	19688		212	50716		24	30519
A	27:04:18	7:31:42 PM	A	1	27580		9	19644		212	51011		24	30446
A	27:04:18	7:31:45 PM	A	1	27236		9	19749		212	50832		24	30429
A	27:04:18	7:31:48 PM	A	1	27433		9	19649		212	50514		24	30422
A	27:04:18	7:31:51 PM	A	1	27412		9	19645		212	50584		24	30389
A	27:04:18	7:31:54 PM	A	1	27334		9	19754		212	50680		24	30371
A	27:04:18	7:31:57 PM	A	1	27171		9	19605		212	50920		24	30363
A	27:04:18	7:32:00 PM	A	1	27479		9	19733		212	50898		24	30324
A	27:04:18	7:32:03 PM	A	1	27627		9	19979		212	50588		24	30275
A	27:04:18	7:32:06 PM	A	1	27262		9	19867		212	50357		24	30299
A	27:04:18	7:32:09 PM	A	1	27421		9	19668		212	50786		24	30233
A	27:04:18	7:32:12 PM	A	1	27380		9	19529		212	50752		24	30214
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A	27:04:18	7:32:18 PM	A	1	27277		9	19449		212	50754		24	30161
A	27:04:18	7:32:21 PM	A	1	27363		9	19412		212	50631		24	30139
A	27:04:18	7:32:24 PM	A	1	27570		9	19573		212	50731		24	30096
A	27:04:18	7:32:27 PM	A	1	27360		9	19506		212	50171		24	30080
A	27:04:18	7:32:30 PM	A	1	27224		9	19084		212	50125		24	30060
A	27:04:18	7:32:33 PM	A	1	27374		9	19267		212	50574		24	30009
A	27:04:18	7:32:36 PM	A	1	27245		9	19194		212	50519		24	29989
A	27:04:18	7:32:39 PM	A	1	27382		9	19218		212	50689		24	29967

A	27:04:18	7:32:42 PM	A	1	27500		9	18859		212	50818		24	29943
A	27:04:18	7:32:45 PM	A	1	27513		9	18599		212	50638		24	29911
A	27:04:18	7:32:48 PM	A	1	27385		9	18174		212	50435		24	29880
A	27:04:18	7:32:51 PM	A	1	27347		9	18429		212	50247		24	29880
A	27:04:18	7:32:54 PM	A	1	27529		9	18698		212	50228		24	29813
A	27:04:18	7:32:57 PM	A	1	27512		9	18495		212	50604		24	29805
A	27:04:18	7:33:00 PM	A	1	27473		9	18212		212	50551		24	29775
A	27:04:18	7:33:03 PM	A	1	27358		9	18271		212	50264		24	29759
A	27:04:18	7:33:06 PM	A	1	27616		9	18112		212	50163		24	29708
A	27:04:18	7:33:09 PM	A	1	27320		9	17996		212	50641		24	29649
A	27:04:18	7:33:12 PM	A	1	27387		9	17430		212	50452		24	29636
A	27:04:18	7:33:15 PM	A	1	27246		9	17337		212	50619		24	29585
A	27:04:18	7:33:18 PM	A	1	27514		9	17606		212	50187		24	29573
A	27:04:18	7:33:21 PM	A	1	27490		9	17494		212	50288		24	29524
A	27:04:18	7:33:24 PM	A	1	27529		9	17119		212	50384		24	29475
A	27:04:18	7:33:27 PM	A	1	27511		9	17133		212	50505		24	29451
A	27:04:18	7:33:30 PM	A	1	27403		9	16993		212	50569		24	29391
A	27:04:18	7:33:33 PM	A	1	27475		9	17063		212	50247		24	29422
A	27:04:18	7:33:36 PM	A	1	27559		9	16818		212	50386		24	29367
A	27:04:18	7:33:39 PM	A	1	27491		9	16831		212	50394		24	29317
A	27:04:18	7:33:42 PM	A	1	27523		9	16595		212	50173		24	29291
A	27:04:18	7:33:45 PM	A	1	27411		9	16270		212	50263		24	29228
A	27:04:18	7:33:48 PM	A	1	27398		9	16873		212	50072		24	29201
A	27:04:18	7:33:51 PM	A	1	27402		9	16689		212	50089		24	29163
A	27:04:18	7:33:54 PM	A	1	27655		9	16353		212	50266		24	29135
A	27:04:18	7:33:57 PM	A	1	27359		9	16302		212	50214		24	29133
A	27:04:18	7:34:00 PM	A	1	27442		9	16263		212	50049		24	29053
A	27:04:18	7:34:03 PM	A	1	27531		9	16401		212	50060		24	29020
A	27:04:18	7:34:06 PM	A	1	27537		9	16092		212	49946		24	28983
A	27:04:18	7:34:09 PM	A	1	27440		9	16190		212	49819		24	28953
A	27:04:18	7:34:12 PM	A	1	27415		9	16248		212	49695		24	28906
A	27:04:18	7:34:15 PM	A	1	27368		9	16009		212	50127		24	28886
A	27:04:18	7:34:18 PM	A	1	27405		9	14856		212	50210		24	28884
A	27:04:18	7:34:21 PM	A	1	27337		9	12701		212	49703		24	28809
A	27:04:18	7:34:24 PM	A	1	27506		9	15049		212	49665		24	28760
A	27:04:18	7:34:27 PM	A	1	27413		9	15631		212	50074		24	28746
A	27:04:18	7:34:30 PM	A	1	27317		9	15865		212	50098		24	28716
A	27:04:18	7:34:33 PM	A	1	27396		9	15795		212	49961		24	28697
A	27:04:18	7:34:36 PM	A	1	27366		9	15783		212	49808		24	28659
A	27:04:18	7:34:39 PM	A	1	27241		9	15586		212	50005		24	28582
A	27:04:18	7:34:42 PM	A	1	27450		9	15727		212	49897		24	28582
A	27:04:18	7:34:45 PM	A	1	27409		9	15550		212	49788		24	28573

A	27:04:18	7:34:48 PM	A	1	27385		9	15582		212	49810		24	28514
A	27:04:18	7:34:51 PM	A	1	27413		9	16174		212	49995		24	28493
A	27:04:18	7:34:54 PM	A	1	27402		9	15089		212	49923		24	28479
A	27:04:18	7:34:57 PM	A	1	27468		9	15468		212	49905		24	28427
A	27:04:18	7:35:00 PM	A	1	27391		9	15524		212	49842		24	28408
A	27:04:18	7:35:03 PM	A	1	27433		9	15427		212	49663		24	28322
A	27:04:18	7:35:06 PM	A	1	27274		9	15528		212	49560		24	28328
A	27:04:18	7:35:09 PM	A	1	27551		9	15305		212	49514		24	28264
A	27:04:18	7:35:12 PM	A	1	27403		9	15276		212	49778		24	28247
A	27:04:18	7:35:15 PM	A	1	27267		9	15368		212	49671		24	28229
A	27:04:18	7:35:18 PM	A	1	27308		9	15102		212	49440		24	28137
A	27:04:18	7:35:21 PM	A	1	27273		9	15021		212	49572		24	28132
A	27:04:18	7:35:24 PM	A	1	27368		9	15775		212	49482		24	28109
A	27:04:18	7:35:27 PM	A	1	27326		9	14462		212	49750		24	28077
A	27:04:18	7:35:30 PM	A	1	27428		9	14642		212	49674		24	28040
A	27:04:18	7:35:33 PM	A	1	27399		9	14656		212	49777		24	27980
A	27:04:18	7:35:36 PM	A	1	27492		9	14664		212	49376		24	27979
A	27:04:18	7:35:39 PM	A	1	27539		9	15078		212	49478		24	27931
A	27:04:18	7:35:42 PM	A	1	27387		9	15082		212	49393		24	27936
A	27:04:18	7:35:45 PM	A	1	27359		9	14828		212	49502		24	27867
A	27:04:18	7:35:48 PM	A	1	27323		9	14758		212	49388		24	27874
A	27:04:18	7:35:51 PM	A	1	27459		9	14807		212	49550		24	27814
A	27:04:18	7:35:54 PM	A	1	27355		9	14759		212	49504		24	27787
A	27:04:18	7:35:57 PM	A	1	27552		9	14820		212	49325		24	27766
A	27:04:18	7:36:00 PM	A	1	27410		9	14787		212	49245		24	27733
A	27:04:18	7:36:03 PM	A	1	27548		9	14731		212	49335		24	27699
A	27:04:18	7:36:06 PM	A	1	27493		9	14646		212	49142		24	27678
A	27:04:18	7:36:09 PM	A	1	27393		9	14569		212	49304		24	27671
A	27:04:18	7:36:12 PM	A	1	27377		9	14481		212	49199		24	27610
A	27:04:18	7:36:15 PM	A	1	27400		9	14443		212	49469		24	27594
A	27:04:18	7:36:18 PM	A	1	27529		9	14328		212	49505		24	27577
A	27:04:18	7:36:21 PM	A	1	27285		9	14097		212	49329		24	27556
A	27:04:18	7:36:24 PM	A	1	27428		9	14020		212	49342		24	27503
A	27:04:18	7:36:27 PM	A	1	27459		9	13758		212	49462		24	27517
A	27:04:18	7:36:30 PM	A	1	27453		9	13748		212	49364		24	27458
A	27:04:18	7:36:33 PM	A	1	27261		9	13830		212	49752		24	27474
A	27:04:18	7:36:36 PM	A	1	27347		9	13624		212	49286		24	27462
A	27:04:18	7:36:39 PM	A	1	27253		9	12988		212	49560		24	27406
A	27:04:18	7:36:42 PM	A	1	27512		9	13351		212	49332		24	27349
A	27:04:18	7:36:45 PM	A	1	27517		9	13326		212	49178		24	27347
A	27:04:18	7:36:48 PM	A	1	27446		9	14828		212	49289		24	27364
A	27:04:18	7:36:51 PM	A	1	27365		9	13746		212	49163		24	27305

A	27:04:18	7:36:54 PM	A	1	27303		9	13441		212	49068		24	27277
A	27:04:18	7:36:57 PM	A	1	27347		9	12792		212	49122		24	27286
A	27:04:18	7:37:00 PM	A	1	27442		9	13191		212	49298		24	27270
A	27:04:18	7:37:03 PM	A	1	27355		9	13328		212	49161		24	27182
A	27:04:18	7:37:06 PM	A	1	27274		9	13319		212	49280		24	27185
A	27:04:18	7:37:09 PM	A	1	27409		9	13335		212	49368		24	27157
A	27:04:18	7:37:12 PM	A	1	27489		9	13071		212	49082		24	27148
A	27:04:18	7:37:15 PM	A	1	27394		9	13367		212	49252		24	27147
A	27:04:18	7:37:18 PM	A	1	27595		9	12879		212	48822		24	27124
A	27:04:18	7:37:21 PM	A	1	27344		9	13147		212	48883		24	27109
A	27:04:18	7:37:24 PM	A	1	27429		9	13037		212	48947		24	27026
A	27:04:18	7:37:27 PM	A	1	27369		9	12820		212	49207		24	27010
A	27:04:18	7:37:30 PM	A	1	27152		9	13357		212	49130		24	26994
A	27:04:18	7:37:33 PM	A	1	27378		9	12832		212	49012		24	26977
A	27:04:18	7:37:36 PM	A	1	26971		9	12793		212	48948		24	26963
A	27:04:18	7:37:39 PM	A	1	27501		9	13046		212	48834		24	26927
A	27:04:18	7:37:42 PM	A	1	27403		9	12526		212	48792		24	26908
A	27:04:18	7:37:45 PM	A	1	27256		9	12174		212	49214		24	26935
A	27:04:18	7:37:48 PM	A	1	27397		9	11783		212	49036		24	26865
A	27:04:18	7:37:51 PM	A	1	27530		9	11483		212	48891		24	26860
A	27:04:18	7:37:54 PM	A	1	27645		9	11545		212	48698		24	26832
A	27:04:18	7:37:57 PM	A	1	27356		9	11259		212	48664		24	26791
A	27:04:18	7:38:00 PM	A	1	27357		9	11938		212	48587		24	26775
A	27:04:18	7:38:03 PM	A	1	27406		9	11784		212	48714		24	26787
A	27:04:18	7:38:06 PM	A	1	27364		9	11811		212	48519		24	26755
A	27:04:18	7:38:09 PM	A	1	27442		9	11787		212	48571		24	26732
A	27:04:18	7:38:12 PM	A	1	27484		9	11476		212	48587		24	26722
A	27:04:18	7:38:15 PM	A	1	27420		9	11573		212	48469		24	26706
A	27:04:18	7:38:18 PM	A	1	27311		9	11243		212	48504		24	26661
A	27:04:18	7:38:21 PM	A	1	27422		9	11106		212	48512		24	26666
A	27:04:18	7:38:24 PM	A	1	27334		9	11070		212	48906		24	26610
A	27:04:18	7:38:27 PM	A	1	27724		9	10935		212	48640		24	26641
A	27:04:18	7:38:30 PM	A	1	27785		9	10962		212	48815		24	26646
A	27:04:18	7:38:33 PM	A	1	27432		9	10928		212	48552		24	26593
A	27:04:18	7:38:36 PM	A	1	27514		9	10985		212	48449		24	26574
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A	27:04:18	7:38:42 PM	A	1	27231		9	10911		212	48845		24	26532
A	27:04:18	7:38:45 PM	A	1	27394		9	10877		212	48680		24	26486
A	27:04:18	7:38:48 PM	A	1	27477		9	10739		212	48601		24	26458
A	27:04:18	7:38:51 PM	A	1	27198		9	10698		212	48422		24	26464
A	27:04:18	7:38:54 PM	A	1	27352		9	10661		212	48339		24	26444
A	27:04:18	7:38:57 PM	A	1	27340		9	10630		212	48648		24	26453

A	27:04:18	7:39:00 PM	A	1	27499		9	10808		212	48642		24	26423
A	27:04:18	7:39:03 PM	A	1	27140		9	10636		212	48123		24	26425
A	27:04:18	7:39:06 PM	A	1	27286		9	10449		212	48466		24	26379
A	27:04:18	7:39:09 PM	A	1	27264		9	10082		212	48651		24	26369
A	27:04:18	7:39:12 PM	A	1	27351		9	9602		212	48587		24	26312
A	27:04:18	7:39:15 PM	A	1	27387		9	10033		212	48554		24	26308
A	27:04:18	7:39:18 PM	A	1	27348		9	9837		212	48640		24	26308
A	27:04:18	7:39:21 PM	A	1	27325		9	9996		212	48575		24	26276
A	27:04:18	7:39:24 PM	A	1	27205		9	9904		212	48202		24	26252
A	27:04:18	7:39:27 PM	A	1	27284		9	9980		212	48371		24	26251
A	27:04:18	7:39:30 PM	A	1	27402		9	9985		212	48648		24	26236
A	27:04:18	7:39:33 PM	A	1	27198		9	10090		212	48578		24	26173
A	27:04:18	7:39:36 PM	A	1	27421		9	9308		212	48064		24	26165
A	27:04:18	7:39:39 PM	A	1	27365		9	9525		212	48118		24	26157
A	27:04:18	7:39:42 PM	A	1	27279		9	9554		212	48206		24	26134
A	27:04:18	7:39:45 PM	A	1	27455		9	9141		212	48125		24	26129
A	27:04:18	7:39:48 PM	A	1	27343		9	9094		212	48077		24	26099
A	27:04:18	7:39:51 PM	A	1	27455		9	9102		212	47957		24	26005
A	27:04:18	7:39:54 PM	A	1	27678		9	9277		212	47982		24	26008
A	27:04:18	7:39:57 PM	A	1	27440		9	9298		212	48035		24	25989
A	27:04:18	7:40:00 PM	A	1	27356		9	9406		212	48423		24	25964
A	27:04:18	7:40:03 PM	A	1	27462		9	8768		212	48259		24	25947
A	27:04:18	7:40:06 PM	A	1	27413		9	8845		212	48315		24	25934
A	27:04:18	7:40:09 PM	A	1	27437		9	8868		212	48239		24	25918
A	27:04:18	7:40:12 PM	A	1	27428		9	9006		212	48323		24	25892
A	27:04:18	7:40:15 PM	A	1	27390		9	9254		212	48216		24	25822
A	27:04:18	7:40:18 PM	A	1	27315		9	8808		212	48199		24	25810
A	27:04:18	7:40:21 PM	A	1	27492		9	8745		212	48262		24	25809
A	27:04:18	7:40:24 PM	A	1	27295		9	8548		212	47899		24	25770
A	27:04:18	7:40:27 PM	A	1	27352		9	8328		212	47969		24	25720
A	27:04:18	7:40:30 PM	A	1	27363		9	8329		212	48260		24	25712
A	27:04:18	7:40:33 PM	A	1	27476		9	8395		212	48245		24	25673
A	27:04:18	7:40:36 PM	A	1	27448		9	8554		212	47969		24	25636
A	27:04:18	7:40:39 PM	A	1	27434		9	8613		212	48182		24	25620
A	27:04:18	7:40:42 PM	A	1	27428		9	8564		212	48183		24	25584
A	27:04:18	7:40:45 PM	A	1	27568		9	8346		212	47936		24	25573
A	27:04:18	7:40:48 PM	A	1	27230		9	8208		212	47922		24	25552
A	27:04:18	7:40:51 PM	A	1	27480		9	7973		212	48205		24	25513
A	27:04:18	7:40:54 PM	A	1	27404		9	7670		212	48101		24	25498
A	27:04:18	7:40:57 PM	A	1	27363		9	7890		212	47839		24	25461
A	27:04:18	7:41:00 PM	A	1	27351		9	7826		212	47968		24	25436
A	27:04:18	7:41:03 PM	A	1	27433		9	7953		212	47950		24	25457

A	27:04:18	7:41:06 PM	A	1	27449		9	7675		212	47836		24	25413
A	27:04:18	7:41:09 PM	A	1	27398		9	7636		212	47841		24	25357
A	27:04:18	7:41:12 PM	A	1	27423		9	7549		212	47769		24	25350
A	27:04:18	7:41:15 PM	A	1	27491		9	7389		212	47806		24	25325
A	27:04:18	7:41:18 PM	A	1	27344		9	7615		212	47642		24	25306
A	27:04:18	7:41:21 PM	A	1	27306		9	7339		212	47590		24	25261
A	27:04:18	7:41:24 PM	A	1	27496		9	7384		212	47541		24	25211
A	27:04:18	7:41:27 PM	A	1	27430		9	7245		212	47825		24	25253
A	27:04:18	7:41:30 PM	A	1	27273		9	6971		212	47996		24	25195
A	27:04:18	7:41:33 PM	A	1	27332		9	7282		212	47705		24	25191
A	27:04:18	7:41:36 PM	A	1	27397		9	7180		212	47774		24	25188
A	27:04:18	7:41:39 PM	A	1	27448		9	7124		212	47926		24	25162
A	27:04:18	7:41:42 PM	A	1	27483		9	7161		212	47818		24	25086
A	27:04:18	7:41:45 PM	A	1	27535		9	6648		212	47690		24	25105
A	27:04:18	7:41:48 PM	A	1	27448		9	6442		212	47404		24	25077
A	27:04:18	7:41:51 PM	A	1	27497		9	6587		212	47679		24	25046
A	27:04:18	7:41:54 PM	A	1	27443		9	6549		212	47671		24	25022
A	27:04:18	7:41:57 PM	A	1	27267		9	6551		212	47762		24	25005
A	27:04:18	7:42:00 PM	A	1	27370		9	6552		212	47555		24	24966
A	27:04:18	7:42:03 PM	A	1	27386		9	6430		212	47548		24	24936
A	27:04:18	7:42:06 PM	A	1	27518		9	6227		212	47564		24	24935
A	27:04:18	7:42:09 PM	A	1	27269		9	6218		212	47456		24	24922
A	27:04:18	7:42:12 PM	A	1	27490		9	6668		212	47396		24	24883
A	27:04:18	7:42:15 PM	A	1	27346		9	6407		212	47638		24	24844
A	27:04:18	7:42:18 PM	A	1	27488		9	5946		212	47707		24	24831
A	27:04:18	7:42:21 PM	A	1	27387		9	4807		212	47800		24	24814
A	27:04:18	7:42:24 PM	A	1	27351		9	4860		212	47670		24	24799
A	27:04:18	7:42:27 PM	A	1	27303		9	5216		212	47537		24	24771
A	27:04:18	7:42:30 PM	A	1	27436		9	5399		212	47575		24	24772
A	27:04:18	7:42:33 PM	A	1	27227		9	5486		212	47842		24	24743
A	27:04:18	7:42:36 PM	A	1	27618		9	5859		212	47588		24	24744
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A	27:04:18	7:42:42 PM	A	1	27590		9	4953		212	47274		24	24653
A	27:04:18	7:42:45 PM	A	1	27403		9	5048		212	47317		24	24622
A	27:04:18	7:42:48 PM	A	1	27302		9	5358		212	47529		24	24593
A	27:04:18	7:42:51 PM	A	1	27464		9	5409		212	47429		24	24587
A	27:04:18	7:42:54 PM	A	1	27392		9	5026		212	47429		24	24514
A	27:04:18	7:42:57 PM	A	1	27473		9	4690		212	47339		24	24521
A	27:04:18	7:43:00 PM	A	1	27292		9	4310		212	47335		24	24473
A	27:04:18	7:43:03 PM	A	1	27346		9	4508		212	47256		24	24469
A	27:04:18	7:43:06 PM	A	1	27428		9	4555		212	47042		24	24460
A	27:04:18	7:43:09 PM	A	1	27578		9	4626		212	47089		24	24431

A	27:04:18	7:43:12 PM	A	1	27373		9	4466		212	46960		24	24409
A	27:04:18	7:43:15 PM	A	1	27480		9	4607		212	47056		24	24352
A	27:04:18	7:43:18 PM	A	1	27386		9	4307		212	47027		24	24382
A	27:04:18	7:43:21 PM	A	1	27075		9	4627		212	47283		24	24341
A	27:04:18	7:43:24 PM	A	1	27411		9	4514		212	47242		24	24273
A	27:04:18	7:43:27 PM	A	1	27350		9	4584		212	47275		24	24298
A	27:04:18	7:43:30 PM	A	1	27341		9	4612		212	47158		24	24232
A	27:04:18	7:43:33 PM	A	1	27378		9	4521		212	46974		24	24219
A	27:04:18	7:43:36 PM	A	1	27403		9	4598		212	46988		24	24189
A	27:04:18	7:43:39 PM	A	1	27560		9	4450		212	46948		24	24196
A	27:04:18	7:43:42 PM	A	1	27339		9	4381		212	47122		24	24147
A	27:04:18	7:43:45 PM	A	1	27552		9	4422		212	47024		24	24126
A	27:04:18	7:43:48 PM	A	1	27538		9	4162		212	46898		24	24122
A	27:04:18	7:43:51 PM	A	1	27368		9	4010		212	46761		24	24071
A	27:04:18	7:43:54 PM	A	1	27353		9	4106		212	47009		24	24098
A	27:04:18	7:43:57 PM	A	1	27322		9	4027		212	46971		24	24069
A	27:04:18	7:44:00 PM	A	1	27483		9	3904		212	46823		24	24065
A	27:04:18	7:44:03 PM	A	1	27282		9	3880		212	46945		24	23984
A	27:04:18	7:44:06 PM	A	1	27220		9	3980		212	47057		24	24000
A	27:04:18	7:44:09 PM	A	1	27362		9	3968		212	47060		24	23973
A	27:04:18	7:44:12 PM	A	1	27306		9	3724		212	46892		24	23970
A	27:04:18	7:44:15 PM	A	1	27452		9	3640		212	46731		24	23900
A	27:04:18	7:44:18 PM	A	1	27396		9	3754		212	46732		24	23909
A	27:04:18	7:44:21 PM	A	1	27522		9	3774		212	46632		24	23891
A	27:04:18	7:44:24 PM	A	1	27620		9	3728		212	46789		24	23852
A	27:04:18	7:44:27 PM	A	1	27450		9	3868		212	46871		24	23850
A	27:04:18	7:44:30 PM	A	1	27473		9	3590		212	46945		24	23821
A	27:04:18	7:44:33 PM	A	1	27430		9	3523		212	46846		24	23778
A	27:04:18	7:44:36 PM	A	1	27364		9	3264		212	46602		24	23819
A	27:04:18	7:44:39 PM	A	1	27427		9	3631		212	46516		24	23735
A	27:04:18	7:44:42 PM	A	1	27412		9	3607		212	46991		24	23732
A	27:04:18	7:44:45 PM	A	1	27295		9	3387		212	46777		24	23716
A	27:04:18	7:44:48 PM	A	1	27406		9	3404		212	46702		24	23689
A	27:04:18	7:44:51 PM	A	1	27430		9	4357		212	46556		24	23687
A	27:04:18	7:44:54 PM	A	1	27353		9	3719		212	46672		24	23642
A	27:04:18	7:44:57 PM	A	1	27468		9	3400		212	46436		24	23645
A	27:04:18	7:45:00 PM	A	1	27300		9	3545		212	46596		24	23631
A	27:04:18	7:45:03 PM	A	1	27354		9	3588		212	46697		24	23572
A	27:04:18	7:45:06 PM	A	1	27351		9	3445		212	46693		24	23565
A	27:04:18	7:45:09 PM	A	1	27486		9	3518		212	46599		24	23543
A	27:04:18	7:45:12 PM	A	1	27394		9	3831		212	46451		24	23507
A	27:04:18	7:45:15 PM	A	1	27348		9	3676		212	46473		24	23513

A	27:04:18	7:45:18 PM	A	1	27467		9	3576		212	46773		24	23467
A	27:04:18	7:45:21 PM	A	1	27353		9	3761		212	46714		24	23445
A	27:04:18	7:45:24 PM	A	1	27431		9	3567		212	46599		24	23413
A	27:04:18	7:45:27 PM	A	1	27256		9	3557		212	46330		24	23406
A	27:04:18	7:45:30 PM	A	1	27397		9	3179		212	46404		24	23343
A	27:04:18	7:45:33 PM	A	1	27486		9	3258		212	46767		24	23345
A	27:04:18	7:45:36 PM	A	1	27378		9	3652		212	46669		24	23312
A	27:04:18	7:45:39 PM	A	1	27497		9	3818		212	46486		24	23268
A	27:04:18	7:45:42 PM	A	1	27290		9	3923		212	46480		24	23279
A	27:04:18	7:45:45 PM	A	1	27387		9	3532		212	46258		24	23234
A	27:04:18	7:45:48 PM	A	1	27408		9	3647		212	46314		24	23216
A	27:04:18	7:45:51 PM	A	1	27281		9	3526		212	46670		24	23189
A	27:04:18	7:45:54 PM	A	1	27550		9	3523		212	46438		24	23175
A	27:04:18	7:45:57 PM	A	1	27430		9	3559		212	46363		24	23155
A	27:04:18	7:46:00 PM	A	1	27522		9	3570		212	46338		24	23129
A	27:04:18	7:46:03 PM	A	1	27344		9	3512		212	46313		24	23121
A	27:04:18	7:46:06 PM	A	1	27398		9	3293		212	46283		24	23109
A	27:04:18	7:46:09 PM	A	1	27476		9	3261		212	46252		24	23056
A	27:04:18	7:46:12 PM	A	1	27340		9	3244		212	46061		24	23053
A	27:04:18	7:46:15 PM	A	1	27535		9	3474		212	46063		24	23030
A	27:04:18	7:46:18 PM	A	1	27426		9	3252		212	45988		24	22991
A	27:04:18	7:46:21 PM	A	1	27388		9	3177		212	45824		24	22962
A	27:04:18	7:46:24 PM	A	1	27419		9	3151		212	46027		24	22986
A	27:04:18	7:46:27 PM	A	1	27519		9	4144		212	46176		24	22934
A	27:04:18	7:46:30 PM	A	1	27419		9	3004		212	46294		24	22930
A	27:04:18	7:46:33 PM	A	1	27375		9	2819		212	46238		24	22897
A	27:04:18	7:46:36 PM	A	1	27471		9	2853		212	46236		24	22899
A	27:04:18	7:46:39 PM	A	1	27460		9	2855		212	46224		24	22868
A	27:04:18	7:46:42 PM	A	1	27403		9	2985		212	46137		24	22842
A	27:04:18	7:46:45 PM	A	1	27339		9	2654		212	45832		24	22797
A	27:04:18	7:46:48 PM	A	1	27360		9	2675		212	45848		24	22791
A	27:04:18	7:46:51 PM	A	1	27330		9	2206		212	45900		24	22772
A	27:04:18	7:46:54 PM	A	1	27430		9	2720		212	46056		24	22742
A	27:04:18	7:46:57 PM	A	1	27373		9	2303		212	46148		24	22723
A	27:04:18	7:47:00 PM	A	1	27512		9	1992		212	46024		24	22713
A	27:04:18	7:47:03 PM	A	1	27420		9	2461		212	45971		24	22708
A	27:04:18	7:47:06 PM	A	1	27502		9	2304		212	45923		24	22666
A	27:04:18	7:47:09 PM	A	1	27478		9	2635		212	46115		24	22618
A	27:04:18	7:47:12 PM	A	1	27274		9	2172		212	46294		24	22617
A	27:04:18	7:47:15 PM	A	1	27206		9	2266		212	45812		24	22572
A	27:04:18	7:47:18 PM	A	1	27421		9	1979		212	46162		24	22571
A	27:04:18	7:47:21 PM	A	1	27253		9	2129		212	45978		24	22553

A	27:04:18	7:47:24 PM	A	1	27435		9	2173		212	45690		24	22484
A	27:04:18	7:47:27 PM	A	1	27409		9	2226		212	45790		24	22511
A	27:04:18	7:47:30 PM	A	1	27440		9	2130		212	45665		24	22488
A	27:04:18	7:47:33 PM	A	1	27315		9	1874		212	45907		24	22450
A	27:04:18	7:47:36 PM	A	1	27404		9	2106		212	45941		24	22388
A	27:04:18	7:47:39 PM	A	1	27474		9	2134		212	45695		24	22382
A	27:04:18	7:47:42 PM	A	1	27349		9	2347		212	45813		24	22376
A	27:04:18	7:47:45 PM	A	1	27298		9	1952		212	45756		24	22350
A	27:04:18	7:47:48 PM	A	1	27424		9	2127		212	45661		24	22296
A	27:04:18	7:47:51 PM	A	1	27490		9	1923		212	45629		24	22274
A	27:04:18	7:47:54 PM	A	1	27610		9	2077		212	45602		24	22267
A	27:04:18	7:47:57 PM	A	1	27464		9	2210		212	45731		24	22246
A	27:04:18	7:48:00 PM	A	1	27348		9	2137		212	45610		24	22189
A	27:04:18	7:48:03 PM	A	1	27421		9	2076		212	45772		24	22176
A	27:04:18	7:48:06 PM	A	1	27404		9	2145		212	45781		24	22203
A	27:04:18	7:48:09 PM	A	1	27488		9	2032		212	45587		24	22146
A	27:04:18	7:48:12 PM	A	1	27781		9	2203		212	45625		24	22120
A	27:04:18	7:48:15 PM	A	1	27401		9	2220		212	45442		24	22077
A	27:04:18	7:48:18 PM	A	1	27282		9	2138		212	45549		24	22082
A	27:04:18	7:48:21 PM	A	1	27380		9	2221		212	45318		24	22029
A	27:04:18	7:48:24 PM	A	1	27317		9	2231		212	45620		24	22032
A	27:04:18	7:48:27 PM	A	1	27413		9	2186		212	45556		24	22025
A	27:04:18	7:48:30 PM	A	1	27312		9	2056		212	45236		24	21975
A	27:04:18	7:48:33 PM	A	1	27412		9	2220		212	45532		24	21923
A	27:04:18	7:48:36 PM	A	1	27249		9	2233		212	45654		24	21932
A	27:04:18	7:48:39 PM	A	1	27418		9	2166		212	45450		24	21913
A	27:04:18	7:48:42 PM	A	1	27509		9	1762		212	45354		24	21872
A	27:04:18	7:48:45 PM	A	1	27211		9	1777		212	45333		24	21872
A	27:04:18	7:48:48 PM	A	1	27179		9	2028		212	45237		24	21799
A	27:04:18	7:48:51 PM	A	1	27479		9	1756		212	45442		24	21812
A	27:04:18	7:48:54 PM	A	1	27371		9	2133		212	45398		24	21781
A	27:04:18	7:48:57 PM	A	1	27347		9	2170		212	45574		24	21740
A	27:04:18	7:49:00 PM	A	1	27393		9	2238		212	43657		24	21729
A	27:04:18	7:49:03 PM	A	1	27432		9	2179		212	45453		24	21698
A	27:04:18	7:49:06 PM	A	1	27267		9	2383		212	45356		24	21699
A	27:04:18	7:49:09 PM	A	1	27485		9	1826		212	45109		24	21684
A	27:04:18	7:49:12 PM	A	1	27301		9	1898		212	43600		24	21645
A	27:04:18	7:49:15 PM	A	1	27436		9	1984		212	45412		24	21625
A	27:04:18	7:49:18 PM	A	1	27426		9	2267		212	45200		24	21617
A	27:04:18	7:49:21 PM	A	1	27377		9	2192		212	45312		24	21555
A	27:04:18	7:49:24 PM	A	1	27047		9	2376		212	45333		24	21510
A	27:04:18	7:49:27 PM	A	1	27259		9	1697		212	43499		24	21484

A	27:04:18	7:49:30 PM	A	1	27323		9	2357		212	43433		24	21493
A	27:04:18	7:49:33 PM	A	1	27479		9	2295		212	45166		24	21461
A	27:04:18	7:49:36 PM	A	1	27367		9	2400		212	43215		24	21462
A	27:04:18	7:49:39 PM	A	1	27359		9	2411		212	43010		24	21436
A	27:04:18	7:49:42 PM	A	1	27342		9	2184		212	44993		24	21399
A	27:04:18	7:49:45 PM	A	1	27307		9	2760		212	43340		24	21366
A	27:04:18	7:49:48 PM	A	1	27363		9	2892		212	45211		24	21324
A	27:04:18	7:49:51 PM	A	1	27656		9	2822		212	42799		24	21305
A	27:04:18	7:49:54 PM	A	1	27414		9	2840		212	42817		24	21283
A	27:04:18	7:49:57 PM	A	1	27331		9	2805		212	43388		24	21272
A	27:04:18	7:50:00 PM	A	1	27417		9	3032		212	43414		24	21234
A	27:04:18	7:50:03 PM	A	1	27327		9	3046		212	45003		24	21195
A	27:04:18	7:50:06 PM	A	1	27454		9	3000		212	42872		24	21199
A	27:04:18	7:50:09 PM	A	1	27587		9	3218		212	42877		24	21134
A	27:04:18	7:50:12 PM	A	1	27397		9	3017		212	42662		24	21152
A	27:04:18	7:50:15 PM	A	1	27580		9	3401		212	42829		24	21075
A	27:04:18	7:50:18 PM	A	1	27330		9	3062		212	42639		24	21045
A	27:04:18	7:50:21 PM	A	1	27341		9	3067		212	42542		24	21045
A	27:04:18	7:50:24 PM	A	1	27352		9	3145		212	42247		24	21015
A	27:04:18	7:50:27 PM	A	1	27469		9	2826		212	42538		24	20980
A	27:04:18	7:50:30 PM	A	1	27527		9	3029		212	42708		24	20966
A	27:04:18	7:50:33 PM	A	1	27266		9	3398		212	42491		24	20922
A	27:04:18	7:50:36 PM	A	1	27291		9	3141		212	42479		24	20907
A	27:04:18	7:50:39 PM	A	1	27406		9	3398		212	42584		24	20838
A	27:04:18	7:50:42 PM	A	1	27474		9	3180		212	41958		24	20848
A	27:04:18	7:50:45 PM	A	1	27396		9	2936		212	41988		24	20823
A	27:04:18	7:50:48 PM	A	1	27405		9	2055		212	41936		24	20772
A	27:04:18	7:50:51 PM	A	1	27299		9	2042		212	41904		24	20723
A	27:04:18	7:50:54 PM	A	1	27282		9	3404		212	42021		24	20701
A	27:04:18	7:50:57 PM	A	1	27406		9	3318		212	42411		24	20646
A	27:04:18	7:51:00 PM	A	1	27477		9	3600		212	42454		24	20644
A	27:04:18	7:51:03 PM	A	1	27469		9	3671		212	42577		24	20658
A	27:04:18	7:51:06 PM	A	1	27279		9	3586		212	42047		24	20602
A	27:04:18	7:51:09 PM	A	1	27369		9	3456		212	42048		24	20535
A	27:04:18	7:51:12 PM	A	1	27309		9	2473		212	42380		24	20500
A	27:04:18	7:51:15 PM	A	1	27309		9	2051		212	42196		24	20499
A	27:04:18	7:51:18 PM	A	1	27460		9	2005		212	41800		24	20467
A	27:04:18	7:51:21 PM	A	1	27418		9	1709		212	41993		24	20460
A	27:04:18	7:51:24 PM	A	1	27407		9	1943		212	41726		24	20409
A	27:04:18	7:51:27 PM	A	1	27376		9	2922		212	42555		24	20417
A	27:04:18	7:51:30 PM	A	1	27298		9	3575		212	42216		24	20378
A	27:04:18	7:51:33 PM	A	1	27363		9	3637		212	42263		24	20369

A	27:04:18	7:51:36 PM	A	1	27376		9	3434		212	42251		24	20350
A	27:04:18	7:51:39 PM	A	1	27320		9	3773		212	42227		24	20329
A	27:04:18	7:51:42 PM	A	1	27520		9	3625		212	42211		24	20353
A	27:04:18	7:51:45 PM	A	1	27332		9	3263		212	41851		24	20294
A	27:04:18	7:51:48 PM	A	1	27438		9	2699		212	41769		24	20276
A	27:04:18	7:51:51 PM	A	1	27330		9	608		212	42407		24	20260
A	27:04:18	7:51:54 PM	A	1	27489		9	1700		212	42270		24	20278
A	27:04:18	7:51:57 PM	A	1	27373		9	2436		212	41859		24	20249
A	27:04:18	7:52:00 PM	A	1	27418		9	3032		212	42135		24	20250
A	27:04:18	7:52:03 PM	A	1	27438		9	3261		212	42280		24	20250
A	27:04:18	7:52:06 PM	A	1	27397		9	3421		212	42119		24	20179
A	27:04:18	7:52:09 PM	A	1	27394		9	3269		212	42194		24	20214
A	27:04:18	7:52:12 PM	A	1	27429		9	2915		212	42269		24	20195
A	27:04:18	7:52:15 PM	A	1	27348		9	2626		212	42159		24	20212
A	27:04:18	7:52:18 PM	A	1	26974		9	2931		212	41666		24	20168
A	27:04:18	7:52:21 PM	A	1	27389		9	2969		212	41804		24	20154
A	27:04:18	7:52:24 PM	A	1	27324		9	2911		212	41604		24	20140
A	27:04:18	7:52:27 PM	A	1	27350		9	2582		212	41731		24	20125
A	27:04:18	7:52:30 PM	A	1	27465		9	2578		212	41648		24	20094
A	27:04:18	7:52:33 PM	A	1	27428		9	2613		212	41568		24	20112
A	27:04:18	7:52:36 PM	A	1	27249		9	2597		212	41562		24	20078
A	27:04:18	7:52:39 PM	A	1	27421		9	2439		212	41448		24	20081
A	27:04:18	7:52:42 PM	A	1	27297		9	2394		212	42202		24	20077
A	27:04:18	7:52:45 PM	A	1	27543		9	2206		212	41991		24	20076
A	27:04:18	7:52:48 PM	A	1	27453		9	2252		212	41678		24	20056
A	27:04:18	7:52:51 PM	A	1	27367		9	2430		212	41691		24	20063
A	27:04:18	7:52:54 PM	A	1	27415		9	2430		212	41678		24	20025
A	27:04:18	7:52:57 PM	A	1	27370		9	2276		212	41523		24	19979
A	27:04:18	7:53:00 PM	A	1	27243		9	2145		212	41988		24	20000
A	27:04:18	7:53:03 PM	A	1	27313		9	2307		212	42047		24	19998
A	27:04:18	7:53:06 PM	A	1	27556		9	2286		212	41980		24	19982
A	27:04:18	7:53:09 PM	A	1	27177		9	1632		212	41809		24	19903
A	27:04:18	7:53:12 PM	A	1	27472		9	1982		212	41497		24	19937
A	27:04:18	7:53:15 PM	A	1	27386		9	1691		212	41392		24	19881
A	27:04:18	7:53:18 PM	A	1	27449		9	1592		212	41998		24	19850
A	27:04:18	7:53:21 PM	A	1	27355		9	2140		212	41716		24	19843
A	27:04:18	7:53:24 PM	A	1	27436		9	1981		212	41504		24	19838
A	27:04:18	7:53:27 PM	A	1	27325		9	2046		212	41372		24	19822
A	27:04:18	7:53:30 PM	A	1	27406		9	2453		212	41286		24	19791
A	27:04:18	7:53:33 PM	A	1	27459		9	2273		212	41812		24	19777
A	27:04:18	7:53:36 PM	A	1	27391		9	2367		212	41820		24	19771
A	27:04:18	7:53:39 PM	A	1	27449		9	2250		212	41643		24	19783

A	27:04:18	7:53:42 PM	A	1	27356		9	2781		212	41165		24	19723
A	27:04:18	7:53:45 PM	A	1	27080		9	2006		212	41334		24	19745
A	27:04:18	7:53:48 PM	A	1	27457		9	2766		212	41358		24	19690
A	27:04:18	7:53:51 PM	A	1	27477		9	2617		212	41301		24	19688
A	27:04:18	7:53:54 PM	A	1	27427		9	2692		212	41810		24	19630
A	27:04:18	7:53:57 PM	A	1	27557		9	2850		212	41649		24	19628
A	27:04:18	7:54:00 PM	A	1	27498		9	2687		212	41615		24	19598
A	27:04:18	7:54:03 PM	A	1	27422		9	2735		212	41644		24	19578
A	27:04:18	7:54:06 PM	A	1	27366		9	2970		212	41263		24	19595
A	27:04:18	7:54:09 PM	A	1	27329		9	2796		212	41183		24	19574
A	27:04:18	7:54:12 PM	A	1	27096		9	3556		212	41171		24	19534
A	27:04:18	7:54:15 PM	A	1	27449		9	3269		212	40957		24	19516
A	27:04:18	7:54:18 PM	A	1	27019		9	3336		212	41227		24	19493
A	27:04:18	7:54:21 PM	A	1	27398		9	3575		212	41066		24	19462
A	27:04:18	7:54:24 PM	A	1	27442		9	3367		212	41188		24	19432
A	27:04:18	7:54:27 PM	A	1	27365		9	3746		212	41125		24	19441
A	27:04:18	7:54:30 PM	A	1	27474		9	3461		212	41404		24	19388
A	27:04:18	7:54:33 PM	A	1	27450		9	3918		212	41489		24	19380
A	27:04:18	7:54:36 PM	A	1	27372		9	3726		212	41426		24	19368
A	27:04:18	7:54:39 PM	A	1	27168		9	3709		212	41041		24	19328
A	27:04:18	7:54:42 PM	A	1	27581		9	4236		212	41056		24	19313
A	27:04:18	7:54:45 PM	A	1	27453		9	4312		212	41183		24	19280
A	27:04:18	7:54:48 PM	A	1	27033		9	4160		212	41020		24	19259
A	27:04:18	7:54:51 PM	A	1	27481		9	4577		212	40942		24	19266
A	27:04:18	7:54:54 PM	A	1	27599		9	4302		212	41291		24	19213
A	27:04:18	7:54:57 PM	A	1	27512		9	4739		212	41147		24	19198
A	27:04:18	7:55:00 PM	A	1	27488		9	4818		212	41053		24	19173
A	27:04:18	7:55:03 PM	A	1	27385		9	4662		212	41266		24	19130
A	27:04:18	7:55:06 PM	A	1	27293		9	4699		212	41370		24	19116
A	27:04:18	7:55:09 PM	A	1	27335		9	4291		212	41059		24	19109
A	27:04:18	7:55:12 PM	A	1	27370		9	5107		212	41017		24	19058
A	27:04:18	7:55:15 PM	A	1	27392		9	5058		212	41483		24	19047
A	27:04:18	7:55:18 PM	A	1	27317		9	4773		212	41420		24	19040
A	27:04:18	7:55:21 PM	A	1	27292		9	5425		212	41141		24	19006
A	27:04:18	7:55:24 PM	A	1	27373		9	4610		212	41460		24	18994
A	27:04:18	7:55:27 PM	A	1	27228		9	5411		212	41358		24	18937
A	27:04:18	7:55:30 PM	A	1	27542		9	5713		212	41333		24	18928
A	27:04:18	7:55:33 PM	A	1	27368		9	5789		212	40891		24	18892
A	27:04:18	7:55:36 PM	A	1	27556		9	5916		212	40972		24	18884
A	27:04:18	7:55:39 PM	A	1	27506		9	5837		212	41128		24	18831
A	27:04:18	7:55:42 PM	A	1	27353		9	5619		212	40840		24	18858
A	27:04:18	7:55:45 PM	A	1	27489		9	5758		212	40816		24	18794

A	27:04:18	7:55:48 PM	A	1	27307		9	5388		212	40817		24	18775
A	27:04:18	7:55:51 PM	A	1	27338		9	6293		212	41190		24	18742
A	27:04:18	7:55:54 PM	A	1	27116		9	5746		212	41113		24	18726
A	27:04:18	7:55:57 PM	A	1	27375		9	5928		212	41023		24	18689
A	27:04:18	7:56:00 PM	A	1	27090		9	5711		212	40921		24	18650
A	27:04:18	7:56:03 PM	A	1	27320		9	5392		212	40869		24	18616
A	27:04:18	7:56:06 PM	A	1	27512		9	5607		212	41278		24	18616
A	27:04:18	7:56:09 PM	A	1	27448		9	5422		212	41003		24	18605
A	27:04:18	7:56:12 PM	A	1	27468		9	5347		212	41151		24	18561
A	27:04:18	7:56:15 PM	A	1	27624		9	5301		212	41036		24	18504
A	27:04:18	7:56:18 PM	A	1	27666		9	5534		212	40850		24	18485
A	27:04:18	7:56:21 PM	A	1	27272		9	5422		212	40743		24	18470
A	27:04:18	7:56:24 PM	A	1	27529		9	5164		212	41353		24	18424
A	27:04:18	7:56:27 PM	A	1	27492		9	5174		212	41179		24	18383
A	27:04:18	7:56:30 PM	A	1	27376		9	5331		212	41119		24	18408
A	27:04:18	7:56:33 PM	A	1	27525		9	5309		212	40934		24	18361
A	27:04:18	7:56:36 PM	A	1	27430		9	5226		212	40719		24	18322
A	27:04:18	7:56:39 PM	A	1	27404		9	4954		212	40676		24	18298
A	27:04:18	7:56:42 PM	A	1	27436		9	4970		212	40662		24	18264
A	27:04:18	7:56:45 PM	A	1	27482		9	5108		212	40680		24	18256
A	27:04:18	7:56:48 PM	A	1	27226		9	4911		212	40592		24	18233
A	27:04:18	7:56:51 PM	A	1	27458		9	4937		212	40695		24	18202
A	27:04:18	7:56:54 PM	A	1	27313		9	4858		212	40586		24	18170
A	27:04:18	7:56:57 PM	A	1	27399		9	4482		212	41062		24	18153
A	27:04:18	7:57:00 PM	A	1	27388		9	4663		212	40856		24	18133
A	27:04:18	7:57:03 PM	A	1	27404		9	4140		212	40881		24	18087
A	27:04:18	7:57:06 PM	A	1	27397		9	3889		212	40960		24	18075
A	27:04:18	7:57:09 PM	A	1	27428		9	3663		212	40639		24	18025
A	27:04:18	7:57:12 PM	A	1	27159		9	3318		212	40777		24	18019
A	27:04:18	7:57:15 PM	A	1	27452		9	3773		212	40902		24	18002
A	27:04:18	7:57:18 PM	A	1	27583		9	3389		212	40675		24	17934
A	27:04:18	7:57:21 PM	A	1	27429		9	3132		212	40631		24	17911
A	27:04:18	7:57:24 PM	A	1	27221		9	3062		212	40447		24	17890
A	27:04:18	7:57:27 PM	A	1	27446		9	2892		212	40321		24	17866
A	27:04:18	7:57:30 PM	A	1	27373		9	2624		212	40707		24	17846
A	27:04:18	7:57:33 PM	A	1	27632		9	2542		212	40752		24	17845
A	27:04:18	7:57:36 PM	A	1	27373		9	2440		212	40475		24	17800
A	27:04:18	7:57:39 PM	A	1	27358		9	1776		212	40678		24	17780
A	27:04:18	7:57:42 PM	A	1	27431		9	2000		212	40359		24	17704
A	27:04:18	7:57:45 PM	A	1	27418		9	1554		212	40211		24	17714
A	27:04:18	7:57:48 PM	A	1	27269		9	1153		212	40382		24	17670
A	27:04:18	7:57:51 PM	A	1	27228		9	1358		212	40260		24	17656

A	27:04:18	7:57:54 PM	A	1	27363		9	222		212	40796		24	17608
A	27:04:18	7:57:57 PM	A	1	27654		9	175		212	40672		24	17580
A	27:04:18	7:58:00 PM	A	1	27351		8	65146		212	40730		24	17578
A	27:04:18	7:58:03 PM	A	1	27369		8	64996		212	40555		24	17557
A	27:04:18	7:58:06 PM	A	1	27308		8	64797		212	40513		24	17514
A	27:04:18	7:58:09 PM	A	1	27544		8	64020		212	40317		24	17481
A	27:04:18	7:58:12 PM	A	1	27420		8	64145		212	40550		24	17463
A	27:04:18	7:58:15 PM	A	1	27452		8	63198		212	40164		24	17412
A	27:04:18	7:58:18 PM	A	1	27334		8	62775		212	40289		24	17405
A	27:04:18	7:58:21 PM	A	1	27386		8	62596		212	40684		24	17410
A	27:04:18	7:58:24 PM	A	1	27349		8	62419		212	40519		24	17399
A	27:04:18	7:58:27 PM	A	1	27533		8	61912		212	40409		24	17367
A	27:04:18	7:58:30 PM	A	1	27371		8	60854		212	40395		24	17370
A	27:04:18	7:58:33 PM	A	1	27447		8	60601		212	40238		24	17352
A	27:04:18	7:58:36 PM	A	1	27401		8	60825		212	40171		24	17325
A	27:04:18	7:58:39 PM	A	1	27467		8	59874		212	40495		24	17344
A	27:04:18	7:58:42 PM	A	1	27517		8	59909		212	40460		24	17300
A	27:04:18	7:58:45 PM	A	1	27385		8	59138		212	40501		24	17282
A	27:04:18	7:58:48 PM	A	1	27354		8	58642		212	40036		24	17241
A	27:04:18	7:58:51 PM	A	1	27258		8	58787		212	40315		24	17287
A	27:04:18	7:58:54 PM	A	1	27315		8	57761		212	40142		24	17231
A	27:04:18	7:58:57 PM	A	1	27473		8	57874		212	40129		24	17231
A	27:04:18	7:59:00 PM	A	1	27413		8	57576		212	40082		24	17207
A	27:04:18	7:59:03 PM	A	1	27378		8	57093		212	39839		24	17196
A	27:04:18	7:59:06 PM	A	1	27437		8	57104		212	40111		24	17181
A	27:04:18	7:59:09 PM	A	1	27528		8	56365		212	39929		24	17158
A	27:04:18	7:59:12 PM	A	1	27493		8	56473		212	40243		24	17091
A	27:04:18	7:59:15 PM	A	1	27390		8	56069		212	40376		24	17099
A	27:04:18	7:59:18 PM	A	1	27505		8	55270		212	40192		24	17075
A	27:04:18	7:59:21 PM	A	1	27308		8	55404		212	40230		24	17025
A	27:04:18	7:59:24 PM	A	1	27276		8	54573		212	40232		24	17075
A	27:04:18	7:59:27 PM	A	1	27454		8	54984		212	40391		24	17025
A	27:04:18	7:59:30 PM	A	1	27445		8	54894		212	40305		24	16992
A	27:04:18	7:59:33 PM	A	1	27456		8	54619		212	40283		24	16959
A	27:04:18	7:59:36 PM	A	1	27428		8	55094		212	39973		24	16926
A	27:04:18	7:59:39 PM	A	1	27500		8	54400		212	39734		24	16899
A	27:04:18	7:59:42 PM	A	1	27334		8	54342		212	40246		24	16894
A	27:04:18	7:59:45 PM	A	1	27370		8	54068		212	40199		24	16858
A	27:04:18	7:59:48 PM	A	1	27460		8	54126		212	39947		24	16858
A	27:04:18	7:59:51 PM	A	1	27361		8	53815		212	39942		24	16841
A	27:04:18	7:59:54 PM	A	1	27394		8	53116		212	40009		24	16823
A	27:04:18	7:59:57 PM	A	1	27327		8	52993		212	40190		24	16773

A	27:04:18	8:00:00 PM	A	1	27305		8	52953		212	40066		24	16758
A	27:04:18	8:00:03 PM	A	1	27402		8	52719		212	40102		24	16723
A	27:04:18	8:00:06 PM	A	1	27333		8	52824		212	40253		24	16735
A	27:04:18	8:00:09 PM	A	1	27539		8	52378		212	39998		24	16666
A	27:04:18	8:00:12 PM	A	1	27596		8	52245		212	40034		24	16653
A	27:04:18	8:00:15 PM	A	1	27386		8	52277		212	40164		24	16652
A	27:04:18	8:00:18 PM	A	1	27447		8	51801		212	40098		24	16654
A	27:04:18	8:00:21 PM	A	1	27489		8	51859		212	39980		24	16604
A	27:04:18	8:00:24 PM	A	1	27348		8	51298		212	40073		24	16571
A	27:04:18	8:00:27 PM	A	1	27386		8	50935		212	39573		24	16561
A	27:04:18	8:00:30 PM	A	1	27587		8	51337		212	39702		24	16522
A	27:04:18	8:00:33 PM	A	1	27953		8	50739		212	40111		24	16504
A	27:04:18	8:00:36 PM	A	1	27474		8	50659		212	40055		24	16485
A	27:04:18	8:00:39 PM	A	1	27298		8	50489		212	39725		24	16430
A	27:04:18	8:00:42 PM	A	1	27353		8	50154		212	39855		24	16413
A	27:04:18	8:00:45 PM	A	1	27324		8	50205		212	39577		24	16637
A	27:04:18	8:00:48 PM	A	1	27214		8	49693		212	39576		24	16387
A	27:04:18	8:00:51 PM	A	1	27367		8	49621		212	39575		24	16308
A	27:04:18	8:00:54 PM	A	1	27371		8	49004		212	39871		24	16303
A	27:04:18	8:00:57 PM	A	1	27394		8	48662		212	39702		24	16283
A	27:04:18	8:01:00 PM	A	1	27366		8	49011		212	39531		24	16255
A	27:04:18	8:01:03 PM	A	1	27398		8	48367		212	39548		24	16247
A	27:04:18	8:01:06 PM	A	1	27484		8	48283		212	39584		24	16236
A	27:04:18	8:01:09 PM	A	1	27423		8	48328		212	39839		24	16163
A	27:04:18	8:01:12 PM	A	1	27443		8	48041		212	39641		24	16165
A	27:04:18	8:01:15 PM	A	1	27459		8	48324		212	39803		24	16161
A	27:04:18	8:01:18 PM	A	1	27320		8	48004		212	39740		24	16100
A	27:04:18	8:01:21 PM	A	1	27324		8	47706		212	39517		24	16074
A	27:04:18	8:01:24 PM	A	1	27461		8	47726		212	39361		24	16061
A	27:04:18	8:01:27 PM	A	1	27333		8	47259		212	39737		24	16025
A	27:04:18	8:01:30 PM	A	1	27441		8	47097		212	39556		24	16014
A	27:04:18	8:01:33 PM	A	1	27230		8	46719		212	39268		24	15987
A	27:04:18	8:01:36 PM	A	1	27432		8	45561		212	39409		24	15939
A	27:04:18	8:01:39 PM	A	1	27435		8	45389		212	39358		24	15901
A	27:04:18	8:01:42 PM	A	1	27383		8	44341		212	39372		24	15912
A	27:04:18	8:01:45 PM	A	1	27487		8	44466		212	39357		24	15864
A	27:04:18	8:01:48 PM	A	1	27418		8	43511		212	39377		24	15845
A	27:04:18	8:01:51 PM	A	1	27356		8	42848		212	39278		24	15834
A	27:04:18	8:01:54 PM	A	1	27212		8	43094		212	39031		24	15769
A	27:04:18	8:01:57 PM	A	1	27369		8	42174		212	39011		24	15731
A	27:04:18	8:02:00 PM	A	1	27345		8	42742		212	39048		24	15730
A	27:04:18	8:02:03 PM	A	1	27476		8	41829		212	39153		24	15694

A	27:04:18	8:02:06 PM	A	1	27316		8	41303		212	39053		24	15699
A	27:04:18	8:02:09 PM	A	1	27242		8	41595		212	39143		24	15625
A	27:04:18	8:02:12 PM	A	1	27559		8	40330		212	39222		24	15604
A	27:04:18	8:02:15 PM	A	1	27436		8	40439		212	39406		24	15613
A	27:04:18	8:02:18 PM	A	1	27119		8	39482		212	39353		24	15596
A	27:04:18	8:02:21 PM	A	1	26936		8	38892		212	39326		24	15564
A	27:04:18	8:02:24 PM	A	1	27281		8	38495		212	39169		24	15512
A	27:04:18	8:02:27 PM	A	1	27294		8	37166		212	39420		24	15518
A	27:04:18	8:02:30 PM	A	1	27477		8	37599		212	39071		24	15510
A	27:04:18	8:02:33 PM	A	1	27519		8	36279		212	39188		24	15457
A	27:04:18	8:02:36 PM	A	1	27445		8	35462		212	39396		24	15434
A	27:04:18	8:02:39 PM	A	1	27329		8	36205		212	39274		24	15429
A	27:04:18	8:02:42 PM	A	1	27353		8	34682		212	39017		24	15399
A	27:04:18	8:02:45 PM	A	1	27389		8	34810		212	39219		24	15350
A	27:04:18	8:02:48 PM	A	1	27423		8	34742		212	39360		24	15353
A	27:04:18	8:02:51 PM	A	1	27419		8	34092		212	39231		24	15299
A	27:04:18	8:02:54 PM	A	1	27516		8	34522		212	39089		24	15277
A	27:04:18	8:02:57 PM	A	1	27393		8	33702		212	38942		24	15272
A	27:04:18	8:03:00 PM	A	1	27572		8	33952		212	39169		24	15241
A	27:04:18	8:03:03 PM	A	1	27454		8	33775		212	39246		24	15215
A	27:04:18	8:03:06 PM	A	1	27517		8	33702		212	39252		24	15189
A	27:04:18	8:03:09 PM	A	1	27315		8	33976		212	39181		24	15190
A	27:04:18	8:03:12 PM	A	1	27272		8	33540		212	38835		24	15169
A	27:04:18	8:03:15 PM	A	1	27522		8	33292		212	38946		24	15094
A	27:04:18	8:03:18 PM	A	1	27314		8	33428		212	39017		24	15101
A	27:04:18	8:03:21 PM	A	1	27360		8	33158		212	39395		24	15082
A	27:04:18	8:03:24 PM	A	1	27462		8	33371		212	39221		24	15055
A	27:04:18	8:03:27 PM	A	1	27391		8	33039		212	39239		24	15016
A	27:04:18	8:03:30 PM	A	1	27417		8	33268		212	39264		24	15005
A	27:04:18	8:03:33 PM	A	1	27459		8	33336		212	39116		24	14964
A	27:04:18	8:03:36 PM	A	1	27169		8	32717		212	39100		24	14927
A	27:04:18	8:03:39 PM	A	1	27400		8	32970		212	39159		24	14931
A	27:04:18	8:03:42 PM	A	1	27388		8	32455		212	38761		24	14870
A	27:04:18	8:03:45 PM	A	1	27297		8	32302		212	38606		24	14852
A	27:04:18	8:03:48 PM	A	1	27451		8	32368		212	38765		24	14838
A	27:04:18	8:03:51 PM	A	1	27422		8	31551		212	39093		24	14798
A	27:04:18	8:03:54 PM	A	1	27423		8	32091		212	38981		24	14782
A	27:04:18	8:03:57 PM	A	1	27297		8	32273		212	38822		24	14795
A	27:04:18	8:04:00 PM	A	1	27425		8	31744		212	38750		24	14729
A	27:04:18	8:04:03 PM	A	1	27378		8	32068		212	38604		24	14736
A	27:04:18	8:04:06 PM	A	1	27344		8	31788		212	38975		24	14669
A	27:04:18	8:04:09 PM	A	1	27456		8	31940		212	39007		24	14630

A	27:04:18	8:04:12 PM	A	1	27312		8	32102		212	38695		24	14629
A	27:04:18	8:04:15 PM	A	1	27443		8	31433		212	38815		24	14598
A	27:04:18	8:04:18 PM	A	1	27569		8	31531		212	38688		24	14586
A	27:04:18	8:04:21 PM	A	1	27615		8	31204		212	38934		24	14560
A	27:04:18	8:04:24 PM	A	1	27522		8	31129		212	38882		24	14531
A	27:04:18	8:04:27 PM	A	1	27391		8	31148		212	38779		24	14504
A	27:04:18	8:04:30 PM	A	1	27596		8	30462		212	38750		24	14454
A	27:04:18	8:04:33 PM	A	1	26979		8	30655		212	38613		24	14424
A	27:04:18	8:04:36 PM	A	1	27243		8	29645		212	38546		24	14395
A	27:04:18	8:04:39 PM	A	1	27616		8	29570		212	38477		24	14388
A	27:04:18	8:04:42 PM	A	1	27362		8	29712		212	39068		24	14376
A	27:04:18	8:04:45 PM	A	1	27315		8	28824		212	38646		24	14337
A	27:04:18	8:04:48 PM	A	1	27806		8	29205		212	38699		24	14322
A	27:04:18	8:04:51 PM	A	1	27375		8	28369		212	38656		24	14303
A	27:04:18	8:04:54 PM	A	1	27416		8	27802		212	38677		24	14280
A	27:04:18	8:04:57 PM	A	1	27457		8	28280		212	38492		24	14235
A	27:04:18	8:05:00 PM	A	1	27458		8	27642		212	38198		24	14217
A	27:04:18	8:05:03 PM	A	1	27374		8	27508		212	38613		24	14163
A	27:04:18	8:05:06 PM	A	1	27380		8	27166		212	38690		24	14192
A	27:04:18	8:05:09 PM	A	1	27294		8	27212		212	38606		24	14124
A	27:04:18	8:05:12 PM	A	1	27328		8	27265		212	38438		24	14124
A	27:04:18	8:05:15 PM	A	1	27079		8	26588		212	38560		24	14074
A	27:04:18	8:05:18 PM	A	1	27048		8	26909		212	38562		24	14078
A	27:04:18	8:05:21 PM	A	1	27451		8	26690		212	38634		24	14059
A	27:04:18	8:05:24 PM	A	1	27204		8	26257		212	38479		24	14006
A	27:04:18	8:05:27 PM	A	1	27378		8	26481		212	38634		24	13997
A	27:04:18	8:05:30 PM	A	1	27348		8	25652		212	38153		24	13980
A	27:04:18	8:05:33 PM	A	1	27394		8	25974		212	38295		24	13926
A	27:04:18	8:05:36 PM	A	1	27394		8	25511		212	38264		24	13901
A	27:04:18	8:05:39 PM	A	1	27285		8	25314		212	38139		24	13877
A	27:04:18	8:05:42 PM	A	1	27211		8	25756		212	38215		24	13843
A	27:04:18	8:05:45 PM	A	1	27428		8	25374		212	38345		24	13828
A	27:04:18	8:05:48 PM	A	1	27333		8	25066		212	38352		24	13819
A	27:04:18	8:05:51 PM	A	1	27300		8	24906		212	38490		24	13771
A	27:04:18	8:05:54 PM	A	1	27265		8	24779		212	38253		24	13751
A	27:04:18	8:05:57 PM	A	1	27437		8	24902		212	38103		24	13697
A	27:04:18	8:06:00 PM	A	1	27399		8	24475		212	38156		24	13697
A	27:04:18	8:06:03 PM	A	1	27282		8	24791		212	38169		24	13660
A	27:04:18	8:06:06 PM	A	1	27486		8	24423		212	38107		24	13636
A	27:04:18	8:06:09 PM	A	1	27454		8	23663		212	38343		24	13619
A	27:04:18	8:06:12 PM	A	1	27186		8	23908		212	38404		24	13554
A	27:04:18	8:06:15 PM	A	1	27403		8	23461		212	38050		24	13544

A	27:04:18	8:06:18 PM	A	1	27587		8	23673		212	38127		24	13514
A	27:04:18	8:06:21 PM	A	1	27246		8	23670		212	38158		24	13504
A	27:04:18	8:06:24 PM	A	1	27356		8	23306		212	38201		24	13488
A	27:04:18	8:06:27 PM	A	1	27519		8	23821		212	38073		24	13419
A	27:04:18	8:06:30 PM	A	1	27648		8	23529		212	37984		24	13419
A	27:04:18	8:06:33 PM	A	1	27482		8	23514		212	37822		24	13385
A	27:04:18	8:06:36 PM	A	1	27472		8	23502		212	37910		24	13366
A	27:04:18	8:06:39 PM	A	1	27514		8	23291		212	38283		24	13289
A	27:04:18	8:06:42 PM	A	1	27400		8	23284		212	38343		24	13266
A	27:04:18	8:06:45 PM	A	1	27502		8	23188		212	37803		24	13273
A	27:04:18	8:06:48 PM	A	1	27802		8	23094		212	38263		24	13232
A	27:04:18	8:06:51 PM	A	1	27479		8	23157		212	38222		24	13216
A	27:04:18	8:06:54 PM	A	1	27343		8	22683		212	37912		24	13193
A	27:04:18	8:06:57 PM	A	1	27533		8	23117		212	37916		24	13164
A	27:04:18	8:07:00 PM	A	1	27489		8	23256		212	38079		24	13155
A	27:04:18	8:07:03 PM	A	1	27450		8	23251		212	38013		24	13130
A	27:04:18	8:07:06 PM	A	1	27376		8	23639		212	38219		24	13042
A	27:04:18	8:07:09 PM	A	1	27380		8	22925		212	37823		24	13038
A	27:04:18	8:07:12 PM	A	1	27459		8	23081		212	38161		24	13035
A	27:04:18	8:07:15 PM	A	1	27464		8	22647		212	38176		24	12986
A	27:04:18	8:07:18 PM	A	1	27344		8	23082		212	38056		24	12984
A	27:04:18	8:07:21 PM	A	1	27336		8	23127		212	38110		24	12985
A	27:04:18	8:07:24 PM	A	1	27391		8	22623		212	38037		24	12947
A	27:04:18	8:07:27 PM	A	1	27430		8	22587		212	38106		24	12918
A	27:04:18	8:07:30 PM	A	1	27432		8	22372		212	37944		24	12912
A	27:04:18	8:07:33 PM	A	1	27331		8	22350		212	37990		24	12899
A	27:04:18	8:07:36 PM	A	1	27484		8	22739		212	37653		24	12834
A	27:04:18	8:07:39 PM	A	1	27217		8	22462		212	38130		24	12817
A	27:04:18	8:07:42 PM	A	1	26813		8	22471		212	38165		24	12816
A	27:04:18	8:07:45 PM	A	1	27502		8	22712		212	37786		24	12760
A	27:04:18	8:07:48 PM	A	1	27524		8	22729		212	37830		24	12760
A	27:04:18	8:07:51 PM	A	1	27338		8	22663		212	37714		24	12765
A	27:04:18	8:07:54 PM	A	1	27463		8	22677		212	37785		24	12742
A	27:04:18	8:07:57 PM	A	1	27490		8	22375		212	37745		24	12692
A	27:04:18	8:08:00 PM	A	1	27296		8	22290		212	37879		24	12668
A	27:04:18	8:08:03 PM	A	1	27504		8	22230		212	37704		24	12654
A	27:04:18	8:08:06 PM	A	1	27322		8	22136		212	37480		24	12650
A	27:04:18	8:08:09 PM	A	1	27276		8	22570		212	37854		24	12607
A	27:04:18	8:08:12 PM	A	1	27325		8	22609		212	37824		24	12603
A	27:04:18	8:08:15 PM	A	1	27492		8	22528		212	37820		24	12583
A	27:04:18	8:08:18 PM	A	1	27396		8	22699		212	37516		24	12582
A	27:04:18	8:08:21 PM	A	1	27437		8	22586		212	37787		24	12529

A	27:04:18	8:08:24 PM	A	1	27411		8	22681		212	37819		24	12530
A	27:04:18	8:08:27 PM	A	1	27314		8	22681		212	37703		24	12512
A	27:04:18	8:08:30 PM	A	1	27165		8	22780		212	37670		24	12492
A	27:04:18	8:08:33 PM	A	1	27313		8	21950		212	37588		24	12499
A	27:04:18	8:08:36 PM	A	1	27118		8	21814		212	37221		24	12483
A	27:04:18	8:08:39 PM	A	1	27462		8	22168		212	37332		24	12460
A	27:04:18	8:08:42 PM	A	1	27339		8	22370		212	37309		24	12445
A	27:04:18	8:08:45 PM	A	1	27455		8	22472		212	37288		24	12452
A	27:04:18	8:08:48 PM	A	1	27315		8	22105		212	37251		24	12386
A	27:04:18	8:08:51 PM	A	1	27346		8	21978		212	37175		24	12362
A	27:04:18	8:08:54 PM	A	1	27354		8	22038		212	37617		24	12328
A	27:04:18	8:08:57 PM	A	1	27362		8	22101		212	37387		24	12299
A	27:04:18	8:09:00 PM	A	1	27319		8	21729		212	37545		24	12323
A	27:04:18	8:09:03 PM	A	1	27402		8	21139		212	37339		24	12266
A	27:04:18	8:09:06 PM	A	1	27647		8	21458		212	37299		24	12268
A	27:04:18	8:09:09 PM	A	1	27469		8	21575		212	37301		24	12243
A	27:04:18	8:09:12 PM	A	1	27223		8	21256		212	37368		24	12212
A	27:04:18	8:09:15 PM	A	1	27340		8	20875		212	37315		24	12164
A	27:04:18	8:09:18 PM	A	1	27381		8	20682		212	37123		24	12121
A	27:04:18	8:09:21 PM	A	1	27450		8	20553		212	37363		24	12122
A	27:04:18	8:09:24 PM	A	1	27396		8	20566		212	37648		24	12077
A	27:04:18	8:09:27 PM	A	1	27421		8	20485		212	37304		24	12080
A	27:04:18	8:09:30 PM	A	1	27380		8	20450		212	37553		24	11996
A	27:04:18	8:09:33 PM	A	1	27436		8	20523		212	37509		24	11975
A	27:04:18	8:09:36 PM	A	1	27430		8	19683		212	37290		24	11971
A	27:04:18	8:09:39 PM	A	1	27427		8	19863		212	37379		24	11945
A	27:04:18	8:09:42 PM	A	1	27501		8	19563		212	37452		24	11912
A	27:04:18	8:09:45 PM	A	1	27449		8	19791		212	37399		24	11884
A	27:04:18	8:09:48 PM	A	1	27632		8	19740		212	37318		24	11856
A	27:04:18	8:09:51 PM	A	1	27524		8	19573		212	37149		24	11832
A	27:04:18	8:09:54 PM	A	1	27409		8	19654		212	37048		24	11788
A	27:04:18	8:09:57 PM	A	1	27423		8	19634		212	37070		24	11756
A	27:04:18	8:10:00 PM	A	1	27380		8	19216		212	37261		24	11738
A	27:04:18	8:10:03 PM	A	1	27142		8	18903		212	37238		24	11679
A	27:04:18	8:10:06 PM	A	1	27365		8	18741		212	37403		24	11694
A	27:04:18	8:10:09 PM	A	1	27289		8	18689		212	37148		24	11621
A	27:04:18	8:10:12 PM	A	1	27300		8	18405		212	37173		24	11637
A	27:04:18	8:10:15 PM	A	1	27148		8	18624		212	37121		24	11595
A	27:04:18	8:10:18 PM	A	1	27482		8	18650		212	36874		24	11549
A	27:04:18	8:10:21 PM	A	1	26983		8	18056		212	37293		24	11562
A	27:04:18	8:10:24 PM	A	1	27277		8	17933		212	37022		24	11476
A	27:04:18	8:10:27 PM	A	1	27357		8	17341		212	37181		24	11481

A	27:04:18	8:10:30 PM	A	1	27478		8	17895		212	36962		24	11458
A	27:04:18	8:10:33 PM	A	1	27443		8	17294		212	37065		24	11412
A	27:04:18	8:10:36 PM	A	1	27283		8	17126		212	37169		24	11371
A	27:04:18	8:10:39 PM	A	1	26946		8	16650		212	36965		24	11358
A	27:04:18	8:10:42 PM	A	1	27343		8	15996		212	37017		24	11308
A	27:04:18	8:10:45 PM	A	1	27453		8	16722		212	36878		24	11319
A	27:04:18	8:10:48 PM	A	1	27452		8	16520		212	36737		24	11281
A	27:04:18	8:10:51 PM	A	1	27637		8	16821		212	37127		24	11286
A	27:04:18	8:10:54 PM	A	1	27466		8	16823		212	36992		24	11209
A	27:04:18	8:10:57 PM	A	1	27451		8	16901		212	36789		24	11198
A	27:04:18	8:11:00 PM	A	1	27474		8	16511		212	36815		24	11190
A	27:04:18	8:11:03 PM	A	1	27394		8	16907		212	36859		24	11144
A	27:04:18	8:11:06 PM	A	1	27378		8	16196		212	36803		24	11105
A	27:04:18	8:11:09 PM	A	1	27749		8	16421		212	37061		24	11099
A	27:04:18	8:11:12 PM	A	1	27421		8	16415		212	36987		24	11072
A	27:04:18	8:11:15 PM	A	1	27510		8	16388		212	36590		24	11023
A	27:04:18	8:11:18 PM	A	1	27552		8	16369		212	36895		24	10998
A	27:04:18	8:11:21 PM	A	1	27493		8	15364		212	36819		24	10951
A	27:04:18	8:11:24 PM	A	1	27364		8	15737		212	36678		24	10950
A	27:04:18	8:11:27 PM	A	1	27437		8	15729		212	36634		24	10891
A	27:04:18	8:11:30 PM	A	1	27256		8	15772		212	36528		24	10901
A	27:04:18	8:11:33 PM	A	1	27554		8	15932		212	36587		24	10832
A	27:04:18	8:11:36 PM	A	1	27229		8	15433		212	36624		24	10800
A	27:04:18	8:11:39 PM	A	1	27213		8	16148		212	36655		24	10798
A	27:04:18	8:11:42 PM	A	1	27446		8	15038		212	36778		24	10758
A	27:04:18	8:11:45 PM	A	1	27440		8	15087		212	36655		24	10716
A	27:04:18	8:11:48 PM	A	1	27013		8	15105		212	36396		24	10667
A	27:04:18	8:11:51 PM	A	1	27364		8	14857		212	36455		24	10653
A	27:04:18	8:11:54 PM	A	1	27595		8	14879		212	36385		24	10622
A	27:04:18	8:11:57 PM	A	1	27392		8	15035		212	36445		24	10599
A	27:04:18	8:12:00 PM	A	1	27485		8	14709		212	36263		24	10546
A	27:04:18	8:12:03 PM	A	1	27556		8	15037		212	36690		24	10572
A	27:04:18	8:12:06 PM	A	1	27513		8	14935		212	36569		24	10500
A	27:04:18	8:12:09 PM	A	1	27420		8	14632		212	36591		24	10486
A	27:04:18	8:12:12 PM	A	1	27424		8	14954		212	36651		24	10428
A	27:04:18	8:12:15 PM	A	1	27724		8	14722		212	36599		24	10427
A	27:04:18	8:12:18 PM	A	1	27382		8	14996		212	36638		24	10381
A	27:04:18	8:12:21 PM	A	1	27370		8	14614		212	36392		24	10340
A	27:04:18	8:12:24 PM	A	1	27488		8	14619		212	36426		24	10353
A	27:04:18	8:12:27 PM	A	1	27488		8	14616		212	36665		24	10309
A	27:04:18	8:12:30 PM	A	1	27217		8	14470		212	36420		24	10244
A	27:04:18	8:12:33 PM	A	1	27511		8	14396		212	36276		24	10239

A	27:04:18	8:12:36 PM	A	1	27349		8	14132		212	36411		24	10239
A	27:04:18	8:12:39 PM	A	1	27313		8	14632		212	36217		24	10179
A	27:04:18	8:12:42 PM	A	1	27341		8	14659		212	36356		24	10159
A	27:04:18	8:12:45 PM	A	1	27427		8	14556		212	36423		24	10115
A	27:04:18	8:12:48 PM	A	1	27460		8	14569		212	36426		24	10120
A	27:04:18	8:12:51 PM	A	1	27382		8	14727		212	36146		24	10071
A	27:04:18	8:12:54 PM	A	1	27294		8	14826		212	36051		24	10039
A	27:04:18	8:12:57 PM	A	1	27465		8	15252		212	36168		24	10039
A	27:04:18	8:13:00 PM	A	1	27323		8	15168		212	36205		24	10007
A	27:04:18	8:13:03 PM	A	1	27413		8	15968		212	36220		24	10020
A	27:04:18	8:13:06 PM	A	1	27206		8	15194		212	36123		24	9999
A	27:04:18	8:13:09 PM	A	1	27501		8	15314		212	36408		24	9941
A	27:04:18	8:13:12 PM	A	1	27376		8	15492		212	36347		24	9948
A	27:04:18	8:13:15 PM	A	1	27320		8	15480		212	36278		24	9925
A	27:04:18	8:13:18 PM	A	1	27513		8	15596		212	36387		24	9888
A	27:04:18	8:13:21 PM	A	1	27419		8	15793		212	36193		24	9827
A	27:04:18	8:13:24 PM	A	1	27451		8	15808		212	35852		24	9833
A	27:04:18	8:13:27 PM	A	1	27227		8	15894		212	36205		24	9805
A	27:04:18	8:13:30 PM	A	1	27471		8	15997		212	35971		24	9811
A	27:04:18	8:13:33 PM	A	1	27353		8	16068		212	36159		24	9767
A	27:04:18	8:13:36 PM	A	1	27675		8	16389		212	36430		24	9724
A	27:04:18	8:13:39 PM	A	1	27492		8	16914		212	36282		24	9701
A	27:04:18	8:13:42 PM	A	1	27410		8	16955		212	36037		24	9683
A	27:04:18	8:13:45 PM	A	1	27431		8	17277		212	35964		24	9619
A	27:04:18	8:13:48 PM	A	1	27268		8	17311		212	35760		24	9595
A	27:04:18	8:13:51 PM	A	1	27364		8	17118		212	36156		24	9578
A	27:04:18	8:13:54 PM	A	1	27307		8	17493		212	36085		24	9569
A	27:04:18	8:13:57 PM	A	1	27352		8	17907		212	35992		24	9515
A	27:04:18	8:14:00 PM	A	1	27470		8	18348		212	35712		24	9469
A	27:04:18	8:14:03 PM	A	1	27426		8	18477		212	35953		24	9489
A	27:04:18	8:14:06 PM	A	1	27336		8	18389		212	35835		24	9454
A	27:04:18	8:14:09 PM	A	1	27422		8	19056		212	35891		24	9408
A	27:04:18	8:14:12 PM	A	1	27354		8	18834		212	36030		24	9373
A	27:04:18	8:14:15 PM	A	1	27436		8	19214		212	36064		24	9373
A	27:04:18	8:14:18 PM	A	1	27504		8	19662		212	36058		24	9328
A	27:04:18	8:14:21 PM	A	1	27290		8	19064		212	36035		24	9288
A	27:04:18	8:14:24 PM	A	1	27454		8	20416		212	35921		24	9288
A	27:04:18	8:14:27 PM	A	1	27156		8	20313		212	36093		24	9275
A	27:04:18	8:14:30 PM	A	1	27566		8	20301		212	36003		24	9226
A	27:04:18	8:14:33 PM	A	1	27227		8	20795		212	35938		24	9171
A	27:04:18	8:14:36 PM	A	1	27444		8	20525		212	35845		24	9176
A	27:04:18	8:14:39 PM	A	1	27268		8	21051		212	35793		24	9125

A	27:04:18	8:14:42 PM	A	1	27356		8	20713		212	35866		24	9093
A	27:04:18	8:14:45 PM	A	1	27242		8	20668		212	35950		24	9099
A	27:04:18	8:14:48 PM	A	1	27171		8	21043		212	35915		24	9009
A	27:04:18	8:14:51 PM	A	1	27436		8	21033		212	35631		24	8995
A	27:04:18	8:14:54 PM	A	1	27049		8	21793		212	35822		24	8939
A	27:04:18	8:14:57 PM	A	1	27371		8	21523		212	35850		24	8944
A	27:04:18	8:15:00 PM	A	1	27192		8	21489		212	35935		24	8908
A	27:04:18	8:15:03 PM	A	1	27423		8	21356		212	35915		24	8887
A	27:04:18	8:15:06 PM	A	1	27422		8	21496		212	35795		24	8822
A	27:04:18	8:15:09 PM	A	1	27315		8	21748		212	35633		24	8816
A	27:04:18	8:15:12 PM	A	1	27603		8	22042		212	35597		24	8792
A	27:04:18	8:15:15 PM	A	1	27241		8	22073		212	35637		24	8751
A	27:04:18	8:15:18 PM	A	1	27542		8	22666		212	35624		24	8711
A	27:04:18	8:15:21 PM	A	1	27396		8	22503		212	35459		24	8718
A	27:04:18	8:15:24 PM	A	1	27268		8	22898		212	35703		24	8615
A	27:04:18	8:15:27 PM	A	1	27279		8	22764		212	35343		24	8596
A	27:04:18	8:15:30 PM	A	1	27177		8	23567		212	35620		24	8581
A	27:04:18	8:15:33 PM	A	1	27483		8	23413		212	35773		24	8551
A	27:04:18	8:15:36 PM	A	1	27243		8	23155		212	35485		24	8515
A	27:04:18	8:15:39 PM	A	1	27638		8	23369		212	35544		24	8452
A	27:04:18	8:15:42 PM	A	1	27523		8	23400		212	35459		24	8423
A	27:04:18	8:15:45 PM	A	1	27868		8	23053		212	35385		24	8353
A	27:04:18	8:15:48 PM	A	1	27429		8	23561		212	35569		24	8350
A	27:04:18	8:15:51 PM	A	1	27353		8	23609		212	35668		24	8325
A	27:04:18	8:15:54 PM	A	1	27436		8	24088		212	35587		24	8303
A	27:04:18	8:15:57 PM	A	1	27168		8	24129		212	35520		24	8235
A	27:04:18	8:16:00 PM	A	1	27296		8	23620		212	35411		24	8208
A	27:04:18	8:16:03 PM	A	1	27589		8	24431		212	35612		24	8187
A	27:04:18	8:16:06 PM	A	1	27465		8	24174		212	35585		24	8159
A	27:04:18	8:16:09 PM	A	1	27299		8	24530		212	35219		24	8101
A	27:04:18	8:16:12 PM	A	1	27139		8	24611		212	34003		24	8067
A	27:04:18	8:16:15 PM	A	1	27347		8	24523		212	35456		24	8019
A	27:04:18	8:16:18 PM	A	1	27515		8	25214		212	33475		24	7992
A	27:04:18	8:16:21 PM	A	1	27487		8	25014		212	33417		24	7924
A	27:04:18	8:16:24 PM	A	1	27446		8	25215		212	33444		24	7920
A	27:04:18	8:16:27 PM	A	1	27489		8	25537		212	35216		24	7920
A	27:04:18	8:16:30 PM	A	1	27427		8	25330		212	33614		24	7853
A	27:04:18	8:16:33 PM	A	1	27485		8	25937		212	33326		24	7781
A	27:04:18	8:16:36 PM	A	1	27422		8	25886		212	33230		24	7737
A	27:04:18	8:16:39 PM	A	1	27269		8	25705		212	33121		24	7675
A	27:04:18	8:16:42 PM	A	1	27384		8	26361		212	32956		24	7653
A	27:04:18	8:16:45 PM	A	1	27456		8	25676		212	33409		24	7624

A	27:04:18	8:16:48 PM	A	1	27332		8	26464		212	33318		24	7603
A	27:04:18	8:16:51 PM	A	1	27417		8	26204		212	33444		24	7569
A	27:04:18	8:16:54 PM	A	1	27525		8	26203		212	33372		24	7509
A	27:04:18	8:16:57 PM	A	1	27743		8	26481		212	33108		24	7461
A	27:04:18	8:17:00 PM	A	1	27621		8	26490		212	32747		24	7437
A	27:04:18	8:17:03 PM	A	1	27525		8	26897		212	32753		24	7374
A	27:04:18	8:17:06 PM	A	1	27421		8	26790		212	32960		24	7370
A	27:04:18	8:17:09 PM	A	1	27266		8	26229		212	32747		24	7306
A	27:04:18	8:17:12 PM	A	1	27358		8	26627		212	32934		24	7265
A	27:04:18	8:17:15 PM	A	1	27303		8	26677		212	33326		24	7267
A	27:04:18	8:17:18 PM	A	1	27432		8	26826		212	33274		24	7204
A	27:04:18	8:17:21 PM	A	1	27300		8	26970		212	33061		24	7171
A	27:04:18	8:17:24 PM	A	1	27300		8	27250		212	33094		24	7148
A	27:04:18	8:17:27 PM	A	1	27421		8	26949		212	32775		24	7120
A	27:04:18	8:17:30 PM	A	1	27385		8	26870		212	33102		24	7024
A	27:04:18	8:17:33 PM	A	1	27353		8	26715		212	33047		24	7020
A	27:04:18	8:17:36 PM	A	1	27508		8	26605		212	32653		24	6984
A	27:04:18	8:17:39 PM	A	1	27428		8	26545		212	32916		24	6933
A	27:04:18	8:17:42 PM	A	1	27574		8	26866		212	33245		24	6886
A	27:04:18	8:17:45 PM	A	1	27436		8	26495		212	32922		24	6856
A	27:04:18	8:17:48 PM	A	1	27231		8	26213		212	33375		24	6833
A	27:04:18	8:17:51 PM	A	1	27322		8	26376		212	33246		24	6812
A	27:04:18	8:17:54 PM	A	1	27458		8	26514		212	33181		24	6762
A	27:04:18	8:17:57 PM	A	1	27511		8	26272		212	33198		24	6744
A	27:04:18	8:18:00 PM	A	1	27480		8	25713		212	33009		24	6718
A	27:04:18	8:18:03 PM	A	1	27401		8	25820		212	33212		24	6646
A	27:04:18	8:18:06 PM	A	1	27315		8	25659		212	32733		24	6653
A	27:04:18	8:18:09 PM	A	1	27548		8	25663		212	33076		24	6590
A	27:04:18	8:18:12 PM	A	1	26998		8	25304		212	33111		24	6575
A	27:04:18	8:18:15 PM	A	1	27157		8	25280		212	33093		24	6553
A	27:04:18	8:18:18 PM	A	1	27228		8	24705		212	32943		24	6478
A	27:04:18	8:18:21 PM	A	1	27233		8	24433		212	33145		24	6480
A	27:04:18	8:18:24 PM	A	1	27264		8	25014		212	33080		24	6417
A	27:04:18	8:18:27 PM	A	1	27368		8	24923		212	32672		24	6384
A	27:04:18	8:18:30 PM	A	1	27295		8	24583		212	32645		24	6350
A	27:04:18	8:18:33 PM	A	1	27462		8	24380		212	33020		24	6316
A	27:04:18	8:18:36 PM	A	1	27428		8	24390		212	33101		24	6280
A	27:04:18	8:18:39 PM	A	1	27298		8	24088		212	32450		24	6245
A	27:04:18	8:18:42 PM	A	1	27420		8	23953		212	32749		24	6248
A	27:04:18	8:18:45 PM	A	1	27318		8	23839		212	32518		24	6201
A	27:04:18	8:18:48 PM	A	1	27296		8	23783		212	32618		24	6191
A	27:04:18	8:18:51 PM	A	1	27459		8	23731		212	32477		24	6147

A	27:04:18	8:18:54 PM	A	1	27601		8	23664		212	32914		24	6114
A	27:04:18	8:18:57 PM	A	1	27381		8	23674		212	32981		24	6095
A	27:04:18	8:19:00 PM	A	1	27358		8	23193		212	32972		24	6050
A	27:04:18	8:19:03 PM	A	1	27313		8	23268		212	32789		24	5997
A	27:04:18	8:19:06 PM	A	1	27309		8	23364		212	32900		24	6000
A	27:04:18	8:19:09 PM	A	1	27585		8	23275		212	32752		24	5996
A	27:04:18	8:19:12 PM	A	1	27331		8	23416		212	32679		24	5920
A	27:04:18	8:19:15 PM	A	1	27438		8	22891		212	32956		24	5905
A	27:04:18	8:19:18 PM	A	1	27345		8	22893		212	32966		24	5880
A	27:04:18	8:19:21 PM	A	1	27325		8	22859		212	32741		24	5883
A	27:04:18	8:19:24 PM	A	1	27406		8	22882		212	32781		24	5816
A	27:04:18	8:19:27 PM	A	1	27447		8	22799		212	32690		24	5796
A	27:04:18	8:19:30 PM	A	1	27297		8	22715		212	32613		24	5796
A	27:04:18	8:19:33 PM	A	1	27268		8	22635		212	32596		24	5706
A	27:04:18	8:19:36 PM	A	1	27385		8	22831		212	32697		24	5711
A	27:04:18	8:19:39 PM	A	1	27350		8	22691		212	32784		24	5680
A	27:04:18	8:19:42 PM	A	1	27431		8	23104		212	32624		24	5642
A	27:04:18	8:19:45 PM	A	1	27359		8	22988		212	32149		24	5641
A	27:04:18	8:19:48 PM	A	1	27209		8	22864		212	32284		24	5563
A	27:04:18	8:19:51 PM	A	1	27368		8	22779		212	32392		24	5601
A	27:04:18	8:19:54 PM	A	1	27380		8	22846		212	32204		24	5582
A	27:04:18	8:19:57 PM	A	1	27420		8	22634		212	32606		24	5507
A	27:04:18	8:20:00 PM	A	1	27524		8	23182		212	32342		24	5473
A	27:04:18	8:20:03 PM	A	1	27390		8	22579		212	32295		24	5434
A	27:04:18	8:20:06 PM	A	1	27415		8	23533		212	32194		24	5430
A	27:04:18	8:20:09 PM	A	1	27320		8	22855		212	32095		24	5380
A	27:04:18	8:20:12 PM	A	1	27349		8	23006		212	32708		24	5385
A	27:04:18	8:20:15 PM	A	1	27359		8	23262		212	32534		24	5333
A	27:04:18	8:20:18 PM	A	1	27384		8	22677		212	32166		24	5317
A	27:04:18	8:20:21 PM	A	1	27505		8	22612		212	32164		24	5269
A	27:04:18	8:20:24 PM	A	1	27339		8	22728		212	31863		24	5255
A	27:04:18	8:20:27 PM	A	1	27601		8	22603		212	32547		24	5206
A	27:04:18	8:20:30 PM	A	1	27375		8	23279		212	32551		24	5162
A	27:04:18	8:20:33 PM	A	1	27469		8	22747		212	32425		24	5142
A	27:04:18	8:20:36 PM	A	1	27383		8	23103		212	32155		24	5133
A	27:04:18	8:20:39 PM	A	1	27509		8	23001		212	32487		24	5124
A	27:04:18	8:20:42 PM	A	1	27314		8	23172		212	32486		24	5052
A	27:04:18	8:20:45 PM	A	1	27270		8	23398		212	32276		24	5017
A	27:04:18	8:20:48 PM	A	1	27387		8	23332		212	32644		24	5006
A	27:04:18	8:20:51 PM	A	1	27506		8	23076		212	32110		24	4984
A	27:04:18	8:20:54 PM	A	1	27362		8	23150		212	32093		24	4909
A	27:04:18	8:20:57 PM	A	1	27306		8	22965		212	32582		24	4883

A	27:04:18	8:21:00 PM	A	1	27491		8	22993		212	32404		24	4858
A	27:04:18	8:21:03 PM	A	1	27587		8	22936		212	32509		24	4845
A	27:04:18	8:21:06 PM	A	1	27267		8	23413		212	32367		24	4809
A	27:04:18	8:21:09 PM	A	1	27444		8	22777		212	32031		24	4746
A	27:04:18	8:21:12 PM	A	1	27490		8	22830		212	32042		24	4727
A	27:04:18	8:21:15 PM	A	1	27396		8	22965		212	32002		24	4695
A	27:04:18	8:21:18 PM	A	1	27378		8	22848		212	31904		24	4689
A	27:04:18	8:21:21 PM	A	1	27679		8	22669		212	32308		24	4634
A	27:04:18	8:21:24 PM	A	1	27540		8	22462		212	32138		24	4637
A	27:04:18	8:21:27 PM	A	1	27280		8	22647		212	31931		24	4544
A	27:04:18	8:21:30 PM	A	1	27356		8	22825		212	31913		24	4539
A	27:04:18	8:21:33 PM	A	1	26875		8	21635		212	31617		24	4493
A	27:04:18	8:21:36 PM	A	1	27397		8	21279		212	31931		24	4496
A	27:04:18	8:21:39 PM	A	1	27491		8	21375		212	32229		24	4477
A	27:04:18	8:21:42 PM	A	1	27205		8	21983		212	32042		24	4459
A	27:04:18	8:21:45 PM	A	1	27450		8	21453		212	32252		24	4386
A	27:04:18	8:21:48 PM	A	1	27550		8	21860		212	32267		24	4390
A	27:04:18	8:21:51 PM	A	1	27444		8	22256		212	31791		24	4340
A	27:04:18	8:21:54 PM	A	1	27277		8	22062		212	32216		24	4287
A	27:04:18	8:21:57 PM	A	1	27340		8	21170		212	32047		24	4290
A	27:04:18	8:22:00 PM	A	1	27346		8	21507		212	32195		24	4262
A	27:04:18	8:22:03 PM	A	1	27303		8	21568		212	32094		24	4224
A	27:04:18	8:22:06 PM	A	1	27410		8	21490		212	32178		24	4193
A	27:04:18	8:22:09 PM	A	1	27441		8	21521		212	32159		24	4166
A	27:04:18	8:22:12 PM	A	1	27862		8	21592		212	32355		24	4171
A	27:04:18	8:22:15 PM	A	1	27371		8	21731		212	32055		24	4142
A	27:04:18	8:22:18 PM	A	1	27461		8	21473		212	32146		24	4072
A	27:04:18	8:22:21 PM	A	1	27583		8	21616		212	31714		24	4067
A	27:04:18	8:22:24 PM	A	1	27318		8	21540		212	31826		24	4018
A	27:04:18	8:22:27 PM	A	1	27557		8	21333		212	31488		24	3973
A	27:04:18	8:22:30 PM	A	1	27302		8	21316		212	31620		24	3954
A	27:04:18	8:22:33 PM	A	1	27493		8	21344		212	31609		24	3944
A	27:04:18	8:22:36 PM	A	1	27356		8	21124		212	32036		24	3905
A	27:04:18	8:22:39 PM	A	1	27406		8	20767		212	31893		24	3894
A	27:04:18	8:22:42 PM	A	1	27562		8	20902		212	32039		24	3842
A	27:04:18	8:22:45 PM	A	1	27276		8	20711		212	31971		24	3837
A	27:04:18	8:22:48 PM	A	1	27420		8	20441		212	31589		24	3799
A	27:04:18	8:22:51 PM	A	1	27479		8	20159		212	31900		24	3784
A	27:04:18	8:22:54 PM	A	1	27534		8	20041		212	31970		24	3750
A	27:04:18	8:22:57 PM	A	1	27461		8	19848		212	31450		24	3706
A	27:04:18	8:23:00 PM	A	1	27409		8	19636		212	31980		24	3692
A	27:04:18	8:23:03 PM	A	1	27452		8	19936		212	31978		24	3662

A	27:04:18	8:23:06 PM	A	1	27361		8	20949		212	31743		24	3630
A	27:04:18	8:23:09 PM	A	1	27531		8	19808		212	31709		24	3594
A	27:04:18	8:23:12 PM	A	1	27353		8	19281		212	31434		24	3558
A	27:04:18	8:23:15 PM	A	1	27437		8	19567		212	31951		24	3560
A	27:04:18	8:23:18 PM	A	1	27320		8	19738		212	31847		24	3517
A	27:04:18	8:23:21 PM	A	1	27315		8	19371		212	31917		24	3494
A	27:04:18	8:23:24 PM	A	1	27386		8	18800		212	31980		24	3457
A	27:04:18	8:23:27 PM	A	1	27364		8	18805		212	31762		24	3463
A	27:04:18	8:23:30 PM	A	1	27442		8	18629		212	31471		24	3422
A	27:04:18	8:23:33 PM	A	1	27485		8	18282		212	31695		24	3399
A	27:04:18	8:23:36 PM	A	1	27439		8	18421		212	31324		24	3357
A	27:04:18	8:23:39 PM	A	1	27439		8	18405		212	31345		24	3333
A	27:04:18	8:23:42 PM	A	1	27539		8	17749		212	31367		24	3296
A	27:04:18	8:23:45 PM	A	1	27461		8	17906		212	31916		24	3312
A	27:04:18	8:23:48 PM	A	1	27480		8	17680		212	31592		24	3257
A	27:04:18	8:23:51 PM	A	1	27442		8	17642		212	31384		24	3230
A	27:04:18	8:23:54 PM	A	1	27459		8	17377		212	31470		24	3221
A	27:04:18	8:23:57 PM	A	1	27379		8	17258		212	31688		24	3181
A	27:04:18	8:24:00 PM	A	1	27492		8	17378		212	31523		24	3165
A	27:04:18	8:24:03 PM	A	1	27378		8	16731		212	31614		24	3128
A	27:04:18	8:24:06 PM	A	1	27468		8	16819		212	31281		24	3087
A	27:04:18	8:24:09 PM	A	1	27558		8	16899		212	31787		24	3069
A	27:04:18	8:24:12 PM	A	1	27636		8	16454		212	31605		24	3047
A	27:04:18	8:24:15 PM	A	1	27414		8	16576		212	31541		24	3032
A	27:04:18	8:24:18 PM	A	1	27656		8	16413		212	31487		24	2988
A	27:04:18	8:24:21 PM	A	1	27335		8	15514		212	31226		24	2965
A	27:04:18	8:24:24 PM	A	1	27423		8	16292		212	31523		24	2937
A	27:04:18	8:24:27 PM	A	1	27293		8	15833		212	31540		24	2888
A	27:04:18	8:24:30 PM	A	1	27465		8	16289		212	31526		24	2857
A	27:04:18	8:24:33 PM	A	1	27414		8	15967		212	31083		24	2823
A	27:04:18	8:24:36 PM	A	1	27523		8	16005		212	31215		24	2833
A	27:04:18	8:24:39 PM	A	1	27401		8	15633		212	31165		24	2765
A	27:04:18	8:24:42 PM	A	1	27292		8	15615		212	31496		24	2737
A	27:04:18	8:24:45 PM	A	1	27456		8	15722		212	31185		24	2716
A	27:04:18	8:24:48 PM	A	1	27432		8	15255		212	31108		24	2695
A	27:04:18	8:24:51 PM	A	1	27514		8	15318		212	31470		24	2685
A	27:04:18	8:24:54 PM	A	1	27265		8	15481		212	31544		24	2616
A	27:04:18	8:24:57 PM	A	1	27406		8	15276		212	31631		24	2616
A	27:04:18	8:25:00 PM	A	1	27459		8	15300		212	31566		24	2562
A	27:04:18	8:25:03 PM	A	1	27377		8	15233		212	31387		24	2517
A	27:04:18	8:25:06 PM	A	1	27332		8	15067		212	31170		24	2494
A	27:04:18	8:25:09 PM	A	1	27585		8	14946		212	31089		24	2474

A	27:04:18	8:25:12 PM	A	1	27502		8	14867		212	31489		24	2429
A	27:04:18	8:25:15 PM	A	1	27644		8	14750		212	31090		24	2388
A	27:04:18	8:25:18 PM	A	1	27523		8	14696		212	31223		24	2373
A	27:04:18	8:25:21 PM	A	1	27375		8	14438		212	31232		24	2344
A	27:04:18	8:25:24 PM	A	1	27321		8	14784		212	31207		24	2356
A	27:04:18	8:25:27 PM	A	1	27392		8	14813		212	30990		24	2330
A	27:04:18	8:25:30 PM	A	1	27272		8	14719		212	31315		24	2273
A	27:04:18	8:25:33 PM	A	1	27361		8	14933		212	31309		24	2222
A	27:04:18	8:25:36 PM	A	1	27391		8	15192		212	31302		24	2224
A	27:04:18	8:25:39 PM	A	1	27342		8	14634		212	31128		24	2181
A	27:04:18	8:25:42 PM	A	1	27432		8	14274		212	31090		24	2114
A	27:04:18	8:25:45 PM	A	1	27360		8	14412		212	31090		24	2126
A	27:04:18	8:25:48 PM	A	1	27565		8	14519		212	30787		24	2100
A	27:04:18	8:25:51 PM	A	1	27277		8	14268		212	30763		24	2065
A	27:04:18	8:25:54 PM	A	1	27306		8	14287		212	31253		24	2045
A	27:04:18	8:25:57 PM	A	1	27540		8	14340		212	31278		24	1979
A	27:04:18	8:26:00 PM	A	1	27331		8	14334		212	31110		24	1960
A	27:04:18	8:26:03 PM	A	1	27366		8	14516		212	30985		24	1955
A	27:04:18	8:26:06 PM	A	1	27225		8	14277		212	30944		24	1904
A	27:04:18	8:26:09 PM	A	1	27492		8	14143		212	30907		24	1912
A	27:04:18	8:26:12 PM	A	1	27733		8	14045		212	31304		24	1837
A	27:04:18	8:26:15 PM	A	1	27430		8	13941		212	31059		24	1821
A	27:04:18	8:26:18 PM	A	1	27386		8	13524		212	31000		24	1785
A	27:04:18	8:26:21 PM	A	1	27337		8	13658		212	30838		24	1757
A	27:04:18	8:26:24 PM	A	1	27287		8	13734		212	30603		24	1710
A	27:04:18	8:26:27 PM	A	1	27326		8	13331		212	30819		24	1674
A	27:04:18	8:26:30 PM	A	1	27404		8	13446		212	30738		24	1670
A	27:04:18	8:26:33 PM	A	1	27413		8	13660		212	30801		24	1629
A	27:04:18	8:26:36 PM	A	1	27548		8	13725		212	31149		24	1578
A	27:04:18	8:26:39 PM	A	1	27245		8	13738		212	31063		24	1552
A	27:04:18	8:26:42 PM	A	1	27337		8	13423		212	30949		24	1527
A	27:04:18	8:26:45 PM	A	1	27475		8	13405		212	30974		24	1499
A	27:04:18	8:26:48 PM	A	1	27384		8	13301		212	30909		24	1457
A	27:04:18	8:26:51 PM	A	1	27337		8	13009		212	30888		24	1439
A	27:04:18	8:26:54 PM	A	1	27313		8	13074		212	30513		24	1373
A	27:04:18	8:26:57 PM	A	1	27167		8	13038		212	30399		24	1361
A	27:04:18	8:27:00 PM	A	1	27249		8	12788		212	30659		24	1318
A	27:04:18	8:27:03 PM	A	1	27354		8	13019		212	30296		24	1324
A	27:04:18	8:27:06 PM	A	1	27361		8	12664		212	30661		24	1260
A	27:04:18	8:27:09 PM	A	1	27453		8	12580		212	30758		24	1234
A	27:04:18	8:27:12 PM	A	1	27402		8	12546		212	30844		24	1212
A	27:04:18	8:27:15 PM	A	1	27336		8	12413		212	30774		24	1185

A	27:04:18	8:27:18 PM	A	1	27317		8	12307		212	30419		24	1121
A	27:04:18	8:27:21 PM	A	1	27366		8	12172		212	30367		24	1101
A	27:04:18	8:27:24 PM	A	1	27387		8	12145		212	30743		24	1083
A	27:04:18	8:27:27 PM	A	1	27459		8	12135		212	30758		24	1046
A	27:04:18	8:27:30 PM	A	1	27343		8	12337		212	30553		24	1036
A	27:04:18	8:27:33 PM	A	1	27436		8	12237		212	30544		24	987
A	27:04:18	8:27:36 PM	A	1	27813		8	12134		212	30773		24	938
A	27:04:18	8:27:39 PM	A	1	27429		8	12178		212	30768		24	896
A	27:04:18	8:27:42 PM	A	1	27529		8	12226		212	30888		24	901
A	27:04:18	8:27:45 PM	A	1	27420		8	12258		212	30412		24	840
A	27:04:18	8:27:48 PM	A	1	27349		8	12283		212	30265		24	809
A	27:04:18	8:27:51 PM	A	1	27442		8	12190		212	30254		24	776
A	27:04:18	8:27:54 PM	A	1	27294		8	12228		212	30251		24	717
A	27:04:18	8:27:57 PM	A	1	27398		8	12231		212	30229		24	676
A	27:04:18	8:28:00 PM	A	1	27486		8	12243		212	30739		24	682
A	27:04:18	8:28:03 PM	A	1	27372		8	12149		212	30290		24	642
A	27:04:18	8:28:06 PM	A	1	27402		8	12213		212	30282		24	585
A	27:04:18	8:28:09 PM	A	1	27413		8	12170		212	30274		24	599
A	27:04:18	8:28:12 PM	A	1	27463		8	12295		212	30470		24	543
A	27:04:18	8:28:15 PM	A	1	27476		8	12238		212	30564		24	514
A	27:04:18	8:28:18 PM	A	1	27497		8	12081		212	30498		24	482
A	27:04:18	8:28:21 PM	A	1	27420		8	11720		212	30650		24	461
A	27:04:18	8:28:24 PM	A	1	27533		8	11829		212	30574		24	417
A	27:04:18	8:28:27 PM	A	1	27285		8	11721		212	30436		24	343
A	27:04:18	8:28:30 PM	A	1	27490		8	11662		212	30170		24	351
A	27:04:18	8:28:33 PM	A	1	27461		8	11469		212	30491		24	331
A	27:04:18	8:28:36 PM	A	1	27386		8	11383		212	30670		24	287
A	27:04:18	8:28:39 PM	A	1	27420		8	10936		212	30521		24	274
A	27:04:18	8:28:42 PM	A	1	27447		8	10748		212	30106		24	263
A	27:04:18	8:28:45 PM	A	1	27459		8	10278		212	30570		24	222
A	27:04:18	8:28:48 PM	A	1	27421		8	10447		212	30371		24	168
A	27:04:18	8:28:51 PM	A	1	27543		8	10663		212	30488		24	179
A	27:04:18	8:28:54 PM	A	1	27468		8	10324		212	30554		24	170
A	27:04:18	8:28:57 PM	A	1	27294		8	10526		212	30534		24	76
A	27:04:18	8:29:00 PM	A	1	27242		8	9906		212	30436		24	57
A	27:04:18	8:29:03 PM	A	1	27353		8	9971		212	30093		24	47
A	27:04:18	8:29:06 PM	A	1	27509		8	9804		212	30530		24	32
A	27:04:18	8:29:09 PM	A	1	27459		8	9874		212	30396		23	65484
A	27:04:18	8:29:12 PM	A	1	27301		8	9731		212	30451		23	65499
A	27:04:18	8:29:15 PM	A	1	27448		8	9473		212	30010		23	65454
A	27:04:18	8:29:18 PM	A	1	27311		8	9504		212	29949		23	65443
A	27:04:18	8:29:21 PM	A	1	27513		8	9548		212	30448		23	65398

A	27:04:18	8:29:24 PM	A	1	27373		8	9113		212	30395		23	65377
A	27:04:18	8:29:27 PM	A	1	27316		8	9165		212	30399		23	65356
A	27:04:18	8:29:30 PM	A	1	27486		8	8815		212	30207		23	65364
A	27:04:18	8:29:33 PM	A	1	27391		8	8768		212	29989		23	65315
A	27:04:18	8:29:36 PM	A	1	27358		8	8837		212	29969		23	65281
A	27:04:18	8:29:39 PM	A	1	27529		8	8782		212	30288		23	65207
A	27:04:18	8:29:42 PM	A	1	27383		8	8882		212	30320		23	65208
A	27:04:18	8:29:45 PM	A	1	27420		8	9060		212	30014		23	65190
A	27:04:18	8:29:48 PM	A	1	27298		8	8619		212	30099		23	65154
A	27:04:18	8:29:51 PM	A	1	27348		8	8587		212	29998		23	65135
A	27:04:18	8:29:54 PM	A	1	27468		8	8577		212	29741		23	65095
A	27:04:18	8:29:57 PM	A	1	27392		8	8833		212	30065		23	65060
A	27:04:18	8:30:00 PM	A	1	27427		8	9044		212	30153		23	65031
A	27:04:18	8:30:03 PM	A	1	27427		8	8633		212	30058		23	65015
A	27:04:18	8:30:06 PM	A	1	27888		8	8669		212	30023		23	65005
A	27:04:18	8:30:09 PM	A	1	27448		8	8608		212	29826		23	64959
A	27:04:18	8:30:12 PM	A	1	27465		8	8723		212	30099		23	64920
A	27:04:18	8:30:15 PM	A	1	27302		8	8633		212	30008		23	64885
A	27:04:18	8:30:18 PM	A	1	27285		8	8659		212	30061		23	64855
A	27:04:18	8:30:21 PM	A	1	27478		8	8582		212	29722		23	64805
A	27:04:18	8:30:24 PM	A	1	27472		8	8788		212	29761		23	64836
A	27:04:18	8:30:27 PM	A	1	27469		8	8922		212	29735		23	64770
A	27:04:18	8:30:30 PM	A	1	27362		8	9134		212	29533		23	64716
A	27:04:18	8:30:33 PM	A	1	27416		8	8870		212	30044		23	64715
A	27:04:18	8:30:36 PM	A	1	27471		8	8853		212	29844		23	64675
A	27:04:18	8:30:39 PM	A	1	27511		8	8776		212	29928		23	64662
A	27:04:18	8:30:42 PM	A	1	27440		8	8256		212	29919		23	64615
A	27:04:18	8:30:45 PM	A	1	27397		8	8499		212	29490		23	64608
A	27:04:18	8:30:48 PM	A	1	27209		8	8631		212	29440		23	64559
A	27:04:18	8:30:51 PM	A	1	27519		8	8710		212	29531		23	64513
A	27:04:18	8:30:54 PM	A	1	27457		8	8645		212	29364		23	64499
A	27:04:18	8:30:57 PM	A	1	27374		8	8706		212	29308		23	64461
A	27:04:18	8:31:00 PM	A	1	27428		8	8632		212	29932		23	64439
A	27:04:18	8:31:03 PM	A	1	27592		8	8582		212	29804		23	64417
A	27:04:18	8:31:06 PM	A	1	27454		8	8547		212	29640		23	64363
A	27:04:18	8:31:09 PM	A	1	27467		8	8449		212	29500		23	64330
A	27:04:18	8:31:12 PM	A	1	27256		8	8445		212	29561		23	64332
A	27:04:18	8:31:15 PM	A	1	27439		8	8250		212	29607		23	64313
A	27:04:18	8:31:18 PM	A	1	27354		8	8202		212	29844		23	64290
A	27:04:18	8:31:21 PM	A	1	27508		8	7985		212	29666		23	64231
A	27:04:18	8:31:24 PM	A	1	27362		8	7933		212	29727		23	64194
A	27:04:18	8:31:27 PM	A	1	27212		8	7725		212	29380		23	64212

A	27:04:18	8:31:30 PM	A	1	27333		8	7775		212	29599		23	64118
A	27:04:18	8:31:33 PM	A	1	27347		8	7371		212	29323		23	64103
A	27:04:18	8:31:36 PM	A	1	27385		8	7332		212	29206		23	64052
A	27:04:18	8:31:39 PM	A	1	27333		8	6980		212	29281		23	64071
A	27:04:18	8:31:42 PM	A	1	27330		8	6744		212	29302		23	64013
A	27:04:18	8:31:45 PM	A	1	27418		8	6812		212	29368		23	64021
A	27:04:18	8:31:48 PM	A	1	27475		8	6250		212	29543		23	63971
A	27:04:18	8:31:51 PM	A	1	27324		8	5874		212	29456		23	63922
A	27:04:18	8:31:54 PM	A	1	27324		8	6409		212	29499		23	63909
A	27:04:18	8:31:57 PM	A	1	27628		8	5966		212	29263		23	63869
A	27:04:18	8:32:00 PM	A	1	27368		8	6141		212	29349		23	63855
A	27:04:18	8:32:03 PM	A	1	27403		8	5371		212	29309		23	63790
A	27:04:18	8:32:06 PM	A	1	27480		8	5103		212	29195		23	63807
A	27:04:18	8:32:09 PM	A	1	27360		8	5091		212	29099		23	63731
A	27:04:18	8:32:12 PM	A	1	27448		8	5169		212	29582		23	63740
A	27:04:18	8:32:15 PM	A	1	27478		8	5305		212	29635		23	63680
A	27:04:18	8:32:18 PM	A	1	27313		8	5002		212	29334		23	63673
A	27:04:18	8:32:21 PM	A	1	27378		8	4861		212	29575		23	63604
A	27:04:18	8:32:24 PM	A	1	27413		8	4821		212	29035		23	63618
A	27:04:18	8:32:27 PM	A	1	27339		8	4438		212	28953		23	63565
A	27:04:18	8:32:30 PM	A	1	27301		8	4479		212	29139		23	63525
A	27:04:18	8:32:33 PM	A	1	27267		8	4601		212	29164		23	63498
A	27:04:18	8:32:36 PM	A	1	27320		8	4619		212	28995		23	63453
A	27:04:18	8:32:39 PM	A	1	27440		8	4599		212	29173		23	63444
A	27:04:18	8:32:42 PM	A	1	27343		8	4482		212	29326		23	63412
A	27:04:18	8:32:45 PM	A	1	27427		8	4633		212	29322		23	63387
A	27:04:18	8:32:48 PM	A	1	27165		8	4447		212	29153		23	63368
A	27:04:18	8:32:51 PM	A	1	27437		8	4349		212	29256		23	63321
A	27:04:18	8:32:54 PM	A	1	27523		8	3637		212	29397		23	63284
A	27:04:18	8:32:57 PM	A	1	27538		8	3896		212	28932		23	63270
A	27:04:18	8:33:00 PM	A	1	27361		8	4358		212	28932		23	63253
A	27:04:18	8:33:03 PM	A	1	27432		8	4518		212	29407		23	63195
A	27:04:18	8:33:06 PM	A	1	27589		8	4581		212	29121		23	63186
A	27:04:18	8:33:09 PM	A	1	27516		8	4613		212	29272		23	63181
A	27:04:18	8:33:12 PM	A	1	27332		8	5228		212	29039		23	63104
A	27:04:18	8:33:15 PM	A	1	27587		8	5250		212	29169		23	63102
A	27:04:18	8:33:18 PM	A	1	27513		8	5635		212	29228		23	63060
A	27:04:18	8:33:21 PM	A	1	27699		8	5378		212	29159		23	63057
A	27:04:18	8:33:24 PM	A	1	27479		8	5337		212	29218		23	62974
A	27:04:18	8:33:27 PM	A	1	27420		8	5690		212	29266		23	62959
A	27:04:18	8:33:30 PM	A	1	27405		8	5626		212	28865		23	62943
A	27:04:18	8:33:33 PM	A	1	27373		8	5683		212	28894		23	62904

A	27:04:18	8:33:36 PM	A	1	27450		8	5766		212	28688		23	62883
A	27:04:18	8:33:39 PM	A	1	27484		8	6147		212	28683		23	62810
A	27:04:18	8:33:42 PM	A	1	27372		8	6568		212	28781		23	62801
A	27:04:18	8:33:45 PM	A	1	27336		8	6743		212	28868		23	62780
A	27:04:18	8:33:48 PM	A	1	27221		8	6840		212	28497		23	62722
A	27:04:18	8:33:51 PM	A	1	27533		8	7305		212	28623		23	62722
A	27:04:18	8:33:54 PM	A	1	27496		8	7039		212	28692		23	62708
A	27:04:18	8:33:57 PM	A	1	27313		8	7339		212	28610		23	62679
A	27:04:18	8:34:00 PM	A	1	27364		8	7531		212	29038		23	62603
A	27:04:18	8:34:03 PM	A	1	27641		8	7875		212	28962		23	62586
A	27:04:18	8:34:06 PM	A	1	27530		8	8555		212	28891		23	62550
A	27:04:18	8:34:09 PM	A	1	27425		8	8537		212	28818		23	62530
A	27:04:18	8:34:12 PM	A	1	27353		8	8787		212	28616		23	62501
A	27:04:18	8:34:15 PM	A	1	27333		8	9148		212	28649		23	62472
A	27:04:18	8:34:18 PM	A	1	27408		8	8958		212	28622		23	62440
A	27:04:18	8:34:21 PM	A	1	27424		8	9352		212	28690		23	62419
A	27:04:18	8:34:24 PM	A	1	27454		8	9287		212	28778		23	62385
A	27:04:18	8:34:27 PM	A	1	27403		8	10073		212	28629		23	62355
A	27:04:18	8:34:30 PM	A	1	27425		8	10494		212	28720		23	62310
A	27:04:18	8:34:33 PM	A	1	27381		8	10070		212	28562		23	62266
A	27:04:18	8:34:36 PM	A	1	27374		8	11036		212	28777		23	62244
A	27:04:18	8:34:39 PM	A	1	27324		8	10451		212	28634		23	62201
A	27:04:18	8:34:42 PM	A	1	27392		8	10839		212	28776		23	62180
A	27:04:18	8:34:45 PM	A	1	27417		8	11184		212	28517		23	62142
A	27:04:18	8:34:48 PM	A	1	27394		8	12123		212	28634		23	62114
A	27:04:18	8:34:51 PM	A	1	27454		8	11576		212	28531		23	62061
A	27:04:18	8:34:54 PM	A	1	27393		8	11706		212	28412		23	62042
A	27:04:18	8:34:57 PM	A	1	27404		8	12171		212	28824		23	61995
A	27:04:18	8:35:00 PM	A	1	27640		8	12657		212	28765		23	61965
A	27:04:18	8:35:03 PM	A	1	27542		8	12555		212	28660		23	61945
A	27:04:18	8:35:06 PM	A	1	27383		8	13116		212	28813		23	61893
A	27:04:18	8:35:09 PM	A	1	27430		8	12994		212	28775		23	61867
A	27:04:18	8:35:12 PM	A	1	27230		8	13343		212	28550		23	61847
A	27:04:18	8:35:15 PM	A	1	27553		8	13606		212	28451		23	61800
A	27:04:18	8:35:18 PM	A	1	27486		8	13512		212	28478		23	61770
A	27:04:18	8:35:21 PM	A	1	27503		8	13998		212	28778		23	61768
A	27:04:18	8:35:24 PM	A	1	27162		8	14133		212	28649		23	61652
A	27:04:18	8:35:27 PM	A	1	27532		8	13908		212	28674		23	61647
A	27:04:18	8:35:30 PM	A	1	27397		8	14437		212	28264		23	61667
A	27:04:18	8:35:33 PM	A	1	27527		8	14156		212	28447		23	61593
A	27:04:18	8:35:36 PM	A	1	27390		8	14146		212	28370		23	61549
A	27:04:18	8:35:39 PM	A	1	27223		8	14472		212	28705		23	61541

A	27:04:18	8:35:42 PM	A	1	27503		8	14118		212	28499		23	61481
A	27:04:18	8:35:45 PM	A	1	27360		8	14527		212	28583		23	61474
A	27:04:18	8:35:48 PM	A	1	27401		8	14260		212	28184		23	61383
A	27:04:18	8:35:51 PM	A	1	27480		8	14675		212	28286		23	61379
A	27:04:18	8:35:54 PM	A	1	27299		8	15006		212	28583		23	61353
A	27:04:18	8:35:57 PM	A	1	27437		8	14645		212	28614		23	61297
A	27:04:18	8:36:00 PM	A	1	27406		8	15270		212	28635		23	61260
A	27:04:18	8:36:03 PM	A	1	27472		8	15253		212	28243		23	61230
A	27:04:18	8:36:06 PM	A	1	27312		8	15367		212	28056		23	61210
A	27:04:18	8:36:09 PM	A	1	27406		8	15590		212	28258		23	61147
A	27:04:18	8:36:12 PM	A	1	27163		8	15542		212	28615		23	61123
A	27:04:18	8:36:15 PM	A	1	27372		8	16322		212	28319		23	61081
A	27:04:18	8:36:18 PM	A	1	27326		8	15990		212	28280		23	61046
A	27:04:18	8:36:21 PM	A	1	27473		8	16261		212	28175		23	61018
A	27:04:18	8:36:24 PM	A	1	27347		8	16580		212	28254		23	61002
A	27:04:18	8:36:27 PM	A	1	27420		8	16450		212	28066		23	60943
A	27:04:18	8:36:30 PM	A	1	27516		8	17014		212	28026		23	60889
A	27:04:18	8:36:33 PM	A	1	27259		8	17150		212	28083		23	60868
A	27:04:18	8:36:36 PM	A	1	27416		8	17037		212	27914		23	60852
A	27:04:18	8:36:39 PM	A	1	27493		8	17478		212	27746		23	60810
A	27:04:18	8:36:42 PM	A	1	27436		8	17601		212	28240		23	60791
A	27:04:18	8:36:45 PM	A	1	27406		8	18041		212	28252		23	60776
A	27:04:18	8:36:48 PM	A	1	27413		8	17899		212	28157		23	60745
A	27:04:18	8:36:51 PM	A	1	27351		8	18061		212	28286		23	60718
A	27:04:18	8:36:54 PM	A	1	27337		8	18574		212	28128		23	60680
A	27:04:18	8:36:57 PM	A	1	27431		8	17590		212	28144		23	60665
A	27:04:18	8:37:00 PM	A	1	27505		8	18072		212	28221		23	60638
A	27:04:18	8:37:03 PM	A	1	27394		8	18418		212	28134		23	60610
A	27:04:18	8:37:06 PM	A	1	27317		8	18137		212	28127		23	60558
A	27:04:18	8:37:09 PM	A	1	27381		8	18841		212	28123		23	60559
A	27:04:18	8:37:12 PM	A	1	27286		8	18819		212	27872		23	60531
A	27:04:18	8:37:15 PM	A	1	27328		8	19318		212	28012		23	60483
A	27:04:18	8:37:18 PM	A	1	27504		8	19455		212	28159		23	60440
A	27:04:18	8:37:21 PM	A	1	27459		8	19276		212	28199		23	60457
A	27:04:18	8:37:24 PM	A	1	27349		8	19399		212	27910		23	60423
A	27:04:18	8:37:27 PM	A	1	27481		8	19125		212	27825		23	60397
A	27:04:18	8:37:30 PM	A	1	27415		8	19430		212	27847		23	60394
A	27:04:18	8:37:33 PM	A	1	27307		8	19354		212	27747		23	60343
A	27:04:18	8:37:36 PM	A	1	27526		8	19287		212	28095		23	60303
A	27:04:18	8:37:39 PM	A	1	27550		8	19928		212	27839		23	60296
A	27:04:18	8:37:42 PM	A	1	27322		8	19842		212	28071		23	60259
A	27:04:18	8:37:45 PM	A	1	27549		8	19939		212	27769		23	60208

A	27:04:18	8:37:48 PM	A	1	27341		8	20102		212	27964		23	60190
A	27:04:18	8:37:51 PM	A	1	27249		8	19880		212	27753		23	60162
A	27:04:18	8:37:54 PM	A	1	27464		8	20325		212	27550		23	60109
A	27:04:18	8:37:57 PM	A	1	27561		8	20306		212	27490		23	60113
A	27:04:18	8:38:00 PM	A	1	27446		8	20271		212	27747		23	60034
A	27:04:18	8:38:03 PM	A	1	27464		8	20558		212	27881		23	60033
A	27:04:18	8:38:06 PM	A	1	27283		8	20242		212	27780		23	59990
A	27:04:18	8:38:09 PM	A	1	27472		8	20660		212	27764		23	59943
A	27:04:18	8:38:12 PM	A	1	27334		8	20440		212	27657		23	59938
A	27:04:18	8:38:15 PM	A	1	27378		8	20528		212	27712		23	59892
A	27:04:18	8:38:18 PM	A	1	27288		8	20520		212	27424		23	59842
A	27:04:18	8:38:21 PM	A	1	27610		8	20161		212	27842		23	59815
A	27:04:18	8:38:24 PM	A	1	27290		8	20225		212	27762		23	59781
A	27:04:18	8:38:27 PM	A	1	27413		8	19834		212	27387		23	59761
A	27:04:18	8:38:30 PM	A	1	27515		8	19592		212	27571		23	59700
A	27:04:18	8:38:33 PM	A	1	27379		8	19614		212	27339		23	59669
A	27:04:18	8:38:36 PM	A	1	27423		8	19651		212	27426		23	59646
A	27:04:18	8:38:39 PM	A	1	27368		8	19550		212	27557		23	59623
A	27:04:18	8:38:42 PM	A	1	27335		8	19709		212	27364		23	59571
A	27:04:18	8:38:45 PM	A	1	27436		8	19247		212	27564		23	59557
A	27:04:18	8:38:48 PM	A	1	27491		8	19266		212	27594		23	59549
A	27:04:18	8:38:51 PM	A	1	27431		8	18857		212	27504		23	59473
A	27:04:18	8:38:54 PM	A	1	27485		8	18984		212	27386		23	59458
A	27:04:18	8:38:57 PM	A	1	27377		8	18278		212	27371		23	59424
A	27:04:18	8:39:00 PM	A	1	27362		8	18012		212	27732		23	59395
A	27:04:18	8:39:03 PM	A	1	27284		8	17858		212	27486		23	59372
A	27:04:18	8:39:06 PM	A	1	27439		8	17664		212	27627		23	59324
A	27:04:18	8:39:09 PM	A	1	27004		8	17656		212	27347		23	59319
A	27:04:18	8:39:12 PM	A	1	27305		8	17410		212	27629		23	59259
A	27:04:18	8:39:15 PM	A	1	27515		8	17296		212	27440		23	59251
A	27:04:18	8:39:18 PM	A	1	27357		8	16812		212	27482		23	59224
A	27:04:18	8:39:21 PM	A	1	27410		8	16401		212	27229		23	59191
A	27:04:18	8:39:24 PM	A	1	27468		8	16346		212	27553		23	59163
A	27:04:18	8:39:27 PM	A	1	27495		8	16285		212	27505		23	59161
A	27:04:18	8:39:30 PM	A	1	27445		8	16066		212	27488		23	59075
A	27:04:18	8:39:33 PM	A	1	27304		8	16080		212	27209		23	59092
A	27:04:18	8:39:36 PM	A	1	27444		8	15567		212	27128		23	59064
A	27:04:18	8:39:39 PM	A	1	27307		8	15421		212	27058		23	59027
A	27:04:18	8:39:42 PM	A	1	27449		8	15070		212	27430		23	58998
A	27:04:18	8:39:45 PM	A	1	27398		8	15179		212	27249		23	58984
A	27:04:18	8:39:48 PM	A	1	27519		8	15194		212	27490		23	58968
A	27:04:18	8:39:51 PM	A	1	27514		8	14878		212	27008		23	58904

A	27:04:18	8:39:54 PM	A	1	27445		8	14785		212	27087		23	58895
A	27:04:18	8:39:57 PM	A	1	27363		8	14447		212	27304		23	58833
A	27:04:18	8:40:00 PM	A	1	27184		8	14370		212	27215		23	58823
A	27:04:18	8:40:03 PM	A	1	27514		8	13601		212	27266		23	58786
A	27:04:18	8:40:06 PM	A	1	27209		8	13213		212	27388		23	58757
A	27:04:18	8:40:09 PM	A	1	27277		8	13043		212	27163		23	58753
A	27:04:18	8:40:12 PM	A	1	27464		8	14185		212	27217		23	58751
A	27:04:18	8:40:15 PM	A	1	27393		8	12955		212	27144		23	58696
A	27:04:18	8:40:18 PM	A	1	27260		8	13042		212	27145		23	58636
A	27:04:18	8:40:21 PM	A	1	26975		8	12694		212	27205		23	58635
A	27:04:18	8:40:24 PM	A	1	27266		8	12654		212	27003		23	58611
A	27:04:18	8:40:27 PM	A	1	27385		8	12425		212	27127		23	58584
A	27:04:18	8:40:30 PM	A	1	27356		8	12544		212	26830		23	58518
A	27:04:18	8:40:33 PM	A	1	27459		8	12240		212	27331		23	58541
A	27:04:18	8:40:36 PM	A	1	27440		8	11884		212	27128		23	58471
A	27:04:18	8:40:39 PM	A	1	27338		8	11877		212	26964		23	58419
A	27:04:18	8:40:42 PM	A	1	27474		8	11398		212	26758		23	58411
A	27:04:18	8:40:45 PM	A	1	27473		8	11208		212	26798		23	58377
A	27:04:18	8:40:48 PM	A	1	27262		8	10704		212	26788		23	58367
A	27:04:18	8:40:51 PM	A	1	27306		8	10491		212	27116		23	58359
A	27:04:18	8:40:54 PM	A	1	27081		8	10808		212	27023		23	58316
A	27:04:18	8:40:57 PM	A	1	27551		8	10654		212	26647		23	58258
A	27:04:18	8:41:00 PM	A	1	27427		8	10582		212	26973		23	58250
A	27:04:18	8:41:03 PM	A	1	27470		8	10813		212	26858		23	58214
A	27:04:18	8:41:06 PM	A	1	27247		8	10343		212	26631		23	58193
A	27:04:18	8:41:09 PM	A	1	27494		8	10591		212	26685		23	58173
A	27:04:18	8:41:12 PM	A	1	27461		8	10645		212	26933		23	58104
A	27:04:18	8:41:15 PM	A	1	27171		8	10306		212	26839		23	58119
A	27:04:18	8:41:18 PM	A	1	27405		8	10144		212	26842		23	58072
A	27:04:18	8:41:21 PM	A	1	27641		8	9556		212	26662		23	58064
A	27:04:18	8:41:24 PM	A	1	27312		8	9716		212	26919		23	58003
A	27:04:18	8:41:27 PM	A	1	27383		8	9713		212	26947		23	57973
A	27:04:18	8:41:30 PM	A	1	27349		8	9335		212	26851		23	57966
A	27:04:18	8:41:33 PM	A	1	27214		8	9549		212	26717		23	57936
A	27:04:18	8:41:36 PM	A	1	27435		8	9439		212	26491		23	57916
A	27:04:18	8:41:39 PM	A	1	27445		8	9308		212	26653		23	57896
A	27:04:18	8:41:42 PM	A	1	27443		8	9095		212	26470		23	57851
A	27:04:18	8:41:45 PM	A	1	27359		8	9163		212	26710		23	57824
A	27:04:18	8:41:48 PM	A	1	27494		8	9121		212	26761		23	57791
A	27:04:18	8:41:51 PM	A	1	27314		8	9098		212	26734		23	57768
A	27:04:18	8:41:54 PM	A	1	27436		8	9175		212	26792		23	57748
A	27:04:18	8:41:57 PM	A	1	27395		8	8823		212	26554		23	57722

A	27:04:18	8:42:00 PM	A	1	27413		8	8832		212	26474		23	57679
A	27:04:18	8:42:03 PM	A	1	27451		8	8894		212	26782		23	57690
A	27:04:18	8:42:06 PM	A	1	27155		8	9105		212	26839		23	57631
A	27:04:18	8:42:09 PM	A	1	27261		8	9031		212	26699		23	57622
A	27:04:18	8:42:12 PM	A	1	27353		8	9190		212	26689		23	57596
A	27:04:18	8:42:15 PM	A	1	27007		8	9282		212	26572		23	57546
A	27:04:18	8:42:18 PM	A	1	27789		8	9391		212	26513		23	57546
A	27:04:18	8:42:21 PM	A	1	27453		8	9634		212	26378		23	57507
A	27:04:18	8:42:24 PM	A	1	27327		8	9517		212	26297		23	57448
A	27:04:18	8:42:27 PM	A	1	27432		8	9572		212	26334		23	57442
A	27:04:18	8:42:30 PM	A	1	27280		8	9728		212	26163		23	57403
A	27:04:18	8:42:33 PM	A	1	26985		8	9670		212	26204		23	57330
A	27:04:18	8:42:36 PM	A	1	27421		8	9976		212	26394		23	57358
A	27:04:18	8:42:39 PM	A	1	27615		8	10038		212	26443		23	57303
A	27:04:18	8:42:42 PM	A	1	27346		8	10043		212	26407		23	57290
A	27:04:18	8:42:45 PM	A	1	27293		8	9787		212	26348		23	57262
A	27:04:18	8:42:48 PM	A	1	27416		8	10008		212	26414		23	57210
A	27:04:18	8:42:51 PM	A	1	27315		8	9785		212	26190		23	57169
A	27:04:18	8:42:54 PM	A	1	27321		8	9888		212	26027		23	57150
A	27:04:18	8:42:57 PM	A	1	27512		8	9908		212	26106		23	57130
A	27:04:18	8:43:00 PM	A	1	27623		8	10199		212	26189		23	57083
A	27:04:18	8:43:03 PM	A	1	27406		8	10247		212	26163		23	57103
A	27:04:18	8:43:06 PM	A	1	27548		8	10257		212	24422		23	57055
A	27:04:18	8:43:09 PM	A	1	27349		8	10430		212	26236		23	56998
A	27:04:18	8:43:12 PM	A	1	27350		8	10184		212	26069		23	56989
A	27:04:18	8:43:15 PM	A	1	27496		8	10560		212	26083		23	56941
A	27:04:18	8:43:18 PM	A	1	27389		8	10643		212	25994		23	56945
A	27:04:18	8:43:21 PM	A	1	27423		8	10531		212	25951		23	56907
A	27:04:18	8:43:24 PM	A	1	27422		8	10518		212	24468		23	56855
A	27:04:18	8:43:27 PM	A	1	27444		8	10470		212	26211		23	56831
A	27:04:18	8:43:30 PM	A	1	27438		8	10380		212	24046		23	56779
A	27:04:18	8:43:33 PM	A	1	27465		8	10228		212	24396		23	56795
A	27:04:18	8:43:36 PM	A	1	27287		8	10525		212	26015		23	56722
A	27:04:18	8:43:39 PM	A	1	27325		8	10570		212	26115		23	56718
A	27:04:18	8:43:42 PM	A	1	27501		8	10641		212	24382		23	56695
A	27:04:18	8:43:45 PM	A	1	27542		8	10592		212	24250		23	56638
A	27:04:18	8:43:48 PM	A	1	27435		8	10646		212	24521		23	56618
A	27:04:18	8:43:51 PM	A	1	27460		8	10549		212	24395		23	56596
A	27:04:18	8:43:54 PM	A	1	27427		8	10385		212	24289		23	56549
A	27:04:18	8:43:57 PM	A	1	27370		8	10505		212	24305		23	56560
A	27:04:18	8:44:00 PM	A	1	27471		8	10220		212	23991		23	56511
A	27:04:18	8:44:03 PM	A	1	27354		8	10142		212	23717		23	56496

A	27:04:18	8:44:06 PM	A	1	27428		8	10172		212	23616		23	56413
A	27:04:18	8:44:09 PM	A	1	27580		8	10144		212	23790		23	56369
A	27:04:18	8:44:12 PM	A	1	27447		8	10435		212	24173		23	56387
A	27:04:18	8:44:15 PM	A	1	27364		8	10297		212	24170		23	56361
A	27:04:18	8:44:18 PM	A	1	27467		8	10079		212	24199		23	56304
A	27:04:18	8:44:21 PM	A	1	27429		8	9921		212	23753		23	56280
A	27:04:18	8:44:24 PM	A	1	27474		8	9739		212	24260		23	56231
A	27:04:18	8:44:27 PM	A	1	27503		8	9755		212	24246		23	56193
A	27:04:18	8:44:30 PM	A	1	27477		8	9684		212	24054		23	56191
A	27:04:18	8:44:33 PM	A	1	27445		8	9727		212	23799		23	56131
A	27:04:18	8:44:36 PM	A	1	27461		8	9682		212	23543		23	56128
A	27:04:18	8:44:39 PM	A	1	27291		8	9647		212	23564		23	56053
A	27:04:18	8:44:42 PM	A	1	27272		8	9424		212	23923		23	56018
A	27:04:18	8:44:45 PM	A	1	27342		8	9476		212	23970		23	56003
A	27:04:18	8:44:48 PM	A	1	27421		8	9336		212	24078		23	55926
A	27:04:18	8:44:51 PM	A	1	27374		8	9317		212	24171		23	55919
A	27:04:18	8:44:54 PM	A	1	27431		8	9200		212	23703		23	55879
A	27:04:18	8:44:57 PM	A	1	27442		8	9021		212	23512		23	55876
A	27:04:18	8:45:00 PM	A	1	27459		8	9047		212	23745		23	55786
A	27:04:18	8:45:03 PM	A	1	27315		8	8941		212	23768		23	55770
A	27:04:18	8:45:06 PM	A	1	27267		8	9043		212	24116		23	55752
A	27:04:18	8:45:09 PM	A	1	27314		8	8613		212	24089		23	55689
A	27:04:18	8:45:12 PM	A	1	27472		8	8645		212	24117		23	55620
A	27:04:18	8:45:15 PM	A	1	27369		8	8456		212	23983		23	55596
A	27:04:18	8:45:18 PM	A	1	27471		8	8655		212	23963		23	55566
A	27:04:18	8:45:21 PM	A	1	27428		8	8493		212	24080		23	55548
A	27:04:18	8:45:24 PM	A	1	27556		8	8672		212	24019		23	55518
A	27:04:18	8:45:27 PM	A	1	27409		8	8572		212	23551		23	55486
A	27:04:18	8:45:30 PM	A	1	27351		8	8829		212	23497		23	55451
A	27:04:18	8:45:33 PM	A	1	27450		8	9095		212	23636		23	55422
A	27:04:18	8:45:36 PM	A	1	27421		8	8997		212	23455		23	55379
A	27:04:18	8:45:39 PM	A	1	27523		8	9032		212	23812		23	55364
A	27:04:18	8:45:42 PM	A	1	27379		8	9193		212	23760		23	55308
A	27:04:18	8:45:45 PM	A	1	27431		8	9194		212	24013		23	55325
A	27:04:18	8:45:48 PM	A	1	27541		8	9131		212	24058		23	55262
A	27:04:18	8:45:51 PM	A	1	27439		8	9311		212	23583		23	55236
A	27:04:18	8:45:54 PM	A	1	27430		8	9264		212	23456		23	55186
A	27:04:18	8:45:57 PM	A	1	27435		8	9367		212	23644		23	55177
A	27:04:18	8:46:00 PM	A	1	27417		8	9334		212	23350		23	55124
A	27:04:18	8:46:03 PM	A	1	27464		8	9313		212	23498		23	55099
A	27:04:18	8:46:06 PM	A	1	27453		8	9199		212	23530		23	55072
A	27:04:18	8:46:09 PM	A	1	27407		8	9012		212	23425		23	55034

A	27:04:18	8:46:12 PM	A	1	27430		8	9207		212	23818		23	55031
A	27:04:18	8:46:15 PM	A	1	27513		8	9297		212	23936		23	55010
A	27:04:18	8:46:18 PM	A	1	27396		8	9308		212	23504		23	54911
A	27:04:18	8:46:21 PM	A	1	27409		8	9133		212	23239		23	54915
A	27:04:18	8:46:24 PM	A	1	27295		8	9477		212	23413		23	54880
A	27:04:18	8:46:27 PM	A	1	27453		8	9557		212	24022		23	54874
A	27:04:18	8:46:30 PM	A	1	27365		8	9378		212	23946		23	54845
A	27:04:18	8:46:33 PM	A	1	27401		8	9458		212	23813		23	54826
A	27:04:18	8:46:36 PM	A	1	27426		8	9540		212	23617		23	54796
A	27:04:18	8:46:39 PM	A	1	27676		8	9332		212	23481		23	54754
A	27:04:18	8:46:42 PM	A	1	27404		8	9410		212	23710		23	54686
A	27:04:18	8:46:45 PM	A	1	27372		8	9650		212	23609		23	54687
A	27:04:18	8:46:48 PM	A	1	27224		8	9762		212	23370		23	54663
A	27:04:18	8:46:51 PM	A	1	27361		8	9859		212	23403		23	54647
A	27:04:18	8:46:54 PM	A	1	27335		8	9946		212	23190		23	54605
A	27:04:18	8:46:57 PM	A	1	27375		8	10201		212	23258		23	54533
A	27:04:18	8:47:00 PM	A	1	27366		8	10180		212	23193		23	54526
A	27:04:18	8:47:03 PM	A	1	27257		8	10178		212	23177		23	54507
A	27:04:18	8:47:06 PM	A	1	27405		8	10063		212	23701		23	54485
A	27:04:18	8:47:09 PM	A	1	27459		8	10257		212	23661		23	54432
A	27:04:18	8:47:12 PM	A	1	27406		8	10053		212	23273		23	54397
A	27:04:18	8:47:15 PM	A	1	27395		8	9813		212	23269		23	54375
A	27:04:18	8:47:18 PM	A	1	27511		8	10231		212	23466		23	54338
A	27:04:18	8:47:21 PM	A	1	27322		8	10549		212	23407		23	54316
A	27:04:18	8:47:24 PM	A	1	27387		8	10828		212	23566		23	54313
A	27:04:18	8:47:27 PM	A	1	27275		8	10860		212	23034		23	54286
A	27:04:18	8:47:30 PM	A	1	27451		8	10699		212	23729		23	54197
A	27:04:18	8:47:33 PM	A	1	27470		8	10774		212	23491		23	54225
A	27:04:18	8:47:36 PM	A	1	27508		8	10804		212	23383		23	54168
A	27:04:18	8:47:39 PM	A	1	27269		8	10194		212	23480		23	54130
A	27:04:18	8:47:42 PM	A	1	27310		8	10254		212	23414		23	54096
A	27:04:18	8:47:45 PM	A	1	27502		8	10408		212	23036		23	54093
A	27:04:18	8:47:48 PM	A	1	27458		8	10932		212	23548		23	54040
A	27:04:18	8:47:51 PM	A	1	27413		8	10949		212	23388		23	53994
A	27:04:18	8:47:54 PM	A	1	27383		8	11320		212	23038		23	53984
A	27:04:18	8:47:57 PM	A	1	27317		8	11648		212	23530		23	53929
A	27:04:18	8:48:00 PM	A	1	27344		8	11113		212	23522		23	53897
A	27:04:18	8:48:03 PM	A	1	27384		8	11060		212	23478		23	53905
A	27:04:18	8:48:06 PM	A	1	27369		8	11334		212	23037		23	53881
A	27:04:18	8:48:09 PM	A	1	27466		8	11344		212	23198		23	53817
A	27:04:18	8:48:12 PM	A	1	27444		8	11554		212	23099		23	53790
A	27:04:18	8:48:15 PM	A	1	27370		8	11349		212	23600		23	53775

A	27:04:18	8:48:18 PM	A	1	27567		8	11348		212	23287		23	53734
A	27:04:18	8:48:21 PM	A	1	27339		8	11385		212	23061		23	53716
A	27:04:18	8:48:24 PM	A	1	27377		8	11082		212	23397		23	53704
A	27:04:18	8:48:27 PM	A	1	27415		8	11243		212	23498		23	53661
A	27:04:18	8:48:30 PM	A	1	27401		8	11241		212	23466		23	53622
A	27:04:18	8:48:33 PM	A	1	27451		8	11439		212	22934		23	53550
A	27:04:18	8:48:36 PM	A	1	27457		8	11156		212	23506		23	53546
A	27:04:18	8:48:39 PM	A	1	27389		8	10874		212	23242		23	53493
A	27:04:18	8:48:42 PM	A	1	27371		8	10558		212	23439		23	53491
A	27:04:18	8:48:45 PM	A	1	27322		8	10199		212	23127		23	53450
A	27:04:18	8:48:48 PM	A	1	27384		8	10420		212	22971		23	53399
A	27:04:18	8:48:51 PM	A	1	27540		8	11035		212	23330		23	53357
A	27:04:18	8:48:54 PM	A	1	27415		8	10779		212	23138		23	53348
A	27:04:18	8:48:57 PM	A	1	27388		8	10852		212	23047		23	53282
A	27:04:18	8:49:00 PM	A	1	27401		8	10659		212	23294		23	53285
A	27:04:18	8:49:03 PM	A	1	27430		8	10428		212	22916		23	53201
A	27:04:18	8:49:06 PM	A	1	27560		8	10368		212	22804		23	53195
A	27:04:18	8:49:09 PM	A	1	27340		8	10261		212	22847		23	53153
A	27:04:18	8:49:12 PM	A	1	27508		8	10247		212	23028		23	53112
A	27:04:18	8:49:15 PM	A	1	27361		8	10282		212	22800		23	53119
A	27:04:18	8:49:18 PM	A	1	27295		8	9912		212	22901		23	53018
A	27:04:18	8:49:21 PM	A	1	27421		8	9874		212	22968		23	52997
A	27:04:18	8:49:24 PM	A	1	27397		8	9941		212	23382		23	52970
A	27:04:18	8:49:27 PM	A	1	27358		8	9856		212	23187		23	52971
A	27:04:18	8:49:30 PM	A	1	27456		8	9722		212	23322		23	52912
A	27:04:18	8:49:33 PM	A	1	27307		8	9676		212	23111		23	52866
A	27:04:18	8:49:36 PM	A	1	27474		8	10448		212	23052		23	52846
A	27:04:18	8:49:39 PM	A	1	27406		8	9533		212	22561		23	52755
A	27:04:18	8:49:42 PM	A	1	27353		8	9081		212	22757		23	52761
A	27:04:18	8:49:45 PM	A	1	27518		8	8580		212	22907		23	52734
A	27:04:18	8:49:48 PM	A	1	27420		8	8478		212	23067		23	52681
A	27:04:18	8:49:51 PM	A	1	27353		8	8058		212	22725		23	52646
A	27:04:18	8:49:54 PM	A	1	27373		8	7727		212	22561		23	52634
A	27:04:18	8:49:57 PM	A	1	27295		8	7267		212	22674		23	52580
A	27:04:18	8:50:00 PM	A	1	27436		8	6894		212	23146		23	52532
A	27:04:18	8:50:03 PM	A	1	27407		8	6669		212	23038		23	52520
A	27:04:18	8:50:06 PM	A	1	27470		8	5699		212	22739		23	52475
A	27:04:18	8:50:09 PM	A	1	27145		8	5674		212	23015		23	52440
A	27:04:18	8:50:12 PM	A	1	27463		8	5149		212	22657		23	52393
A	27:04:18	8:50:15 PM	A	1	27389		8	4375		212	22500		23	52393
A	27:04:18	8:50:18 PM	A	1	27504		8	4592		212	22658		23	52323
A	27:04:18	8:50:21 PM	A	1	27161		8	3146		212	22548		23	52302

A	27:04:18	8:50:24 PM	A	1	27387		8	3155		212	22668		23	52280
A	27:04:18	8:50:27 PM	A	1	27447		8	2442		212	22544		23	52209
A	27:04:18	8:50:30 PM	A	1	27431		8	1712		212	22529		23	52194
A	27:04:18	8:50:33 PM	A	1	27328		8	2000		212	22937		23	52147
A	27:04:18	8:50:36 PM	A	1	27369		8	769		212	23045		23	52104
A	27:04:18	8:50:39 PM	A	1	27389		8	1059		212	22497		23	52078
A	27:04:18	8:50:42 PM	A	1	27422		7	65403		212	22362		23	52027
A	27:04:18	8:50:45 PM	A	1	27356		7	64606		212	22453		23	52018
A	27:04:18	8:50:48 PM	A	1	27393		7	64702		212	22917		23	52004
A	27:04:18	8:50:51 PM	A	1	27327		7	63036		212	22658		23	51984
A	27:04:18	8:50:54 PM	A	1	27512		7	63454		212	22596		23	51931
A	27:04:18	8:50:57 PM	A	1	27495		7	63370		212	22728		23	51892
A	27:04:18	8:51:00 PM	A	1	27387		7	62930		212	22950		23	51873
A	27:04:18	8:51:03 PM	A	1	27451		7	63156		212	22699		23	51801
A	27:04:18	8:51:06 PM	A	1	27416		7	62308		212	22866		23	51809
A	27:04:18	8:51:09 PM	A	1	27346		7	62005		212	22328		23	51782
A	27:04:18	8:51:12 PM	A	1	27236		7	61552		212	22249		23	51766
A	27:04:18	8:51:15 PM	A	1	27396		7	60499		212	22489		23	51701
A	27:04:18	8:51:18 PM	A	1	27360		7	60891		212	22100		23	51675
A	27:04:18	8:51:21 PM	A	1	27239		7	60473		212	22330		23	51701
A	27:04:18	8:51:24 PM	A	1	27518		7	60094		212	22297		23	51612
A	27:04:18	8:51:27 PM	A	1	27488		7	60449		212	22273		23	51562
A	27:04:18	8:51:30 PM	A	1	27454		7	59504		212	22204		23	51555
A	27:04:18	8:51:33 PM	A	1	27464		7	60053		212	22135		23	51555
A	27:04:18	8:51:36 PM	A	1	27508		7	59253		212	22285		23	51530
A	27:04:18	8:51:39 PM	A	1	27161		7	59015		212	22116		23	51480
A	27:04:18	8:51:42 PM	A	1	27389		7	59233		212	22606		23	51484
A	27:04:18	8:51:45 PM	A	1	27121		7	58428		212	22579		23	51410
A	27:04:18	8:51:48 PM	A	1	27427		7	59079		212	22363		23	51404
A	27:04:18	8:51:51 PM	A	1	27375		7	58514		212	22699		23	51365
A	27:04:18	8:51:54 PM	A	1	27402		7	58276		212	22468		23	51346
A	27:04:18	8:51:57 PM	A	1	27487		7	58472		212	22557		23	51294
A	27:04:18	8:52:00 PM	A	1	27433		7	58040		212	22550		23	51270
A	27:04:18	8:52:03 PM	A	1	27344		7	58255		212	22102		23	51257
A	27:04:18	8:52:06 PM	A	1	27562		7	57825		212	22417		23	51218
A	27:04:18	8:52:09 PM	A	1	27609		7	57289		212	22396		23	51161
A	27:04:18	8:52:12 PM	A	1	27400		7	57506		212	22288		23	51168
A	27:04:18	8:52:15 PM	A	1	27473		7	56884		212	22055		23	51140
A	27:04:18	8:52:18 PM	A	1	27530		7	56579		212	22169		23	51096
A	27:04:18	8:52:21 PM	A	1	27411		7	56369		212	22278		23	51053
A	27:04:18	8:52:24 PM	A	1	27402		7	55728		212	22137		23	51017
A	27:04:18	8:52:27 PM	A	1	27543		7	56356		212	22011		23	50974

A	27:04:18	8:52:30 PM	A	1	27338		7	55078		212	22461		23	50925
A	27:04:18	8:52:33 PM	A	1	27453		7	54783		212	22442		23	50936
A	27:04:18	8:52:36 PM	A	1	27421		7	54551		212	22447		23	50884
A	27:04:18	8:52:39 PM	A	1	27280		7	53892		212	22014		23	50852
A	27:04:18	8:52:42 PM	A	1	27386		7	54014		212	22060		23	50847
A	27:04:18	8:52:45 PM	A	1	27385		7	52996		212	22322		23	50787
A	27:04:18	8:52:48 PM	A	1	27382		7	52885		212	22291		23	50751
A	27:04:18	8:52:51 PM	A	1	27257		7	53194		212	22427		23	50728
A	27:04:18	8:52:54 PM	A	1	27445		7	52141		212	22239		23	50694
A	27:04:18	8:52:57 PM	A	1	27430		7	52579		212	21940		23	50650
A	27:04:18	8:53:00 PM	A	1	27278		7	51694		212	21881		23	50670
A	27:04:18	8:53:03 PM	A	1	27458		7	51381		212	21936		23	50586
A	27:04:18	8:53:06 PM	A	1	27510		7	51588		212	22289		23	50558
A	27:04:18	8:53:09 PM	A	1	27685		7	50100		212	22018		23	50522
A	27:04:18	8:53:12 PM	A	1	27413		7	50636		212	21963		23	50504
A	27:04:18	8:53:15 PM	A	1	27435		7	49997		212	21931		23	50463
A	27:04:18	8:53:18 PM	A	1	27285		7	49870		212	21861		23	50425
A	27:04:18	8:53:21 PM	A	1	27312		7	50318		212	22101		23	50386
A	27:04:18	8:53:24 PM	A	1	27438		7	49515		212	22052		23	50361
A	27:04:18	8:53:27 PM	A	1	27323		7	49720		212	22140		23	50339
A	27:04:18	8:53:30 PM	A	1	27510		7	49102		212	21842		23	50282
A	27:04:18	8:53:33 PM	A	1	27336		7	49101		212	21907		23	50268
A	27:04:18	8:53:36 PM	A	1	27586		7	49415		212	21929		23	50227
A	27:04:18	8:53:39 PM	A	1	27421		7	48759		212	21737		23	50198
A	27:04:18	8:53:42 PM	A	1	27473		7	48958		212	21674		23	50162
A	27:04:18	8:53:45 PM	A	1	27244		7	48430		212	22253		23	50127
A	27:04:18	8:53:48 PM	A	1	27337		7	48062		212	21960		23	50080
A	27:04:18	8:53:51 PM	A	1	27336		7	48591		212	21853		23	50059
A	27:04:18	8:53:54 PM	A	1	27421		7	48577		212	22088		23	49988
A	27:04:18	8:53:57 PM	A	1	27345		7	48011		212	22029		23	50000
A	27:04:18	8:54:00 PM	A	1	27330		7	47932		212	21648		23	49959
A	27:04:18	8:54:03 PM	A	1	27444		7	47421		212	21621		23	49924
A	27:04:18	8:54:06 PM	A	1	27483		7	47813		212	22119		23	49883
A	27:04:18	8:54:09 PM	A	1	27354		7	47189		212	21842		23	49826
A	27:04:18	8:54:12 PM	A	1	27455		7	47239		212	21673		23	49821
A	27:04:18	8:54:15 PM	A	1	27362		7	47432		212	21689		23	49799
A	27:04:18	8:54:18 PM	A	1	27384		7	46996		212	21333		23	49759
A	27:04:18	8:54:21 PM	A	1	27528		7	47132		212	22169		23	49704
A	27:04:18	8:54:24 PM	A	1	27462		7	46740		212	21911		23	49702
A	27:04:18	8:54:27 PM	A	1	27424		7	46724		212	21870		23	49672
A	27:04:18	8:54:30 PM	A	1	27368		7	46755		212	21873		23	49654
A	27:04:18	8:54:33 PM	A	1	27498		7	46433		212	21763		23	49598

A	27:04:18	8:54:36 PM	A	1	27482		7	46788		212	21711		23	49585
A	27:04:18	8:54:39 PM	A	1	27332		7	46505		212	21600		23	49514
A	27:04:18	8:54:42 PM	A	1	27585		7	46127		212	22001		23	49485
A	27:04:18	8:54:45 PM	A	1	27404		7	46452		212	21885		23	49459
A	27:04:18	8:54:48 PM	A	1	27354		7	45815		212	21616		23	49427
A	27:04:18	8:54:51 PM	A	1	27406		7	45918		212	21575		23	49380
A	27:04:18	8:54:54 PM	A	1	27370		7	45798		212	21552		23	49359
A	27:04:18	8:54:57 PM	A	1	27415		7	45615		212	21528		23	49350
A	27:04:18	8:55:00 PM	A	1	27486		7	46305		212	21483		23	49294
A	27:04:18	8:55:03 PM	A	1	27388		7	45370		212	21494		23	49281
A	27:04:18	8:55:06 PM	A	1	27403		7	45274		212	21954		23	49229
A	27:04:18	8:55:09 PM	A	1	27510		7	45410		212	21690		23	49224
A	27:04:18	8:55:12 PM	A	1	27501		7	45171		212	21901		23	49173
A	27:04:18	8:55:15 PM	A	1	27411		7	45409		212	21488		23	49154
A	27:04:18	8:55:18 PM	A	1	27261		7	44941		212	21388		23	49147
A	27:04:18	8:55:21 PM	A	1	27339		7	44878		212	21677		23	49097
A	27:04:18	8:55:24 PM	A	1	27344		7	44672		212	21613		23	49045
A	27:04:18	8:55:27 PM	A	1	27323		7	44940		212	21404		23	49025
A	27:04:18	8:55:30 PM	A	1	27379		7	45339		212	21197		23	48998
A	27:04:18	8:55:33 PM	A	1	27400		7	45299		212	21431		23	48997
A	27:04:18	8:55:36 PM	A	1	27377		7	45647		212	21810		23	48963
A	27:04:18	8:55:39 PM	A	1	27432		7	45606		212	21644		23	48908
A	27:04:18	8:55:42 PM	A	1	27433		7	45925		212	21453		23	48926
A	27:04:18	8:55:45 PM	A	1	27305		7	46157		212	21324		23	48859
A	27:04:18	8:55:48 PM	A	1	27517		7	46080		212	21790		23	48839
A	27:04:18	8:55:51 PM	A	1	27520		7	45850		212	21503		23	48864
A	27:04:18	8:55:54 PM	A	1	27155		7	46081		212	21556		23	48810
A	27:04:18	8:55:57 PM	A	1	27417		7	45430		212	21696		23	48781
A	27:04:18	8:56:00 PM	A	1	27450		7	46129		212	21569		23	48764
A	27:04:18	8:56:03 PM	A	1	27393		7	45758		212	21361		23	48744
A	27:04:18	8:56:06 PM	A	1	27325		7	45549		212	21393		23	48711
A	27:04:18	8:56:09 PM	A	1	27325		7	45574		212	21211		23	48678
A	27:04:18	8:56:12 PM	A	1	27280		7	44806		212	21430		23	48688
A	27:04:18	8:56:15 PM	A	1	27565		7	45046		212	21326		23	48609
A	27:04:18	8:56:18 PM	A	1	27265		7	44559		212	21339		23	48565
A	27:04:18	8:56:21 PM	A	1	27415		7	44081		212	21041		23	48550
A	27:04:18	8:56:24 PM	A	1	27412		7	44156		212	21606		23	48546
A	27:04:18	8:56:27 PM	A	1	27314		7	43123		212	21348		23	48533
A	27:04:18	8:56:30 PM	A	1	27320		7	43335		212	21497		23	48495
A	27:04:18	8:56:33 PM	A	1	27440		7	42742		212	21529		23	48484
A	27:04:18	8:56:36 PM	A	1	27447		7	42390		212	21467		23	48432
A	27:04:18	8:56:39 PM	A	1	27399		7	42375		212	21266		23	48410

A	27:04:18	8:56:42 PM	A	1	27410		7	41584		212	21029		23	48368
A	27:04:18	8:56:45 PM	A	1	27528		7	41591		212	21259		23	48372
A	27:04:18	8:56:48 PM	A	1	27421		7	41151		212	21476		23	48323
A	27:04:18	8:56:51 PM	A	1	27524		7	40528		212	21221		23	48298
A	27:04:18	8:56:54 PM	A	1	27433		7	40692		212	21057		23	48262
A	27:04:18	8:56:57 PM	A	1	27353		7	39823		212	21026		23	48228
A	27:04:18	8:57:00 PM	A	1	27509		7	40039		212	21421		23	48174
A	27:04:18	8:57:03 PM	A	1	27447		7	39767		212	21469		23	48155
A	27:04:18	8:57:06 PM	A	1	27520		7	39345		212	20995		23	48130
A	27:04:18	8:57:09 PM	A	1	27361		7	39736		212	21353		23	48069
A	27:04:18	8:57:12 PM	A	1	27424		7	38646		212	21241		23	48073
A	27:04:18	8:57:15 PM	A	1	27362		7	38702		212	21392		23	48047
A	27:04:18	8:57:18 PM	A	1	27383		7	38571		212	21418		23	48015
A	27:04:18	8:57:21 PM	A	1	27468		7	38123		212	20992		23	48003
A	27:04:18	8:57:24 PM	A	1	27307		7	38879		212	21101		23	47992
A	27:04:18	8:57:27 PM	A	1	27496		7	38113		212	21083		23	47925
A	27:04:18	8:57:30 PM	A	1	27544		7	38415		212	21158		23	47902
A	27:04:18	8:57:33 PM	A	1	27480		7	38543		212	21298		23	47859
A	27:04:18	8:57:36 PM	A	1	27259		7	38413		212	21102		23	47788
A	27:04:18	8:57:39 PM	A	1	27342		7	39649		212	21131		23	47780
A	27:04:18	8:57:42 PM	A	1	27239		7	39047		212	20968		23	47720
A	27:04:18	8:57:45 PM	A	1	27678		7	39464		212	20731		23	47712
A	27:04:18	8:57:48 PM	A	1	27578		7	39568		212	20820		23	47669
A	27:04:18	8:57:51 PM	A	1	27570		7	39939		212	20865		23	47651
A	27:04:18	8:57:54 PM	A	1	27475		7	40260		212	20817		23	47598
A	27:04:18	8:57:57 PM	A	1	27450		7	40217		212	21248		23	47591
A	27:04:18	8:58:00 PM	A	1	27390		7	40664		212	21033		23	47551
A	27:04:18	8:58:03 PM	A	1	27300		7	40967		212	21067		23	47539
A	27:04:18	8:58:06 PM	A	1	27515		7	41409		212	20783		23	47471
A	27:04:18	8:58:09 PM	A	1	27266		7	41711		212	20689		23	47434
A	27:04:18	8:58:12 PM	A	1	27449		7	41962		212	20728		23	47403
A	27:04:18	8:58:15 PM	A	1	27507		7	42278		212	20745		23	47406
A	27:04:18	8:58:18 PM	A	1	27398		7	42004		212	20729		23	47354
A	27:04:18	8:58:21 PM	A	1	27424		7	42546		212	20774		23	47274
A	27:04:18	8:58:24 PM	A	1	27274		7	42879		212	20766		23	47260
A	27:04:18	8:58:27 PM	A	1	27224		7	43037		212	20620		23	47240
A	27:04:18	8:58:30 PM	A	1	27429		7	43405		212	20572		23	47189
A	27:04:18	8:58:33 PM	A	1	27076		7	43455		212	20549		23	47156
A	27:04:18	8:58:36 PM	A	1	27393		7	43546		212	20479		23	47114
A	27:04:18	8:58:39 PM	A	1	27388		7	43595		212	20750		23	47091
A	27:04:18	8:58:42 PM	A	1	27279		7	43755		212	20831		23	47066
A	27:04:18	8:58:45 PM	A	1	27405		7	44105		212	20622		23	47042

A	27:04:18	8:58:48 PM	A	1	27373		7	43914		212	20556		23	47032
A	27:04:18	8:58:51 PM	A	1	27412		7	43991		212	20749		23	46948
A	27:04:18	8:58:54 PM	A	1	27474		7	44012		212	20798		23	46950
A	27:04:18	8:58:57 PM	A	1	27463		7	43981		212	21048		23	46877
A	27:04:18	8:59:00 PM	A	1	27443		7	43950		212	20826		23	46844
A	27:04:18	8:59:03 PM	A	1	27292		7	44050		212	20758		23	46803
A	27:04:18	8:59:06 PM	A	1	27435		7	43933		212	20644		23	46763
A	27:04:18	8:59:09 PM	A	1	27330		7	44090		212	20907		23	46763
A	27:04:18	8:59:12 PM	A	1	27330		7	44371		212	20688		23	46766
A	27:04:18	8:59:15 PM	A	1	27302		7	44546		212	20368		23	46722
A	27:04:18	8:59:18 PM	A	1	27514		7	44624		212	20576		23	46676
A	27:04:18	8:59:21 PM	A	1	27482		7	44769		212	20781		23	46622
A	27:04:18	8:59:24 PM	A	1	27107		7	44905		212	20734		23	46596
A	27:04:18	8:59:27 PM	A	1	27288		7	44928		212	20764		23	46556
A	27:04:18	8:59:30 PM	A	1	27299		7	45189		212	20350		23	46536
A	27:04:18	8:59:33 PM	A	1	27414		7	45194		212	20426		23	46486
A	27:04:18	8:59:36 PM	A	1	27385		7	45252		212	20859		23	46448
A	27:04:18	8:59:39 PM	A	1	27432		7	45814		212	20476		23	46401
A	27:04:18	8:59:42 PM	A	1	27402		7	45797		212	20541		23	46375
A	27:04:18	8:59:45 PM	A	1	27470		7	46042		212	20423		23	46345
A	27:04:18	8:59:48 PM	A	1	27268		7	46351		212	20425		23	46319
A	27:04:18	8:59:51 PM	A	1	27460		7	46365		212	20359		23	46331
A	27:04:18	8:59:54 PM	A	1	27375		7	46826		212	20632		23	46267
A	27:04:18	8:59:57 PM	A	1	27294		7	46746		212	20620		23	46265
A	27:04:18	9:00:00 PM	A	1	27544		7	47313		212	20362		23	46249
A	27:04:18	9:00:03 PM	A	1	27433		7	47284		212	20143		23	46243
A	27:04:18	9:00:06 PM	A	1	27427		7	47428		212	20258		23	46167
A	27:04:18	9:00:09 PM	A	1	27290		7	47948		212	20829		23	46155
A	27:04:18	9:00:12 PM	A	1	27321		7	47880		212	20657		23	46122
A	27:04:18	9:00:15 PM	A	1	27427		7	48673		212	20234		23	46056
A	27:04:18	9:00:18 PM	A	1	27449		7	48870		212	20454		23	46036
A	27:04:18	9:00:21 PM	A	1	27415		7	48906		212	20630		23	46002
A	27:04:18	9:00:24 PM	A	1	27363		7	49267		212	20130		23	45970
A	27:04:18	9:00:27 PM	A	1	27460		7	49342		212	20103		23	45948
A	27:04:18	9:00:30 PM	A	1	27320		7	49789		212	20684		23	45911
A	27:04:18	9:00:33 PM	A	1	27484		7	50372		212	20739		23	45886
A	27:04:18	9:00:36 PM	A	1	27439		7	49959		212	20282		23	45845
A	27:04:18	9:00:39 PM	A	1	27351		7	50578		212	20089		23	45821
A	27:04:18	9:00:42 PM	A	1	27456		7	50444		212	20678		23	45800
A	27:04:18	9:00:45 PM	A	1	27512		7	50929		212	20325		23	45736
A	27:04:18	9:00:48 PM	A	1	27386		7	50978		212	20264		23	45726
A	27:04:18	9:00:51 PM	A	1	27445		7	50663		212	20120		23	45674

A	27:04:18	9:00:54 PM	A	1	27388		7	50933		212	19945		23	45674
A	27:04:18	9:00:57 PM	A	1	27437		7	50612		212	19994		23	45622
A	27:04:18	9:01:00 PM	A	1	27382		7	50670		212	20400		23	45588
A	27:04:18	9:01:03 PM	A	1	27282		7	50170		212	20288		23	45579
A	27:04:18	9:01:06 PM	A	1	27285		7	49921		212	20213		23	45540
A	27:04:18	9:01:09 PM	A	1	27417		7	49418		212	20212		23	45503
A	27:04:18	9:01:12 PM	A	1	27345		7	48896		212	20489		23	45485
A	27:04:18	9:01:15 PM	A	1	27390		7	48874		212	20175		23	45463
A	27:04:18	9:01:18 PM	A	1	27368		7	48269		212	20226		23	45431
A	27:04:18	9:01:21 PM	A	1	27419		7	48289		212	20006		23	45396
A	27:04:18	9:01:24 PM	A	1	27377		7	47668		212	20332		23	45353
A	27:04:18	9:01:27 PM	A	1	27387		7	47466		212	20047		23	45298
A	27:04:18	9:01:30 PM	A	1	27401		7	46731		212	20085		23	45247
A	27:04:18	9:01:33 PM	A	1	27294		7	45487		212	20196		23	45248
A	27:04:18	9:01:36 PM	A	1	27452		7	45449		212	20250		23	45192
A	27:04:18	9:01:39 PM	A	1	27501		7	44321		212	20259		23	45186
A	27:04:18	9:01:42 PM	A	1	27415		7	43818		212	20113		23	45129
A	27:04:18	9:01:45 PM	A	1	27466		7	43698		212	20177		23	45123
A	27:04:18	9:01:48 PM	A	1	27429		7	42775		212	19896		23	45079
A	27:04:18	9:01:51 PM	A	1	27487		7	43464		212	19823		23	45019
A	27:04:18	9:01:54 PM	A	1	27504		7	42693		212	20228		23	45026
A	27:04:18	9:01:57 PM	A	1	27505		7	42427		212	19912		23	44971
A	27:04:18	9:02:00 PM	A	1	27577		7	42266		212	19781		23	44964
A	27:04:18	9:02:03 PM	A	1	27460		7	41844		212	20122		23	44924
A	27:04:18	9:02:06 PM	A	1	27537		7	41940		212	19936		23	44853
A	27:04:18	9:02:09 PM	A	1	27514		7	41117		212	19960		23	44836
A	27:04:18	9:02:12 PM	A	1	27468		7	40485		212	19893		23	44776
A	27:04:18	9:02:15 PM	A	1	27520		7	40515		212	19798		23	44774
A	27:04:18	9:02:18 PM	A	1	27366		7	39563		212	19600		23	44715
A	27:04:18	9:02:21 PM	A	1	27606		7	39509		212	19918		23	44688
A	27:04:18	9:02:24 PM	A	1	27239		7	39180		212	20256		23	44652
A	27:04:18	9:02:27 PM	A	1	27429		7	38610		212	19912		23	44628
A	27:04:18	9:02:30 PM	A	1	27551		7	38721		212	19848		23	44583
A	27:04:18	9:02:33 PM	A	1	27406		7	37904		212	19963		23	44580
A	27:04:18	9:02:36 PM	A	1	27542		7	37824		212	20042		23	44512
A	27:04:18	9:02:39 PM	A	1	27358		7	37452		212	19798		23	44495
A	27:04:18	9:02:42 PM	A	1	27390		7	37002		212	19659		23	44461
A	27:04:18	9:02:45 PM	A	1	27405		7	37330		212	19538		23	44418
A	27:04:18	9:02:48 PM	A	1	27267		7	36344		212	19659		23	44408
A	27:04:18	9:02:51 PM	A	1	27577		7	36503		212	19525		23	44348
A	27:04:18	9:02:54 PM	A	1	27321		7	36362		212	19509		23	44343
A	27:04:18	9:02:57 PM	A	1	27319		7	35720		212	19804		23	44289

A	27:04:18	9:03:00 PM	A	1	27480		7	35904		212	19630		23	44208
A	27:04:18	9:03:03 PM	A	1	27440		7	35285		212	19625		23	44229
A	27:04:18	9:03:06 PM	A	1	27395		7	35441		212	19491		23	44180
A	27:04:18	9:03:09 PM	A	1	27411		7	35123		212	19383		23	44115
A	27:04:18	9:03:12 PM	A	1	27375		7	34715		212	19386		23	44106
A	27:04:18	9:03:15 PM	A	1	27384		7	35122		212	19453		23	44099
A	27:04:18	9:03:18 PM	A	1	27448		7	34545		212	19828		23	44052
A	27:04:18	9:03:21 PM	A	1	27371		7	34739		212	19658		23	44007
A	27:04:18	9:03:24 PM	A	1	27265		7	34669		212	19774		23	43998
A	27:04:18	9:03:27 PM	A	1	27394		7	34248		212	19547		23	43960
A	27:04:18	9:03:30 PM	A	1	27307		7	34377		212	19508		23	43906
A	27:04:18	9:03:33 PM	A	1	27208		7	33763		212	19451		23	43849
A	27:04:18	9:03:36 PM	A	1	27880		7	33965		212	19287		23	43818
A	27:04:18	9:03:39 PM	A	1	27365		7	33967		212	19651		23	43811
A	27:04:18	9:03:42 PM	A	1	27280		7	33660		212	19562		23	43786
A	27:04:18	9:03:45 PM	A	1	27381		7	33556		212	19403		23	43751
A	27:04:18	9:03:48 PM	A	1	27475		7	33341		212	19293		23	43697
A	27:04:18	9:03:51 PM	A	1	27307		7	33209		212	19245		23	43662
A	27:04:18	9:03:54 PM	A	1	27610		7	33287		212	19728		23	43660
A	27:04:18	9:03:57 PM	A	1	27325		7	33137		212	19731		23	43637
A	27:04:18	9:04:00 PM	A	1	27682		7	33283		212	19337		23	43606
A	27:04:18	9:04:03 PM	A	1	27523		7	33047		212	19099		23	43528
A	27:04:18	9:04:06 PM	A	1	27479		7	33116		212	19691		23	43529
A	27:04:18	9:04:09 PM	A	1	27469		7	33145		212	19616		23	43483
A	27:04:18	9:04:12 PM	A	1	27389		7	32918		212	19212		23	43432
A	27:04:18	9:04:15 PM	A	1	27448		7	32946		212	19587		23	43399
A	27:04:18	9:04:18 PM	A	1	27148		7	32748		212	19544		23	43388
A	27:04:18	9:04:21 PM	A	1	27316		7	32563		212	18944		23	43363
A	27:04:18	9:04:24 PM	A	1	27340		7	32622		212	19536		23	43319
A	27:04:18	9:04:27 PM	A	1	27416		7	32409		212	19515		23	43274
A	27:04:18	9:04:30 PM	A	1	27413		7	32324		212	19568		23	43250
A	27:04:18	9:04:33 PM	A	1	27434		7	32180		212	19268		23	43217
A	27:04:18	9:04:36 PM	A	1	27388		7	32253		212	19283		23	43184
A	27:04:18	9:04:39 PM	A	1	27374		7	32504		212	19483		23	43152
A	27:04:18	9:04:42 PM	A	1	27330		7	32347		212	19494		23	43084
A	27:04:18	9:04:45 PM	A	1	27483		7	32511		212	19100		23	43059
A	27:04:18	9:04:48 PM	A	1	27374		7	32122		212	19161		23	43003
A	27:04:18	9:04:51 PM	A	1	27465		7	31900		212	19426		23	42988
A	27:04:18	9:04:54 PM	A	1	27421		7	31670		212	19289		23	42960
A	27:04:18	9:04:57 PM	A	1	27474		7	31500		212	19327		23	42919
A	27:04:18	9:05:00 PM	A	1	27443		7	31651		212	19443		23	42901
A	27:04:18	9:05:03 PM	A	1	27360		7	31584		212	19273		23	42836

A	27:04:18	9:05:06 PM	A	1	27500		7	30693		212	19192		23	42803
A	27:04:18	9:05:09 PM	A	1	27396		7	31004		212	19033		23	42776
A	27:04:18	9:05:12 PM	A	1	27279		7	30032		212	18918		23	42730
A	27:04:18	9:05:15 PM	A	1	27247		7	30082		212	19205		23	42709
A	27:04:18	9:05:18 PM	A	1	27460		7	29924		212	19086		23	42674
A	27:04:18	9:05:21 PM	A	1	27397		7	28598		212	19216		23	42598
A	27:04:18	9:05:24 PM	A	1	27414		7	29261		212	18911		23	42558
A	27:04:18	9:05:27 PM	A	1	27527		7	28944		212	18946		23	42522
A	27:04:18	9:05:30 PM	A	1	27542		7	29424		212	18742		23	42514
A	27:04:18	9:05:33 PM	A	1	27435		7	29885		212	19067		23	42447
A	27:04:18	9:05:36 PM	A	1	27410		7	29501		212	19168		23	42411
A	27:04:18	9:05:39 PM	A	1	27398		7	29794		212	19144		23	42393
A	27:04:18	9:05:42 PM	A	1	27468		7	29690		212	18845		23	42329
A	27:04:18	9:05:45 PM	A	1	27399		7	29632		212	18939		23	42300
A	27:04:18	9:05:48 PM	A	1	27390		7	29652		212	18923		23	42280
A	27:04:18	9:05:51 PM	A	1	27451		7	29038		212	18655		23	42242
A	27:04:18	9:05:54 PM	A	1	27424		7	29171		212	18803		23	42162
A	27:04:18	9:05:57 PM	A	1	27334		7	29241		212	18833		23	42151
A	27:04:18	9:06:00 PM	A	1	27425		7	29350		212	18712		23	42106
A	27:04:18	9:06:03 PM	A	1	27312		7	29098		212	18966		23	42048
A	27:04:18	9:06:06 PM	A	1	27424		7	28893		212	18811		23	42045
A	27:04:18	9:06:09 PM	A	1	27430		7	28933		212	18855		23	42011
A	27:04:18	9:06:12 PM	A	1	27316		7	28949		212	18679		23	41939
A	27:04:18	9:06:15 PM	A	1	27602		7	28798		212	18733		23	41894
A	27:04:18	9:06:18 PM	A	1	27543		7	28961		212	18667		23	41832
A	27:04:18	9:06:21 PM	A	1	27415		7	28500		212	18980		23	41806
A	27:04:18	9:06:24 PM	A	1	27378		7	28593		212	18894		23	41755
A	27:04:18	9:06:27 PM	A	1	27368		7	28549		212	18756		23	41714
A	27:04:18	9:06:30 PM	A	1	27237		7	27971		212	18880		23	41688
A	27:04:18	9:06:33 PM	A	1	27390		7	28500		212	18692		23	41641
A	27:04:18	9:06:36 PM	A	1	27474		7	28283		212	18862		23	41600
A	27:04:18	9:06:39 PM	A	1	27304		7	28177		212	18611		23	41569
A	27:04:18	9:06:42 PM	A	1	27316		7	28335		212	18713		23	41479
A	27:04:18	9:06:45 PM	A	1	27461		7	28606		212	18859		23	41482
A	27:04:18	9:06:48 PM	A	1	27255		7	29053		212	18733		23	41443
A	27:04:18	9:06:51 PM	A	1	27386		7	29090		212	18575		23	41389
A	27:04:18	9:06:54 PM	A	1	27447		7	29568		212	18436		23	41326
A	27:04:18	9:06:57 PM	A	1	27501		7	29906		212	18732		23	41281
A	27:04:18	9:07:00 PM	A	1	27330		7	30491		212	18529		23	41245
A	27:04:18	9:07:03 PM	A	1	27489		7	30033		212	18402		23	41235
A	27:04:18	9:07:06 PM	A	1	27455		7	30769		212	18715		23	41166
A	27:04:18	9:07:09 PM	A	1	27369		7	31567		212	18741		23	41124

A	27:04:18	9:07:12 PM	A	1	27288		7	32065		212	18588		23	41108
A	27:04:18	9:07:15 PM	A	1	27521		7	32512		212	18530		23	41054
A	27:04:18	9:07:18 PM	A	1	27388		7	32375		212	18476		23	41026
A	27:04:18	9:07:21 PM	A	1	27470		7	32768		212	18584		23	40999
A	27:04:18	9:07:24 PM	A	1	27495		7	32877		212	18568		23	40905
A	27:04:18	9:07:27 PM	A	1	27476		7	32772		212	18689		23	40938
A	27:04:18	9:07:30 PM	A	1	27330		7	32828		212	18634		23	40863
A	27:04:18	9:07:33 PM	A	1	27488		7	33014		212	18490		23	40830
A	27:04:18	9:07:36 PM	A	1	27431		7	33178		212	18434		23	40787
A	27:04:18	9:07:39 PM	A	1	27508		7	33742		212	18301		23	40756
A	27:04:18	9:07:42 PM	A	1	27339		7	33447		212	18180		23	40692
A	27:04:18	9:07:45 PM	A	1	27407		7	33782		212	18583		23	40670
A	27:04:18	9:07:48 PM	A	1	27325		7	33328		212	18589		23	40632
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A	27:04:18	9:08:03 PM	A	1	27630		7	32355		212	18571		23	40443
A	27:04:18	9:08:06 PM	A	1	27402		7	32201		212	18308		23	40425
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A	27:04:18	9:08:12 PM	A	1	27527		7	31441		212	18192		23	40318
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A	27:04:18	9:08:18 PM	A	1	27506		7	30281		212	18408		23	40273
A	27:04:18	9:08:21 PM	A	1	27439		7	30291		212	18104		23	40249
A	27:04:18	9:08:24 PM	A	1	27490		7	29625		212	18446		23	40214
A	27:04:18	9:08:27 PM	A	1	27251		7	29651		212	18186		23	40150
A	27:04:18	9:08:30 PM	A	1	27427		7	28975		212	18264		23	40152
A	27:04:18	9:08:33 PM	A	1	27582		7	28500		212	17932		23	40132
A	27:04:18	9:08:36 PM	A	1	27365		7	28504		212	17987		23	40056
A	27:04:18	9:08:39 PM	A	1	27454		7	27309		212	18195		23	40027
A	27:04:18	9:08:42 PM	A	1	27342		7	27761		212	18059		23	40018
A	27:04:18	9:08:45 PM	A	1	27368		7	26562		212	17908		23	39957
A	27:04:18	9:08:48 PM	A	1	27383		7	26217		212	18230		23	39924
A	27:04:18	9:08:51 PM	A	1	27477		7	26290		212	18264		23	39896
A	27:04:18	9:08:54 PM	A	1	27541		7	25664		212	18112		23	39852
A	27:04:18	9:08:57 PM	A	1	27497		7	25560		212	17989		23	39811
A	27:04:18	9:09:00 PM	A	1	27315		7	25308		212	18056		23	39766
A	27:04:18	9:09:03 PM	A	1	27361		7	24835		212	18250		23	39759
A	27:04:18	9:09:06 PM	A	1	27346		7	25230		212	18133		23	39746
A	27:04:18	9:09:09 PM	A	1	27355		7	24910		212	17998		23	39713
A	27:04:18	9:09:12 PM	A	1	27422		7	25185		212	17816		23	39688
A	27:04:18	9:09:15 PM	A	1	27549		7	25272		212	17820		23	39626

A	27:04:18	9:09:18 PM	A	1	27431		7	25424		212	18036		23	39624
A	27:04:18	9:09:21 PM	A	1	27480		7	26143		212	18044		23	39584
A	27:04:18	9:09:24 PM	A	1	27305		7	26382		212	17813		23	39523
A	27:04:18	9:09:27 PM	A	1	27551		7	26814		212	17989		23	39511
A	27:04:18	9:09:30 PM	A	1	27522		7	27228		212	18047		23	39464
A	27:04:18	9:09:33 PM	A	1	27503		7	28182		212	17960		23	39419
A	27:04:18	9:09:36 PM	A	1	27449		7	28211		212	18054		23	39416
A	27:04:18	9:09:39 PM	A	1	27627		7	28962		212	17995		23	39364
A	27:04:18	9:09:42 PM	A	1	27270		7	29599		212	17868		23	39376
A	27:04:18	9:09:45 PM	A	1	27422		7	29970		212	17803		23	39333
A	27:04:18	9:09:48 PM	A	1	27367		7	31010		212	17682		23	39302
A	27:04:18	9:09:51 PM	A	1	27410		7	31148		212	17919		23	39255
A	27:04:18	9:09:54 PM	A	1	27259		7	32171		212	17808		23	39243
A	27:04:18	9:09:57 PM	A	1	27506		7	32746		212	17720		23	39206
A	27:04:18	9:10:00 PM	A	1	27539		7	32878		212	17798		23	39160
A	27:04:18	9:10:03 PM	A	1	27420		7	34586		212	17701		23	39138
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A	27:04:18	9:10:30 PM	A	1	27441		7	37047		212	15782		23	38840
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A	27:04:18	9:10:36 PM	A	1	27155		7	37683		212	15469		23	38770
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A	27:04:18	9:10:48 PM	A	1	27362		7	39609		212	15816		23	38611
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A	27:04:18	9:11:00 PM	A	1	27529		7	40934		212	15361		23	38443
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A	27:04:18	9:11:06 PM	A	1	27471		7	42368		212	15632		23	38393
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A	27:04:18	9:11:15 PM	A	1	27401		7	43887		212	15181		23	38246
A	27:04:18	9:11:18 PM	A	1	27458		7	44714		212	15140		23	38265
A	27:04:18	9:11:21 PM	A	1	27578		7	45073		212	15718		23	38189

A	27:04:18	9:11:24 PM	A	1	27390		7	45336		212	15766		23	38121
A	27:04:18	9:11:27 PM	A	1	27454		7	45751		212	15422		23	38117
A	27:04:18	9:11:30 PM	A	1	27490		7	45699		212	15304		23	38062
A	27:04:18	9:11:33 PM	A	1	27302		7	45836		212	15203		23	38027
A	27:04:18	9:11:36 PM	A	1	27222		7	46350		212	15731		23	38022
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A	27:04:18	9:11:45 PM	A	1	27497		7	46570		212	15470		23	37907
A	27:04:18	9:11:48 PM	A	1	27447		7	46517		212	15121		23	37836
A	27:04:18	9:11:51 PM	A	1	27460		7	46294		212	15709		23	37790
A	27:04:18	9:11:54 PM	A	1	27429		7	45809		212	15600		23	37803
A	27:04:18	9:11:57 PM	A	1	27375		7	46282		212	15814		23	37755
A	27:04:18	9:12:00 PM	A	1	27305		7	45844		212	15805		23	37693
A	27:04:18	9:12:03 PM	A	1	27360		7	45915		212	15521		23	37642
A	27:04:18	9:12:06 PM	A	1	27399		7	45659		212	15397		23	37612
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A	27:04:18	9:12:15 PM	A	1	27427		7	45328		212	15088		23	37511
A	27:04:18	9:12:18 PM	A	1	27452		7	45328		212	15210		23	37462
A	27:04:18	9:12:21 PM	A	1	27375		7	45137		212	15310		23	37447
A	27:04:18	9:12:24 PM	A	1	27547		7	44889		212	15497		23	37355
A	27:04:18	9:12:27 PM	A	1	27373		7	44976		212	15744		23	37351
A	27:04:18	9:12:30 PM	A	1	27494		7	44647		212	15044		23	37287
A	27:04:18	9:12:33 PM	A	1	27448		7	45272		212	15678		23	37259
A	27:04:18	9:12:36 PM	A	1	27475		7	45988		212	15715		23	37255
A	27:04:18	9:12:39 PM	A	1	27437		7	45659		212	15237		23	37190
A	27:04:18	9:12:42 PM	A	1	27469		7	46326		212	14898		23	37143
A	27:04:18	9:12:45 PM	A	1	27271		7	46764		212	15153		23	37146
A	27:04:18	9:12:48 PM	A	1	27391		7	46603		212	15294		23	37149
A	27:04:18	9:12:51 PM	A	1	27511		7	47645		212	15066		23	37065
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A	27:04:18	9:12:57 PM	A	1	27455		7	48032		212	14854		23	36951
A	27:04:18	9:13:00 PM	A	1	27433		7	48599		212	15465		23	36942
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A	27:04:18	9:13:09 PM	A	1	27489		7	49312		212	14924		23	36815
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A	27:04:18	9:13:15 PM	A	1	27433		7	50362		212	14958		23	36740
A	27:04:18	9:13:18 PM	A	1	27324		7	50279		212	14968		23	36688
A	27:04:18	9:13:21 PM	A	1	27436		7	50890		212	14875		23	36687
A	27:04:18	9:13:24 PM	A	1	27353		7	50604		212	14842		23	36650
A	27:04:18	9:13:27 PM	A	1	27457		7	51315		212	14875		23	36611

A	27:04:18	9:13:30 PM	A	1	27455		7	51598		212	14858		23	36567
A	27:04:18	9:13:33 PM	A	1	27751		7	51001		212	15310		23	36540
A	27:04:18	9:13:36 PM	A	1	27404		7	51836		212	14840		23	36522
A	27:04:18	9:13:39 PM	A	1	27365		7	51233		212	14891		23	36459
A	27:04:18	9:13:42 PM	A	1	27673		7	51091		212	14565		23	36440
A	27:04:18	9:13:45 PM	A	1	27340		7	51716		212	14777		23	36398
A	27:04:18	9:13:48 PM	A	1	27461		7	51069		212	14854		23	36409
A	27:04:18	9:13:51 PM	A	1	27342		7	51589		212	15276		23	36385
A	27:04:18	9:13:54 PM	A	1	27377		7	51356		212	15144		23	36324
A	27:04:18	9:13:57 PM	A	1	27509		7	51184		212	14856		23	36285
A	27:04:18	9:14:00 PM	A	1	27368		7	50640		212	15043		23	36220
A	27:04:18	9:14:03 PM	A	1	27646		7	50359		212	15256		23	36209
A	27:04:18	9:14:06 PM	A	1	27445		7	50185		212	15288		23	36174
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A	27:04:18	9:14:15 PM	A	1	27329		7	49705		212	15099		23	36098
A	27:04:18	9:14:18 PM	A	1	27396		7	49287		212	15179		23	36046
A	27:04:18	9:14:21 PM	A	1	27415		7	49601		212	15041		23	36029
A	27:04:18	9:14:24 PM	A	1	27484		7	50058		212	14897		23	35985
A	27:04:18	9:14:27 PM	A	1	27417		7	49924		212	15065		23	35944
A	27:04:18	9:14:30 PM	A	1	27356		7	51304		212	14919		23	35921
A	27:04:18	9:14:33 PM	A	1	27337		7	51682		212	14729		23	35881
A	27:04:18	9:14:36 PM	A	1	27419		7	52364		212	14904		23	35857
A	27:04:18	9:14:39 PM	A	1	27553		7	53191		212	15177		23	35823
A	27:04:18	9:14:42 PM	A	1	27455		7	52787		212	14868		23	35763
A	27:04:18	9:14:45 PM	A	1	27361		7	54611		212	15098		23	35758
A	27:04:18	9:14:48 PM	A	1	27491		7	54251		212	14979		23	35712
A	27:04:18	9:14:51 PM	A	1	27370		7	55750		212	15144		23	35700
A	27:04:18	9:14:54 PM	A	1	27347		7	55965		212	14836		23	35665
A	27:04:18	9:14:57 PM	A	1	27294		7	55553		212	15063		23	35637
A	27:04:18	9:15:00 PM	A	1	27349		7	56279		212	15071		23	35569
A	27:04:18	9:15:03 PM	A	1	27171		7	56040		212	15153		23	35560
A	27:04:18	9:15:06 PM	A	1	27305		7	56480		212	14767		23	35494
A	27:04:18	9:15:09 PM	A	1	27309		7	56541		212	15096		23	35444
A	27:04:18	9:15:12 PM	A	1	27392		7	56282		212	14867		23	35425
A	27:04:18	9:15:15 PM	A	1	27363		7	56651		212	14547		23	35393
A	27:04:18	9:15:18 PM	A	1	27454		7	56106		212	14555		23	35339
A	27:04:18	9:15:21 PM	A	1	27315		7	56184		212	14980		23	35333
A	27:04:18	9:15:24 PM	A	1	27612		7	55465		212	14826		23	35290
A	27:04:18	9:15:27 PM	A	1	27241		7	55101		212	14971		23	35256
A	27:04:18	9:15:30 PM	A	1	27401		7	54892		212	14542		23	35214
A	27:04:18	9:15:33 PM	A	1	27379		7	54403		212	14697		23	35199

A	27:04:18	9:15:36 PM	A	1	27378		7	54042		212	14835		23	35133
A	27:04:18	9:15:39 PM	A	1	27323		7	53222		212	15028		23	35113
A	27:04:18	9:15:42 PM	A	1	27380		7	52674		212	14822		23	35073
A	27:04:18	9:15:45 PM	A	1	27475		7	52126		212	14851		23	35054
A	27:04:18	9:15:48 PM	A	1	27393		7	51756		212	14562		23	34978
A	27:04:18	9:15:51 PM	A	1	27156		7	51409		212	14989		23	34966
A	27:04:18	9:15:54 PM	A	1	27281		7	50833		212	14846		23	34937
A	27:04:18	9:15:57 PM	A	1	27291		7	50527		212	15032		23	34892
A	27:04:18	9:16:00 PM	A	1	27363		7	49603		212	14980		23	34822
A	27:04:18	9:16:03 PM	A	1	27428		7	49171		212	14896		23	34769
A	27:04:18	9:16:06 PM	A	1	27409		7	49010		212	14535		23	34732
A	27:04:18	9:16:09 PM	A	1	27360		7	48092		212	14819		23	34707
A	27:04:18	9:16:12 PM	A	1	27368		7	48367		212	14606		23	34656
A	27:04:18	9:16:15 PM	A	1	27467		7	47373		212	14513		23	34635
A	27:04:18	9:16:18 PM	A	1	27458		7	47133		212	14413		23	34582
A	27:04:18	9:16:21 PM	A	1	27557		7	46952		212	14960		23	34553
A	27:04:18	9:16:24 PM	A	1	27381		7	46026		212	14874		23	34521
A	27:04:18	9:16:27 PM	A	1	27405		7	46052		212	14808		23	34470
A	27:04:18	9:16:30 PM	A	1	27344		7	45189		212	14626		23	34455
A	27:04:18	9:16:33 PM	A	1	27170		7	44788		212	14774		23	34405
A	27:04:18	9:16:36 PM	A	1	27359		7	44782		212	14119		23	34357
A	27:04:18	9:16:39 PM	A	1	27466		7	44235		212	14773		23	34321
A	27:04:18	9:16:42 PM	A	1	27464		7	44161		212	14703		23	34241
A	27:04:18	9:16:45 PM	A	1	27430		7	43469		212	14508		23	34213
A	27:04:18	9:16:48 PM	A	1	27237		7	43450		212	14833		23	34219
A	27:04:18	9:16:51 PM	A	1	27621		7	43587		212	14813		23	34136
A	27:04:18	9:16:54 PM	A	1	27185		7	42801		212	14698		23	34137
A	27:04:18	9:16:57 PM	A	1	27263		7	42517		212	14749		23	34085
A	27:04:18	9:17:00 PM	A	1	27468		7	42340		212	14657		23	34081
A	27:04:18	9:17:03 PM	A	1	27265		7	41563		212	14604		23	33996
A	27:04:18	9:17:06 PM	A	1	27443		7	42110		212	15064		23	33979
A	27:04:18	9:17:09 PM	A	1	27170		7	41231		212	14727		23	33899
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A	27:04:18	9:17:15 PM	A	1	27240		7	40544		212	14572		23	33844
A	27:04:18	9:17:18 PM	A	1	27391		7	39496		212	14353		23	33816
A	27:04:18	9:17:21 PM	A	1	27417		7	39845		212	14669		23	33763
A	27:04:18	9:17:24 PM	A	1	27437		7	38948		212	14471		23	33742
A	27:04:18	9:17:27 PM	A	1	27416		7	38211		212	14028		23	33700
A	27:04:18	9:17:30 PM	A	1	27451		7	38563		212	14038		23	33649
A	27:04:18	9:17:33 PM	A	1	27519		7	37746		212	14129		23	33634
A	27:04:18	9:17:36 PM	A	1	27571		7	37869		212	14618		23	33599
A	27:04:18	9:17:39 PM	A	1	27479		7	37126		212	14540		23	33568

A	27:04:18	9:17:42 PM	A	1	27464		7	36941		212	14678		23	33523
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A	27:04:18	9:17:48 PM	A	1	27519		7	35953		212	14234		23	33422
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A	27:04:18	9:17:54 PM	A	1	27322		7	35795		212	14581		23	33380
A	27:04:18	9:17:57 PM	A	1	27435		7	35506		212	14619		23	33285
A	27:04:18	9:18:00 PM	A	1	27300		7	35549		212	14194		23	33253
A	27:04:18	9:18:03 PM	A	1	27651		7	34965		212	14387		23	33222
A	27:04:18	9:18:06 PM	A	1	27231		7	34771		212	14144		23	33140
A	27:04:18	9:18:09 PM	A	1	27438		7	34127		212	14070		23	33099
A	27:04:18	9:18:12 PM	A	1	27435		7	33907		212	14104		23	33089
A	27:04:18	9:18:15 PM	A	1	27302		7	33857		212	14630		23	33047
A	27:04:18	9:18:18 PM	A	1	27524		7	33304		212	14435		23	33025
A	27:04:18	9:18:21 PM	A	1	27226		7	33161		212	13868		23	32986
A	27:04:18	9:18:24 PM	A	1	27420		7	33061		212	13901		23	32907
A	27:04:18	9:18:27 PM	A	1	27538		7	32658		212	14126		23	32874
A	27:04:18	9:18:30 PM	A	1	27580		7	32139		212	14212		23	32853
A	27:04:18	9:18:33 PM	A	1	27340		7	31463		212	13867		23	32770
A	27:04:18	9:18:36 PM	A	1	27309		7	31656		212	14162		23	32752
A	27:04:18	9:18:39 PM	A	1	27493		7	31431		212	14147		23	32717
A	27:04:18	9:18:42 PM	A	1	27474		7	30340		212	14043		23	32676
A	27:04:18	9:18:45 PM	A	1	27471		7	31008		212	13738		23	32646
A	27:04:18	9:18:48 PM	A	1	27484		7	30181		212	14303		23	32597
A	27:04:18	9:18:51 PM	A	1	27372		7	29916		212	14375		23	32528
A	27:04:18	9:18:54 PM	A	1	27466		7	29370		212	13877		23	32522
A	27:04:18	9:18:57 PM	A	1	27409		7	28459		212	13882		23	32449
A	27:04:18	9:19:00 PM	A	1	27462		7	28862		212	14302		23	32423
A	27:04:18	9:19:03 PM	A	1	27370		7	27495		212	14004		23	32371
A	27:04:18	9:19:06 PM	A	1	27389		7	27786		212	13719		23	32312
A	27:04:18	9:19:09 PM	A	1	27515		7	27803		212	13777		23	32308
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A	27:04:18	9:19:15 PM	A	1	27580		7	27422		212	13829		23	32199
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A	27:04:18	9:19:21 PM	A	1	27345		7	27211		212	14121		23	32164
A	27:04:18	9:19:24 PM	A	1	27592		7	27139		212	14123		23	32094
A	27:04:18	9:19:27 PM	A	1	27325		7	26938		212	13947		23	32062
A	27:04:18	9:19:30 PM	A	1	27357		7	27457		212	14060		23	32004
A	27:04:18	9:19:33 PM	A	1	27396		7	27015		212	13789		23	31975
A	27:04:18	9:19:36 PM	A	1	27409		7	27103		212	13661		23	31923
A	27:04:18	9:19:39 PM	A	1	27426		7	27406		212	13717		23	31894
A	27:04:18	9:19:42 PM	A	1	27408		7	26448		212	13543		23	31842
A	27:04:18	9:19:45 PM	A	1	27632		7	27541		212	13712		23	31764

A	27:04:18	9:19:48 PM	A	1	27214		7	27161		212	14088		23	31770
A	27:04:18	9:19:51 PM	A	1	27300		7	26712		212	13538		23	31722
A	27:04:18	9:19:54 PM	A	1	27266		7	26944		212	13656		23	31669
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A	27:04:18	9:20:54 PM	A	1	27332		7	24537		212	13828		23	30869
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A	27:04:18	9:21:30 PM	A	1	27360		7	22887		212	13475		23	30387
A	27:04:18	9:21:33 PM	A	1	27525		7	23290		212	13457		23	30341
A	27:04:18	9:21:36 PM	A	1	27276		7	23007		212	13503		23	30282
A	27:04:18	9:21:39 PM	A	1	27431		7	22931		212	13400		23	30269
A	27:04:18	9:21:42 PM	A	1	27548		7	22542		212	13333		23	30216
A	27:04:18	9:21:45 PM	A	1	27312		7	22335		212	13251		23	30158
A	27:04:18	9:21:48 PM	A	1	27224		7	22660		212	13162		23	30154
A	27:04:18	9:21:51 PM	A	1	27386		7	21575		212	13043		23	30126

A	27:04:18	9:21:54 PM	A	1	27289		7	22364		212	13434		23	30071
A	27:04:18	9:21:57 PM	A	1	27457		7	22171		212	13430		23	30013
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A	27:04:18	9:22:03 PM	A	1	27546		7	22421		212	13207		23	29932
A	27:04:18	9:22:06 PM	A	1	27001		7	22063		212	12993		23	29898
A	27:04:18	9:22:09 PM	A	1	27351		7	22635		212	13005		23	29876
A	27:04:18	9:22:12 PM	A	1	27234		7	22593		212	13035		23	29838
A	27:04:18	9:22:15 PM	A	1	27601		7	22871		212	12923		23	29819
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A	27:04:18	9:22:21 PM	A	1	27029		7	24537		212	13372		23	29709
A	27:04:18	9:22:24 PM	A	1	27462		7	24824		212	13153		23	29668
A	27:04:18	9:22:27 PM	A	1	27491		7	24612		212	13305		23	29625
A	27:04:18	9:22:30 PM	A	1	27369		7	25138		212	13218		23	29593
A	27:04:18	9:22:33 PM	A	1	27792		7	25765		212	13260		23	29551
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A	27:04:18	9:22:48 PM	A	1	27335		7	26088		212	13241		23	29372
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A	27:04:18	9:23:06 PM	A	1	27390		7	25016		212	12943		23	29117
A	27:04:18	9:23:09 PM	A	1	27551		7	24375		212	13325		23	29075
A	27:04:18	9:23:12 PM	A	1	27462		7	24518		212	13055		23	29053
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A	27:04:18	9:23:18 PM	A	1	27384		7	23244		212	12688		23	28969
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A	27:04:18	9:23:36 PM	A	1	27418		7	20732		212	12862		23	28759
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A	27:04:18	9:23:42 PM	A	1	27467		7	20481		212	13038		23	28649
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A	27:04:18	9:23:48 PM	A	1	27551		7	19390		212	12778		23	28607
A	27:04:18	9:23:51 PM	A	1	27451		7	19469		212	12516		23	28549
A	27:04:18	9:23:54 PM	A	1	27505		7	18977		212	12726		23	28526
A	27:04:18	9:23:57 PM	A	1	27265		7	19163		212	12640		23	28492

A	27:04:18	9:24:00 PM	A	1	27536		7	18498		212	12682		23	28445
A	27:04:18	9:24:03 PM	A	1	27357		7	18377		212	12969		23	28438
A	27:04:18	9:24:06 PM	A	1	27328		7	18310		212	12919		23	28370
A	27:04:18	9:24:09 PM	A	1	27327		7	17751		212	12913		23	28337
A	27:04:18	9:24:12 PM	A	1	27256		7	17876		212	12609		23	28297
A	27:04:18	9:24:15 PM	A	1	27502		7	17613		212	12877		23	28262
A	27:04:18	9:24:18 PM	A	1	27565		7	17428		212	12849		23	28195
A	27:04:18	9:24:21 PM	A	1	27113		7	17612		212	12589		23	28237
A	27:04:18	9:24:24 PM	A	1	27432		7	16975		212	12888		23	28139
A	27:04:18	9:24:27 PM	A	1	27400		7	17336		212	12544		23	28071
A	27:04:18	9:24:30 PM	A	1	27439		7	17012		212	12635		23	28048
A	27:04:18	9:24:33 PM	A	1	27542		7	16773		212	12579		23	28025
A	27:04:18	9:24:36 PM	A	1	27397		7	16924		212	12794		23	27983
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A	27:04:18	9:24:42 PM	A	1	27374		7	16829		212	12633		23	27886
A	27:04:18	9:24:45 PM	A	1	27372		7	16738		212	12744		23	27855
A	27:04:18	9:24:48 PM	A	1	27480		7	16334		212	12781		23	27842
A	27:04:18	9:24:51 PM	A	1	27323		7	16309		212	12519		23	27783
A	27:04:18	9:24:54 PM	A	1	27246		7	16096		212	12936		23	27715
A	27:04:18	9:24:57 PM	A	1	27453		7	16123		212	12767		23	27676
A	27:04:18	9:25:00 PM	A	1	27380		7	15874		212	12558		23	27662
A	27:04:18	9:25:03 PM	A	1	27481		7	15626		212	12423		23	27608
A	27:04:18	9:25:06 PM	A	1	27286		7	15691		212	12765		23	27561
A	27:04:18	9:25:09 PM	A	1	27526		7	15056		212	12564		23	27506
A	27:04:18	9:25:12 PM	A	1	27596		7	14927		212	12479		23	27488
A	27:04:18	9:25:15 PM	A	1	27254		7	15074		212	12482		23	27450
A	27:04:18	9:25:18 PM	A	1	27337		7	14566		212	12455		23	27410
A	27:04:18	9:25:21 PM	A	1	27355		7	14998		212	12419		23	27370
A	27:04:18	9:25:24 PM	A	1	27296		7	14951		212	12682		23	27304
A	27:04:18	9:25:27 PM	A	1	27375		7	14999		212	12715		23	27278
A	27:04:18	9:25:30 PM	A	1	27202		7	14703		212	12369		23	27217
A	27:04:18	9:25:33 PM	A	1	27226		7	14531		212	12260		23	27178
A	27:04:18	9:25:36 PM	A	1	27468		7	14756		212	12179		23	27131
A	27:04:18	9:25:39 PM	A	1	27561		7	14499		212	12462		23	27118
A	27:04:18	9:25:42 PM	A	1	27413		7	14683		212	12120		23	27061
A	27:04:18	9:25:45 PM	A	1	27443		7	14824		212	12308		23	27012
A	27:04:18	9:25:48 PM	A	1	27548		7	14393		212	12318		23	26970
A	27:04:18	9:25:51 PM	A	1	27338		7	14449		212	11992		23	26914
A	27:04:18	9:25:54 PM	A	1	27295		7	14551		212	12517		23	26891
A	27:04:18	9:25:57 PM	A	1	27324		7	14431		212	12463		23	26826
A	27:04:18	9:26:00 PM	A	1	27409		7	14515		212	12229		23	26749
A	27:04:18	9:26:03 PM	A	1	27300		7	13941		212	12023		23	26730

A	27:04:18	9:26:06 PM	A	1	27310		7	14318		212	12244		23	26680
A	27:04:18	9:26:09 PM	A	1	27321		7	14108		212	12000		23	26689
A	27:04:18	9:26:12 PM	A	1	27309		7	14069		212	12288		23	26631
A	27:04:18	9:26:15 PM	A	1	27547		7	14234		212	12390		23	26573
A	27:04:18	9:26:18 PM	A	1	27552		7	13850		212	12328		23	26533
A	27:04:18	9:26:21 PM	A	1	27406		7	14056		212	12000		23	26511
A	27:04:18	9:26:24 PM	A	1	27445		7	13885		212	12020		23	26482
A	27:04:18	9:26:27 PM	A	1	27432		7	13491		212	11923		23	26441
A	27:04:18	9:26:30 PM	A	1	27345		7	13432		212	12002		23	26398
A	27:04:18	9:26:33 PM	A	1	27231		7	13191		212	12548		23	26352
A	27:04:18	9:26:36 PM	A	1	27570		7	13035		212	12306		23	26333
A	27:04:18	9:26:39 PM	A	1	27423		7	12936		212	12208		23	26304
A	27:04:18	9:26:42 PM	A	1	27436		7	12793		212	12259		23	26231
A	27:04:18	9:26:45 PM	A	1	27318		7	12986		212	12078		23	26193
A	27:04:18	9:26:48 PM	A	1	27672		7	12272		212	11995		23	26158
A	27:04:18	9:26:51 PM	A	1	27211		7	12070		212	12072		23	26125
A	27:04:18	9:26:54 PM	A	1	27455		7	12336		212	12311		23	26068
A	27:04:18	9:26:57 PM	A	1	27403		7	11833		212	12168		23	26025
A	27:04:18	9:27:00 PM	A	1	27504		7	12107		212	11865		23	26007
A	27:04:18	9:27:03 PM	A	1	27345		7	11520		212	11969		23	25974
A	27:04:18	9:27:06 PM	A	1	27209		7	11564		212	12258		23	25935
A	27:04:18	9:27:09 PM	A	1	27474		7	11695		212	11959		23	25878
A	27:04:18	9:27:12 PM	A	1	27483		7	11386		212	11805		23	25846
A	27:04:18	9:27:15 PM	A	1	27369		7	11859		212	12190		23	25832
A	27:04:18	9:27:18 PM	A	1	27380		7	11610		212	12222		23	25783
A	27:04:18	9:27:21 PM	A	1	27485		7	12203		212	12222		23	25755
A	27:04:18	9:27:24 PM	A	1	27443		7	12087		212	12095		23	25750
A	27:04:18	9:27:27 PM	A	1	27411		7	12335		212	11868		23	25674
A	27:04:18	9:27:30 PM	A	1	27508		7	12644		212	12084		23	25621
A	27:04:18	9:27:33 PM	A	1	27437		7	13066		212	12029		23	25599
A	27:04:18	9:27:36 PM	A	1	27652		7	13392		212	11931		23	25559
A	27:04:18	9:27:39 PM	A	1	27342		7	13209		212	12041		23	25504
A	27:04:18	9:27:42 PM	A	1	27394		7	13530		212	12186		23	25475
A	27:04:18	9:27:45 PM	A	1	27533		7	13789		212	11930		23	25424
A	27:04:18	9:27:48 PM	A	1	27376		7	13732		212	11940		23	25416
A	27:04:18	9:27:51 PM	A	1	27659		7	14048		212	11792		23	25367
A	27:04:18	9:27:54 PM	A	1	27432		7	13972		212	11745		23	25337
A	27:04:18	9:27:57 PM	A	1	27658		7	14056		212	11930		23	25300
A	27:04:18	9:28:00 PM	A	1	27273		7	13897		212	11808		23	25262
A	27:04:18	9:28:03 PM	A	1	27391		7	13741		212	11747		23	25223
A	27:04:18	9:28:06 PM	A	1	27496		7	13346		212	11832		23	25163
A	27:04:18	9:28:09 PM	A	1	27452		7	13446		212	11814		23	25146

A	27:04:18	9:28:12 PM	A	1	27384		7	13152		212	12038		23	25083
A	27:04:18	9:28:15 PM	A	1	27436		7	13096		212	11787		23	25069
A	27:04:18	9:28:18 PM	A	1	27440		7	13088		212	11609		23	25032
A	27:04:18	9:28:21 PM	A	1	27258		7	12634		212	11963		23	24995
A	27:04:18	9:28:24 PM	A	1	27450		7	12727		212	11923		23	24960
A	27:04:18	9:28:27 PM	A	1	27510		7	12427		212	11507		23	24881
A	27:04:18	9:28:30 PM	A	1	27247		7	12050		212	11907		23	24857
A	27:04:18	9:28:33 PM	A	1	27458		7	12030		212	11974		23	24820
A	27:04:18	9:28:36 PM	A	1	27551		7	11613		212	11618		23	24756
A	27:04:18	9:28:39 PM	A	1	27443		7	11871		212	11422		23	24719
A	27:04:18	9:28:42 PM	A	1	27326		7	11471		212	11446		23	24701
A	27:04:18	9:28:45 PM	A	1	27534		7	11106		212	11865		23	24642
A	27:04:18	9:28:48 PM	A	1	27337		7	11313		212	11719		23	24618
A	27:04:18	9:28:51 PM	A	1	27441		7	11054		212	11582		23	24559
A	27:04:18	9:28:54 PM	A	1	27358		7	10815		212	11324		23	24520
A	27:04:18	9:28:57 PM	A	1	27432		7	10392		212	11456		23	24504
A	27:04:18	9:29:00 PM	A	1	27511		7	10128		212	11766		23	24465
A	27:04:18	9:29:03 PM	A	1	27406		7	10272		212	11908		23	24431
A	27:04:18	9:29:06 PM	A	1	27451		7	9775		212	11722		23	24391
A	27:04:18	9:29:09 PM	A	1	27450		7	10070		212	11599		23	24362
A	27:04:18	9:29:12 PM	A	1	27507		7	9412		212	11690		23	24299
A	27:04:18	9:29:15 PM	A	1	27787		7	8996		212	11531		23	24214
A	27:04:18	9:29:18 PM	A	1	27502		7	9249		212	11644		23	24181
A	27:04:18	9:29:21 PM	A	1	27416		7	8462		212	11344		23	24191
A	27:04:18	9:29:24 PM	A	1	27310		7	8304		212	11260		23	24144
A	27:04:18	9:29:27 PM	A	1	27428		7	8189		212	11614		23	24087
A	27:04:18	9:29:30 PM	A	1	27464		7	7451		212	11635		23	24011
A	27:04:18	9:29:33 PM	A	1	27428		7	7795		212	11730		23	23999
A	27:04:18	9:29:36 PM	A	1	27449		7	6902		212	11257		23	23951
A	27:04:18	9:29:39 PM	A	1	27413		7	6718		212	11315		23	23895
A	27:04:18	9:29:42 PM	A	1	27489		7	6424		212	11183		23	23883
A	27:04:18	9:29:45 PM	A	1	27563		7	5667		212	11296		23	23811
A	27:04:18	9:29:48 PM	A	1	27510		7	5786		212	11341		23	23797
A	27:04:18	9:29:51 PM	A	1	27406		7	5226		212	11297		23	23759
A	27:04:18	9:29:54 PM	A	1	27440		7	5059		212	11446		23	23705
A	27:04:18	9:29:57 PM	A	1	27468		7	4968		212	11639		23	23656
A	27:04:18	9:30:00 PM	A	1	27398		7	4586		212	11069		23	23587
A	27:04:18	9:30:03 PM	A	1	27439		7	4789		212	11117		23	23544
A	27:04:18	9:30:06 PM	A	1	27330		7	4017		212	11114		23	23500
A	27:04:18	9:30:09 PM	A	1	27514		7	3764		212	11316		23	23511
A	27:04:18	9:30:12 PM	A	1	27425		7	3930		212	11178		23	23442
A	27:04:18	9:30:15 PM	A	1	27507		7	3175		212	11153		23	23431

A	27:04:18	9:30:18 PM	A	1	27490		7	3544		212	11262		23	23394
A	27:04:18	9:30:21 PM	A	1	27482		7	2854		212	10803		23	23354
A	27:04:18	9:30:24 PM	A	1	27383		7	3127		212	11085		23	23323
A	27:04:18	9:30:27 PM	A	1	27633		7	3439		212	11207		23	23294
A	27:04:18	9:30:30 PM	A	1	27404		7	2885		212	11362		23	23239
A	27:04:18	9:30:33 PM	A	1	27431		7	2928		212	11249		23	23187
A	27:04:18	9:30:36 PM	A	1	27308		7	2739		212	11260		23	23142
A	27:04:18	9:30:39 PM	A	1	27283		7	2725		212	10965		23	23142
A	27:04:18	9:30:42 PM	A	1	27468		7	2877		212	11097		23	23081
A	27:04:18	9:30:45 PM	A	1	27496		7	2479		212	11191		23	23061
A	27:04:18	9:30:48 PM	A	1	27545		7	2434		212	10944		23	22981
A	27:04:18	9:30:51 PM	A	1	27200		7	2468		212	11157		23	22955
A	27:04:18	9:30:54 PM	A	1	27326		7	2508		212	11147		23	22953
A	27:04:18	9:30:57 PM	A	1	27208		7	2845		212	11090		23	22893
A	27:04:18	9:31:00 PM	A	1	27397		7	2649		212	10910		23	22899
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A	27:04:18	9:31:09 PM	A	1	27372		7	2677		212	11150		23	22746
A	27:04:18	9:31:12 PM	A	1	27396		7	3079		212	10994		23	22701
A	27:04:18	9:31:15 PM	A	1	27334		7	2959		212	10964		23	22694
A	27:04:18	9:31:18 PM	A	1	27333		7	2894		212	10963		23	22675
A	27:04:18	9:31:21 PM	A	1	27456		7	3007		212	11093		23	22601
A	27:04:18	9:31:24 PM	A	1	27487		7	2881		212	11184		23	22595
A	27:04:18	9:31:27 PM	A	1	27314		7	2978		212	11084		23	22563
A	27:04:18	9:31:30 PM	A	1	27445		7	2935		212	11130		23	22529
A	27:04:18	9:31:33 PM	A	1	27342		7	2990		212	11130		23	22507
A	27:04:18	9:31:36 PM	A	1	27423		7	3146		212	11155		23	22461
A	27:04:18	9:31:39 PM	A	1	27458		7	2837		212	10989		23	22438
A	27:04:18	9:31:42 PM	A	1	27598		7	2970		212	10901		23	22396
A	27:04:18	9:31:45 PM	A	1	27421		7	2658		212	10801		23	22345
A	27:04:18	9:31:48 PM	A	1	27379		7	2511		212	10945		23	22338
A	27:04:18	9:31:51 PM	A	1	27450		7	2522		212	11080		23	22296
A	27:04:18	9:31:54 PM	A	1	27383		7	1963		212	10868		23	22298
A	27:04:18	9:31:57 PM	A	1	27394		7	2108		212	10910		23	22250
A	27:04:18	9:32:00 PM	A	1	27525		7	1909		212	10998		23	22214
A	27:04:18	9:32:03 PM	A	1	27550		7	1577		212	10890		23	22174
A	27:04:18	9:32:06 PM	A	1	27352		7	1987		212	10627		23	22143
A	27:04:18	9:32:09 PM	A	1	27337		7	1603		212	10619		23	22121
A	27:04:18	9:32:12 PM	A	1	27331		7	1477		212	11003		23	22082
A	27:04:18	9:32:15 PM	A	1	27434		7	1006		212	10735		23	22079
A	27:04:18	9:32:18 PM	A	1	27454		7	838		212	10981		23	22045
A	27:04:18	9:32:21 PM	A	1	27445		7	1284		212	10677		23	22001

A	27:04:18	9:32:24 PM	A	1	27453		7	684		212	10997		23	21962
A	27:04:18	9:32:27 PM	A	1	27336		7	661		212	11001		23	21944
A	27:04:18	9:32:30 PM	A	1	27391		7	186		212	10866		23	21863
A	27:04:18	9:32:33 PM	A	1	27545		6	65393		212	10647		23	21848
A	27:04:18	9:32:36 PM	A	1	27402		7	88		212	10865		23	21816
A	27:04:18	9:32:39 PM	A	1	27431		6	64777		212	10725		23	21799
A	27:04:18	9:32:42 PM	A	1	27144		6	64915		212	11010		23	21752
A	27:04:18	9:32:45 PM	A	1	27417		6	64779		212	10502		23	21725
A	27:04:18	9:32:48 PM	A	1	27430		6	64364		212	10843		23	21706
A	27:04:18	9:32:51 PM	A	1	27332		6	64768		212	10914		23	21642
A	27:04:18	9:32:54 PM	A	1	27455		6	64387		212	10615		23	21594
A	27:04:18	9:32:57 PM	A	1	27421		6	64713		212	10558		23	21583
A	27:04:18	9:33:00 PM	A	1	27515		6	64864		212	10424		23	21548
A	27:04:18	9:33:03 PM	A	1	27475		6	64707		212	10506		23	21494
A	27:04:18	9:33:06 PM	A	1	27411		6	65059		212	11036		23	21462
A	27:04:18	9:33:09 PM	A	1	27500		6	64649		212	10640		23	21395
A	27:04:18	9:33:12 PM	A	1	27464		6	64727		212	10345		23	21380
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A	27:04:18	9:33:21 PM	A	1	27436		6	64919		212	10383		23	21271
A	27:04:18	9:33:24 PM	A	1	27454		6	64704		212	10778		23	21233
A	27:04:18	9:33:27 PM	A	1	27436		6	64480		212	10520		23	21161
A	27:04:18	9:33:30 PM	A	1	27303		6	64661		212	10399		23	21185
A	27:04:18	9:33:33 PM	A	1	27454		6	64370		212	10624		23	21107
A	27:04:18	9:33:36 PM	A	1	27270		6	64711		212	10663		23	21056
A	27:04:18	9:33:39 PM	A	1	27411		6	64303		212	10569		23	21040
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A	27:04:18	9:33:54 PM	A	1	27359		6	63665		212	10515		23	20805
A	27:04:18	9:33:57 PM	A	1	27502		6	63555		212	10189		23	20793
A	27:04:18	9:34:00 PM	A	1	27527		6	63532		212	10455		23	20791
A	27:04:18	9:34:03 PM	A	1	27418		6	63324		212	10633		23	20719
A	27:04:18	9:34:06 PM	A	1	27512		6	63381		212	10479		23	20689
A	27:04:18	9:34:09 PM	A	1	27229		6	63383		212	10394		23	20649
A	27:04:18	9:34:12 PM	A	1	27375		6	63246		212	10100		23	20608
A	27:04:18	9:34:15 PM	A	1	27540		6	63685		212	10130		23	20547
A	27:04:18	9:34:18 PM	A	1	27386		6	63154		212	10387		23	20511
A	27:04:18	9:34:21 PM	A	1	27276		6	63050		212	10394		23	20492
A	27:04:18	9:34:24 PM	A	1	27511		6	63197		212	10279		23	20420
A	27:04:18	9:34:27 PM	A	1	27445		6	63150		212	10253		23	20399

A	27:04:18	9:34:30 PM	A	1	27583		6	63275		212	10127		23	20314
A	27:04:18	9:34:33 PM	A	1	27346		6	63211		212	9918		23	20256
A	27:04:18	9:34:36 PM	A	1	27385		6	63241		212	10293		23	20242
A	27:04:18	9:34:39 PM	A	1	27496		6	63235		212	10201		23	20210
A	27:04:18	9:34:42 PM	A	1	27362		6	63154		212	10446		23	20134
A	27:04:18	9:34:45 PM	A	1	27513		6	63444		212	10215		23	20141
A	27:04:18	9:34:48 PM	A	1	27287		6	63162		212	10256		23	20074
A	27:04:18	9:34:51 PM	A	1	27323		6	63338		212	10328		23	20042
A	27:04:18	9:34:54 PM	A	1	27326		6	63389		212	10559		23	20014
A	27:04:18	9:34:57 PM	A	1	27500		6	63310		212	10281		23	19909
A	27:04:18	9:35:00 PM	A	1	27340		6	63308		212	10161		23	19871
A	27:04:18	9:35:03 PM	A	1	27521		6	63301		212	10203		23	19854
A	27:04:18	9:35:06 PM	A	1	27397		6	63266		212	10072		23	19799
A	27:04:18	9:35:09 PM	A	1	27364		6	63187		212	10286		23	19771
A	27:04:18	9:35:12 PM	A	1	27339		6	62951		212	10207		23	19733
A	27:04:18	9:35:15 PM	A	1	27329		6	63161		212	10188		23	19681
A	27:04:18	9:35:18 PM	A	1	27334		6	62831		212	10194		23	19644
A	27:04:18	9:35:21 PM	A	1	27414		6	62524		212	10072		23	19606
A	27:04:18	9:35:24 PM	A	1	27358		6	62542		212	10356		23	19511
A	27:04:18	9:35:27 PM	A	1	27304		6	62202		212	10099		23	19513
A	27:04:18	9:35:30 PM	A	1	27333		6	61982		212	10173		23	19465
A	27:04:18	9:35:33 PM	A	1	27373		6	61825		212	10011		23	19415
A	27:04:18	9:35:36 PM	A	1	27379		6	61894		212	9969		23	19385
A	27:04:18	9:35:39 PM	A	1	27560		6	62026		212	9810		23	19321
A	27:04:18	9:35:42 PM	A	1	27419		6	61745		212	9975		23	19288
A	27:04:18	9:35:45 PM	A	1	27448		6	61800		212	10060		23	19252
A	27:04:18	9:35:48 PM	A	1	27350		6	61532		212	9954		23	19187
A	27:04:18	9:35:51 PM	A	1	27452		6	61303		212	9903		23	19190
A	27:04:18	9:35:54 PM	A	1	27360		6	61680		212	9705		23	19134
A	27:04:18	9:35:57 PM	A	1	27390		6	61231		212	9857		23	19092
A	27:04:18	9:36:00 PM	A	1	27441		6	61357		212	9857		23	19095
A	27:04:18	9:36:03 PM	A	1	27423		6	61391		212	9792		23	19043
A	27:04:18	9:36:06 PM	A	1	27337		6	61531		212	10142		23	18976
A	27:04:18	9:36:09 PM	A	1	27492		6	61674		212	9959		23	18950
A	27:04:18	9:36:12 PM	A	1	27478		6	61453		212	9911		23	18871
A	27:04:18	9:36:15 PM	A	1	27436		6	61433		212	9536		23	18849
A	27:04:18	9:36:18 PM	A	1	27409		6	61422		212	9571		23	18799
A	27:04:18	9:36:21 PM	A	1	27311		6	61125		212	9644		23	18782
A	27:04:18	9:36:24 PM	A	1	27423		6	61304		212	9516		23	18697
A	27:04:18	9:36:27 PM	A	1	27387		6	60982		212	9841		23	18671
A	27:04:18	9:36:30 PM	A	1	27381		6	60799		212	9719		23	18650
A	27:04:18	9:36:33 PM	A	1	27361		6	60973		212	9677		23	18611

A	27:04:18	9:36:36 PM	A	1	27377		6	60795		212	9430		23	18566
A	27:04:18	9:36:39 PM	A	1	27437		6	60943		212	9557		23	18544
A	27:04:18	9:36:42 PM	A	1	27453		6	61032		212	9666		23	18478
A	27:04:18	9:36:45 PM	A	1	27413		6	60898		212	9703		23	18445
A	27:04:18	9:36:48 PM	A	1	27473		6	60927		212	9571		23	18400
A	27:04:18	9:36:51 PM	A	1	27587		6	60724		212	9558		23	18368
A	27:04:18	9:36:54 PM	A	1	27296		6	61166		212	9538		23	18349
A	27:04:18	9:36:57 PM	A	1	27337		6	61098		212	7216		23	18267
A	27:04:18	9:37:00 PM	A	1	27407		6	61141		212	9701		23	18222
A	27:04:18	9:37:03 PM	A	1	27319		6	61233		212	7834		23	18220
A	27:04:18	9:37:06 PM	A	1	27440		6	61223		212	9474		23	18164
A	27:04:18	9:37:09 PM	A	1	27328		6	61364		212	9439		23	18138
A	27:04:18	9:37:12 PM	A	1	27315		6	61426		212	9301		23	18101
A	27:04:18	9:37:15 PM	A	1	27536		6	61612		212	7207		23	18032
A	27:04:18	9:37:18 PM	A	1	27545		6	61722		212	9205		23	18025
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A	27:04:18	9:37:27 PM	A	1	27476		6	61746		212	7850		23	17894
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A	27:04:18	9:37:33 PM	A	1	27333		6	61800		212	9249		23	17778
A	27:04:18	9:37:36 PM	A	1	27273		6	61652		212	7300		23	17731
A	27:04:18	9:37:39 PM	A	1	27457		6	61626		212	7830		23	17728
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A	27:04:18	9:37:45 PM	A	1	27470		6	61637		212	7981		23	17627
A	27:04:18	9:37:48 PM	A	1	27592		6	61902		212	7725		23	17593
A	27:04:18	9:37:51 PM	A	1	27460		6	61846		212	7686		23	17560
A	27:04:18	9:37:54 PM	A	1	27491		6	61780		212	7814		23	17519
A	27:04:18	9:37:57 PM	A	1	27328		6	61905		212	7525		23	17450
A	27:04:18	9:38:00 PM	A	1	27468		6	62368		212	7523		23	17394
A	27:04:18	9:38:03 PM	A	1	27382		6	61765		212	7797		23	17360
A	27:04:18	9:38:06 PM	A	1	27407		6	61474		212	7252		23	17302
A	27:04:18	9:38:09 PM	A	1	27428		6	61419		212	7395		23	17282
A	27:04:18	9:38:12 PM	A	1	27390		6	61560		212	7584		23	17246
A	27:04:18	9:38:15 PM	A	1	27465		6	61886		212	7713		23	17224
A	27:04:18	9:38:18 PM	A	1	27610		6	61797		212	7530		23	17142
A	27:04:18	9:38:21 PM	A	1	27535		6	61851		212	7265		23	17098
A	27:04:18	9:38:24 PM	A	1	27346		6	61787		212	7220		23	17053
A	27:04:18	9:38:27 PM	A	1	27532		6	62083		212	7725		23	17033
A	27:04:18	9:38:30 PM	A	1	27412		6	61767		212	7631		23	16980
A	27:04:18	9:38:33 PM	A	1	27279		6	61871		212	7511		23	16924
A	27:04:18	9:38:36 PM	A	1	27368		6	61748		212	7233		23	16900
A	27:04:18	9:38:39 PM	A	1	27387		6	61756		212	7693		23	16831

A	27:04:18	9:38:42 PM	A	1	27394		6	61983		212	7470		23	16802
A	27:04:18	9:38:45 PM	A	1	27342		6	62021		212	7514		23	16758
A	27:04:18	9:38:48 PM	A	1	27326		6	62044		212	7445		23	16735
A	27:04:18	9:38:51 PM	A	1	27366		6	62444		212	7407		23	16654
A	27:04:18	9:38:54 PM	A	1	27412		6	62728		212	7454		23	16593
A	27:04:18	9:38:57 PM	A	1	27501		6	62492		212	7466		23	16565
A	27:04:18	9:39:00 PM	A	1	27422		6	62583		212	7545		23	16540
A	27:04:18	9:39:03 PM	A	1	27366		6	62493		212	7415		23	16489
A	27:04:18	9:39:06 PM	A	1	27379		6	62552		212	7256		23	16455
A	27:04:18	9:39:09 PM	A	1	27465		6	62496		212	7735		23	16389
A	27:04:18	9:39:12 PM	A	1	27365		6	62557		212	7576		23	16399
A	27:04:18	9:39:15 PM	A	1	27411		6	62311		212	7527		23	16330
A	27:04:18	9:39:18 PM	A	1	27471		6	62296		212	6983		23	16290
A	27:04:18	9:39:21 PM	A	1	27399		6	61557		212	7179		23	16241
A	27:04:18	9:39:24 PM	A	1	27428		6	61849		212	7238		23	16195
A	27:04:18	9:39:27 PM	A	1	27430		6	61826		212	7186		23	16145
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A	27:04:18	9:39:33 PM	A	1	27483		6	61782		212	7521		23	16067
A	27:04:18	9:39:36 PM	A	1	27328		6	61654		212	7380		23	16013
A	27:04:18	9:39:39 PM	A	1	27432		6	61513		212	7424		23	16016
A	27:04:18	9:39:42 PM	A	1	27299		6	61341		212	7364		23	15987
A	27:04:18	9:39:45 PM	A	1	27352		6	61256		212	7426		23	15906
A	27:04:18	9:39:48 PM	A	1	27261		6	61097		212	7224		23	15837
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A	27:04:18	9:39:54 PM	A	1	27315		6	60781		212	6941		23	15785
A	27:04:18	9:39:57 PM	A	1	27406		6	60788		212	7351		23	15720
A	27:04:18	9:40:00 PM	A	1	27424		6	60695		212	7292		23	15698
A	27:04:18	9:40:03 PM	A	1	27467		6	60453		212	7185		23	15632
A	27:04:18	9:40:06 PM	A	1	27387		6	60622		212	7218		23	15608
A	27:04:18	9:40:09 PM	A	1	27374		6	60026		212	6848		23	15544
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A	27:04:18	9:40:18 PM	A	1	27315		6	59461		212	6766		23	15459
A	27:04:18	9:40:21 PM	A	1	27383		6	59893		212	6663		23	15406
A	27:04:18	9:40:24 PM	A	1	27433		6	59118		212	6792		23	15365
A	27:04:18	9:40:27 PM	A	1	27469		6	59149		212	6583		23	15328
A	27:04:18	9:40:30 PM	A	1	27427		6	58849		212	6793		23	15296
A	27:04:18	9:40:33 PM	A	1	27418		6	58687		212	6673		23	15245
A	27:04:18	9:40:36 PM	A	1	27451		6	58779		212	6847		23	15230
A	27:04:18	9:40:39 PM	A	1	27322		6	58354		212	7168		23	15174
A	27:04:18	9:40:42 PM	A	1	27325		6	58399		212	7147		23	15138
A	27:04:18	9:40:45 PM	A	1	27523		6	58312		212	6710		23	15122

A	27:04:18	9:40:48 PM	A	1	27438		6	57896		212	6739		23	15072
A	27:04:18	9:40:51 PM	A	1	27340		6	58150		212	6827		23	15033
A	27:04:18	9:40:54 PM	A	1	27431		6	57610		212	7084		23	14993
A	27:04:18	9:40:57 PM	A	1	27490		6	57878		212	6901		23	14965
A	27:04:18	9:41:00 PM	A	1	27431		6	57760		212	6766		23	14930
A	27:04:18	9:41:03 PM	A	1	27337		6	57460		212	6802		23	14873
A	27:04:18	9:41:06 PM	A	1	27504		6	57789		212	6534		23	14857
A	27:04:18	9:41:09 PM	A	1	27315		6	57259		212	7056		23	14795
A	27:04:18	9:41:12 PM	A	1	27344		6	56969		212	7073		23	14766
A	27:04:18	9:41:15 PM	A	1	27372		6	57192		212	6796		23	14752
A	27:04:18	9:41:18 PM	A	1	27359		6	56493		212	6860		23	14686
A	27:04:18	9:41:21 PM	A	1	27390		6	56688		212	6733		23	14688
A	27:04:18	9:41:24 PM	A	1	27563		6	56474		212	6628		23	14622
A	27:04:18	9:41:27 PM	A	1	27456		6	56087		212	6605		23	14619
A	27:04:18	9:41:30 PM	A	1	27315		6	56198		212	6966		23	14574
A	27:04:18	9:41:33 PM	A	1	27373		6	55811		212	7047		23	14496
A	27:04:18	9:41:36 PM	A	1	27512		6	55982		212	6520		23	14469
A	27:04:18	9:41:39 PM	A	1	27497		6	55813		212	6581		23	14412
A	27:04:18	9:41:42 PM	A	1	27472		6	55570		212	6685		23	14382
A	27:04:18	9:41:45 PM	A	1	27436		6	55776		212	7145		23	14355
A	27:04:18	9:41:48 PM	A	1	27336		6	55355		212	6991		23	14326
A	27:04:18	9:41:51 PM	A	1	27461		6	55228		212	6503		23	14323
A	27:04:18	9:41:54 PM	A	1	27498		6	55122		212	6983		23	14266
A	27:04:18	9:41:57 PM	A	1	27401		6	54713		212	7009		23	14230
A	27:04:18	9:42:00 PM	A	1	27476		6	55053		212	6644		23	14199
A	27:04:18	9:42:03 PM	A	1	27392		6	54478		212	6685		23	14126
A	27:04:18	9:42:06 PM	A	1	27394		6	54108		212	6793		23	14093
A	27:04:18	9:42:09 PM	A	1	27396		6	54058		212	6864		23	14074
A	27:04:18	9:42:12 PM	A	1	27413		6	53581		212	6860		23	14052
A	27:04:18	9:42:15 PM	A	1	27449		6	53593		212	6537		23	14002
A	27:04:18	9:42:18 PM	A	1	27346		6	52910		212	6505		23	13989
A	27:04:18	9:42:21 PM	A	1	27476		6	52665		212	6891		23	13953
A	27:04:18	9:42:24 PM	A	1	27452		6	52671		212	6928		23	13887
A	27:04:18	9:42:27 PM	A	1	27450		6	51686		212	6839		23	13875
A	27:04:18	9:42:30 PM	A	1	27359		6	51943		212	6557		23	13805
A	27:04:18	9:42:33 PM	A	1	27407		6	51207		212	6456		23	13747
A	27:04:18	9:42:36 PM	A	1	27303		6	50851		212	6842		23	13716
A	27:04:18	9:42:39 PM	A	1	27405		6	50833		212	6811		23	13723
A	27:04:18	9:42:42 PM	A	1	27418		6	49909		212	6425		23	13633
A	27:04:18	9:42:45 PM	A	1	27455		6	50142		212	6947		23	13599
A	27:04:18	9:42:48 PM	A	1	27371		6	49383		212	6754		23	13584
A	27:04:18	9:42:51 PM	A	1	27345		6	48829		212	6513		23	13506

A	27:04:18	9:42:54 PM	A	1	27358		6	49074		212	6473		23	13468
A	27:04:18	9:42:57 PM	A	1	27429		6	47861		212	6087		23	13463
A	27:04:18	9:43:00 PM	A	1	27517		6	48129		212	6585		23	13429
A	27:04:18	9:43:03 PM	A	1	27224		6	47661		212	6498		23	13367
A	27:04:18	9:43:06 PM	A	1	27327		6	47037		212	6317		23	13335
A	27:04:18	9:43:09 PM	A	1	27448		6	47245		212	6648		23	13341
A	27:04:18	9:43:12 PM	A	1	27346		6	46234		212	6509		23	13295
A	27:04:18	9:43:15 PM	A	1	27391		6	46422		212	6623		23	13238
A	27:04:18	9:43:18 PM	A	1	27447		6	45935		212	6504		23	13200
A	27:04:18	9:43:21 PM	A	1	27349		6	45055		212	6664		23	13146
A	27:04:18	9:43:24 PM	A	1	27351		6	45775		212	6537		23	13133
A	27:04:18	9:43:27 PM	A	1	27318		6	44246		212	6277		23	13073
A	27:04:18	9:43:30 PM	A	1	27459		6	44375		212	6239		23	13022
A	27:04:18	9:43:33 PM	A	1	27413		6	44020		212	6373		23	12979
A	27:04:18	9:43:36 PM	A	1	27451		6	43127		212	6286		23	12929
A	27:04:18	9:43:39 PM	A	1	27382		6	43574		212	6275		23	12925
A	27:04:18	9:43:42 PM	A	1	27436		6	42559		212	6548		23	12884
A	27:04:18	9:43:45 PM	A	1	27457		6	42537		212	6388		23	12812
A	27:04:18	9:43:48 PM	A	1	27406		6	42450		212	6773		23	12783
A	27:04:18	9:43:51 PM	A	1	27465		6	41468		212	6564		23	12764
A	27:04:18	9:43:54 PM	A	1	27413		6	41821		212	6523		23	12724
A	27:04:18	9:43:57 PM	A	1	27415		6	40780		212	6153		23	12678
A	27:04:18	9:44:00 PM	A	1	27571		6	40716		212	6148		23	12637
A	27:04:18	9:44:03 PM	A	1	27440		6	40846		212	6500		23	12580
A	27:04:18	9:44:06 PM	A	1	27357		6	39807		212	6355		23	12529
A	27:04:18	9:44:09 PM	A	1	27428		6	40231		212	6414		23	12495
A	27:04:18	9:44:12 PM	A	1	27312		6	39408		212	6491		23	12429
A	27:04:18	9:44:15 PM	A	1	27423		6	38901		212	6119		23	12415
A	27:04:18	9:44:18 PM	A	1	27481		6	39505		212	6100		23	12368
A	27:04:18	9:44:21 PM	A	1	27439		6	39337		212	6118		23	12327
A	27:04:18	9:44:24 PM	A	1	27441		6	39093		212	5954		23	12289
A	27:04:18	9:44:27 PM	A	1	27449		6	38858		212	6500		23	12242
A	27:04:18	9:44:30 PM	A	1	27393		6	38626		212	6272		23	12207
A	27:04:18	9:44:33 PM	A	1	27473		6	39113		212	6359		23	12171
A	27:04:18	9:44:36 PM	A	1	27409		6	38056		212	6067		23	12123
A	27:04:18	9:44:39 PM	A	1	27406		6	38494		212	6011		23	12049
A	27:04:18	9:44:42 PM	A	1	27502		6	38060		212	5804		23	12016
A	27:04:18	9:44:45 PM	A	1	27469		6	38090		212	5801		23	11983
A	27:04:18	9:44:48 PM	A	1	27312		6	38659		212	6227		23	11955
A	27:04:18	9:44:51 PM	A	1	27432		6	37686		212	6164		23	11894
A	27:04:18	9:44:54 PM	A	1	27449		6	38044		212	6322		23	11849
A	27:04:18	9:44:57 PM	A	1	27540		6	38079		212	6089		23	11778

A	27:04:18	9:45:00 PM	A	1	27491		6	37888		212	6106		23	11754
A	27:04:18	9:45:03 PM	A	1	27399		6	38142		212	6196		23	11714
A	27:04:18	9:45:06 PM	A	1	27459		6	37661		212	6101		23	11685
A	27:04:18	9:45:09 PM	A	1	27381		6	37800		212	6062		23	11619
A	27:04:18	9:45:12 PM	A	1	27448		6	37849		212	5853		23	11561
A	27:04:18	9:45:15 PM	A	1	27482		6	37413		212	5718		23	11561
A	27:04:18	9:45:18 PM	A	1	27344		6	37753		212	5909		23	11519
A	27:04:18	9:45:21 PM	A	1	27391		6	37363		212	5998		23	11489
A	27:04:18	9:45:24 PM	A	1	27337		6	37622		212	6064		23	11430
A	27:04:18	9:45:27 PM	A	1	27455		6	37718		212	6178		23	11395
A	27:04:18	9:45:30 PM	A	1	27337		6	37360		212	6245		23	11378
A	27:04:18	9:45:33 PM	A	1	27461		6	37726		212	6083		23	11328
A	27:04:18	9:45:36 PM	A	1	27343		6	37531		212	5876		23	11304
A	27:04:18	9:45:39 PM	A	1	27356		6	37607		212	5882		23	11296
A	27:04:18	9:45:42 PM	A	1	27332		6	37787		212	6075		23	11221
A	27:04:18	9:45:45 PM	A	1	27416		6	37219		212	5933		23	11145
A	27:04:18	9:45:48 PM	A	1	27371		6	37641		212	5845		23	11164
A	27:04:18	9:45:51 PM	A	1	27448		6	37472		212	5869		23	11105
A	27:04:18	9:45:54 PM	A	1	27308		6	37647		212	5578		23	11046
A	27:04:18	9:45:57 PM	A	1	27474		6	37953		212	5924		23	11054
A	27:04:18	9:46:00 PM	A	1	27352		6	37638		212	5902		23	10995
A	27:04:18	9:46:03 PM	A	1	27416		6	37837		212	5715		23	10971
A	27:04:18	9:46:06 PM	A	1	27286		6	37894		212	6117		23	10899
A	27:04:18	9:46:09 PM	A	1	27387		6	37823		212	6085		23	10902
A	27:04:18	9:46:12 PM	A	1	27353		6	38109		212	5999		23	10864
A	27:04:18	9:46:15 PM	A	1	27444		6	37911		212	6236		23	10829
A	27:04:18	9:46:18 PM	A	1	27330		6	38153		212	6231		23	10792
A	27:04:18	9:46:21 PM	A	1	27360		6	37934		212	6241		23	10733
A	27:04:18	9:46:24 PM	A	1	27339		6	37715		212	5889		23	10691
A	27:04:18	9:46:27 PM	A	1	27452		6	38112		212	5654		23	10635
A	27:04:18	9:46:30 PM	A	1	27394		6	37692		212	5827		23	10618
A	27:04:18	9:46:33 PM	A	1	27556		6	37619		212	5521		23	10597
A	27:04:18	9:46:36 PM	A	1	27377		6	37548		212	6123		23	10536
A	27:04:18	9:46:39 PM	A	1	27519		6	37195		212	6033		23	10484
A	27:04:18	9:46:42 PM	A	1	27390		6	37386		212	5957		23	10432
A	27:04:18	9:46:45 PM	A	1	27349		6	36743		212	5578		23	10432
A	27:04:18	9:46:48 PM	A	1	27353		6	36672		212	5800		23	10389
A	27:04:18	9:46:51 PM	A	1	27451		6	36708		212	5706		23	10328
A	27:04:18	9:46:54 PM	A	1	27545		6	36087		212	5928		23	10304
A	27:04:18	9:46:57 PM	A	1	27438		6	36243		212	5944		23	10265
A	27:04:18	9:47:00 PM	A	1	27549		6	35589		212	5913		23	10241
A	27:04:18	9:47:03 PM	A	1	27561		6	35353		212	5592		23	10206

A	27:04:18	9:47:06 PM	A	1	27450		6	35136		212	6088		23	10125
A	27:04:18	9:47:09 PM	A	1	27503		6	34171		212	5928		23	10066
A	27:04:18	9:47:12 PM	A	1	27488		6	34563		212	5994		23	10055
A	27:04:18	9:47:15 PM	A	1	27339		6	34319		212	5594		23	9988
A	27:04:18	9:47:18 PM	A	1	27436		6	33797		212	5767		23	9961
A	27:04:18	9:47:21 PM	A	1	27501		6	34164		212	5947		23	9947
A	27:04:18	9:47:24 PM	A	1	27516		6	33267		212	5903		23	9895
A	27:04:18	9:47:27 PM	A	1	27459		6	33327		212	5567		23	9871
A	27:04:18	9:47:30 PM	A	1	27389		6	33091		212	5157		23	9793
A	27:04:18	9:47:33 PM	A	1	27318		6	32682		212	5491		23	9771
A	27:04:18	9:47:36 PM	A	1	27416		6	32815		212	5817		23	9707
A	27:04:18	9:47:39 PM	A	1	27273		6	32199		212	5602		23	9698
A	27:04:18	9:47:42 PM	A	1	27398		6	32681		212	5649		23	9623
A	27:04:18	9:47:45 PM	A	1	27420		6	32721		212	5557		23	9604
A	27:04:18	9:47:48 PM	A	1	27527		6	32525		212	5425		23	9545
A	27:04:18	9:47:51 PM	A	1	27594		6	32909		212	5555		23	9509
A	27:04:18	9:47:54 PM	A	1	27406		6	32261		212	5424		23	9447
A	27:04:18	9:47:57 PM	A	1	27461		6	32724		212	5526		23	9438
A	27:04:18	9:48:00 PM	A	1	27523		6	32759		212	5607		23	9375
A	27:04:18	9:48:03 PM	A	1	27350		6	32826		212	5797		23	9331
A	27:04:18	9:48:06 PM	A	1	27463		6	33180		212	5571		23	9279
A	27:04:18	9:48:09 PM	A	1	27429		6	33006		212	5773		23	9215
A	27:04:18	9:48:12 PM	A	1	27503		6	33242		212	5562		23	9450
A	27:04:18	9:48:15 PM	A	1	27353		6	33543		212	5524		23	9183
A	27:04:18	9:48:18 PM	A	1	27464		6	33654		212	5685		23	9115
A	27:04:18	9:48:21 PM	A	1	27498		6	33732		212	5647		23	9058
A	27:04:18	9:48:24 PM	A	1	27348		6	33911		212	5637		23	9059
A	27:04:18	9:48:27 PM	A	1	27499		6	34332		212	5268		23	8984
A	27:04:18	9:48:30 PM	A	1	27368		6	34465		212	5602		23	8917
A	27:04:18	9:48:33 PM	A	1	27334		6	34713		212	5663		23	8890
A	27:04:18	9:48:36 PM	A	1	27451		6	34973		212	5471		23	8858
A	27:04:18	9:48:39 PM	A	1	27389		6	34797		212	5526		23	8815
A	27:04:18	9:48:42 PM	A	1	27432		6	34912		212	5354		23	8795
A	27:04:18	9:48:45 PM	A	1	27448		6	34809		212	5210		23	8720
A	27:04:18	9:48:48 PM	A	1	27471		6	34955		212	5420		23	8666
A	27:04:18	9:48:51 PM	A	1	27396		6	35159		212	5524		23	8675
A	27:04:18	9:48:54 PM	A	1	27398		6	35182		212	5490		23	8611
A	27:04:18	9:48:57 PM	A	1	27463		6	35240		212	5569		23	8570
A	27:04:18	9:49:00 PM	A	1	27390		6	35204		212	5211		23	8546
A	27:04:18	9:49:03 PM	A	1	27449		6	35374		212	5741		23	8480
A	27:04:18	9:49:06 PM	A	1	27533		6	35516		212	5479		23	8468
A	27:04:18	9:49:09 PM	A	1	27349		6	35546		212	5284		23	8423

A	27:04:18	9:49:12 PM	A	1	27356		6	35663		212	5041		23	8392
A	27:04:18	9:49:15 PM	A	1	27467		6	35878		212	5434		23	8301
A	27:04:18	9:49:18 PM	A	1	27503		6	35836		212	5413		23	8290
A	27:04:18	9:49:21 PM	A	1	27451		6	35868		212	5287		23	8251
A	27:04:18	9:49:24 PM	A	1	27398		6	35726		212	5082		23	8169
A	27:04:18	9:49:27 PM	A	1	27454		6	35602		212	5554		23	8152
A	27:04:18	9:49:30 PM	A	1	27337		6	36814		212	5498		23	8098
A	27:04:18	9:49:33 PM	A	1	27455		6	35841		212	5254		23	8071
A	27:04:18	9:49:36 PM	A	1	27402		6	35731		212	5173		23	8064
A	27:04:18	9:49:39 PM	A	1	27479		6	35688		212	5206		23	8016
A	27:04:18	9:49:42 PM	A	1	27419		6	35881		212	5104		23	7959
A	27:04:18	9:49:45 PM	A	1	27455		6	35745		212	5298		23	7923
A	27:04:18	9:49:48 PM	A	1	27378		6	35749		212	5224		23	7867
A	27:04:18	9:49:51 PM	A	1	27453		6	35608		212	5141		23	7822
A	27:04:18	9:49:54 PM	A	1	27437		6	35665		212	5047		23	7812
A	27:04:18	9:49:57 PM	A	1	27409		6	35239		212	4976		23	7780
A	27:04:18	9:50:00 PM	A	1	27271		6	35170		212	5468		23	7706
A	27:04:18	9:50:03 PM	A	1	27464		6	35053		212	5027		23	7691
A	27:04:18	9:50:06 PM	A	1	27428		6	34938		212	5158		23	7651
A	27:04:18	9:50:09 PM	A	1	27360		6	34788		212	5170		23	7607
A	27:04:18	9:50:12 PM	A	1	27304		6	34819		212	4874		23	7564
A	27:04:18	9:50:15 PM	A	1	27495		6	35181		212	4813		23	7534
A	27:04:18	9:50:18 PM	A	1	27447		6	35015		212	4852		23	7495
A	27:04:18	9:50:21 PM	A	1	27378		6	35284		212	5208		23	7419
A	27:04:18	9:50:24 PM	A	1	27456		6	35779		212	4808		23	7409
A	27:04:18	9:50:27 PM	A	1	27431		6	36290		212	4881		23	7347
A	27:04:18	9:50:30 PM	A	1	27294		6	36701		212	5102		23	7302
A	27:04:18	9:50:33 PM	A	1	27395		6	36874		212	5205		23	7251
A	27:04:18	9:50:36 PM	A	1	27368		6	37227		212	5148		23	7207
A	27:04:18	9:50:39 PM	A	1	27464		6	37446		212	5010		23	7195
A	27:04:18	9:50:42 PM	A	1	27386		6	37748		212	4891		23	7147
A	27:04:18	9:50:45 PM	A	1	27406		6	37630		212	5135		23	7147
A	27:04:18	9:50:48 PM	A	1	27482		6	37681		212	5231		23	7080
A	27:04:18	9:50:51 PM	A	1	27449		6	38321		212	4954		23	7020
A	27:04:18	9:50:54 PM	A	1	27442		6	38091		212	4924		23	7015
A	27:04:18	9:50:57 PM	A	1	27436		6	38407		212	4999		23	6975
A	27:04:18	9:51:00 PM	A	1	27404		6	38464		212	5018		23	6936
A	27:04:18	9:54:00 PM	A	1	27412		6	43404		212	4281		23	4338
A	27:04:18	9:57:00 PM	A	1	27407		6	42070		212	3715		23	1956
A	27:04:18	10:00:00 PM	A	1	27405		6	49911		212	2875		22	65293
A	27:04:18	10:03:00 PM	A	1	27423		6	48658		212	2202		22	63282
A	27:04:18	10:06:00 PM	A	1	27411		6	42372		211	64708		22	60807

A	27:04:18	10:09:00 PM	A	1	27354		6	44701		211	64517		22	58325
A	27:04:18	10:12:00 PM	A	1	27563		6	43756		211	64055		22	55761
A	27:04:18	10:15:00 PM	A	1	27385		6	41738		211	63349		22	53329
A	27:04:18	10:18:00 PM	A	1	27542		6	50800		211	62722		22	50839
A	27:04:18	10:21:00 PM	A	1	24339		6	57590		211	61909		22	48371
A	27:04:18	10:24:00 PM	A	1	27548		6	56612		211	61161		22	45743
A	27:04:18	10:30:00 PM	A	1	27532		6	63023		211	59835		22	40493
A	27:04:18	10:33:00 PM	A	1	27412		6	63349		211	57366		22	37828
A	27:04:18	10:36:00 PM	A	1	27284		6	62849		211	56754		22	35042
A	27:04:18	10:36:03 PM	A	1	27638		6	62997		211	56764		22	35021
A	27:04:18	10:36:06 PM	A	1	27395		6	62963		211	56509		22	34971
A	27:04:18	10:36:09 PM	A	1	27410		6	62978		211	56696		22	34946
A	27:04:18	10:36:12 PM	A	1	27366		6	63308		211	57112		22	34894
A	27:04:18	10:36:15 PM	A	1	27393		6	62877		211	56926		22	34854
A	27:04:18	10:36:18 PM	A	1	27388		6	63207		211	56898		22	34826
A	27:04:18	10:36:21 PM	A	1	27336		6	63214		211	56825		22	34751
A	27:04:18	10:36:24 PM	A	1	27406		6	63191		211	56605		22	34741
A	27:04:18	10:36:27 PM	A	1	27316		6	63270		211	57000		22	34697
A	27:04:18	10:36:30 PM	A	1	27531		6	63288		211	56980		22	34643
A	27:04:18	10:36:33 PM	A	1	27368		6	63220		211	56462		22	34609
A	27:04:18	10:36:36 PM	A	1	27435		6	63402		211	56421		22	34570
A	27:04:18	10:36:39 PM	A	1	27558		6	63172		211	56605		22	34499
A	27:04:18	10:36:42 PM	A	1	27139		6	63343		211	56551		22	34464
A	27:04:18	10:36:45 PM	A	1	27472		6	63176		211	56792		22	34415
A	27:04:18	10:36:48 PM	A	1	27491		6	63213		211	56823		22	34376
A	27:04:18	10:36:51 PM	A	1	27363		6	63312		211	56459		22	34349
A	27:04:18	10:36:54 PM	A	1	27413		6	63122		211	56567		22	34307
A	27:04:18	10:36:57 PM	A	1	27480		6	63270		211	56543		22	34288
A	27:04:18	10:37:00 PM	A	1	27335		6	63080		211	56405		22	34230
A	27:04:18	10:37:03 PM	A	1	27167		6	63121		211	56883		22	34177
A	27:04:18	10:37:06 PM	A	1	27335		6	63136		211	56774		22	34132
A	27:04:18	10:37:09 PM	A	1	27492		6	63015		211	56725		22	34079
A	27:04:18	10:37:12 PM	A	1	27379		6	63084		211	56460		22	34052
A	27:04:18	10:37:15 PM	A	1	27426		6	63073		211	56266		22	34024
A	27:04:18	10:37:18 PM	A	1	27401		6	62976		211	56447		22	33949
A	27:04:18	10:37:21 PM	A	1	27411		6	63236		211	56633		22	33908
A	27:04:18	10:37:24 PM	A	1	27395		6	63213		211	56321		22	33891
A	27:04:18	10:37:27 PM	A	1	27460		6	63380		211	56195		22	33840
A	27:04:18	10:37:30 PM	A	1	27367		6	63462		211	56333		22	33778
A	27:04:18	10:37:33 PM	A	1	27440		6	63423		211	56376		22	33749
A	27:04:18	10:37:36 PM	A	1	27464		6	63540		211	56798		22	33691
A	27:04:18	10:37:39 PM	A	1	27398		6	63452		211	56497		22	33649

A	27:04:18	10:37:42 PM	A	1	27307		6	63383		211	56520		22	33594
A	27:04:18	10:37:45 PM	A	1	27406		6	63493		211	56272		22	33565
A	27:04:18	10:37:48 PM	A	1	27362		6	63318		211	56284		22	33543
A	27:04:18	10:37:51 PM	A	1	27324		6	63557		211	56568		22	33503
A	27:04:18	10:37:54 PM	A	1	27436		6	63462		211	56633		22	33489
A	27:04:18	10:37:57 PM	A	1	27387		6	63463		211	56083		22	33424
A	27:04:18	10:38:00 PM	A	1	27482		6	63631		211	56318		22	33336
A	27:04:18	10:38:03 PM	A	1	27408		6	63548		211	56630		22	33329
A	27:04:18	10:38:06 PM	A	1	27353		6	63718		211	56686		22	33259
A	27:04:18	10:38:09 PM	A	1	27521		6	63797		211	56696		22	33226
A	27:04:18	10:38:12 PM	A	1	27360		6	63670		211	56105		22	33187
A	27:04:18	10:38:15 PM	A	1	27431		6	63907		211	56323		22	33147
A	27:04:18	10:38:18 PM	A	1	27452		6	63581		211	56171		22	33084
A	27:04:18	10:38:21 PM	A	1	27401		6	63962		211	56325		22	33078
A	27:04:18	10:38:24 PM	A	1	27481		6	63913		211	56829		22	33009
A	27:04:18	10:38:27 PM	A	1	27447		6	63955		211	56444		22	32952
A	27:04:18	10:38:30 PM	A	1	27353		6	64261		211	56590		22	32914
A	27:04:18	10:38:33 PM	A	1	27489		6	64196		211	56583		22	32857
A	27:04:18	10:38:36 PM	A	1	27446		6	64188		211	56372		22	32817
A	27:04:18	10:38:39 PM	A	1	27261		6	64448		211	56456		22	32799
A	27:04:18	10:38:42 PM	A	1	27486		6	65082		211	56371		22	32758
A	27:04:18	10:38:45 PM	A	1	27513		6	64431		211	56566		22	32691
A	27:04:18	10:38:48 PM	A	1	27369		6	64423		211	56298		22	32653
A	27:04:18	10:38:51 PM	A	1	27423		6	64312		211	56213		22	32610
A	27:04:18	10:38:54 PM	A	1	27240		6	64725		211	56190		22	32574
A	27:04:18	10:38:57 PM	A	1	27328		6	64622		211	56362		22	32512
A	27:04:18	10:39:00 PM	A	1	27424		6	64940		211	56469		22	32505
A	27:04:18	10:39:03 PM	A	1	27473		6	64876		211	56320		22	32434
A	27:04:18	10:39:06 PM	A	1	27497		6	64856		211	56447		22	32419
A	27:04:18	10:39:09 PM	A	1	27409		6	64932		211	55982		22	32355
A	27:04:18	10:39:12 PM	A	1	27476		6	64786		211	56180		22	32289
A	27:04:18	10:39:15 PM	A	1	27331		6	64888		211	56502		22	32254
A	27:04:18	10:39:18 PM	A	1	27383		6	64926		211	56410		22	32240
A	27:04:18	10:39:21 PM	A	1	27300		6	64866		211	56318		22	32178
A	27:04:18	10:39:24 PM	A	1	27405		6	65102		211	56363		22	32124
A	27:04:18	10:39:27 PM	A	1	27357		6	64849		211	56054		22	32127
A	27:04:18	10:39:30 PM	A	1	27583		6	65044		211	56021		22	32024
A	27:04:18	10:39:33 PM	A	1	27373		6	65028		211	56448		22	32013
A	27:04:18	10:39:36 PM	A	1	27557		6	65114		211	56293		22	31977
A	27:04:18	10:39:39 PM	A	1	27388		6	65197		211	56491		22	31913
A	27:04:18	10:39:42 PM	A	1	27360		6	64857		211	56026		22	31885
A	27:04:18	10:39:45 PM	A	1	27342		6	65226		211	56107		22	31826

A	27:04:18	10:39:48 PM	A	1	27467		6	65148		211	55761		22	31811
A	27:04:18	10:39:51 PM	A	1	27453		6	65171		211	55851		22	31783
A	27:04:18	10:39:54 PM	A	1	27390		6	65404		211	55939		22	31727
A	27:04:18	10:39:57 PM	A	1	27528		6	65300		211	56351		22	31686
A	27:04:18	10:40:00 PM	A	1	27441		6	65116		211	56218		22	31665
A	27:04:18	10:40:03 PM	A	1	27455		6	65201		211	55997		22	31615
A	27:04:18	10:40:06 PM	A	1	27481		6	65037		211	56244		22	31570
A	27:04:18	10:40:09 PM	A	1	27381		6	65060		211	56156		22	31513
A	27:04:18	10:40:12 PM	A	1	27421		6	65098		211	56183		22	31490
A	27:04:18	10:40:15 PM	A	1	27338		6	65089		211	56031		22	31478
A	27:04:18	10:40:18 PM	A	1	27440		6	65064		211	56110		22	31428
A	27:04:18	10:40:21 PM	A	1	27513		6	64920		211	56003		22	31382
A	27:04:18	10:40:24 PM	A	1	27391		6	64906		211	56262		22	31365
A	27:04:18	10:40:27 PM	A	1	27457		6	64695		211	55685		22	31339
A	27:04:18	10:40:30 PM	A	1	27380		6	64729		211	56073		22	31305
A	27:04:18	10:40:33 PM	A	1	27294		6	64883		211	56177		22	31272
A	27:04:18	10:40:36 PM	A	1	27246		6	64712		211	55946		22	31191
A	27:04:18	10:40:39 PM	A	1	27393		6	64910		211	55715		22	31151
A	27:04:18	10:40:42 PM	A	1	27403		6	64942		211	55778		22	31111
A	27:04:18	10:40:45 PM	A	1	27424		6	64858		211	55931		22	31098
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A	27:04:18	10:40:54 PM	A	1	27455		6	64942		211	55930		22	30921
A	27:04:18	10:40:57 PM	A	1	27385		6	64849		211	55696		22	30937
A	27:04:18	10:41:00 PM	A	1	27400		6	64633		211	55605		22	30865
A	27:04:18	10:41:03 PM	A	1	27356		6	64796		211	55688		22	30846
A	27:04:18	10:41:06 PM	A	1	27369		6	64318		211	55475		22	30819
A	27:04:18	10:41:09 PM	A	1	27310		6	64431		211	55625		22	30741
A	27:04:18	10:41:12 PM	A	1	27457		6	64282		211	55554		22	30710
A	27:04:18	10:41:15 PM	A	1	27259		6	64266		211	55651		22	30704
A	27:04:18	10:41:18 PM	A	1	27510		6	64293		211	55690		22	30633
A	27:04:18	10:41:21 PM	A	1	27408		6	64005		211	55972		22	30604
A	27:04:18	10:41:24 PM	A	1	27420		6	64133		211	55877		22	30547
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A	27:04:18	10:41:36 PM	A	1	27430		6	63811		211	55480		22	30403
A	27:04:18	10:41:39 PM	A	1	27402		6	63854		211	55944		22	30356
A	27:04:18	10:41:42 PM	A	1	27403		6	63940		211	55805		22	30322
A	27:04:18	10:41:45 PM	A	1	27466		6	63783		211	55796		22	30283
A	27:04:18	10:41:48 PM	A	1	27436		6	63972		211	55749		22	30255
A	27:04:18	10:41:51 PM	A	1	27405		6	63716		211	55833		22	30212

A	27:04:18	10:41:54 PM	A	1	27457		6	63847		211	55654		22	30146
A	27:04:18	10:41:57 PM	A	1	27503		6	63833		211	55732		22	30108
A	27:04:18	10:42:00 PM	A	1	27471		6	63768		211	55795		22	30093
A	27:04:18	10:42:03 PM	A	1	27445		6	63893		211	55688		22	30050
A	27:04:18	10:42:06 PM	A	1	27429		6	63914		211	55624		22	29987
A	27:04:18	10:42:09 PM	A	1	27318		6	63984		211	55630		22	29947
A	27:04:18	10:42:12 PM	A	1	27399		6	63884		211	55881		22	29932
A	27:04:18	10:42:15 PM	A	1	27494		6	63680		211	55617		22	29902
A	27:04:18	10:42:18 PM	A	1	27379		6	63796		211	55450		22	29854
A	27:04:18	10:42:21 PM	A	1	27316		6	63829		211	55351		22	29811
A	27:04:18	10:42:24 PM	A	1	27383		6	64023		211	55364		22	29768
A	27:04:18	10:42:27 PM	A	1	27478		6	64121		211	55191		22	29704
A	27:04:18	10:42:30 PM	A	1	27459		6	63961		211	55303		22	29711
A	27:04:18	10:42:33 PM	A	1	27371		6	64077		211	55626		22	29642
A	27:04:18	10:42:36 PM	A	1	27404		6	64080		211	55516		22	29596
A	27:04:18	10:42:39 PM	A	1	27472		6	64458		211	55590		22	29559
A	27:04:18	10:42:42 PM	A	1	27451		6	64502		211	55471		22	29539
A	27:04:18	10:42:45 PM	A	1	27437		6	64407		211	55615		22	29464
A	27:04:18	10:42:48 PM	A	1	27397		6	64421		211	55711		22	29453
A	27:04:18	10:42:51 PM	A	1	27382		6	64258		211	55548		22	29423
A	27:04:18	10:42:54 PM	A	1	27403		6	64386		211	55246		22	29381
A	27:04:18	10:42:57 PM	A	1	27334		6	64379		211	55328		22	29334
A	27:04:18	10:43:00 PM	A	1	27483		6	64469		211	55577		22	29292
A	27:04:18	10:43:03 PM	A	1	27355		6	64345		211	55561		22	29238
A	27:04:18	10:43:06 PM	A	1	27423		6	64369		211	55597		22	29191
A	27:04:18	10:43:09 PM	A	1	27423		6	64270		211	55716		22	29152
A	27:04:18	10:43:12 PM	A	1	27498		6	64380		211	55458		22	29125
A	27:04:18	10:43:15 PM	A	1	27394		6	64194		211	55334		22	29086
A	27:04:18	10:43:18 PM	A	1	27352		6	64279		211	55148		22	29049
A	27:04:18	10:43:21 PM	A	1	27439		6	64391		211	55365		22	29005
A	27:04:18	10:43:24 PM	A	1	27422		6	64044		211	55124		22	28957
A	27:04:18	10:43:27 PM	A	1	27345		6	64064		211	55624		22	28914
A	27:04:18	10:43:30 PM	A	1	27402		6	64112		211	55578		22	28868
A	27:04:18	10:43:33 PM	A	1	27459		6	64247		211	55625		22	28824
A	27:04:18	10:43:36 PM	A	1	27402		6	64206		211	55516		22	28785
A	27:04:18	10:43:39 PM	A	1	27354		6	63976		211	55114		22	28725
A	27:04:18	10:43:42 PM	A	1	27460		6	63846		211	55211		22	28724
A	27:04:18	10:43:45 PM	A	1	27519		6	63960		211	55329		22	28655
A	27:04:18	10:43:48 PM	A	1	27396		6	64021		211	55003		22	28612
A	27:04:18	10:43:51 PM	A	1	27397		6	64159		211	55149		22	28539
A	27:04:18	10:43:54 PM	A	1	27487		6	64013		211	55048		22	28524
A	27:04:18	10:43:57 PM	A	1	27453		6	64118		211	54885		22	28458

A	27:04:18	10:44:00 PM	A	1	27430		6	64009		211	55122		22	28470
A	27:04:18	10:44:03 PM	A	1	27313		6	63925		211	55520		22	28422
A	27:04:18	10:44:06 PM	A	1	27422		6	63842		211	55130		22	28361
A	27:04:18	10:44:09 PM	A	1	27557		6	63621		211	55327		22	28321
A	27:04:18	10:44:12 PM	A	1	27421		6	63691		211	55339		22	28284
A	27:04:18	10:44:15 PM	A	1	27452		6	63595		211	55347		22	28263
A	27:04:18	10:44:18 PM	A	1	27402		6	63677		211	55322		22	28201
A	27:04:18	10:44:21 PM	A	1	27375		6	63357		211	55084		22	28181
A	27:04:18	10:44:24 PM	A	1	27393		6	63328		211	54943		22	28127
A	27:04:18	10:44:27 PM	A	1	27291		6	63214		211	54878		22	28080
A	27:04:18	10:44:30 PM	A	1	27437		6	63264		211	55003		22	28072
A	27:04:18	10:44:33 PM	A	1	27494		6	63329		211	55048		22	28045
A	27:04:18	10:44:36 PM	A	1	27348		6	63244		211	54779		22	27985
A	27:04:18	10:44:39 PM	A	1	27377		6	63214		211	54878		22	27931
A	27:04:18	10:44:42 PM	A	1	27340		6	63199		211	55183		22	27922
A	27:04:18	10:44:45 PM	A	1	27373		6	63125		211	55220		22	27843
A	27:04:18	10:44:48 PM	A	1	27386		6	63233		211	54978		22	27825
A	27:04:18	10:44:51 PM	A	1	27429		6	63043		211	54933		22	27785
A	27:04:18	10:44:54 PM	A	1	27344		6	63047		211	54735		22	27750
A	27:04:18	10:44:57 PM	A	1	27420		6	62915		211	54817		22	27682
A	27:04:18	10:45:00 PM	A	1	27413		6	63127		211	55088		22	27664
A	27:04:18	10:45:03 PM	A	1	27309		6	63047		211	55144		22	27610
A	27:04:18	10:45:06 PM	A	1	27496		6	63296		211	54879		22	27573
A	27:04:18	10:45:09 PM	A	1	27407		6	62963		211	54722		22	27548
A	27:04:18	10:45:12 PM	A	1	27476		6	62807		211	55121		22	27475
A	27:04:18	10:45:15 PM	A	1	27496		6	62636		211	55134		22	27465
A	27:04:18	10:45:18 PM	A	1	27371		6	62632		211	54941		22	27431
A	27:04:18	10:45:21 PM	A	1	27387		6	62631		211	54853		22	27411
A	27:04:18	10:45:24 PM	A	1	27341		6	62550		211	54626		22	27326
A	27:04:18	10:45:27 PM	A	1	27375		6	62876		211	54725		22	27280
A	27:04:18	10:45:30 PM	A	1	27389		6	62959		211	54604		22	27226
A	27:04:18	10:45:33 PM	A	1	27338		6	62962		211	54861		22	27179
A	27:04:18	10:45:36 PM	A	1	27428		6	63218		211	54578		22	27138
A	27:04:18	10:45:39 PM	A	1	27388		6	63203		211	55026		22	27093
A	27:04:18	10:45:42 PM	A	1	27419		6	63055		211	54887		22	27052
A	27:04:18	10:45:45 PM	A	1	27508		6	63246		211	54909		22	27028
A	27:04:18	10:45:48 PM	A	1	27380		6	63077		211	54652		22	26978
A	27:04:18	10:45:51 PM	A	1	27419		6	63335		211	54808		22	26922
A	27:04:18	10:45:54 PM	A	1	27413		6	63440		211	54788		22	26899
A	27:04:18	10:45:57 PM	A	1	27594		6	63395		211	54999		22	26832
A	27:04:18	10:46:00 PM	A	1	27355		6	63403		211	54826		22	26790
A	27:04:18	10:46:03 PM	A	1	27368		6	63270		211	54524		22	26742

A	27:04:18	10:46:06 PM	A	1	27346		6	63402		211	54483		22	26704
A	27:04:18	10:46:09 PM	A	1	27293		6	63347		211	54849		22	26659
A	27:04:18	10:46:12 PM	A	1	27370		6	63207		211	54797		22	26610
A	27:04:18	10:46:15 PM	A	1	27426		6	63284		211	54702		22	26558
A	27:04:18	10:46:18 PM	A	1	27375		6	63220		211	54583		22	26505
A	27:04:18	10:46:21 PM	A	1	27456		6	63243		211	54961		22	26465
A	27:04:18	10:46:24 PM	A	1	27405		6	63235		211	54954		22	26405
A	27:04:18	10:46:27 PM	A	1	27497		6	63211		211	54697		22	26365
A	27:04:18	10:46:30 PM	A	1	27415		6	63349		211	54654		22	26303
A	27:04:18	10:46:33 PM	A	1	27424		6	63359		211	54680		22	26268
A	27:04:18	10:46:36 PM	A	1	27431		6	63243		211	54592		22	26206
A	27:04:18	10:46:39 PM	A	1	27466		6	63136		211	54497		22	26150
A	27:04:18	10:46:42 PM	A	1	27352		6	63312		211	54847		22	26104
A	27:04:18	10:46:45 PM	A	1	27409		6	63162		211	54670		22	26047
A	27:04:18	10:46:48 PM	A	1	27435		6	63069		211	54520		22	25988
A	27:04:18	10:46:51 PM	A	1	27385		6	63058		211	54487		22	25952
A	27:04:18	10:46:54 PM	A	1	27338		6	63119		211	54292		22	25874
A	27:04:18	10:46:57 PM	A	1	27549		6	62889		211	54327		22	25853
A	27:04:18	10:47:00 PM	A	1	27500		6	62992		211	54461		22	25792
A	27:04:18	10:47:03 PM	A	1	27291		6	62819		211	54608		22	25764
A	27:04:18	10:47:06 PM	A	1	27511		6	62732		211	54566		22	25697
A	27:04:18	10:47:09 PM	A	1	27406		6	62614		211	54395		22	25625
A	27:04:18	10:47:12 PM	A	1	27372		6	62721		211	54523		22	25595
A	27:04:18	10:47:15 PM	A	1	27299		6	62421		211	54589		22	25543
A	27:04:18	10:47:18 PM	A	1	27419		6	62403		211	54430		22	25496
A	27:04:18	10:47:21 PM	A	1	27463		6	62165		211	54349		22	25452
A	27:04:18	10:47:24 PM	A	1	27383		6	62104		211	54551		22	25394
A	27:04:18	10:47:27 PM	A	1	27466		6	62101		211	54607		22	25343
A	27:04:18	10:47:30 PM	A	1	27519		6	61931		211	54656		22	25311
A	27:04:18	10:47:33 PM	A	1	27458		6	62068		211	54436		22	25249
A	27:04:18	10:47:36 PM	A	1	27412		6	61854		211	54391		22	25214
A	27:04:18	10:47:39 PM	A	1	27411		6	61952		211	54188		22	25158
A	27:04:18	10:47:42 PM	A	1	27468		6	61738		211	54099		22	25085
A	27:04:18	10:47:45 PM	A	1	27331		6	61462		211	54302		22	25038
A	27:04:18	10:47:48 PM	A	1	27375		6	61850		211	54261		22	24988
A	27:04:18	10:47:51 PM	A	1	27471		6	61659		211	54468		22	24937
A	27:04:18	10:47:54 PM	A	1	27568		6	61756		211	54442		22	24887
A	27:04:18	10:47:57 PM	A	1	27317		6	61742		211	54194		22	24845
A	27:04:18	10:48:00 PM	A	1	27472		6	62897		211	53974		22	24815
A	27:04:18	10:48:03 PM	A	1	27338		6	61706		211	54339		22	24764
A	27:04:18	10:48:06 PM	A	1	27432		6	61728		211	54128		22	24714
A	27:04:18	10:48:09 PM	A	1	27504		6	61609		211	54235		22	24677

A	27:04:18	10:48:12 PM	A	1	27411		6	61596		211	54464		22	24624
A	27:04:18	10:48:15 PM	A	1	27468		6	61516		211	54251		22	24584
A	27:04:18	10:48:18 PM	A	1	27373		6	61417		211	54308		22	24540
A	27:04:18	10:48:21 PM	A	1	27380		6	61282		211	54182		22	24514
A	27:04:18	10:48:24 PM	A	1	27524		6	61346		211	54066		22	24423
A	27:04:18	10:48:27 PM	A	1	27430		6	61000		211	53843		22	24389
A	27:04:18	10:48:30 PM	A	1	27364		6	60822		211	54139		22	24370
A	27:04:18	10:48:33 PM	A	1	27401		6	60804		211	54308		22	24326
A	27:04:18	10:48:36 PM	A	1	27368		6	60542		211	54263		22	24298
A	27:04:18	10:48:39 PM	A	1	27509		6	60970		211	54203		22	24195
A	27:04:18	10:48:42 PM	A	1	27548		6	60863		211	54111		22	24208
A	27:04:18	10:48:45 PM	A	1	27454		6	60930		211	54018		22	24106
A	27:04:18	10:48:48 PM	A	1	27523		6	60926		211	54381		22	24089
A	27:04:18	10:48:51 PM	A	1	27544		6	60808		211	54389		22	24036
A	27:04:18	10:48:54 PM	A	1	27495		6	60836		211	54057		22	24026
A	27:04:18	10:48:57 PM	A	1	27504		6	60844		211	54036		22	23946
A	27:04:18	10:49:00 PM	A	1	27332		6	60651		211	54200		22	23929
A	27:04:18	10:49:03 PM	A	1	27401		6	60456		211	53983		22	23868
A	27:04:18	10:49:06 PM	A	1	27358		6	60537		211	54269		22	23769
A	27:04:18	10:49:09 PM	A	1	27312		6	60640		211	54103		22	23766
A	27:04:18	10:49:12 PM	A	1	27468		6	60620		211	54207		22	23706
A	27:04:18	10:49:15 PM	A	1	27465		6	60402		211	54135		22	23666
A	27:04:18	10:49:18 PM	A	1	27407		6	60446		211	54172		22	23637
A	27:04:18	10:49:21 PM	A	1	27353		6	60295		211	54257		22	23603
A	27:04:18	10:49:24 PM	A	1	27428		6	60250		211	53926		22	23574
A	27:04:18	10:49:27 PM	A	1	27353		6	60087		211	54273		22	23520
A	27:04:18	10:49:30 PM	A	1	27463		6	60023		211	54209		22	23467
A	27:04:18	10:49:33 PM	A	1	27505		6	60010		211	53982		22	23406
A	27:04:18	10:49:36 PM	A	1	27512		6	59952		211	53893		22	23369
A	27:04:18	10:49:39 PM	A	1	27316		6	59981		211	53996		22	23310
A	27:04:18	10:49:42 PM	A	1	27381		6	60174		211	53670		22	23291
A	27:04:18	10:49:45 PM	A	1	27448		6	59992		211	54012		22	23210
A	27:04:18	10:49:48 PM	A	1	27385		6	60028		211	54051		22	23217
A	27:04:18	10:49:51 PM	A	1	27384		6	59849		211	54048		22	23161
A	27:04:18	10:49:54 PM	A	1	27431		6	59969		211	53881		22	23106
A	27:04:18	10:49:57 PM	A	1	27425		6	59982		211	54251		22	23060
A	27:04:18	10:50:00 PM	A	1	27491		6	60076		211	54051		22	23010
A	27:04:18	10:50:03 PM	A	1	27447		6	59910		211	53824		22	22958
A	27:04:18	10:50:06 PM	A	1	27277		6	59986		211	53637		22	22914
A	27:04:18	10:50:09 PM	A	1	27347		6	59827		211	53583		22	22868
A	27:04:18	10:50:12 PM	A	1	27299		6	59889		211	54171		22	22848
A	27:04:18	10:50:15 PM	A	1	27463		6	59914		211	54016		22	22797

A	27:04:18	10:50:18 PM	A	1	27322		6	59966		211	53998		22	22745
A	27:04:18	10:50:21 PM	A	1	27319		6	59767		211	53668		22	22691
A	27:04:18	10:50:24 PM	A	1	27398		6	59446		211	53973		22	22616
A	27:04:18	10:50:27 PM	A	1	27393		6	59463		211	53839		22	22588
A	27:04:18	10:50:30 PM	A	1	27411		6	59722		211	53792		22	22525
A	27:04:18	10:50:33 PM	A	1	27425		6	59526		211	53685		22	22489
A	27:04:18	10:50:36 PM	A	1	27350		6	59482		211	53565		22	22415
A	27:04:18	10:50:39 PM	A	1	27394		6	59419		211	53465		22	22399
A	27:04:18	10:50:42 PM	A	1	27521		6	59340		211	53749		22	22358
A	27:04:18	10:50:45 PM	A	1	27413		6	59179		211	53570		22	22270
A	27:04:18	10:50:48 PM	A	1	27438		6	59033		211	53707		22	22242
A	27:04:18	10:50:51 PM	A	1	27370		6	59184		211	53748		22	22180
A	27:04:18	10:50:54 PM	A	1	27421		6	59173		211	54059		22	22131
A	27:04:18	10:50:57 PM	A	1	27506		6	58988		211	53716		22	22088
A	27:04:18	10:51:00 PM	A	1	27278		6	58910		211	53752		22	22067
A	27:04:18	10:51:03 PM	A	1	27370		6	58982		211	53326		22	22011
A	27:04:18	10:51:06 PM	A	1	27437		6	59055		211	53886		22	22002
A	27:04:18	10:51:09 PM	A	1	27389		6	58821		211	53617		22	21913
A	27:04:18	10:51:12 PM	A	1	27474		6	58777		211	53551		22	21901
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A	27:04:18	10:51:33 PM	A	1	27390		6	58162		211	53554		22	21563
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A	27:04:18	10:51:48 PM	A	1	27368		6	57674		211	53771		22	21322
A	27:04:18	10:51:51 PM	A	1	27208		6	57803		211	53802		22	21292
A	27:04:18	10:51:54 PM	A	1	27404		6	57793		211	53488		22	21258
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A	27:04:18	10:52:03 PM	A	1	27597		6	57382		211	53168		22	21106
A	27:04:18	10:52:06 PM	A	1	27444		6	57267		211	53093		22	21048
A	27:04:18	10:52:09 PM	A	1	27386		6	57402		211	53237		22	20974
A	27:04:18	10:52:12 PM	A	1	27382		6	57588		211	53289		22	20972
A	27:04:18	10:52:15 PM	A	1	27371		6	57469		211	53539		22	20912
A	27:04:18	10:52:18 PM	A	1	27393		6	57353		211	53448		22	20879
A	27:04:18	10:52:21 PM	A	1	27395		6	57303		211	53366		22	20823

A	27:04:18	10:52:24 PM	A	1	27321		6	57484		211	53229		22	20779
A	27:04:18	10:52:27 PM	A	1	27291		6	57333		211	53527		22	20747
A	27:04:18	10:52:30 PM	A	1	27510		6	57035		211	53408		22	20718
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A	27:04:18	10:52:39 PM	A	1	27369		6	56567		211	53103		22	20597
A	27:04:18	10:52:42 PM	A	1	27362		6	56722		211	53235		22	20555
A	27:04:18	10:52:45 PM	A	1	27400		6	56752		211	53386		22	20515
A	27:04:18	10:52:48 PM	A	1	27428		6	56625		211	53209		22	20424
A	27:04:18	10:52:51 PM	A	1	27388		6	56403		211	53112		22	20425
A	27:04:18	10:52:54 PM	A	1	27302		6	56547		211	52966		22	20381
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A	27:04:18	10:53:00 PM	A	1	27465		6	56378		211	53284		22	20274
A	27:04:18	10:53:03 PM	A	1	27309		6	56381		211	52907		22	20251
A	27:04:18	10:53:06 PM	A	1	27407		6	56228		211	52938		22	20185
A	27:04:18	10:53:09 PM	A	1	27355		6	56312		211	53055		22	20148
A	27:04:18	10:53:12 PM	A	1	27450		6	56268		211	53069		22	20138
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A	27:04:18	10:53:18 PM	A	1	27344		6	56163		211	53002		22	20024
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A	27:04:18	10:53:24 PM	A	1	27550		6	56050		211	53307		22	19943
A	27:04:18	10:53:27 PM	A	1	27493		6	55923		211	53171		22	19890
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A	27:04:18	10:53:36 PM	A	1	27554		6	55616		211	53032		22	19727
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A	27:04:18	10:53:51 PM	A	1	27388		6	55003		211	53033		22	19569
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A	27:04:18	10:54:24 PM	A	1	27356		6	54561		211	52833		22	19092
A	27:04:18	10:54:27 PM	A	1	27438		6	54716		211	52996		22	19081

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A	27:04:18	10:54:36 PM	A	1	27419		6	54379		211	52773		22	18931
A	27:04:18	10:54:39 PM	A	1	27406		6	54377		211	53008		22	18897
A	27:04:18	10:54:42 PM	A	1	27415		6	54330		211	52788		22	18850
A	27:04:18	10:54:45 PM	A	1	27279		6	54433		211	52600		22	18810
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A	27:04:18	10:54:57 PM	A	1	27420		6	54267		211	52626		22	18632
A	27:04:18	10:55:00 PM	A	1	27345		6	54322		211	52657		22	18622
A	27:04:18	10:55:03 PM	A	1	27353		6	54307		211	52862		22	18543
A	27:04:18	10:55:06 PM	A	1	27386		6	54264		211	52692		22	18508
A	27:04:18	10:55:09 PM	A	1	27402		6	53914		211	53011		22	18496
A	27:04:18	10:55:12 PM	A	1	27309		6	54044		211	52793		22	18436
A	27:04:18	10:55:15 PM	A	1	27377		6	54001		211	52762		22	18364
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A	27:04:18	10:55:21 PM	A	1	27375		6	53837		211	52793		22	18307
A	27:04:18	10:55:24 PM	A	1	27518		6	53735		211	52672		22	18241
A	27:04:18	10:55:27 PM	A	1	27444		6	53587		211	52766		22	18186
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A	27:04:18	10:55:42 PM	A	1	27327		6	52828		211	52640		22	17987
A	27:04:18	10:55:45 PM	A	1	27379		6	52827		211	52685		22	17934
A	27:04:18	10:55:48 PM	A	1	27347		6	52695		211	52405		22	17890
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A	27:04:18	10:55:54 PM	A	1	27515		6	52545		211	52410		22	17778
A	27:04:18	10:55:57 PM	A	1	27322		6	52402		211	52536		22	17730
A	27:04:18	10:56:00 PM	A	1	27475		6	52318		211	52694		22	17711
A	27:04:18	10:56:03 PM	A	1	27315		6	52341		211	52565		22	17664
A	27:04:18	10:56:06 PM	A	1	27439		6	52204		211	52579		22	17612
A	27:04:18	10:56:09 PM	A	1	27397		6	51862		211	52477		22	17563
A	27:04:18	10:56:12 PM	A	1	27324		6	52048		211	52396		22	17517
A	27:04:18	10:56:15 PM	A	1	27374		6	51710		211	52372		22	17472
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A	27:04:18	10:56:21 PM	A	1	27323		6	51852		211	52503		22	17398
A	27:04:18	10:56:24 PM	A	1	27462		6	51687		211	52526		22	17359
A	27:04:18	10:56:27 PM	A	1	27429		6	51538		211	52412		22	17287
A	27:04:18	10:56:30 PM	A	1	27429		6	51504		211	52411		22	17254
A	27:04:18	10:56:33 PM	A	1	27451		6	51737		211	50179		22	17217

A	27:04:18	10:56:36 PM	A	1	27479		6	51736		211	52297		22	17195
A	27:04:18	10:56:39 PM	A	1	27413		6	51452		211	50470		22	17150
A	27:04:18	10:56:42 PM	A	1	27444		6	51370		211	52410		22	17113
A	27:04:18	10:56:45 PM	A	1	27524		6	51271		211	50588		22	17073
A	27:04:18	10:56:48 PM	A	1	27353		6	51284		211	50283		22	17026
A	27:04:18	10:56:51 PM	A	1	27404		6	51301		211	50245		22	16970
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A	27:04:18	10:56:57 PM	A	1	27441		6	51152		211	50594		22	16894
A	27:04:18	10:57:00 PM	A	1	27378		6	51263		211	50308		22	16863
A	27:04:18	10:57:03 PM	A	1	27224		6	50963		211	50191		22	16815
A	27:04:18	10:57:06 PM	A	1	27436		6	51054		211	49993		22	16793
A	27:04:18	10:57:09 PM	A	1	27255		6	51161		211	50211		22	16738
A	27:04:18	10:57:12 PM	A	1	27323		6	51109		211	50347		22	16679
A	27:04:18	10:57:15 PM	A	1	27325		6	51185		211	50131		22	16655
A	27:04:18	10:57:18 PM	A	1	27463		6	51278		211	50130		22	16646
A	27:04:18	10:57:21 PM	A	1	27400		6	51370		211	50088		22	16571
A	27:04:18	10:57:24 PM	A	1	27407		6	51539		211	49987		22	16562
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A	27:04:18	10:57:30 PM	A	1	27486		6	51672		211	50315		22	16447
A	27:04:18	10:57:33 PM	A	1	27424		6	51658		211	49550		22	16433
A	27:04:18	10:57:36 PM	A	1	27371		6	51588		211	49697		22	16384
A	27:04:18	10:57:39 PM	A	1	27495		6	51640		211	49913		22	16363
A	27:04:18	10:57:42 PM	A	1	27341		6	51574		211	49907		22	16324
A	27:04:18	10:57:45 PM	A	1	27423		6	51352		211	49884		22	16261
A	27:04:18	10:57:48 PM	A	1	27416		6	51315		211	49778		22	16229
A	27:04:18	10:57:51 PM	A	1	27365		6	51297		211	50524		22	16170
A	27:04:18	10:57:54 PM	A	1	27342		6	51248		211	50173		22	16132
A	27:04:18	10:57:57 PM	A	1	27360		6	51242		211	50313		22	16128
A	27:04:18	10:58:00 PM	A	1	27362		6	50948		211	50027		22	16065
A	27:04:18	10:58:03 PM	A	1	27429		6	50870		211	50268		22	16032
A	27:04:18	10:58:06 PM	A	1	27437		6	50830		211	50164		22	16002
A	27:04:18	10:58:09 PM	A	1	27504		6	50869		211	50253		22	15935
A	27:04:18	10:58:12 PM	A	1	27430		6	50964		211	49919		22	15924
A	27:04:18	10:58:15 PM	A	1	27396		6	50929		211	49656		22	15861
A	27:04:18	10:58:18 PM	A	1	27431		6	50985		211	49768		22	15816
A	27:04:18	10:58:21 PM	A	1	27491		6	50968		211	49720		22	15813
A	27:04:18	10:58:24 PM	A	1	27400		6	51125		211	49685		22	15752
A	27:04:18	10:58:27 PM	A	1	27316		6	51151		211	49698		22	15696
A	27:04:18	10:58:30 PM	A	1	27331		6	51338		211	49626		22	15635
A	27:04:18	10:58:33 PM	A	1	27408		6	51293		211	50201		22	15614
A	27:04:18	10:58:36 PM	A	1	27401		6	51234		211	50132		22	15577
A	27:04:18	10:58:39 PM	A	1	27406		6	51029		211	50140		22	15532

A	27:04:18	10:58:42 PM	A	1	27381		6	50986		211	49853		22	15499
A	27:04:18	10:58:45 PM	A	1	27414		6	51344		211	49618		22	15449
A	27:04:18	10:58:48 PM	A	1	27364		6	51090		211	50325		22	15387
A	27:04:18	10:58:51 PM	A	1	27526		6	50948		211	50059		22	15371
A	27:04:18	10:58:54 PM	A	1	27316		6	50908		211	49575		22	15346
A	27:04:18	10:58:57 PM	A	1	27333		6	50877		211	49767		22	15253
A	27:04:18	10:59:00 PM	A	1	27308		6	50907		211	49514		22	15245
A	27:04:18	10:59:03 PM	A	1	27420		6	50715		211	49482		22	15223
A	27:04:18	10:59:06 PM	A	1	27423		6	50746		211	49588		22	15159
A	27:04:18	10:59:09 PM	A	1	27341		6	50852		211	50112		22	15145
A	27:04:18	10:59:12 PM	A	1	27439		6	50774		211	50149		22	15082
A	27:04:18	10:59:15 PM	A	1	27502		6	50589		211	49964		22	15060
A	27:04:18	10:59:18 PM	A	1	27359		6	50599		211	50009		22	14997
A	27:04:18	10:59:21 PM	A	1	27384		6	50749		211	50139		22	14959
A	27:04:18	10:59:24 PM	A	1	27350		6	50657		211	49911		22	14928
A	27:04:18	10:59:27 PM	A	1	27340		6	50822		211	50002		22	14874
A	27:04:18	10:59:30 PM	A	1	27375		6	50628		211	49817		22	14840
A	27:04:18	10:59:33 PM	A	1	27453		6	50733		211	49800		22	14805
A	27:04:18	10:59:36 PM	A	1	27490		6	50694		211	50229		22	14756
A	27:04:18	10:59:39 PM	A	1	27354		6	50756		211	49987		22	14707
A	27:04:18	10:59:42 PM	A	1	27426		6	50649		211	49549		22	14689
A	27:04:18	10:59:45 PM	A	1	27353		6	50626		211	49672		22	14643
A	27:04:18	10:59:48 PM	A	1	27393		6	50549		211	49625		22	14587
A	27:04:18	10:59:51 PM	A	1	27468		6	50452		211	49506		22	14560
A	27:04:18	10:59:54 PM	A	1	27553		6	50114		211	49981		22	14514
A	27:04:18	10:59:57 PM	A	1	27508		6	50345		211	49922		22	14487
A	27:04:18	11:00:00 PM	A	1	27307		6	50227		211	49590		22	14466
A	27:04:18	11:00:03 PM	A	1	27516		6	50265		211	49471		22	14415
A	27:04:18	11:00:06 PM	A	1	27388		6	50375		211	49474		22	14371
A	27:04:18	11:00:09 PM	A	1	27448		6	50149		211	49588		22	14336
A	27:04:18	11:00:12 PM	A	1	27417		6	50168		211	50035		22	14284
A	27:04:18	11:00:15 PM	A	1	27428		6	49994		211	49724		22	14227
A	27:04:18	11:00:18 PM	A	1	27457		6	50134		211	49971		22	14231
A	27:04:18	11:00:21 PM	A	1	27384		6	50314		211	49411		22	14165
A	27:04:18	11:00:24 PM	A	1	27438		6	50422		211	49531		22	14114
A	27:04:18	11:00:27 PM	A	1	27500		6	50500		211	49979		22	14109
A	27:04:18	11:00:30 PM	A	1	27467		6	50827		211	49558		22	14069
A	27:04:18	11:00:33 PM	A	1	27429		6	50543		211	49394		22	13982
A	27:04:18	11:00:36 PM	A	1	27536		6	50679		211	50050		22	13970
A	27:04:18	11:00:39 PM	A	1	27252		6	50730		211	49685		22	13935
A	27:04:18	11:00:42 PM	A	1	27517		6	50691		211	49443		22	13881
A	27:04:18	11:00:45 PM	A	1	27348		6	50880		211	49985		22	13852

A	27:04:18	11:00:48 PM	A	1	27341		6	50855		211	49645		22	13810
A	27:04:18	11:00:51 PM	A	1	27421		6	50968		211	49514		22	13761
A	27:04:18	11:00:54 PM	A	1	27337		6	50771		211	49605		22	13727
A	27:04:18	11:00:57 PM	A	1	27307		6	50931		211	49829		22	13683
A	27:04:18	11:01:00 PM	A	1	27431		6	51145		211	49922		22	13633
A	27:04:18	11:01:03 PM	A	1	27390		6	51028		211	49685		22	13585
A	27:04:18	11:01:06 PM	A	1	27414		6	51196		211	49444		22	13579
A	27:04:18	11:01:09 PM	A	1	27394		6	51098		211	50015		22	13532
A	27:04:18	11:01:12 PM	A	1	27375		6	51315		211	49770		22	13450
A	27:04:18	11:01:15 PM	A	1	27410		6	51199		211	49383		22	13420
A	27:04:18	11:01:18 PM	A	1	27402		6	51197		211	49437		22	13387
A	27:04:18	11:01:21 PM	A	1	27326		6	51384		211	49741		22	13328
A	27:04:18	11:01:24 PM	A	1	27556		6	51803		211	49747		22	13311
A	27:04:18	11:01:27 PM	A	1	27481		6	51484		211	49191		22	13246
A	27:04:18	11:01:30 PM	A	1	27420		6	51994		211	49265		22	13234
A	27:04:18	11:01:33 PM	A	1	27440		6	51732		211	49904		22	13158
A	27:04:18	11:01:36 PM	A	1	27484		6	51838		211	49768		22	13161
A	27:04:18	11:01:39 PM	A	1	27485		6	52003		211	49558		22	13091
A	27:04:18	11:01:42 PM	A	1	27368		6	51884		211	49367		22	13066
A	27:04:18	11:01:45 PM	A	1	27483		6	51869		211	49444		22	13022
A	27:04:18	11:01:48 PM	A	1	27292		6	52004		211	49602		22	12987
A	27:04:18	11:01:51 PM	A	1	27366		6	51772		211	49793		22	12889
A	27:04:18	11:01:54 PM	A	1	27332		6	51727		211	49254		22	12880
A	27:04:18	11:01:57 PM	A	1	27438		6	51632		211	49393		22	12844
A	27:04:18	11:02:00 PM	A	1	27442		6	51686		211	49902		22	12783
A	27:04:18	11:02:03 PM	A	1	27369		6	51716		211	49713		22	12735
A	27:04:18	11:02:06 PM	A	1	27350		6	51489		211	49641		22	12704
A	27:04:18	11:02:09 PM	A	1	27382		6	51668		211	49320		22	12681
A	27:04:18	11:02:12 PM	A	1	27464		6	51748		211	49406		22	12648
A	27:04:18	11:02:15 PM	A	1	27468		6	51666		211	49406		22	12589
A	27:04:18	11:02:18 PM	A	1	27439		6	51705		211	49291		22	12570
A	27:04:18	11:02:21 PM	A	1	27435		6	51732		211	49744		22	12508
A	27:04:18	11:02:24 PM	A	1	27398		6	51917		211	49728		22	12479
A	27:04:18	11:02:27 PM	A	1	27492		6	51854		211	49169		22	12426
A	27:04:18	11:02:30 PM	A	1	27271		6	51770		211	49790		22	12426
A	27:04:18	11:02:33 PM	A	1	27309		6	51766		211	49525		22	12345
A	27:04:18	11:02:36 PM	A	1	27367		6	51569		211	49303		22	12308
A	27:04:18	11:02:39 PM	A	1	27322		6	51722		211	49606		22	12304
A	27:04:18	11:02:42 PM	A	1	27491		6	51700		211	49214		22	12255
A	27:04:18	11:02:45 PM	A	1	27388		6	51597		211	49592		22	12205
A	27:04:18	11:02:48 PM	A	1	27353		6	51668		211	49391		22	12185
A	27:04:18	11:02:51 PM	A	1	27428		6	51594		211	49443		22	12137

A	27:04:18	11:02:54 PM	A	1	27493		6	51559		211	49504		22	12115
A	27:04:18	11:02:57 PM	A	1	27389		6	51425		211	49588		22	12063
A	27:04:18	11:03:00 PM	A	1	27367		6	51430		211	49413		22	12039
A	27:04:18	11:03:03 PM	A	1	27426		6	51351		211	49336		22	12042
A	27:04:18	11:03:06 PM	A	1	27449		6	51148		211	49560		22	12003
A	27:04:18	11:03:09 PM	A	1	27578		6	51259		211	49603		22	11969
A	27:04:18	11:03:12 PM	A	1	27154		6	51297		211	49596		22	11916
A	27:04:18	11:03:15 PM	A	1	27402		6	51224		211	49420		22	11880
A	27:04:18	11:03:18 PM	A	1	27421		6	51244		211	49590		22	11867
A	27:04:18	11:03:21 PM	A	1	27265		6	51133		211	48928		22	11817
A	27:04:18	11:03:24 PM	A	1	27419		6	51347		211	49253		22	11771
A	27:04:18	11:03:27 PM	A	1	27458		6	51213		211	49118		22	11766
A	27:04:18	11:03:30 PM	A	1	27469		6	51055		211	49445		22	11719
A	27:04:18	11:03:33 PM	A	1	27341		6	50809		211	49512		22	11679
A	27:04:18	11:03:36 PM	A	1	27380		6	50992		211	49446		22	11654
A	27:04:18	11:03:39 PM	A	1	27538		6	51039		211	49468		22	11623
A	27:04:18	11:03:42 PM	A	1	27533		6	51014		211	49343		22	11560
A	27:04:18	11:03:45 PM	A	1	27401		6	51018		211	49351		22	11530
A	27:04:18	11:03:48 PM	A	1	27463		6	51157		211	49435		22	11502
A	27:04:18	11:03:51 PM	A	1	27405		6	50889		211	49347		22	11472
A	27:04:18	11:03:54 PM	A	1	27503		6	51084		211	49285		22	11449
A	27:04:18	11:03:57 PM	A	1	27184		6	50917		211	49059		22	11420
A	27:04:18	11:04:00 PM	A	1	27429		6	51176		211	49296		22	11351
A	27:04:18	11:04:03 PM	A	1	27437		6	51163		211	49346		22	11336
A	27:04:18	11:04:06 PM	A	1	27470		6	51061		211	49492		22	11301
A	27:04:18	11:04:09 PM	A	1	27480		6	50942		211	49336		22	11290
A	27:04:18	11:04:12 PM	A	1	27437		6	51152		211	49028		22	11212
A	27:04:18	11:04:15 PM	A	1	27413		6	50866		211	49301		22	11214
A	27:04:18	11:04:18 PM	A	1	27390		6	51057		211	49295		22	11200
A	27:04:18	11:04:21 PM	A	1	27252		6	51139		211	49317		22	11118
A	27:04:18	11:04:24 PM	A	1	27445		6	51350		211	49327		22	11097
A	27:04:18	11:04:27 PM	A	1	27496		6	51448		211	49349		22	11080
A	27:04:18	11:04:30 PM	A	1	27370		6	51254		211	48929		22	11013
A	27:04:18	11:04:33 PM	A	1	27485		6	51153		211	48694		22	10995
A	27:04:18	11:04:36 PM	A	1	27567		6	51117		211	49288		22	10924
A	27:04:18	11:04:39 PM	A	1	27354		6	51614		211	49156		22	10882
A	27:04:18	11:04:42 PM	A	1	27563		6	51518		211	49215		22	10851
A	27:04:18	11:04:45 PM	A	1	27482		6	51344		211	49061		22	10848
A	27:04:18	11:04:48 PM	A	1	27476		6	51325		211	48990		22	10792
A	27:04:18	11:04:51 PM	A	1	27458		6	51693		211	48915		22	10759
A	27:04:18	11:04:54 PM	A	1	27603		6	51684		211	49238		22	10749
A	27:04:18	11:04:57 PM	A	1	27356		6	51700		211	49031		22	10689

A	27:04:18	11:05:00 PM	A	1	27336		6	51616		211	49222		22	10638
A	27:04:18	11:05:03 PM	A	1	27468		6	51701		211	48982		22	10608
A	27:04:18	11:05:06 PM	A	1	27438		6	51641		211	49218		22	10585
A	27:04:18	11:05:09 PM	A	1	27452		6	51598		211	49033		22	10572
A	27:04:18	11:05:12 PM	A	1	27388		6	51498		211	48660		22	10487
A	27:04:18	11:05:15 PM	A	1	27348		6	51365		211	48885		22	10462
A	27:04:18	11:05:18 PM	A	1	27346		6	51551		211	48689		22	10421
A	27:04:18	11:05:21 PM	A	1	27380		6	51504		211	49173		22	10358
A	27:04:18	11:05:24 PM	A	1	27544		6	51281		211	49060		22	10323
A	27:04:18	11:05:27 PM	A	1	27419		6	51301		211	48860		22	10267
A	27:04:18	11:05:30 PM	A	1	27450		6	51406		211	48838		22	10253
A	27:04:18	11:05:33 PM	A	1	27497		6	51145		211	49102		22	10203
A	27:04:18	11:05:36 PM	A	1	27280		6	50964		211	49032		22	10179
A	27:04:18	11:05:39 PM	A	1	27427		6	50913		211	49037		22	10107
A	27:04:18	11:05:42 PM	A	1	27288		6	51102		211	49158		22	10079
A	27:04:18	11:05:45 PM	A	1	27353		6	50931		211	49045		22	10028
A	27:04:18	11:05:48 PM	A	1	27383		6	50845		211	49001		22	10001
A	27:04:18	11:05:51 PM	A	1	27487		6	50534		211	48745		22	9976
A	27:04:18	11:05:54 PM	A	1	27465		6	50656		211	48695		22	9946
A	27:04:18	11:05:57 PM	A	1	27495		6	50607		211	49011		22	9884
A	27:04:18	11:06:00 PM	A	1	27455		6	50597		211	48937		22	9846
A	27:04:18	11:06:03 PM	A	1	27468		6	50391		211	48581		22	9765
A	27:04:18	11:06:06 PM	A	1	27238		6	50201		211	48541		22	9739
A	27:04:18	11:06:09 PM	A	1	27374		6	50296		211	48992		22	9715
A	27:04:18	11:06:12 PM	A	1	27375		6	50493		211	48697		22	9684
A	27:04:18	11:06:15 PM	A	1	27441		6	50066		211	48880		22	9630
A	27:04:18	11:06:18 PM	A	1	27467		6	50118		211	48678		22	9566
A	27:04:18	11:06:21 PM	A	1	27465		6	50067		211	48651		22	9532
A	27:04:18	11:06:24 PM	A	1	27310		6	50156		211	48439		22	9508
A	27:04:18	11:06:27 PM	A	1	27294		6	49875		211	48823		22	9450
A	27:04:18	11:06:30 PM	A	1	27489		6	49789		211	48633		22	9402
A	27:04:18	11:06:33 PM	A	1	27232		6	49661		211	48779		22	9370
A	27:04:18	11:06:36 PM	A	1	27398		6	49735		211	48884		22	9335
A	27:04:18	11:06:39 PM	A	1	27488		6	49669		211	48853		22	9284
A	27:04:18	11:06:42 PM	A	1	27394		6	49723		211	48817		22	9276
A	27:04:18	11:06:45 PM	A	1	27227		6	49458		211	48824		22	9184
A	27:04:18	11:06:48 PM	A	1	27291		6	49494		211	48849		22	9185
A	27:04:18	11:06:51 PM	A	1	27363		6	49650		211	48599		22	9115
A	27:04:18	11:06:54 PM	A	1	27352		6	49566		211	48773		22	9107
A	27:04:18	11:06:57 PM	A	1	27449		6	49583		211	48596		22	9069
A	27:04:18	11:07:00 PM	A	1	27491		6	49582		211	48847		22	9011
A	27:04:18	11:07:03 PM	A	1	27192		6	49581		211	48459		22	8934

A	27:04:18	11:07:06 PM	A	1	27392		6	49671		211	48528		22	8949
A	27:04:18	11:07:09 PM	A	1	27438		6	49535		211	48810		22	8861
A	27:04:18	11:07:12 PM	A	1	27316		6	49339		211	48770		22	8822
A	27:04:18	11:07:15 PM	A	1	27458		6	49795		211	48628		22	8743
A	27:04:18	11:07:18 PM	A	1	27499		6	49392		211	48586		22	8765
A	27:04:18	11:07:21 PM	A	1	27334		6	49500		211	48329		22	8699
A	27:04:18	11:07:24 PM	A	1	27380		6	49381		211	48577		22	8655
A	27:04:18	11:07:27 PM	A	1	27304		6	49678		211	48366		22	8593
A	27:04:18	11:07:30 PM	A	1	27251		6	49401		211	48664		22	8585
A	27:04:18	11:07:33 PM	A	1	27237		6	49387		211	48644		22	8525
A	27:04:18	11:07:36 PM	A	1	27435		6	49503		211	48302		22	8483
A	27:04:18	11:07:39 PM	A	1	27522		6	49271		211	48291		22	8443
A	27:04:18	11:07:42 PM	A	1	27428		6	49646		211	48358		22	8415
A	27:04:18	11:07:45 PM	A	1	27500		6	49525		211	48623		22	8357
A	27:04:18	11:07:48 PM	A	1	27379		6	49748		211	48593		22	8306
A	27:04:18	11:07:51 PM	A	1	27332		6	49741		211	48655		22	8259
A	27:04:18	11:07:54 PM	A	1	27406		6	49652		211	48276		22	8237
A	27:04:18	11:07:57 PM	A	1	27244		6	49609		211	48249		22	8194
A	27:04:18	11:08:00 PM	A	1	27372		6	49623		211	48214		22	8166
A	27:04:18	11:08:03 PM	A	1	27389		6	49566		211	48156		22	8139
A	27:04:18	11:08:06 PM	A	1	27454		6	49824		211	48408		22	8073
A	27:04:18	11:08:09 PM	A	1	27500		6	49558		211	48595		22	8064
A	27:04:18	11:08:12 PM	A	1	27478		6	50111		211	48312		22	7991
A	27:04:18	11:08:15 PM	A	1	27463		6	49722		211	48247		22	7958
A	27:04:18	11:08:18 PM	A	1	27425		6	49811		211	48211		22	7914
A	27:04:18	11:08:21 PM	A	1	27416		6	49797		211	48124		22	7865
A	27:04:18	11:08:24 PM	A	1	27566		6	49856		211	47984		22	7833
A	27:04:18	11:08:27 PM	A	1	27348		6	49646		211	48027		22	7764
A	27:04:18	11:08:30 PM	A	1	27392		6	49880		211	48076		22	7756
A	27:04:18	11:08:33 PM	A	1	27388		6	49758		211	48086		22	7732
A	27:04:18	11:08:36 PM	A	1	27343		6	49834		211	48077		22	7669
A	27:04:18	11:08:39 PM	A	1	27398		6	49616		211	48068		22	7615
A	27:04:18	11:08:42 PM	A	1	27356		6	49861		211	48078		22	7555
A	27:04:18	11:08:45 PM	A	1	27347		6	49861		211	48121		22	7546
A	27:04:18	11:08:48 PM	A	1	27478		6	49755		211	48322		22	7461
A	27:04:18	11:08:51 PM	A	1	27262		6	49596		211	48323		22	7430
A	27:04:18	11:08:54 PM	A	1	27486		6	49457		211	48004		22	7404
A	27:04:18	11:08:57 PM	A	1	27446		6	49382		211	47893		22	7360
A	27:04:18	11:09:00 PM	A	1	27474		6	49150		211	48382		22	7317
A	27:04:18	11:09:03 PM	A	1	27373		6	49243		211	48318		22	7278
A	27:04:18	11:09:06 PM	A	1	27372		6	49596		211	47821		22	7232
A	27:04:18	11:09:09 PM	A	1	27502		6	49083		211	47982		22	7190

A	27:04:18	11:09:12 PM	A	1	27306		6	49072		211	48437		22	7176
A	27:04:18	11:09:15 PM	A	1	27388		6	49144		211	48231		22	7091
A	27:04:18	11:09:18 PM	A	1	27175		6	49229		211	47927		22	7075
A	27:04:18	11:09:21 PM	A	1	27000		6	48876		211	48020		22	7022
A	27:04:18	11:09:24 PM	A	1	27485		6	48991		211	47902		22	6996
A	27:04:18	11:09:27 PM	A	1	27530		6	48716		211	47805		22	6961
A	27:04:18	11:09:30 PM	A	1	27564		6	48654		211	47996		22	6933
A	27:04:18	11:09:33 PM	A	1	27436		6	48670		211	48265		22	6870
A	27:04:18	11:09:36 PM	A	1	27323		6	49045		211	48198		22	6816
A	27:04:18	11:09:39 PM	A	1	27351		6	48728		211	48190		22	6775
A	27:04:18	11:09:42 PM	A	1	27480		6	49129		211	47954		22	6738
A	27:04:18	11:09:45 PM	A	1	27387		6	48706		211	48012		22	6697
A	27:04:18	11:09:48 PM	A	1	27222		6	48844		211	47754		22	6653
A	27:04:18	11:09:51 PM	A	1	27320		6	48863		211	48260		22	6613
A	27:04:18	11:09:54 PM	A	1	27444		6	48903		211	48231		22	6587
A	27:04:18	11:09:57 PM	A	1	27466		6	48571		211	48079		22	6523
A	27:04:18	11:10:00 PM	A	1	27734		6	48663		211	47735		22	6501
A	27:04:18	11:10:03 PM	A	1	27503		6	48560		211	47840		22	6446
A	27:04:18	11:10:06 PM	A	1	27522		6	48737		211	48079		22	6433
A	27:04:18	11:10:09 PM	A	1	27446		6	48696		211	48149		22	6365
A	27:04:18	11:10:12 PM	A	1	27326		6	48466		211	47672		22	6335
A	27:04:18	11:10:15 PM	A	1	27531		6	48604		211	48022		22	6292
A	27:04:18	11:10:18 PM	A	1	27430		6	48710		211	47650		22	6273
A	27:04:18	11:10:21 PM	A	1	27553		6	48257		211	48114		22	6250
A	27:04:18	11:10:24 PM	A	1	27123		6	48932		211	48083		22	6182
A	27:04:18	11:10:27 PM	A	1	27315		6	48515		211	47759		22	6123
A	27:04:18	11:10:30 PM	A	1	27338		6	48601		211	47812		22	6115
A	27:04:18	11:10:33 PM	A	1	27407		6	48384		211	47676		22	6038
A	27:04:18	11:10:36 PM	A	1	27568		6	48212		211	47683		22	6009
A	27:04:18	11:10:39 PM	A	1	27274		6	48301		211	47990		22	5974
A	27:04:18	11:10:42 PM	A	1	27408		6	47976		211	48005		22	5944
A	27:04:18	11:10:45 PM	A	1	27254		6	47921		211	48003		22	5892
A	27:04:18	11:10:48 PM	A	1	27582		6	47991		211	47518		22	5826
A	27:04:18	11:10:51 PM	A	1	27338		6	47963		211	47882		22	5835
A	27:04:18	11:10:54 PM	A	1	27262		6	48122		211	47777		22	5787
A	27:04:18	11:10:57 PM	A	1	27450		6	48371		211	47612		22	5743
A	27:04:18	11:11:00 PM	A	1	27547		6	47907		211	47610		22	5692
A	27:04:18	11:11:03 PM	A	1	27336		6	47618		211	47385		22	5669
A	27:04:18	11:11:06 PM	A	1	27244		6	47782		211	47458		22	5609
A	27:04:18	11:11:09 PM	A	1	27482		6	48533		211	47391		22	5565
A	27:04:18	11:11:12 PM	A	1	27223		6	47992		211	47821		22	5525
A	27:04:18	11:11:15 PM	A	1	27316		6	47861		211	47575		22	5486

A	27:04:18	11:11:18 PM	A	1	27037		6	48279		211	47680		22	5455
A	27:04:18	11:11:21 PM	A	1	27418		6	48055		211	47484		22	5425
A	27:04:18	11:11:24 PM	A	1	27497		6	48178		211	47929		22	5376
A	27:04:18	11:11:27 PM	A	1	27613		6	48138		211	47853		22	5330
A	27:04:18	11:11:30 PM	A	1	27296		6	48260		211	47929		22	5296
A	27:04:18	11:11:33 PM	A	1	27464		6	47872		211	47912		22	5236
A	27:04:18	11:11:36 PM	A	1	27616		6	48083		211	47708		22	5205
A	27:04:18	11:11:39 PM	A	1	27419		6	48011		211	47915		22	5175
A	27:04:18	11:11:42 PM	A	1	27293		6	48249		211	47697		22	5110
A	27:04:18	11:11:45 PM	A	1	27439		6	47981		211	47549		22	5060
A	27:04:18	11:11:48 PM	A	1	27483		6	48062		211	47690		22	4995
A	27:04:18	11:11:51 PM	A	1	27342		6	48088		211	47748		22	4967
A	27:04:18	11:11:54 PM	A	1	27447		6	48107		211	47794		22	4912
A	27:04:18	11:11:57 PM	A	1	27394		6	47891		211	47377		22	4860
A	27:04:18	11:12:00 PM	A	1	27415		6	48204		211	47559		22	4817
A	27:04:18	11:12:03 PM	A	1	27407		6	48157		211	47705		22	4782
A	27:04:18	11:12:06 PM	A	1	27524		6	48194		211	47650		22	4740
A	27:04:18	11:12:09 PM	A	1	27451		6	48028		211	47369		22	4688
A	27:04:18	11:12:12 PM	A	1	27169		6	48132		211	47390		22	4592
A	27:04:18	11:12:15 PM	A	1	27545		6	48064		211	47414		22	4572
A	27:04:18	11:12:18 PM	A	1	27241		6	48424		211	47597		22	4492
A	27:04:18	11:12:21 PM	A	1	27567		6	47737		211	47524		22	4506
A	27:04:18	11:12:24 PM	A	1	27489		6	48020		211	47677		22	4435
A	27:04:18	11:12:27 PM	A	1	27379		6	47585		211	47360		22	4406
A	27:04:18	11:12:30 PM	A	1	27297		6	47657		211	47202		22	4344
A	27:04:18	11:12:33 PM	A	1	27190		6	47710		211	47338		22	4316
A	27:04:18	11:12:36 PM	A	1	27172		6	47851		211	47589		22	4287
A	27:04:18	11:12:39 PM	A	1	27471		6	47551		211	47529		22	4226
A	27:04:18	11:12:42 PM	A	1	27423		6	47854		211	47653		22	4179
A	27:04:18	11:12:45 PM	A	1	27560		6	47826		211	47195		22	4116
A	27:04:18	11:12:48 PM	A	1	27357		6	47665		211	47153		22	4108
A	27:04:18	11:12:51 PM	A	1	27471		6	47332		211	47495		22	4045
A	27:04:18	11:12:54 PM	A	1	27294		6	47776		211	47641		22	4024
A	27:04:18	11:12:57 PM	A	1	27412		6	48421		211	47514		22	3974
A	27:04:18	11:13:00 PM	A	1	27792		6	47937		211	47369		22	3931
A	27:04:18	11:13:03 PM	A	1	27431		6	47939		211	47193		22	3850
A	27:04:18	11:13:06 PM	A	1	27382		6	47763		211	47239		22	3852
A	27:04:18	11:13:09 PM	A	1	27459		6	47902		211	47322		22	3827
A	27:04:18	11:13:12 PM	A	1	27384		6	47899		211	47537		22	3782
A	27:04:18	11:13:15 PM	A	1	27591		6	47882		211	47538		22	3735
A	27:04:18	11:13:18 PM	A	1	27554		6	47790		211	47138		22	3680
A	27:04:18	11:13:21 PM	A	1	27385		6	47287		211	47467		22	3652

A	27:04:18	11:13:24 PM	A	1	27431		6	47631		211	47421		22	3602
A	27:04:18	11:13:27 PM	A	1	27331		6	47590		211	47094		22	3571
A	27:04:18	11:13:30 PM	A	1	27344		6	47848		211	47526		22	3544
A	27:04:18	11:13:33 PM	A	1	27306		6	47571		211	47268		22	3487
A	27:04:18	11:13:36 PM	A	1	27584		6	47579		211	47106		22	3448
A	27:04:18	11:13:39 PM	A	1	27641		6	47686		211	47289		22	3392
A	27:04:18	11:13:42 PM	A	1	27659		6	47472		211	47406		22	3369
A	27:04:18	11:13:45 PM	A	1	27474		6	47445		211	47238		22	3335
A	27:04:18	11:13:48 PM	A	1	27383		6	47529		211	47238		22	3283
A	27:04:18	11:13:51 PM	A	1	27435		6	47652		211	47114		22	3258
A	27:04:18	11:13:54 PM	A	1	27343		6	47451		211	47059		22	3190
A	27:04:18	11:13:57 PM	A	1	27332		6	47463		211	47306		22	3149
A	27:04:18	11:14:00 PM	A	1	27248		6	47146		211	47252		22	3084
A	27:04:18	11:14:03 PM	A	1	27409		6	47245		211	47120		22	3107
A	27:04:18	11:14:06 PM	A	1	27405		6	47518		211	46888		22	3025
A	27:04:18	11:14:09 PM	A	1	27294		6	47460		211	46847		22	2994
A	27:04:18	11:14:12 PM	A	1	27662		6	47613		211	47158		22	2967
A	27:04:18	11:14:15 PM	A	1	27373		6	47639		211	47072		22	2925
A	27:04:18	11:14:18 PM	A	1	27697		6	47260		211	47160		22	2872
A	27:04:18	11:14:21 PM	A	1	27367		6	47128		211	46865		22	2837
A	27:04:18	11:14:24 PM	A	1	27740		6	47073		211	47093		22	2803
A	27:04:18	11:14:27 PM	A	1	27512		6	47065		211	46657		22	2757
A	27:04:18	11:14:30 PM	A	1	27394		6	47109		211	46776		22	2725
A	27:04:18	11:14:33 PM	A	1	27596		6	47065		211	47181		22	2709
A	27:04:18	11:14:36 PM	A	1	27715		6	47148		211	47037		22	2622
A	27:04:18	11:14:39 PM	A	1	27442		6	47193		211	46966		22	2586
A	27:04:18	11:14:42 PM	A	1	27175		6	47255		211	47079		22	2551
A	27:04:18	11:14:45 PM	A	1	27219		6	47254		211	47096		22	2498
A	27:04:18	11:14:48 PM	A	1	27251		6	47403		211	46943		22	2477
A	27:04:18	11:14:51 PM	A	1	27523		6	47132		211	47039		22	2469
A	27:04:18	11:14:54 PM	A	1	27275		6	47172		211	46931		22	2419
A	27:04:18	11:14:57 PM	A	1	27535		6	47157		211	47006		22	2356
A	27:04:18	11:15:00 PM	A	1	27499		6	47226		211	46699		22	2305
A	27:04:18	11:15:03 PM	A	1	27379		6	47122		211	46945		22	2281
A	27:04:18	11:15:06 PM	A	1	27275		6	47237		211	46702		22	2220
A	27:04:18	11:15:09 PM	A	1	27428		6	46891		211	47078		22	2190
A	27:04:18	11:15:12 PM	A	1	27504		6	46946		211	46952		22	2140
A	27:04:18	11:15:15 PM	A	1	27572		6	46814		211	46631		22	2080
A	27:04:18	11:15:18 PM	A	1	27236		6	47581		211	46944		22	2038
A	27:04:18	11:15:21 PM	A	1	27542		6	47020		211	46928		22	2030
A	27:04:18	11:15:24 PM	A	1	27325		6	46945		211	46824		22	1955
A	27:04:18	11:15:27 PM	A	1	27272		6	46927		211	46659		22	1958

A	27:04:18	11:15:30 PM	A	1	27376		6	46871		211	46589		22	1909
A	27:04:18	11:15:33 PM	A	1	27303		6	46924		211	46729		22	1853
A	27:04:18	11:15:36 PM	A	1	27359		6	46494		211	46830		22	1814
A	27:04:18	11:15:39 PM	A	1	27466		6	46725		211	46711		22	1781
A	27:04:18	11:15:42 PM	A	1	27362		6	46778		211	46856		22	1758
A	27:04:18	11:15:45 PM	A	1	27442		6	46809		211	46571		22	1685
A	27:04:18	11:15:48 PM	A	1	27269		6	46536		211	46590		22	1656
A	27:04:18	11:15:51 PM	A	1	27299		6	46929		211	46421		22	1622
A	27:04:18	11:15:54 PM	A	1	27709		6	47156		211	46544		22	1541
A	27:04:18	11:15:57 PM	A	1	27297		6	46785		211	46388		22	1508
A	27:04:18	11:16:00 PM	A	1	27348		6	47323		211	46739		22	1503
A	27:04:18	11:16:03 PM	A	1	27375		6	46691		211	46941		22	1443
A	27:04:18	11:16:06 PM	A	1	27436		6	47027		211	46743		22	1394
A	27:04:18	11:16:09 PM	A	1	27473		6	47045		211	46724		22	1347
A	27:04:18	11:16:12 PM	A	1	27298		6	46867		211	46686		22	1266
A	27:04:18	11:16:15 PM	A	1	27344		6	47199		211	46694		22	1253
A	27:04:18	11:16:18 PM	A	1	27494		6	47060		211	46702		22	1224
A	27:04:18	11:16:21 PM	A	1	27426		6	47316		211	46484		22	1207
A	27:04:18	11:16:24 PM	A	1	27359		6	47375		211	46644		22	1144
A	27:04:18	11:16:27 PM	A	1	27415		6	47133		211	46516		22	1061
A	27:04:18	11:16:30 PM	A	1	27580		6	47580		211	46408		22	1009
A	27:04:18	11:16:33 PM	A	1	27424		6	44915		211	46584		22	985
A	27:04:18	11:16:36 PM	A	1	27349		6	45170		211	46448		22	970
A	27:04:18	11:16:39 PM	A	1	27182		6	45326		211	46415		22	917
A	27:04:18	11:16:42 PM	A	1	27383		6	45510		211	46511		22	871
A	27:04:18	11:16:45 PM	A	1	27460		6	45317		211	46645		22	856
A	27:04:18	11:16:48 PM	A	1	27301		6	45403		211	46472		22	803
A	27:04:18	11:16:51 PM	A	1	27450		6	45471		211	46577		22	724
A	27:04:18	11:16:54 PM	A	1	27886		6	45473		211	46598		22	696
A	27:04:18	11:16:57 PM	A	1	27409		6	45420		211	46531		22	672
A	27:04:18	11:17:00 PM	A	1	27330		6	45620		211	46419		22	600
A	27:04:18	11:17:03 PM	A	1	27328		6	45509		211	46285		22	575
A	27:04:18	11:17:06 PM	A	1	27411		6	45959		211	46284		22	493
A	27:04:18	11:17:09 PM	A	1	27368		6	46187		211	46204		22	462
A	27:04:18	11:17:12 PM	A	1	27505		6	46037		211	46115		22	441
A	27:04:18	11:17:15 PM	A	1	27431		6	46279		211	46462		22	402
A	27:04:18	11:17:18 PM	A	1	27168		6	46271		211	46402		22	311
A	27:04:18	11:17:21 PM	A	1	27310		6	46504		211	45998		22	278
A	27:04:18	11:17:24 PM	A	1	27397		6	46279		211	46138		22	249
A	27:04:18	11:17:27 PM	A	1	27440		6	46738		211	46181		22	184
A	27:04:18	11:17:30 PM	A	1	27255		6	46906		211	46399		22	132
A	27:04:18	11:17:33 PM	A	1	27567		6	47173		211	46471		22	93

A	27:04:18	11:17:36 PM	A	1	27304		6	47261		211	46201		22	51
A	27:04:18	11:17:39 PM	A	1	27323		6	47350		211	45913		22	30
A	27:04:18	11:17:42 PM	A	1	27321		6	47100		211	46163		21	65479
A	27:04:18	11:17:45 PM	A	1	27366		6	47385		211	46220		21	65463
A	27:04:18	11:17:48 PM	A	1	27527		6	47462		211	46331		21	65402
A	27:04:18	11:17:51 PM	A	1	27377		6	47433		211	46045		21	65398
A	27:04:18	11:17:54 PM	A	1	27478		6	47659		211	46119		21	65295
A	27:04:18	11:17:57 PM	A	1	27475		6	47562		211	46395		21	65259
A	27:04:18	11:18:00 PM	A	1	27446		6	47606		211	46325		21	65225
A	27:04:18	11:18:03 PM	A	1	26943		6	47445		211	46308		21	65165
A	27:04:18	11:18:06 PM	A	1	27144		6	47258		211	46130		21	65145
A	27:04:18	11:18:09 PM	A	1	27497		6	47619		211	46236		21	65062
A	27:04:18	11:18:12 PM	A	1	27383		6	47452		211	46110		21	65036
A	27:04:18	11:18:15 PM	A	1	27163		6	47385		211	45929		21	64976
A	27:04:18	11:18:18 PM	A	1	27447		6	47251		211	45843		21	64970
A	27:04:18	11:18:21 PM	A	1	27470		6	47263		211	46280		21	64910
A	27:04:18	11:18:24 PM	A	1	27477		6	47097		211	46300		21	64844
A	27:04:18	11:18:27 PM	A	1	27440		6	47111		211	46080		21	64809
A	27:04:18	11:18:30 PM	A	1	27457		6	46920		211	46267		21	64748
A	27:04:18	11:18:33 PM	A	1	27396		6	47207		211	46186		21	64699
A	27:04:18	11:18:36 PM	A	1	27353		6	46925		211	46186		21	64669
A	27:04:18	11:18:39 PM	A	1	27632		6	47131		211	45768		21	64610
A	27:04:18	11:18:42 PM	A	1	27488		6	47069		211	45877		21	64550
A	27:04:18	11:18:45 PM	A	1	27527		6	47063		211	45792		21	64478
A	27:04:18	11:18:48 PM	A	1	27516		6	47188		211	45775		21	64432
A	27:04:18	11:18:51 PM	A	1	27507		6	47118		211	45868		21	64444
A	27:04:18	11:18:54 PM	A	1	27316		6	47140		211	46233		21	64365
A	27:04:18	11:18:57 PM	A	1	27391		6	47151		211	46152		21	64331
A	27:04:18	11:19:00 PM	A	1	27339		6	46993		211	45944		21	64276
A	27:04:18	11:19:03 PM	A	1	27381		6	47069		211	45735		21	64239
A	27:04:18	11:19:06 PM	A	1	27371		6	46724		211	45904		21	64175
A	27:04:18	11:19:09 PM	A	1	27365		6	46706		211	45781		21	64129
A	27:04:18	11:19:12 PM	A	1	27426		6	46800		211	46043		21	64114
A	27:04:18	11:19:15 PM	A	1	27428		6	47115		211	46119		21	64045
A	27:04:18	11:19:18 PM	A	1	27439		6	46832		211	46180		21	64007
A	27:04:18	11:19:21 PM	A	1	27365		6	46815		211	46023		21	63957
A	27:04:18	11:19:24 PM	A	1	27495		6	47389		211	45690		21	63867
A	27:04:18	11:19:27 PM	A	1	27473		6	46809		211	46168		21	63867
A	27:04:18	11:19:30 PM	A	1	27445		6	46782		211	45880		21	63818
A	27:04:18	11:19:33 PM	A	1	27412		6	46719		211	46108		21	63786
A	27:04:18	11:19:36 PM	A	1	27430		6	46748		211	45854		21	63714
A	27:04:18	11:19:39 PM	A	1	27305		6	46811		211	45762		21	63647

A	27:04:18	11:19:42 PM	A	1	27404		6	46488		211	45911		21	63613
A	27:04:18	11:19:45 PM	A	1	27304		6	46688		211	45953		21	63554
A	27:04:18	11:19:48 PM	A	1	27432		6	46916		211	45978		21	63520
A	27:04:18	11:19:51 PM	A	1	27402		6	46705		211	45926		21	63459
A	27:04:18	11:19:54 PM	A	1	27463		6	47486		211	45782		21	63439
A	27:04:18	11:19:57 PM	A	1	27489		6	46584		211	46079		21	63381
A	27:04:18	11:20:00 PM	A	1	27433		6	46405		211	45907		21	63347
A	27:04:18	11:20:03 PM	A	1	27478		6	46582		211	45781		21	63284
A	27:04:18	11:20:06 PM	A	1	27394		6	46661		211	45927		21	63237
A	27:04:18	11:20:09 PM	A	1	27499		6	46635		211	45728		21	63217
A	27:04:18	11:20:12 PM	A	1	27538		6	46688		211	45773		21	63186
A	27:04:18	11:20:15 PM	A	1	27326		6	46580		211	45857		21	63153
A	27:04:18	11:20:18 PM	A	1	27394		6	46460		211	45976		21	63095
A	27:04:18	11:20:21 PM	A	1	27318		6	46706		211	45738		21	63043
A	27:04:18	11:20:24 PM	A	1	27448		6	46740		211	45828		21	62978
A	27:04:18	11:20:27 PM	A	1	27330		6	46648		211	45790		21	62995
A	27:04:18	11:20:30 PM	A	1	27452		6	46622		211	45718		21	62922
A	27:04:18	11:20:33 PM	A	1	27681		6	46633		211	45673		21	62855
A	27:04:18	11:20:36 PM	A	1	27611		6	46685		211	45601		21	62837
A	27:04:18	11:20:39 PM	A	1	27378		6	46653		211	45572		21	62789
A	27:04:18	11:20:42 PM	A	1	27475		6	46720		211	45897		21	62755
A	27:04:18	11:20:45 PM	A	1	27605		6	46550		211	45709		21	62683
A	27:04:18	11:20:48 PM	A	1	27440		6	46787		211	45691		21	62662
A	27:04:18	11:20:51 PM	A	1	27332		6	46584		211	45438		21	62597
A	27:04:18	11:20:54 PM	A	1	27530		6	46495		211	45319		21	62568
A	27:04:18	11:20:57 PM	A	1	27240		6	46666		211	45750		21	62530
A	27:04:18	11:21:00 PM	A	1	27473		6	46521		211	45569		21	62477
A	27:04:18	11:21:03 PM	A	1	27387		6	46782		211	45478		21	62426
A	27:04:18	11:21:06 PM	A	1	27331		6	46564		211	45477		21	62390
A	27:04:18	11:21:09 PM	A	1	27435		6	46609		211	45451		21	62342
A	27:04:18	11:21:12 PM	A	1	27438		6	46968		211	45572		21	62319
A	27:04:18	11:21:15 PM	A	1	27425		6	46637		211	45383		21	62259
A	27:04:18	11:21:18 PM	A	1	27645		6	46764		211	45449		21	62234
A	27:04:18	11:21:21 PM	A	1	27419		6	46848		211	45474		21	62192
A	27:04:18	11:21:24 PM	A	1	27446		6	46635		211	45403		21	62100
A	27:04:18	11:21:27 PM	A	1	27511		6	46924		211	45386		21	62099
A	27:04:18	11:21:30 PM	A	1	27466		6	46749		211	45384		21	62041
A	27:04:18	11:21:33 PM	A	1	27428		6	46831		211	45527		21	62012
A	27:04:18	11:21:36 PM	A	1	27295		6	46654		211	45614		21	61945
A	27:04:18	11:21:39 PM	A	1	27490		6	47010		211	45185		21	61916
A	27:04:18	11:21:42 PM	A	1	27461		6	47044		211	45229		21	61898
A	27:04:18	11:21:45 PM	A	1	27394		6	46785		211	45290		21	61855

A	27:04:18	11:21:48 PM	A	1	27420		6	46756		211	45439		21	61804
A	27:04:18	11:21:51 PM	A	1	27383		6	46710		211	45352		21	61727
A	27:04:18	11:21:54 PM	A	1	27163		6	46685		211	45529		21	61711
A	27:04:18	11:21:57 PM	A	1	27570		6	47267		211	45304		21	61624
A	27:04:18	11:22:00 PM	A	1	27445		6	46838		211	45303		21	61627
A	27:04:18	11:22:03 PM	A	1	27481		6	46934		211	45296		21	61561
A	27:04:18	11:22:06 PM	A	1	27436		6	47064		211	45308		21	61497
A	27:04:18	11:22:09 PM	A	1	27248		6	46881		211	45198		21	61500
A	27:04:18	11:22:12 PM	A	1	27266		6	47212		211	45328		21	61451
A	27:04:18	11:22:15 PM	A	1	27424		6	46929		211	45389		21	61375
A	27:04:18	11:22:18 PM	A	1	27383		6	46780		211	45166		21	61327
A	27:04:18	11:22:21 PM	A	1	27847		6	46824		211	45103		21	61306
A	27:04:18	11:22:24 PM	A	1	27306		6	46438		211	43360		21	61244
A	27:04:18	11:22:27 PM	A	1	27358		6	46738		211	43490		21	61195
A	27:04:18	11:22:30 PM	A	1	27431		6	46798		211	43669		21	61187
A	27:04:18	11:22:33 PM	A	1	27635		6	46835		211	45092		21	61148
A	27:04:18	11:22:36 PM	A	1	27284		6	46982		211	45308		21	61078
A	27:04:18	11:22:39 PM	A	1	27443		6	46644		211	45200		21	61022
A	27:04:18	11:22:42 PM	A	1	27373		6	46785		211	45350		21	61004
A	27:04:18	11:22:45 PM	A	1	27125		6	46790		211	44949		21	60929
A	27:04:18	11:22:48 PM	A	1	27366		6	46717		211	44938		21	60872
A	27:04:18	11:22:51 PM	A	1	27329		6	46835		211	42804		21	60833
A	27:04:18	11:22:54 PM	A	1	27427		6	46568		211	44923		21	60813
A	27:04:18	11:22:57 PM	A	1	27435		6	46628		211	45086		21	60785
A	27:04:18	11:23:00 PM	A	1	27172		6	46522		211	42935		21	60683
A	27:04:18	11:23:03 PM	A	1	27262		6	46636		211	42923		21	60672
A	27:04:18	11:23:06 PM	A	1	27151		6	46700		211	44888		21	60607
A	27:04:18	11:23:09 PM	A	1	27474		6	46482		211	43371		21	60547
A	27:04:18	11:23:12 PM	A	1	27288		6	46379		211	43416		21	60493
A	27:04:18	11:23:15 PM	A	1	27333		6	46371		211	42925		21	60455
A	27:04:18	11:23:18 PM	A	1	27461		6	46176		211	43398		21	60411
A	27:04:18	11:23:21 PM	A	1	27507		6	46401		211	45009		21	60389
A	27:04:18	11:23:24 PM	A	1	27246		6	46798		211	42832		21	60354
A	27:04:18	11:23:27 PM	A	1	27323		6	46580		211	43364		21	60305
A	27:04:18	11:23:30 PM	A	1	27322		6	46474		211	43199		21	60258
A	27:04:18	11:23:33 PM	A	1	27467		6	46579		211	43159		21	60189
A	27:04:18	11:23:36 PM	A	1	26968		6	46604		211	43235		21	60152
A	27:04:18	11:23:39 PM	A	1	27548		6	46574		211	43081		21	60084
A	27:04:18	11:23:42 PM	A	1	27475		6	46642		211	42799		21	60058
A	27:04:18	11:23:45 PM	A	1	27376		6	46708		211	42733		21	60032
A	27:04:18	11:23:48 PM	A	1	27432		6	46629		211	42569		21	59987
A	27:04:18	11:23:51 PM	A	1	27941		6	46526		211	43212		21	59928

A	27:04:18	11:23:54 PM	A	1	27534		6	46507		211	43009		21	59901
A	27:04:18	11:23:57 PM	A	1	27473		6	46356		211	42704		21	59846
A	27:04:18	11:24:00 PM	A	1	27452		6	46406		211	42852		21	59803
A	27:04:18	11:24:03 PM	A	1	27364		6	46367		211	42881		21	59748
A	27:04:18	11:24:06 PM	A	1	27478		6	46287		211	42729		21	59689
A	27:04:18	11:24:09 PM	A	1	27523		6	46630		211	42721		21	59692
A	27:04:18	11:24:12 PM	A	1	27453		6	46345		211	42962		21	59639
A	27:04:18	11:24:15 PM	A	1	27421		6	46228		211	43169		21	59588
A	27:04:18	11:24:18 PM	A	1	27406		6	46126		211	42721		21	59555
A	27:04:18	11:24:21 PM	A	1	27519		6	46338		211	43094		21	59518
A	27:04:18	11:24:24 PM	A	1	27509		6	46017		211	43084		21	59508
A	27:04:18	11:24:27 PM	A	1	27301		6	45977		211	42558		21	59398
A	27:04:18	11:24:30 PM	A	1	27385		6	45834		211	43253		21	59393
A	27:04:18	11:24:33 PM	A	1	27388		6	45760		211	43083		21	59350
A	27:04:18	11:24:36 PM	A	1	27368		6	45745		211	42644		21	59307
A	27:04:18	11:24:39 PM	A	1	27465		6	45441		211	42772		21	59270
A	27:04:18	11:24:42 PM	A	1	27092		6	45625		211	42582		21	59230
A	27:04:18	11:24:45 PM	A	1	27527		6	45098		211	42688		21	59173
A	27:04:18	11:24:48 PM	A	1	27424		6	44756		211	43178		21	59133
A	27:04:18	11:24:51 PM	A	1	27336		6	44814		211	42860		21	59095
A	27:04:18	11:24:54 PM	A	1	27456		6	44853		211	42822		21	59049
A	27:04:18	11:24:57 PM	A	1	27471		6	44581		211	42568		21	59024
A	27:04:18	11:25:00 PM	A	1	27169		6	44632		211	42721		21	58992
A	27:04:18	11:25:03 PM	A	1	27415		6	44711		211	42632		21	58925
A	27:04:18	11:25:06 PM	A	1	27351		6	44638		211	42407		21	58884
A	27:04:18	11:25:09 PM	A	1	27322		6	44413		211	42402		21	58842
A	27:04:18	11:25:12 PM	A	1	27445		6	44230		211	42360		21	58793
A	27:04:18	11:25:15 PM	A	1	27372		6	44023		211	42299		21	58764
A	27:04:18	11:25:18 PM	A	1	27440		6	43913		211	42204		21	58687
A	27:04:18	11:25:21 PM	A	1	27131		6	43855		211	42310		21	58688
A	27:04:18	11:25:24 PM	A	1	27460		6	44019		211	42892		21	58637
A	27:04:18	11:25:27 PM	A	1	27390		6	43887		211	42821		21	58605
A	27:04:18	11:25:30 PM	A	1	27417		6	43849		211	42418		21	58535
A	27:04:18	11:25:33 PM	A	1	27543		6	43688		211	42495		21	58507
A	27:04:18	11:25:36 PM	A	1	27641		6	43734		211	43014		21	58466
A	27:04:18	11:25:39 PM	A	1	27403		6	43719		211	43027		21	58451
A	27:04:18	11:25:42 PM	A	1	27536		6	43731		211	43018		21	58387
A	27:04:18	11:25:45 PM	A	1	27317		6	43563		211	42808		21	58353
A	27:04:18	11:25:48 PM	A	1	27451		6	43475		211	42906		21	58313
A	27:04:18	11:25:51 PM	A	1	27480		6	43309		211	42701		21	58303
A	27:04:18	11:25:54 PM	A	1	27402		6	43223		211	42432		21	58224
A	27:04:18	11:25:57 PM	A	1	27391		6	43215		211	42414		21	58192

A	27:04:18	11:26:00 PM	A	1	27459		6	43132		211	42312		21	58151
A	27:04:18	11:26:03 PM	A	1	27468		6	43087		211	42352		21	58116
A	27:04:18	11:26:06 PM	A	1	27503		6	42873		211	42930		21	58048
A	27:04:18	11:26:09 PM	A	1	27407		6	42804		211	42744		21	58058
A	27:04:18	11:26:12 PM	A	1	27462		6	42713		211	42857		21	58018
A	27:04:18	11:26:15 PM	A	1	27413		6	42700		211	42753		21	57959
A	27:04:18	11:26:18 PM	A	1	27356		6	42595		211	42708		21	57908
A	27:04:18	11:26:21 PM	A	1	27369		6	42814		211	42376		21	57860
A	27:04:18	11:26:24 PM	A	1	27504		6	42300		211	42268		21	57831
A	27:04:18	11:26:27 PM	A	1	27458		6	42322		211	42341		21	57794
A	27:04:18	11:26:30 PM	A	1	27278		6	42214		211	42812		21	57758
A	27:04:18	11:26:33 PM	A	1	27443		6	41844		211	42824		21	57678
A	27:04:18	11:26:36 PM	A	1	27355		6	42393		211	42886		21	57683
A	27:04:18	11:26:39 PM	A	1	27273		6	41684		211	42424		21	57615
A	27:04:18	11:26:42 PM	A	1	27387		6	41735		211	42842		21	57573
A	27:04:18	11:26:45 PM	A	1	27332		6	41710		211	42798		21	57557
A	27:04:18	11:26:48 PM	A	1	27320		6	41643		211	42734		21	57467
A	27:04:18	11:26:51 PM	A	1	27380		6	41858		211	42669		21	57416
A	27:04:18	11:26:54 PM	A	1	27379		6	41440		211	42359		21	57368
A	27:04:18	11:26:57 PM	A	1	27519		6	41498		211	42229		21	57337
A	27:04:18	11:27:00 PM	A	1	27367		6	41731		211	42876		21	57313
A	27:04:18	11:27:03 PM	A	1	27290		6	41428		211	42694		21	57247
A	27:04:18	11:27:06 PM	A	1	27378		6	41538		211	42161		21	57193
A	27:04:18	11:27:09 PM	A	1	27350		6	41473		211	42444		21	57136
A	27:04:18	11:27:12 PM	A	1	27444		6	41284		211	42135		21	57113
A	27:04:18	11:27:15 PM	A	1	27528		6	41346		211	42203		21	57080
A	27:04:18	11:27:18 PM	A	1	27293		6	41460		211	42382		21	56997
A	27:04:18	11:27:21 PM	A	1	27431		6	41639		211	42400		21	56952
A	27:04:18	11:27:24 PM	A	1	27421		6	41318		211	42463		21	56914
A	27:04:18	11:27:27 PM	A	1	27457		6	41342		211	42514		21	56836
A	27:04:18	11:27:30 PM	A	1	27444		6	41152		211	42499		21	56813
A	27:04:18	11:27:33 PM	A	1	27469		6	41237		211	42193		21	56784
A	27:04:18	11:27:36 PM	A	1	27445		6	41102		211	42759		21	56740
A	27:04:18	11:27:39 PM	A	1	27405		6	41066		211	42661		21	56697
A	27:04:18	11:27:42 PM	A	1	27419		6	40864		211	42202		21	56671
A	27:04:18	11:27:45 PM	A	1	27557		6	40973		211	42100		21	56590
A	27:04:18	11:27:48 PM	A	1	27426		6	40768		211	42146		21	56560
A	27:04:18	11:27:51 PM	A	1	27270		6	40778		211	42178		21	56513
A	27:04:18	11:27:54 PM	A	1	27406		6	40445		211	42687		21	56470
A	27:04:18	11:27:57 PM	A	1	27556		6	40698		211	42484		21	56417
A	27:04:18	11:28:00 PM	A	1	27441		6	40535		211	42660		21	56363
A	27:04:18	11:28:03 PM	A	1	27077		6	40262		211	42165		21	56337

A	27:04:18	11:28:06 PM	A	1	27414		6	40145		211	42039		21	56286
A	27:04:18	11:28:09 PM	A	1	27466		6	40071		211	42468		21	56241
A	27:04:18	11:28:12 PM	A	1	27461		6	40136		211	42493		21	56188
A	27:04:18	11:28:15 PM	A	1	27447		6	40029		211	42461		21	56110
A	27:04:18	11:28:18 PM	A	1	27545		6	39794		211	42413		21	56084
A	27:04:18	11:28:21 PM	A	1	27375		6	39782		211	42440		21	56038
A	27:04:18	11:28:24 PM	A	1	27381		6	39691		211	42026		21	55990
A	27:04:18	11:28:27 PM	A	1	27288		6	39500		211	42014		21	55944
A	27:04:18	11:28:30 PM	A	1	27385		6	39562		211	41865		21	55913
A	27:04:18	11:28:33 PM	A	1	27373		6	39362		211	41926		21	55873
A	27:04:18	11:28:36 PM	A	1	27282		6	39187		211	42458		21	55820
A	27:04:18	11:28:39 PM	A	1	27508		6	39030		211	42390		21	55795
A	27:04:18	11:28:42 PM	A	1	27466		6	38990		211	42322		21	55712
A	27:04:18	11:28:45 PM	A	1	27540		6	39011		211	42347		21	55662
A	27:04:18	11:28:48 PM	A	1	27398		6	38750		211	41986		21	55615
A	27:04:18	11:28:51 PM	A	1	27353		6	38520		211	41901		21	55591
A	27:04:18	11:28:54 PM	A	1	27500		6	38657		211	41998		21	55576
A	27:04:18	11:28:57 PM	A	1	27370		6	38210		211	42175		21	55521
A	27:04:18	11:29:00 PM	A	1	27453		6	38136		211	42257		21	55479
A	27:04:18	11:29:03 PM	A	1	27480		6	37844		211	41781		21	55429
A	27:04:18	11:29:06 PM	A	1	27682		6	37766		211	41649		21	55363
A	27:04:18	11:29:09 PM	A	1	27285		6	37880		211	42004		21	55366
A	27:04:18	11:29:12 PM	A	1	27157		6	37624		211	41904		21	55307
A	27:04:18	11:29:15 PM	A	1	27341		6	37709		211	42436		21	55281
A	27:04:18	11:29:18 PM	A	1	27459		6	37268		211	42409		21	55237
A	27:04:18	11:29:21 PM	A	1	27438		6	37179		211	42072		21	55216
A	27:04:18	11:29:24 PM	A	1	27444		6	37277		211	42281		21	55157
A	27:04:18	11:29:27 PM	A	1	27440		6	37148		211	42346		21	55114
A	27:04:18	11:29:30 PM	A	1	27307		6	37208		211	42188		21	55094
A	27:04:18	11:29:33 PM	A	1	27498		6	37129		211	41882		21	55048
A	27:04:18	11:29:36 PM	A	1	27314		6	36480		211	41904		21	54968
A	27:04:18	11:29:39 PM	A	1	27639		6	36702		211	42194		21	54967
A	27:04:18	11:29:42 PM	A	1	27434		6	36387		211	41935		21	54892
A	27:04:18	11:29:45 PM	A	1	27583		6	36354		211	41635		21	54867
A	27:04:18	11:29:48 PM	A	1	27452		6	36255		211	41942		21	54851
A	27:04:18	11:29:51 PM	A	1	27427		6	36006		211	42210		21	54795
A	27:04:18	11:29:54 PM	A	1	27601		6	36184		211	41955		21	54730
A	27:04:18	11:29:57 PM	A	1	27498		6	35669		211	41663		21	54720
A	27:04:18	11:30:00 PM	A	1	27402		6	35667		211	41701		21	54683
A	27:04:18	11:30:03 PM	A	1	27466		6	35406		211	41655		21	54666
A	27:04:18	11:30:06 PM	A	1	27343		6	35417		211	41715		21	54603
A	27:04:18	11:30:09 PM	A	1	27541		6	35429		211	42033		21	54526

A	27:04:18	11:30:12 PM	A	1	27367		6	35181		211	42295		21	54508
A	27:04:18	11:30:15 PM	A	1	27392		6	34828		211	42158		21	54466
A	27:04:18	11:30:18 PM	A	1	27449		6	34918		211	42130		21	54396
A	27:04:18	11:30:21 PM	A	1	27430		6	34556		211	42127		21	54379
A	27:04:18	11:30:24 PM	A	1	27494		6	34547		211	41680		21	54325
A	27:04:18	11:30:27 PM	A	1	27521		6	34408		211	41707		21	54304
A	27:04:18	11:30:30 PM	A	1	27383		6	34193		211	41666		21	54238
A	27:04:18	11:30:33 PM	A	1	27256		6	34176		211	41498		21	54229
A	27:04:18	11:30:36 PM	A	1	27375		6	33768		211	41724		21	54163
A	27:04:18	11:30:39 PM	A	1	27442		6	34001		211	42116		21	54106
A	27:04:18	11:30:42 PM	A	1	27414		6	33672		211	41923		21	54041
A	27:04:18	11:30:45 PM	A	1	27393		6	33492		211	42059		21	54067
A	27:04:18	11:30:48 PM	A	1	27535		6	33634		211	42229		21	53994
A	27:04:18	11:30:51 PM	A	1	27488		6	33237		211	41810		21	53975
A	27:04:18	11:30:54 PM	A	1	27527		6	33346		211	41651		21	53950
A	27:04:18	11:30:57 PM	A	1	27415		6	32973		211	41678		21	53858
A	27:04:18	11:31:00 PM	A	1	27486		6	32745		211	41544		21	53823
A	27:04:18	11:31:03 PM	A	1	27400		6	32875		211	41305		21	53808
A	27:04:18	11:31:06 PM	A	1	27456		6	32620		211	41619		21	53733
A	27:04:18	11:31:09 PM	A	1	27421		6	32564		211	42150		21	53715
A	27:04:18	11:31:12 PM	A	1	27398		6	32447		211	41971		21	53689
A	27:04:18	11:31:15 PM	A	1	27483		6	32386		211	42021		21	53619
A	27:04:18	11:31:18 PM	A	1	27479		6	32540		211	42101		21	53544
A	27:04:18	11:31:21 PM	A	1	27553		6	31850		211	41943		21	53517
A	27:04:18	11:31:24 PM	A	1	27286		6	32114		211	41430		21	53463
A	27:04:18	11:31:27 PM	A	1	27460		6	32303		211	41442		21	53418
A	27:04:18	11:31:30 PM	A	1	27487		6	31856		211	42013		21	53380
A	27:04:18	11:31:33 PM	A	1	27527		6	31704		211	41802		21	53363
A	27:04:18	11:31:36 PM	A	1	27489		6	31551		211	41325		21	53298
A	27:04:18	11:31:39 PM	A	1	27488		6	31531		211	41676		21	53225
A	27:04:18	11:31:42 PM	A	1	27518		6	31335		211	41435		21	53186
A	27:04:18	11:31:45 PM	A	1	27198		6	30993		211	41860		21	53184
A	27:04:18	11:31:48 PM	A	1	27417		6	31044		211	41833		21	53103
A	27:04:18	11:31:51 PM	A	1	27410		6	30780		211	41860		21	53041
A	27:04:18	11:31:54 PM	A	1	27532		6	31202		211	41546		21	52992
A	27:04:18	11:31:57 PM	A	1	27415		6	31121		211	41401		21	52953
A	27:04:18	11:32:00 PM	A	1	27337		6	31193		211	41568		21	52900
A	27:04:18	11:32:03 PM	A	1	27241		6	31124		211	41628		21	52847
A	27:04:18	11:32:06 PM	A	1	27379		6	30725		211	41636		21	52787
A	27:04:18	11:32:09 PM	A	1	27503		6	30681		211	41506		21	52762
A	27:04:18	11:32:12 PM	A	1	27453		6	30765		211	41906		21	52680
A	27:04:18	11:32:15 PM	A	1	27375		6	30387		211	41745		21	52645

A	27:04:18	11:32:18 PM	A	1	27311		6	30357		211	41555		21	52595
A	27:04:18	11:32:21 PM	A	1	27395		6	30424		211	41367		21	52539
A	27:04:18	11:32:24 PM	A	1	27483		6	30625		211	41542		21	52497
A	27:04:18	11:32:27 PM	A	1	27559		6	30402		211	41328		21	52436
A	27:04:18	11:32:30 PM	A	1	27798		6	30104		211	41299		21	52365
A	27:04:18	11:32:33 PM	A	1	27054		6	30403		211	41211		21	52314
A	27:04:18	11:32:36 PM	A	1	27322		6	30131		211	41673		21	52248
A	27:04:18	11:32:39 PM	A	1	27634		6	29956		211	41318		21	52217
A	27:04:18	11:32:42 PM	A	1	27392		6	30157		211	41397		21	52171
A	27:04:18	11:32:45 PM	A	1	27635		6	29737		211	41855		21	52123
A	27:04:18	11:32:48 PM	A	1	27425		6	29996		211	41627		21	52096
A	27:04:18	11:32:51 PM	A	1	27230		6	29923		211	41371		21	52038
A	27:04:18	11:32:54 PM	A	1	27606		6	29934		211	41839		21	51971
A	27:04:18	11:32:57 PM	A	1	27452		6	30450		211	41588		21	51943
A	27:04:18	11:33:00 PM	A	1	27607		6	29558		211	41704		21	51841
A	27:04:18	11:33:03 PM	A	1	27549		6	29774		211	41334		21	51825
A	27:04:18	11:33:06 PM	A	1	27405		6	29818		211	41480		21	51761
A	27:04:18	11:33:09 PM	A	1	27096		6	29655		211	41298		21	51718
A	27:04:18	11:33:12 PM	A	1	27449		6	29778		211	41552		21	51699
A	27:04:18	11:33:15 PM	A	1	27367		6	29588		211	41472		21	51623
A	27:04:18	11:33:18 PM	A	1	27452		6	29525		211	41488		21	51558
A	27:04:18	11:33:21 PM	A	1	27494		6	29570		211	41471		21	51506
A	27:04:18	11:33:24 PM	A	1	27374		6	29575		211	41627		21	51460
A	27:04:18	11:33:27 PM	A	1	27000		6	29624		211	41579		21	51416
A	27:04:18	11:33:30 PM	A	1	27438		6	29552		211	41145		21	51358
A	27:04:18	11:33:33 PM	A	1	27437		6	29702		211	41180		21	51322
A	27:04:18	11:33:36 PM	A	1	27350		6	29580		211	41324		21	51253
A	27:04:18	11:33:39 PM	A	1	27333		6	29522		211	41025		21	51230
A	27:04:18	11:33:42 PM	A	1	27567		6	29447		211	41496		21	51187
A	27:04:18	11:33:45 PM	A	1	27397		6	29413		211	41682		21	51139
A	27:04:18	11:33:48 PM	A	1	27526		6	29847		211	41386		21	51092
A	27:04:18	11:33:51 PM	A	1	27341		6	29374		211	41197		21	51049
A	27:04:18	11:33:54 PM	A	1	27369		6	29357		211	41343		21	51029
A	27:04:18	11:33:57 PM	A	1	27446		6	29329		211	41474		21	50965
A	27:04:18	11:34:00 PM	A	1	27551		6	29429		211	41413		21	50892
A	27:04:18	11:34:03 PM	A	1	27254		6	29387		211	41718		21	50870
A	27:04:18	11:34:06 PM	A	1	27444		6	29467		211	41329		21	50830
A	27:04:18	11:34:09 PM	A	1	27510		6	29395		211	41653		21	50771
A	27:04:18	11:34:12 PM	A	1	27509		6	29380		211	41104		21	50725
A	27:04:18	11:34:15 PM	A	1	27436		6	29124		211	41018		21	50703
A	27:04:18	11:34:18 PM	A	1	27421		6	29086		211	41086		21	50656
A	27:04:18	11:34:21 PM	A	1	27355		6	29304		211	41289		21	50593

A	27:04:18	11:34:24 PM	A	1	27428		6	29077		211	41365		21	50559
A	27:04:18	11:34:27 PM	A	1	27475		6	29111		211	41261		21	50532
A	27:04:18	11:34:30 PM	A	1	27340		6	28677		211	40998		21	50488
A	27:04:18	11:34:33 PM	A	1	27311		6	28846		211	40876		21	50438
A	27:04:18	11:34:36 PM	A	1	27410		6	28896		211	41383		21	50403
A	27:04:18	11:34:39 PM	A	1	27347		6	28717		211	40954		21	50363
A	27:04:18	11:34:42 PM	A	1	27465		6	28761		211	41231		21	50311
A	27:04:18	11:34:45 PM	A	1	27286		6	28833		211	41059		21	50271
A	27:04:18	11:34:48 PM	A	1	27527		6	28909		211	41428		21	50234
A	27:04:18	11:34:51 PM	A	1	27428		6	28736		211	41332		21	50193
A	27:04:18	11:34:54 PM	A	1	27352		6	28592		211	41439		21	50149
A	27:04:18	11:34:57 PM	A	1	27336		6	28470		211	41187		21	50083
A	27:04:18	11:35:00 PM	A	1	27337		6	28755		211	41402		21	50032
A	27:04:18	11:35:03 PM	A	1	27410		6	28382		211	41303		21	49973
A	27:04:18	11:35:06 PM	A	1	27399		6	28882		211	41128		21	49960
A	27:04:18	11:35:09 PM	A	1	27389		6	28510		211	40970		21	49955
A	27:04:18	11:35:12 PM	A	1	27364		6	28462		211	41300		21	49888
A	27:04:18	11:35:15 PM	A	1	27287		6	28579		211	41107		21	49812
A	27:04:18	11:35:18 PM	A	1	27418		6	28383		211	40732		21	49745
A	27:04:18	11:35:21 PM	A	1	27357		6	28433		211	41094		21	49722
A	27:04:18	11:35:24 PM	A	1	27489		6	28269		211	40940		21	49690
A	27:04:18	11:35:27 PM	A	1	27290		6	28663		211	41121		21	49628
A	27:04:18	11:35:30 PM	A	1	27302		6	28287		211	40801		21	49598
A	27:04:18	11:35:33 PM	A	1	27339		6	28175		211	40943		21	49558
A	27:04:18	11:35:36 PM	A	1	27412		6	28217		211	41004		21	49498
A	27:04:18	11:35:39 PM	A	1	27520		6	28135		211	41181		21	49430
A	27:04:18	11:35:42 PM	A	1	27372		6	28177		211	40897		21	49422
A	27:04:18	11:35:45 PM	A	1	27509		6	28236		211	41012		21	49345
A	27:04:18	11:35:48 PM	A	1	27360		6	28207		211	41179		21	49302
A	27:04:18	11:35:51 PM	A	1	27433		6	28163		211	40975		21	49241
A	27:04:18	11:35:54 PM	A	1	27354		6	28023		211	40970		21	49196
A	27:04:18	11:35:57 PM	A	1	27443		6	28053		211	41208		21	49187
A	27:04:18	11:36:00 PM	A	1	27471		6	28098		211	41102		21	49087
A	27:04:18	11:36:03 PM	A	1	27517		6	27903		211	40959		21	49110
A	27:04:18	11:36:06 PM	A	1	27250		6	27906		211	40819		21	48990
A	27:04:18	11:36:09 PM	A	1	27603		6	28076		211	40765		21	48978
A	27:04:18	11:36:12 PM	A	1	27549		6	28193		211	41215		21	48935
A	27:04:18	11:36:15 PM	A	1	27489		6	28022		211	41033		21	48894
A	27:04:18	11:36:18 PM	A	1	27359		6	28105		211	40992		21	48824
A	27:04:18	11:36:21 PM	A	1	27232		6	28105		211	40924		21	48789
A	27:04:18	11:36:24 PM	A	1	27487		6	27924		211	40912		21	48777
A	27:04:18	11:36:27 PM	A	1	27378		6	27825		211	40805		21	48671

A	27:04:18	11:36:30 PM	A	1	27353		6	27637		211	40841		21	48668
A	27:04:18	11:36:33 PM	A	1	27458		6	27840		211	40604		21	48604
A	27:04:18	11:36:36 PM	A	1	27545		6	27781		211	40459		21	48553
A	27:04:18	11:36:39 PM	A	1	27512		6	27624		211	40985		21	48499
A	27:04:18	11:36:42 PM	A	1	27367		6	27521		211	40883		21	48473
A	27:04:18	11:36:45 PM	A	1	27463		6	27692		211	40990		21	48425
A	27:04:18	11:36:48 PM	A	1	27399		6	27726		211	40671		21	48368
A	27:04:18	11:36:51 PM	A	1	27478		6	27496		211	40609		21	48347
A	27:04:18	11:36:54 PM	A	1	27337		6	27667		211	40695		21	48302
A	27:04:18	11:36:57 PM	A	1	27413		6	27407		211	40462		21	48257
A	27:04:18	11:37:00 PM	A	1	27358		6	27445		211	40937		21	48205
A	27:04:18	11:37:03 PM	A	1	27309		6	27540		211	40621		21	48180
A	27:04:18	11:37:06 PM	A	1	27428		6	27606		211	40520		21	48153
A	27:04:18	11:37:09 PM	A	1	27509		6	27629		211	40328		21	48112
A	27:04:18	11:37:12 PM	A	1	27475		6	27473		211	40470		21	48072
A	27:04:18	11:37:15 PM	A	1	27432		6	27492		211	40574		21	48018
A	27:04:18	11:37:18 PM	A	1	27459		6	27343		211	40390		21	48001
A	27:04:18	11:37:21 PM	A	1	27391		6	27340		211	40608		21	47915
A	27:04:18	11:37:24 PM	A	1	27376		6	27125		211	40447		21	47888
A	27:04:18	11:37:27 PM	A	1	27411		6	27264		211	40631		21	47847
A	27:04:18	11:37:30 PM	A	1	27438		6	27395		211	40961		21	47830
A	27:04:18	11:37:33 PM	A	1	27453		6	27209		211	40783		21	47753
A	27:04:18	11:37:36 PM	A	1	27445		6	27284		211	40832		21	47743
A	27:04:18	11:37:39 PM	A	1	27343		6	27492		211	40648		21	47709
A	27:04:18	11:37:42 PM	A	1	27341		6	27585		211	40760		21	47653
A	27:04:18	11:37:45 PM	A	1	27359		6	27471		211	40548		21	47584
A	27:04:18	11:37:48 PM	A	1	27218		6	27108		211	40447		21	47590
A	27:04:18	11:37:51 PM	A	1	27505		6	27440		211	40428		21	47525
A	27:04:18	11:37:54 PM	A	1	27433		6	27327		211	40749		21	47487
A	27:04:18	11:37:57 PM	A	1	27354		6	27542		211	40785		21	47462
A	27:04:18	11:38:00 PM	A	1	27408		6	27429		211	40570		21	47399
A	27:04:18	11:38:03 PM	A	1	27384		6	27254		211	40374		21	47322
A	27:04:18	11:38:06 PM	A	1	27475		6	27361		211	40276		21	47329
A	27:04:18	11:38:09 PM	A	1	27466		6	27395		211	40115		21	47254
A	27:04:18	11:38:12 PM	A	1	27355		6	27101		211	40104		21	47239
A	27:04:18	11:38:15 PM	A	1	27347		6	27181		211	40260		21	47146
A	27:04:18	11:38:18 PM	A	1	27489		6	27004		211	40258		21	47136
A	27:04:18	11:38:21 PM	A	1	27512		6	27022		211	40201		21	47087
A	27:04:18	11:38:24 PM	A	1	27354		6	26908		211	40319		21	47084
A	27:04:18	11:38:27 PM	A	1	27346		6	26933		211	40196		21	47032
A	27:04:18	11:38:30 PM	A	1	27414		6	26605		211	40555		21	46969
A	27:04:18	11:38:33 PM	A	1	27493		6	26643		211	40269		21	46930

A	27:04:18	11:38:36 PM	A	1	27463		6	26538		211	40452		21	46854
A	27:04:18	11:38:39 PM	A	1	27355		6	26380		211	40431		21	46851
A	27:04:18	11:38:42 PM	A	1	27329		6	26327		211	40425		21	46798
A	27:04:18	11:38:45 PM	A	1	27527		6	26299		211	40135		21	46760
A	27:04:18	11:38:48 PM	A	1	27566		6	26143		211	40479		21	46701
A	27:04:18	11:38:51 PM	A	1	27478		6	25746		211	40444		21	46679
A	27:04:18	11:38:54 PM	A	1	27412		6	25469		211	40459		21	46682
A	27:04:18	11:38:57 PM	A	1	27419		6	25574		211	40355		21	46599
A	27:04:18	11:39:00 PM	A	1	27340		6	25554		211	40245		21	46571
A	27:04:18	11:39:03 PM	A	1	27515		6	25667		211	40160		21	46546
A	27:04:18	11:39:06 PM	A	1	27348		6	25347		211	40027		21	46502
A	27:04:18	11:39:09 PM	A	1	27386		6	25431		211	40352		21	46470
A	27:04:18	11:39:12 PM	A	1	27447		6	25388		211	40293		21	46390
A	27:04:18	11:39:15 PM	A	1	27556		6	25197		211	40383		21	46379
A	27:04:18	11:39:18 PM	A	1	27231		6	25087		211	40439		21	46331
A	27:04:18	11:39:21 PM	A	1	27384		6	25075		211	40229		21	46271
A	27:04:18	11:39:24 PM	A	1	27440		6	25268		211	40066		21	46243
A	27:04:18	11:39:27 PM	A	1	27328		6	25229		211	40033		21	46246
A	27:04:18	11:39:30 PM	A	1	27396		6	25253		211	39808		21	46162
A	27:04:18	11:39:33 PM	A	1	27342		6	25297		211	40422		21	46108
A	27:04:18	11:39:36 PM	A	1	27441		6	25333		211	40184		21	46071
A	27:04:18	11:39:39 PM	A	1	27658		6	25227		211	40215		21	46092
A	27:04:18	11:39:42 PM	A	1	27342		6	25127		211	40280		21	46010
A	27:04:18	11:39:45 PM	A	1	27527		6	25244		211	39923		21	45947
A	27:04:18	11:39:48 PM	A	1	27435		6	25203		211	39878		21	45943
A	27:04:18	11:39:51 PM	A	1	27389		6	25326		211	40072		21	45915
A	27:04:18	11:39:54 PM	A	1	27588		6	25212		211	40264		21	45863
A	27:04:18	11:39:57 PM	A	1	27502		6	25618		211	39954		21	45817
A	27:04:18	11:40:00 PM	A	1	27466		6	25322		211	40193		21	45770
A	27:04:18	11:40:03 PM	A	1	27509		6	25564		211	40230		21	45758
A	27:04:18	11:40:06 PM	A	1	27596		6	25321		211	40344		21	45755
A	27:04:18	11:40:09 PM	A	1	27296		6	25313		211	40393		21	45659
A	27:04:18	11:40:12 PM	A	1	27610		6	25381		211	39952		21	45622
A	27:04:18	11:40:15 PM	A	1	27542		6	25516		211	39986		21	45581
A	27:04:18	11:40:18 PM	A	1	27313		6	25467		211	40411		21	45522
A	27:04:18	11:40:21 PM	A	1	27505		6	25595		211	40215		21	45510
A	27:04:18	11:40:24 PM	A	1	27732		6	25850		211	39966		21	45456
A	27:04:18	11:40:27 PM	A	1	27390		6	25571		211	40270		21	45413
A	27:04:18	11:40:30 PM	A	1	27325		6	25629		211	40115		21	45403
A	27:04:18	11:40:33 PM	A	1	27438		6	25695		211	40026		21	45348
A	27:04:18	11:40:36 PM	A	1	27565		6	25694		211	40252		21	45273
A	27:04:18	11:40:39 PM	A	1	27486		6	25735		211	40224		21	45252

A	27:04:18	11:40:42 PM	A	1	27433		6	25647		211	40105		21	45223
A	27:04:18	11:40:45 PM	A	1	27428		6	25338		211	39899		21	45167
A	27:04:18	11:40:48 PM	A	1	27435		6	25591		211	39913		21	45146
A	27:04:18	11:40:51 PM	A	1	27407		6	25715		211	40199		21	45106
A	27:04:18	11:40:54 PM	A	1	27424		6	25785		211	39956		21	45038
A	27:04:18	11:40:57 PM	A	1	27381		6	25488		211	39748		21	44977
A	27:04:18	11:41:00 PM	A	1	27426		6	25801		211	39465		21	44961
A	27:04:18	11:41:03 PM	A	1	27248		6	25716		211	39496		21	44910
A	27:04:18	11:41:06 PM	A	1	27276		6	25727		211	39861		21	44876
A	27:04:18	11:41:09 PM	A	1	27354		6	25581		211	39853		21	44869
A	27:04:18	11:41:12 PM	A	1	27498		6	25577		211	39824		21	44812
A	27:04:18	11:41:15 PM	A	1	27404		6	25563		211	39730		21	44770
A	27:04:18	11:41:18 PM	A	1	27170		6	25537		211	39809		21	44679
A	27:04:18	11:41:21 PM	A	1	27412		6	25543		211	39938		21	44697
A	27:04:18	11:41:24 PM	A	1	27409		6	25497		211	39676		21	44634
A	27:04:18	11:41:27 PM	A	1	27396		6	25549		211	39567		21	44613
A	27:04:18	11:41:30 PM	A	1	27476		6	25480		211	39658		21	44541
A	27:04:18	11:41:33 PM	A	1	27427		6	25500		211	39506		21	44550
A	27:04:18	11:41:36 PM	A	1	27489		6	25455		211	39806		21	44461
A	27:04:18	11:41:39 PM	A	1	27319		6	25331		211	39864		21	44429
A	27:04:18	11:41:42 PM	A	1	27283		6	25343		211	39791		21	44405
A	27:04:18	11:41:45 PM	A	1	27288		6	25407		211	39933		21	44326
A	27:04:18	11:41:48 PM	A	1	27414		6	25494		211	39715		21	44308
A	27:04:18	11:41:51 PM	A	1	27453		6	25085		211	39575		21	44242
A	27:04:18	11:41:54 PM	A	1	27311		6	25178		211	39467		21	44207
A	27:04:18	11:41:57 PM	A	1	27436		6	25446		211	39850		21	44148
A	27:04:18	11:42:00 PM	A	1	27408		6	25153		211	39637		21	44113
A	27:04:18	11:42:03 PM	A	1	27452		6	25387		211	39374		21	44091
A	27:04:18	11:42:06 PM	A	1	27344		6	25520		211	39806		21	44040
A	27:04:18	11:42:09 PM	A	1	27452		6	25288		211	39932		21	44018
A	27:04:18	11:42:12 PM	A	1	27312		6	25400		211	39783		21	43967
A	27:04:18	11:42:15 PM	A	1	27375		6	25466		211	39468		21	43919
A	27:04:18	11:42:18 PM	A	1	27444		6	25263		211	39768		21	43876
A	27:04:18	11:42:21 PM	A	1	27556		6	25277		211	39725		21	43843
A	27:04:18	11:42:24 PM	A	1	27463		6	25326		211	39609		21	43787
A	27:04:18	11:42:27 PM	A	1	27384		6	25368		211	39745		21	43734
A	27:04:18	11:42:30 PM	A	1	27521		6	25470		211	39617		21	43718
A	27:04:18	11:42:33 PM	A	1	27492		6	25176		211	39603		21	43662
A	27:04:18	11:42:36 PM	A	1	27343		6	25273		211	39434		21	43618
A	27:04:18	11:42:39 PM	A	1	27304		6	25370		211	39499		21	43553
A	27:04:18	11:42:42 PM	A	1	27544		6	25359		211	39643		21	43512
A	27:04:18	11:42:45 PM	A	1	27430		6	25185		211	39397		21	43488

A	27:04:18	11:42:48 PM	A	1	27473		6	25331		211	39495		21	43452
A	27:04:18	11:42:51 PM	A	1	27386		6	25160		211	39766		21	43410
A	27:04:18	11:42:54 PM	A	1	27304		6	25174		211	39536		21	43361
A	27:04:18	11:42:57 PM	A	1	27415		6	25014		211	39592		21	43298
A	27:04:18	11:43:00 PM	A	1	27406		6	25145		211	39269		21	43274
A	27:04:18	11:43:03 PM	A	1	27332		6	24849		211	39297		21	43233
A	27:04:18	11:43:06 PM	A	1	27435		6	25182		211	39171		21	43201
A	27:04:18	11:43:09 PM	A	1	27532		6	24911		211	39506		21	43134
A	27:04:18	11:43:12 PM	A	1	27301		6	24854		211	39723		21	43085
A	27:04:18	11:43:15 PM	A	1	27546		6	24644		211	39492		21	43078
A	27:04:18	11:43:18 PM	A	1	27386		6	24955		211	39147		21	43002
A	27:04:18	11:43:21 PM	A	1	27374		6	24839		211	39482		21	42971
A	27:04:18	11:43:24 PM	A	1	27464		6	24740		211	39621		21	42926
A	27:04:18	11:43:27 PM	A	1	27322		6	24595		211	39208		21	42828
A	27:04:18	11:43:30 PM	A	1	27375		6	24666		211	39211		21	42829
A	27:04:18	11:43:33 PM	A	1	27323		6	24283		211	39476		21	42819
A	27:04:18	11:43:36 PM	A	1	27377		6	24469		211	39522		21	42767
A	27:04:18	11:43:39 PM	A	1	27337		6	24519		211	39488		21	42707
A	27:04:18	11:43:42 PM	A	1	27389		6	24373		211	39322		21	42676
A	27:04:18	11:43:45 PM	A	1	27308		6	24321		211	39103		21	42644
A	27:04:18	11:43:48 PM	A	1	27405		6	24294		211	39099		21	42568
A	27:04:18	11:43:51 PM	A	1	27423		6	24150		211	39443		21	42522
A	27:04:18	11:43:54 PM	A	1	27460		6	24235		211	39315		21	42513
A	27:04:18	11:43:57 PM	A	1	27395		6	24192		211	39333		21	42465
A	27:04:18	11:44:00 PM	A	1	27513		6	24069		211	39448		21	42410
A	27:04:18	11:44:03 PM	A	1	27399		6	24045		211	39406		21	42387
A	27:04:18	11:44:06 PM	A	1	27352		6	23862		211	39048		21	42339
A	27:04:18	11:44:09 PM	A	1	27660		6	23832		211	39117		21	42305
A	27:04:18	11:44:12 PM	A	1	27480		6	23872		211	38925		21	42242
A	27:04:18	11:44:15 PM	A	1	27414		6	23869		211	39472		21	42229
A	27:04:18	11:44:18 PM	A	1	27389		6	23842		211	39275		21	42160
A	27:04:18	11:44:21 PM	A	1	27317		6	23846		211	39335		21	42120
A	27:04:18	11:44:24 PM	A	1	27515		6	23627		211	39332		21	42073
A	27:04:18	11:44:27 PM	A	1	27517		6	23526		211	39101		21	42001
A	27:04:18	11:44:30 PM	A	1	27507		6	23479		211	39018		21	41994
A	27:04:18	11:44:33 PM	A	1	27307		6	23515		211	39271		21	41970
A	27:04:18	11:44:36 PM	A	1	27459		6	23802		211	39205		21	41891
A	27:04:18	11:44:39 PM	A	1	27335		6	23591		211	39252		21	41868
A	27:04:18	11:44:42 PM	A	1	27538		6	23590		211	39223		21	41839
A	27:04:18	11:44:45 PM	A	1	27464		6	23570		211	39059		21	41819
A	27:04:18	11:44:48 PM	A	1	27250		6	23561		211	38940		21	41747
A	27:04:18	11:44:51 PM	A	1	27487		6	23533		211	38962		21	41713

A	27:04:18	11:44:54 PM	A	1	27465		6	23414		211	38930		21	41685
A	27:04:18	11:44:57 PM	A	1	27370		6	23400		211	38676		21	41609
A	27:04:18	11:45:00 PM	A	1	27540		6	23435		211	38942		21	41602
A	27:04:18	11:45:03 PM	A	1	27248		6	23283		211	38980		21	41530
A	27:04:18	11:45:06 PM	A	1	27391		6	23355		211	38709		21	41506
A	27:04:18	11:45:09 PM	A	1	27435		6	23325		211	38671		21	41444
A	27:04:18	11:45:12 PM	A	1	27360		6	23222		211	38808		21	41406
A	27:04:18	11:45:15 PM	A	1	27290		6	23395		211	38784		21	41365
A	27:04:18	11:45:18 PM	A	1	27351		6	23104		211	38701		21	41349
A	27:04:18	11:45:21 PM	A	1	27460		6	23045		211	39127		21	41285
A	27:04:18	11:45:24 PM	A	1	27282		6	22923		211	39140		21	41241
A	27:04:18	11:45:27 PM	A	1	27360		6	22956		211	38878		21	41191
A	27:04:18	11:45:30 PM	A	1	27492		6	22915		211	38932		21	41162
A	27:04:18	11:45:33 PM	A	1	27275		6	22832		211	38701		21	41125
A	27:04:18	11:45:36 PM	A	1	27363		6	23072		211	38775		21	41070
A	27:04:18	11:45:39 PM	A	1	27307		6	22816		211	39070		21	41019
A	27:04:18	11:45:42 PM	A	1	27239		6	22692		211	39171		21	40997
A	27:04:18	11:45:45 PM	A	1	27337		6	22446		211	39132		21	40916
A	27:04:18	11:45:48 PM	A	1	27369		6	22611		211	38714		21	40875
A	27:04:18	11:45:51 PM	A	1	27527		6	22567		211	38831		21	40827
A	27:04:18	11:45:54 PM	A	1	27440		6	22677		211	39247		21	40815
A	27:04:18	11:45:57 PM	A	1	27526		6	22519		211	39003		21	40765
A	27:04:18	11:46:00 PM	A	1	27492		6	22353		211	38885		21	40738
A	27:04:18	11:46:03 PM	A	1	27379		6	22295		211	38834		21	40700
A	27:04:18	11:46:06 PM	A	1	27375		6	22220		211	39048		21	40644
A	27:04:18	11:46:09 PM	A	1	27362		6	22103		211	38867		21	40570
A	27:04:18	11:46:12 PM	A	1	27462		6	22036		211	38785		21	40562
A	27:04:18	11:46:15 PM	A	1	27347		6	21897		211	38613		21	40490
A	27:04:18	11:46:18 PM	A	1	27342		6	22155		211	38679		21	40477
A	27:04:18	11:46:21 PM	A	1	27304		6	21913		211	38610		21	40422
A	27:04:18	11:46:24 PM	A	1	27472		6	21741		211	38671		21	40379
A	27:04:18	11:46:27 PM	A	1	27438		6	21853		211	38929		21	40341
A	27:04:18	11:46:30 PM	A	1	27501		6	21507		211	38833		21	40302
A	27:04:18	11:46:33 PM	A	1	27419		6	21619		211	38677		21	40279
A	27:04:18	11:46:36 PM	A	1	27414		6	21625		211	38717		21	40235
A	27:04:18	11:46:39 PM	A	1	27534		6	21696		211	38564		21	40165
A	27:04:18	11:46:42 PM	A	1	27330		6	21519		211	38767		21	40143
A	27:04:18	11:46:45 PM	A	1	27404		6	21623		211	38592		21	40093
A	27:04:18	11:46:48 PM	A	1	27347		6	21595		211	38499		21	40038
A	27:04:18	11:46:51 PM	A	1	27466		6	21456		211	38529		21	40003
A	27:04:18	11:46:54 PM	A	1	27434		6	21435		211	38425		21	39966
A	27:04:18	11:46:57 PM	A	1	27552		6	21337		211	38506		21	39896

A	27:04:18	11:47:00 PM	A	1	27505		6	21327		211	38722		21	39871
A	27:04:18	11:47:03 PM	A	1	27347		6	21568		211	38594		21	39822
A	27:04:18	11:47:06 PM	A	1	27435		6	21448		211	38721		21	39791
A	27:04:18	11:47:09 PM	A	1	27276		6	21486		211	38921		21	39764
A	27:04:18	11:47:12 PM	A	1	27453		6	21659		211	38606		21	39718
A	27:04:18	11:47:15 PM	A	1	27342		6	21395		211	38574		21	39677
A	27:04:18	11:47:18 PM	A	1	27468		6	21477		211	38481		21	39650
A	27:04:18	11:47:21 PM	A	1	27351		6	21404		211	38394		21	39613
A	27:04:18	11:47:24 PM	A	1	27491		6	21504		211	38397		21	39570
A	27:04:18	11:47:27 PM	A	1	27264		6	21261		211	38469		21	39540
A	27:04:18	11:47:30 PM	A	1	27428		6	21363		211	38029		21	39486
A	27:04:18	11:47:33 PM	A	1	27328		6	21430		211	38464		21	39422
A	27:04:18	11:47:36 PM	A	1	27395		6	21315		211	38308		21	39391
A	27:04:18	11:47:39 PM	A	1	27464		6	21409		211	38488		21	39352
A	27:04:18	11:47:42 PM	A	1	27326		6	21338		211	38352		21	39297
A	27:04:18	11:47:45 PM	A	1	27434		6	21365		211	38242		21	39247
A	27:04:18	11:47:48 PM	A	1	27416		6	21218		211	38253		21	39251
A	27:04:18	11:47:51 PM	A	1	27318		6	21429		211	38357		21	39196
A	27:04:18	11:47:54 PM	A	1	27431		6	21235		211	38177		21	39147
A	27:04:18	11:47:57 PM	A	1	27371		6	21143		211	38269		21	39087
A	27:04:18	11:48:00 PM	A	1	27344		6	21154		211	38548		21	39063
A	27:04:18	11:48:03 PM	A	1	27259		6	21229		211	38502		21	39020
A	27:04:18	11:48:06 PM	A	1	27628		6	21116		211	38609		21	38992
A	27:04:18	11:48:09 PM	A	1	27674		6	21053		211	38119		21	38931
A	27:04:18	11:48:12 PM	A	1	27486		6	21112		211	38551		21	38902
A	27:04:18	11:48:15 PM	A	1	27516		6	21095		211	38647		21	38864
A	27:04:18	11:48:18 PM	A	1	27333		6	21021		211	38601		21	38822
A	27:04:18	11:48:21 PM	A	1	27406		6	20974		211	38600		21	38750
A	27:04:18	11:48:24 PM	A	1	27309		6	20879		211	38246		21	38718
A	27:04:18	11:48:27 PM	A	1	27494		6	20997		211	38202		21	38692
A	27:04:18	11:48:30 PM	A	1	27413		6	20934		211	38138		21	38649
A	27:04:18	11:48:33 PM	A	1	27463		6	20665		211	38149		21	38599
A	27:04:18	11:48:36 PM	A	1	27514		6	20747		211	38259		21	38571
A	27:04:18	11:48:39 PM	A	1	27405		6	20823		211	36581		21	38501
A	27:04:18	11:48:42 PM	A	1	27502		6	20506		211	38514		21	38465
A	27:04:18	11:48:45 PM	A	1	27432		6	20630		211	38127		21	38439
A	27:04:18	11:48:48 PM	A	1	27319		6	20830		211	38086		21	38393
A	27:04:18	11:48:51 PM	A	1	27344		6	21020		211	38070		21	38338
A	27:04:18	11:48:54 PM	A	1	27339		6	20820		211	38097		21	38307
A	27:04:18	11:48:57 PM	A	1	27501		6	20575		211	36557		21	38283
A	27:04:18	11:49:00 PM	A	1	27185		6	20681		211	38467		21	38205
A	27:04:18	11:49:03 PM	A	1	27353		6	20786		211	36536		21	38175

A	27:04:18	11:49:06 PM	A	1	27452		6	20720		211	38033		21	38140
A	27:04:18	11:49:09 PM	A	1	27291		6	20598		211	36065		21	38075
A	27:04:18	11:49:12 PM	A	1	27452		6	20651		211	38224		21	38024
A	27:04:18	11:49:15 PM	A	1	27367		6	20111		211	36136		21	38002
A	27:04:18	11:49:18 PM	A	1	27417		6	20472		211	36358		21	37934
A	27:04:18	11:49:21 PM	A	1	27318		6	20566		211	35973		21	37877
A	27:04:18	11:49:24 PM	A	1	27428		6	20607		211	35962		21	37843
A	27:04:18	11:49:27 PM	A	1	27381		6	20558		211	35810		21	37796
A	27:04:18	11:49:30 PM	A	1	27551		6	20496		211	36195		21	37766
A	27:04:18	11:49:33 PM	A	1	27374		6	20598		211	36356		21	37751
A	27:04:18	11:49:36 PM	A	1	27421		6	20421		211	36180		21	37684
A	27:04:18	11:49:39 PM	A	1	27306		6	20235		211	35782		21	37641
A	27:04:18	11:49:42 PM	A	1	27420		6	20179		211	35642		21	37567
A	27:04:18	11:49:45 PM	A	1	27379		6	20054		211	36285		21	37523
A	27:04:18	11:49:48 PM	A	1	27366		6	20187		211	36321		21	37480
A	27:04:18	11:49:51 PM	A	1	27392		6	19904		211	35973		21	37423
A	27:04:18	11:49:54 PM	A	1	27483		6	19819		211	35807		21	37422
A	27:04:18	11:49:57 PM	A	1	27526		6	19888		211	36315		21	37328
A	27:04:18	11:50:00 PM	A	1	27314		6	19854		211	36292		21	37309
A	27:04:18	11:50:03 PM	A	1	27399		6	19810		211	35783		21	37281
A	27:04:18	11:50:06 PM	A	1	27315		6	19780		211	36309		21	37214
A	27:04:18	11:50:09 PM	A	1	27398		6	19723		211	36066		21	37156
A	27:04:18	11:50:12 PM	A	1	27478		6	19534		211	36089		21	37120
A	27:04:18	11:50:15 PM	A	1	27470		6	19536		211	35725		21	37091
A	27:04:18	11:50:18 PM	A	1	27409		6	19536		211	35774		21	36998
A	27:04:18	11:50:21 PM	A	1	27478		6	19506		211	36190		21	36979
A	27:04:18	11:50:24 PM	A	1	27550		6	19529		211	36054		21	36945
A	27:04:18	11:50:27 PM	A	1	27396		6	19563		211	35838		21	36883
A	27:04:18	11:50:30 PM	A	1	27284		6	19446		211	35622		21	36831
A	27:04:18	11:50:33 PM	A	1	27451		6	19310		211	35634		21	36795
A	27:04:18	11:50:36 PM	A	1	27473		6	19360		211	36071		21	36744
A	27:04:18	11:50:39 PM	A	1	27329		6	19224		211	35934		21	36697
A	27:04:18	11:50:42 PM	A	1	27496		6	19137		211	35535		21	36664
A	27:04:18	11:50:45 PM	A	1	27333		6	19052		211	35817		21	36576
A	27:04:18	11:50:48 PM	A	1	27438		6	19082		211	35769		21	36552
A	27:04:18	11:50:51 PM	A	1	27416		6	19219		211	36028		21	36490
A	27:04:18	11:50:54 PM	A	1	27568		6	18811		211	35948		21	36449
A	27:04:18	11:50:57 PM	A	1	27464		6	18872		211	36011		21	36379
A	27:04:18	11:51:00 PM	A	1	27406		6	19016		211	35585		21	36361
A	27:04:18	11:54:00 PM	A	1	27629		6	18686		211	35104		21	33764
A	27:04:18	11:57:00 PM	A	1	27417		6	19812		211	35265		21	31166
A	28:04:18	12:00:00 AM	A	1	27283		6	20780		211	34423		21	28737

A	28:04:18	12:03:00 AM	A	1	27363		6	21264		211	34079		21	26165
A	28:04:18	12:06:00 AM	A	1	27174		6	20517		211	33131		21	23542
A	28:04:18	12:09:00 AM	A	1	27479		6	19577		211	32471		21	21194
A	28:04:18	12:12:00 AM	A	1	27518		6	19407		211	31965		21	18712
A	28:04:18	12:15:00 AM	A	1	27375		6	18827		211	29290		21	16399
A	28:04:18	12:18:00 AM	A	1	27487		6	16859		211	28974		21	14243
A	28:04:18	12:21:00 AM	A	1	27394		6	16007		211	27905		21	12044
A	28:04:18	12:24:00 AM	A	1	27442		6	14697		211	27699		21	9907
A	28:04:18	12:27:00 AM	A	1	27437		6	14081		211	27069		21	7776
A	28:04:18	12:30:00 AM	A	1	27455		6	13348		211	26479		21	5818
A	28:04:18	12:33:00 AM	A	1	27467		6	11634		211	26125		21	3900
A	28:04:18	12:36:00 AM	A	1	27467		6	11081		211	25280		21	2003
A	28:04:18	12:39:00 AM	A	1	27488		6	11452		211	24942		20	65304
A	28:04:18	12:42:00 AM	A	1	27504		6	11055		211	22193		20	63363
A	28:04:18	12:45:00 AM	A	1	27628		6	10230		211	22029		20	61283
A	28:04:18	12:48:00 AM	A	1	27548		6	8864		211	21411		20	59416
A	28:04:18	12:51:00 AM	A	1	27391		6	7684		211	21397		20	57599
A	28:04:18	12:54:00 AM	A	1	27349		6	7150		211	20360		20	55415
A	28:04:18	12:57:00 AM	A	1	27522		6	6218		211	19950		20	53755
A	28:04:18	1:00:00 AM	A	1	27420		6	4851		211	19197		20	52045
A	28:04:18	1:03:00 AM	A	1	27351		6	5052		211	19064		20	50448
A	28:04:18	1:06:00 AM	A	1	27336		6	4427		211	18038		20	48876
A	28:04:18	1:09:00 AM	A	1	27211		6	4620		211	16070		20	47322
A	28:04:18	1:12:00 AM	A	1	27559		6	3275		211	15871		20	45748
A	28:04:18	1:15:00 AM	A	1	27408		6	2990		211	15028		20	44102
A	28:04:18	1:18:00 AM	A	1	27426		6	3346		211	14622		20	42642
A	28:04:18	1:21:00 AM	A	1	27696		6	2249		211	13757		20	41049
A	28:04:18	1:24:00 AM	A	1	27382		6	2783		211	13336		20	39314
A	28:04:18	1:27:00 AM	A	1	27353		6	3199		211	12844		20	37694
A	28:04:18	1:30:00 AM	A	1	27378		6	2587		211	12099		20	35971
A	28:04:18	1:33:00 AM	A	1	27347		6	2308		211	10036		20	34509
A	28:04:18	1:36:00 AM	A	1	27356		6	1483		211	9232		20	32736
A	28:04:18	1:39:00 AM	A	1	27421		6	224		211	9457		20	31129
A	28:04:18	1:42:00 AM	A	1	27380		5	65511		211	8369		20	29552
A	28:04:18	1:45:00 AM	A	1	27412		5	64253		211	7948		20	28047
A	28:04:18	1:48:00 AM	A	1	27342		5	64316		211	7753		20	26380
A	28:04:18	1:51:00 AM	A	1	27551		5	63682		211	6939		20	24736
A	28:04:18	1:54:00 AM	A	1	27372		5	62585		211	6620		20	23286
A	28:04:18	1:57:00 AM	A	1	27410		5	62089		211	5926		20	21777
A	28:04:18	2:00:00 AM	A	1	27203		5	61193		211	3826		20	20268

Appendix I

Code used to produce Figure 7.5 and Figure 7.6 can be found below

```
library(readxl) #read excel files
library(readr) #read csv files
library(ggplot2)
library(pracma) #for the cumtrapz function

getwd()
setwd("C:\\Users\\User\\OneDrive\\2019\\PhD 2018\\UFZ\\Experimental
data\\Impulse test 27 April")


UFZ_27<- read.csv2("Impulse 27 april 2018 fluoro.txt", sep = "\t", header =
FALSE)
Calibration<-read.csv2("2018_04_20_623.txt",sep = " ", header = FALSE)

Calibration_conc<-(as.numeric(unlist(Calibration$V8))*(2^16)+
                     as.numeric(unlist(Calibration$V9)))*2500/(2^24)
Calibration_time<-strptime(paste(as.character(Calibration$V2),
as.character(Calibration$V3)),
                           "%d:%m:%y %I:%M:%S %p")

Exp_conc<-(as.numeric(unlist(UFZ_27$V8))*(2^16)+
             as.numeric(unlist(UFZ_27$V9)))*2500/(2^24)
Exp_time<-as.numeric(difftime(strptime(paste(as.character(UFZ_27$V2),
as.character(UFZ_27$V3)),
                                "%d:%m:%y %I:%M:%S %p"),"2018-04-27 08:00:00
UTC",
                                tz="UCT", units="hours"))


Concentration<-
70+(70/(mean(Calibration_conc[74:90])+mean(Calibration_conc[4:31])))*
                 (Exp_conc-mean(Calibration_conc[4:31]))

Conc_mean<-mean(Concentration[1:50])
Concentration_1<-c()
#Need to rerun 'Concentration' before running the loop
for (i in 1:length(Concentration)) {
if (Concentration[i]> Conc_mean) {
  Concentration_1[i]<-Concentration[i]-Conc_mean
}
else {
  Concentration_1[i]<-0
}
}

#RTD modelling

Et_U<-Concentration_1/trapz(Exp_time,Concentration_1)
tm_U<-(trapz(Exp_time,Exp_time*Et_U))/trapz(Exp_time,(Et_U))
var_U<-trapz(Exp_time,(((Exp_time-tm_U)^2)*Et_U))
N_U<-(tm_U^2)/(var_U)
e_U<-tm_U/4
```

```
he_U<-e_U*(1-(1/N_U))


#Model attempt

t1_U<-
trapz(Exp_time[1:93],(Exp_time[1:93]*Et_U[1:93]))/trapz(Exp_time[1:93],(Et_
U[1:93]))

g1_U<-trapz(Exp_time[1:93],Et_U[1:93])

var1_U<-trapz(Exp_time[1:93],((Exp_time[1:93]-t1_U)^2)*Et_U[1:93])

tau1_U<-Exp_time[1]+10*g1_U/2.5

t2_U<-trapz(Exp_time[93:114],(Exp_time[93:114]*Et_U[93:114]))/
  trapz(Exp_time[93:114],(Et_U[93:114]))

g2_U<-trapz(Exp_time[93:114],Et_U[93:114])

var2_U<-trapz(Exp_time[93:114],((Exp_time[93:114]-t1_U)^2)*Et_U[93:114])

tau2_U<-Exp_time[93]+10*g2_U/2.5

t3_U<-trapz(Exp_time[114:140],(Exp_time[114:140]*Et_U[114:140]))/
        trapz(Exp_time[114:140],(Et_U[114:140]))

g3_U<-trapz(Exp_time[114:140],Et_U[114:140])

var3_U<-trapz(Exp_time[114:140],((Exp_time[114:140]-t1_U)^2)*Et_U[114:140])

tau3_U<-Exp_time[114]+10*g3_U/2.5

t4_U<-trapz(Exp_time[140:177],(Exp_time[140:177]*Et_U[140:177]))/
        trapz(Exp_time[140:177],(Et_U[140:177]))

g4_U<-trapz(Exp_time[140:177],Et_U[140:177])

var4_U<-trapz(Exp_time[140:177],((Exp_time[140:177]-t1_U)^2)*Et_U[140:177])

tau4_U<-Exp_time[140]+10*g4_U/2.5

t5_U<-trapz(Exp_time[177:7557],(Exp_time[177:7557]*Et_U[177:7557]))/
      trapz(Exp_time[177:7557],(Et_U[177:7557]))

g5_U<-trapz(Exp_time[177:7557],Et_U[177:7557])

var5_U<-trapz(Exp_time[177:7557],((Exp_time[177:7557]-
t1_U)^2)*Et_U[177:7557])

tau5_U<-Exp_time[177]+10*g5_U/2.5

#Plots
#Basic
UFZ<-data.frame(Conc=c(Concentration_1),
                Time=c(Exp_time))
UFZ_plot<-ggplot(data=UFZ)+
          geom_line(aes(x=Time,y=Conc), colour='grey12',size=1.2)+
          theme_bw()+
          theme(legend.title = element_blank(),
                text=element_text(family="Times New Roman"))+
```

```
          xlab('Time (hours)')+
          ylab('Concentration (ppb)')+
          scale_x_continuous(n.breaks=10)

plot(UFZ_plot)


#Model sections
U_Et<-data.frame(Et=c(Et_U),
                 Time=c(Exp_time))

U_fill<-
data.frame(Time=c(Exp_time[1:93],Exp_time[93],Exp_time[1],Exp_time[1],

Exp_time[93:114],Exp_time[114],Exp_time[93],Exp_time[93],

Exp_time[114:140],Exp_time[140],Exp_time[114],Exp_time[114],

Exp_time[140:177],Exp_time[177],Exp_time[140],Exp_time[140],

Exp_time[177:7557],Exp_time[7557],Exp_time[177],Exp_time[177]),
                   Et=c(Et_U[1:93],0,0,Et_U[1],Et_U[93:114],0,0,Et_U[93],

Et_U[114:140],0,0,Et_U[114],Et_U[140:177],0,0,Et_U[140],
                         Et_U[177:7557],0,0,Et_U[177]),

Group=c(rep('1',times=96),rep('2',times=25),rep('3',times=30),
                           rep('4',times=41),rep('5',times=7384)))

U_groups<-ggplot()+
          geom_polygon(data=U_fill,aes(x=Time,y=Et,fill=Group,color=Group),
                       alpha=0.7,size=0.1)+
          scale_color_brewer(palette="Greens")+
          scale_fill_brewer(palette="Greens")+
          geom_jitter(data=U_Et,aes(x=Time,y=Et),color='grey12',size=0.4)+
          geom_line(data=U_Et,aes(x=Time,y=Et),color='grey12')+
          theme_bw()+
          theme(legend.position = 'none',
                text=element_text(family="Times New Roman"))+
          xlab('Time (hours)')+
          ylab('E(t) (-)')+
          scale_x_continuous(n.breaks=10)

plot(U_groups)
```

Appendix J

Data used to determine hydraulic parameters and generate graphs in section 7.3

Column1	Column2	Column3	Column4	Column5	Column6	Column7	Column8	Column9	Column10	Column11	Column12	Column13	Column14	Column15	Column16	Column17	Column18	Column19	Column20	Column21	Column22	Column23	Column24	Column25	Column26
_	2:09:18 AM	4:00:01 PM	_	1	27311	9	30932	1	27224	1	41016	1	26274	1	28388	1	27224	3	34830	216	36495	22	55213	0	1160
_	2:09:18 AM	4:05:01 PM	_	1	27458	9	31997	1	27226	1	42257	1	26253	1	28200	1	27226	3	43645	216	36163	22	60303	0	1204
_	2:09:18 AM	4:10:01 PM	_	1	27283	9	33106	1	27204	1	41107	1	26240	1	28116	1	27204	3	36142	216	36126	22	56846	0	1163
_	2:09:18 AM	4:15:01 PM	_	1	27380	9	26837	1	27256	1	41077	1	26253	1	28028	1	27256	3	34901	216	36051	22	56523	0	1141
_	2:09:18 AM	4:20:01 PM	_	1	27455	9	32854	1	27167	1	41022	1	26290	1	28264	1	27167	3	33629	216	35957	22	59997	0	1169
_	2:09:18 AM	4:25:01 PM	_	1	27203	9	34179	1	27191	1	41080	1	26354	1	28113	1	27191	3	33813	216	35820	22	61627	0	1151
_	2:09:18 AM	4:30:01 PM	_	1	27372	9	35033	1	27282	1	41131	1	26369	1	27959	1	27282	3	33312	216	35608	22	63710	0	1126
_	2:09:18 AM	4:35:01 PM	_	1	27432	9	35427	1	27213	1	41194	1	26402	1	27893	1	27213	3	33493	216	35393	23	491	0	1154
_	2:09:18 AM	4:40:01 PM	_	1	27420	9	35537	1	27245	1	41013	1	26451	1	28275	1	27245	3	32535	216	35309	22	63762	0	1139
_	2:09:18 AM	4:45:01 PM	_	1	27360	9	35633	1	27208	1	41170	1	26275	1	27932	1	27208	3	32234	216	35225	23	814	0	1159
_	2:09:18 AM	4:50:01 PM	_	1	27341	9	36436	1	27182	1	41041	1	26331	1	27945	1	27182	3	32769	216	34872	23	2483	0	1183
_	2:09:18 AM	4:55:01 PM	_	1	27390	9	36993	1	27137	1	40858	1	26301	1	28040	1	27137	3	31604	216	34951	23	5816	0	1164
_	2:09:18 AM	5:00:01 PM	_	1	27266	9	37577	1	27284	1	41142	1	26416	1	27918	1	27284	3	30339	216	34752	23	8726	0	1136
_	2:09:18 AM	5:05:01 PM	_	1	27450	9	37327	1	27158	1	41029	1	26292	1	27751	1	27158	3	30277	216	34461	23	11057	0	1156
_	2:09:18 AM	5:10:01 PM	_	1	27330	9	38276	1	27099	1	41119	1	26297	1	27715	1	27099	3	30051	216	34505	23	14401	0	1140
_	2:09:18 AM	5:15:01 PM	_	1	27476	9	38456	1	27110	1	40999	1	26333	1	27857	1	27110	3	30307	216	34806	23	17279	0	1175
_	2:09:18 AM	5:20:01 PM	_	1	27451	9	41574	1	27155	1	41043	1	26228	1	27784	1	27155	3	28848	216	34371	23	15844	0	1133
_	2:09:18 AM	5:25:01 PM	_	1	27391	9	39698	1	27130	1	40899	1	26339	1	27884	1	27130	3	28872	216	33965	23	14857	0	1129
_	2:09:18 AM	5:30:01 PM	_	1	27435	9	39154	1	27087	1	41039	1	26141	1	27762	1	27087	3	28784	216	33752	23	19633	0	1199
_	2:09:18 AM	5:35:01 PM	_	1	27486	9	38130	1	27181	1	41110	1	26370	1	27619	1	27181	3	29283	216	34034	23	23160	0	1153
_	2:09:18 AM	5:40:01 PM	_	1	27323	9	37899	1	27162	1	41017	1	26188	1	27941	1	27162	3	29592	216	33852	23	25588	0	1153
_	2:09:18 AM	5:45:01 PM	_	1	27407	9	35569	1	27144	1	41042	1	26349	1	28037	1	27144	3	27783	216	33254	23	25822	0	1167
_	2:09:18 AM	5:50:01 PM	_	1	27255	9	34271	1	27223	1	40807	1	26294	1	27778	1	27223	3	27643	216	33634	23	26345	0	1145
_	2:09:18 AM	5:55:01 PM	_	1	27468	9	35173	1	27247	1	41037	1	26316	1	27885	1	27247	3	26661	216	33127	23	30264	0	1140
_	2:09:18 AM	6:00:01 PM	_	1	27562	9	33159	1	27193	1	41028	1	26279	1	27922	1	27193	3	27337	216	33344	23	33259	0	1156
_	2:09:18 AM	6:05:01 PM	_	1	27515	9	33402	1	27094	1	41057	1	26344	1	28383	1	27094	3	28128	216	33243	23	35672	0	1122
_	2:09:18 AM	6:10:01 PM	_	1	27498	9	31083	1	27214	1	40913	1	26240	1	28053	1	27214	3	30461	216	32858	23	39407	0	1164
_	2:09:18 AM	6:15:01 PM	_	1	27427	9	32364	1	27046	1	41062	1	26312	1	28034	1	27046	3	29369	216	32754	23	41418	0	1153
_	2:09:18 AM	6:20:01 PM	_	1	27352	9	31653	1	27171	1	41024	1	26208	1	28132	1	27171	3	28384	216	32963	23	44446	0	1139
_	2:09:18 AM	6:25:01 PM	_	1	27381	9	32315	1	27074	1	41063	1	26266	1	28062	1	27074	3	27906	216	32485	23	46987	0	1142
_	2:09:18 AM	6:30:01 PM	_	1	27285	9	32677	1	27032	1	41009	1	26425	1	27878	1	27032	3	27227	216	32774	23	50080	0	1184
_	2:09:18 AM	6:35:01 PM	_	1	27080	9	31331	1	27102	1	41099	1	26413	1	27944	1	27102	3	26854	216	32353	23	51089	0	1158
_	2:09:18 AM	6:40:01 PM	_	1	27487	9	32622	1	27159	1	41124	1	26379	1	28127	1	27159	3	26135	216	32610	23	54360	0	1118
_	2:09:18 AM	6:45:01 PM	_	1	27443	9	32075	1	27210	1	41331	1	26217	1	27989	1	27210	3	29685	216	32320	23	57286	0	1176
_	2:09:18 AM	6:50:01 PM	_	1	27426	9	34313	1	27197	1	41192	1	26380	1	28078	1	27197	3	25606	216	32357	23	59013	0	1153
_	2:09:18 AM	6:55:01 PM	_	1	27612	9	32249	1	27242	1	41069	1	26262	1	28149	1	27242	3	28970	216	32624	23	59907	0	1139
_	2:09:18 AM	7:00:01 PM	_	1	27377	9	31957	1	27159	1	41001	1	26241	1	27953	1	27159	3	30248	216	32716	23	61270	0	1153
_	2:09:18 AM	7:05:01 PM	_	1	27325	9	31925	1	27119	1	41062	1	26408	1	28085	1	27119	3	30467	216	32742	23	62183	0	1147
_	2:09:18 AM	7:10:01 PM	_	1	27452	9	32006	1	27221	1	41017	1	26354	1	28172	1	27221	3	32011	216	32270	23	63019	0	1124
_	2:09:18 AM	7:15:01 PM	_	1	27243	9	32040	1	27133	1	41060	1	26274	1	28036	1	27133	3	53802	216	32474	23	64007	0	1127
_	2:09:18 AM	7:20:01 PM	_	1	27549	9	32369	1	27219	1	41153	1	26406	1	28444	1	27219	3	34004	216	32026	23	65188	0	1133
_	2:09:18 AM	7:25:01 PM	_	1	27431	9	31746	1	27136	1	41091	1	26307	1	27856	1	27136	3	30369	216	32151	24	1064	0	1141
_	2:09:18 AM	7:30:01 PM	_	1	27461	9	32320	1	27164	1	41642	1	26295	1	28228	1	27164	3	29957	216	31979	24	2517	0	1102
_	2:09:18 AM	7:35:01 PM	_	1	27464	9	31668	1	27109	1	41190	1	26240	1	27973	1	27109	3	29854	216	32033	24	3940	0	1142
_	2:09:18 AM	7:40:01 PM	_	1	27365	9	32105	1	27136	1	41218	1	26374	1	27926	1	27136	3	27007	216	32131	24	5281	0	1117
_	2:09:18 AM	7:45:01 PM	_	1	27516	9	32176	1	27206	1	41236	1	26294	1	27956	1	27206	3	27708	216	31886	24	6545	0	1167
_	2:09:18 AM	7:50:01 PM	_	1	27257	9	31914	1	27233	1	41262	1	26335	1	28024	1	27233	3	26556	216	31770	24	7678	0	1218
_	2:09:18 AM	7:55:01 PM	_	1	27647	9	31974	1	27193	1	41317	1	26354	1	28069	1	27193	3	33528	216	31711	24	8748	0	1121
_	2:09:18 AM	8:00:01 PM	_	1	27363	9	31951	1	27246	1	41006	1	26386	1	27887	1	27246	3	27337	216	31774	24	9770	0	1129
_	2:09:18 AM	8:05:01 PM	_	1	27272	9	32163	1	27093	1	41083	1	26282	1	28118	1	27093	3	35855	216	31712	24	10727	0	1167
_	2:09:18 AM	8:10:01 PM	_	1	27355	9	31851	1	27217	1	41023	1	26254	1	28074	1	27217	3	26997	216	31746	24	11556	0	1114
_	2:09:18 AM	8:15:01 PM	_	1	27284	9	31970	1	27112	1	41064	1	26346	1	27969	1	27112	3	27630	216	31682	24	12357	0	1113
_	2:09:18 AM	8:20:01 PM	_	1	27293	9	31156	1	27203	1	40980	1	26354	1	27917	1	27203	3	26891	216	31370	24	13167	0	1149
_	2:09:18 AM	8:25:01 PM	_	1	27394	9	31719	1	27170	1	41223	1	26305	1	27993	1	27170	3	26885	216	30913	24	13851	0	1121
_	2:09:18 AM	8:30:01 PM	_	1	27485	9	32235	1	27147	1	41124	1	26253	1	27915	1	27147	3	28211	216	31269	24	14531	0	1159
_	2:09:18 AM	8:35:01 PM	_	1	27169	9	33263	1	27263	1	41196	1	26310	1	27813	1	27263	3	27550	216	30887	24	15125	0	1107
_	2:09:18 AM	8:40:01 PM	_	1	27452	9	33354	1	27195	1	41163	1	26365	1	27861	1	27195	3	27178	216	30960	24	15696	0	1187
_	2:09:18 AM	8:45:01 PM	_	1	27493	9	33140	1	27163	1	41152	1	26283	1	27837	1	27163	3	27487	216	30393	24	16280	0	1141
_	2:09:18 AM	8:50:01 PM	_	1	27322	9	33050	1	27196	1	40975	1	26350	1	28086	1	27196	3	27568	216	30628	24	16787	0	1108
_	2:09:18 AM	8:55:01 PM	_	1	27215	9	33002	1	27157	1	41144	1	26305	1	28085	1	27157	3	27709	216	30331	24	17246	0	1124
_	2:09:18 AM	9:00:01 PM	_	1	27171	9	32391	1	27095	1	41142	1	26276	1	27778	1	27095	3	28032	216	30130	24	17748	0	1112
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_	2:09:18 AM	9:10:01 PM	_	1	27427	9	32300	1	27185	1	41036	1	26268	1	27971	1	27185	3	26782	216	29935	24	18129	0	1159
_	2:09:18 AM	9:15:01 PM	_	1	27381	9	32445	1	27266	1	40985	1	26407	1	28036	1	27266	3	26537	216	29690	24	18042	0	1122
_	2:09:18 AM	9:20:01 PM	_	1	27588	9	32652	1	27226	1	41001	1	26364	1	27919	1	27226	3	28255	216	29436	24	17831	0	1138
_	2:09:18 AM	9:25:01 PM	_	1	27631	9	32176	1	27189	1	40984	1	26308	1	27887	1	27189	3	28789	216	29556	24	17436	0	1195
_	2:09:18 AM	9:30:01 PM	_	1	27424	9	33193	1	27154	1	41007	1	26324	1	27992	1	27154	3	27670	216	29482	24	16736	0	1097
_	2:09:18 AM	9:35:01 PM	_	1	27549	9	34108	1	27191	1	41011	1	26336	1	27902	1	27191	3	26675	216	29332	24	15742	0	1158
_	2:09:18 AM	9:40:01 PM	_	1	27350	9	35020	1	27255	1	41054	1	26341	1	28034	1	27255	3	27742	216	29013	24	14550	0	1105
_	2:09:18 AM	9:45:01 PM	_	1	27402	9	33710	1	27074	1	40880	1	26337	1	27936	1	27074	3	26183	216	28679	24	13120	0	1154
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_	2:09:18 AM	9:55:01 PM	_	1	27341	9	35273	1	27176	1	41084	1	26359	1	27818	1	27176	3	26005	216	28430	24	9741	0	1170
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_	2:09:18 AM	10:05:01 PM	_	1	27476	9	34741	1	27218	1	41135	1	26216	1	27832	1	27218	3	27700	216	28104	24	5832	0	1117
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_	2:09:18 AM	10:20:01 PM	_	1	27416	9	35357	1	27085	1	41087	1	26192	1	27735	1	27085	3	24903	216	26678	23	64605	0	1137
_	2:09:18 AM	10:25:01 PM	_	1	27324	9	35366	1	27265	1	41109	1	26325	1	27801	1	27265	3	25506	216	26367	23	62188	0	1096
_	2:09:18 AM	10:30:01 PM	_	1	27293	9	35576	1	27083	1	41005	1	26259	1	28353	1	27083	3	31843	216	26205	23	59659	0	1199
_	2:09:18 AM	10:35:01 PM	_	1	27340	9	35601	1	27298	1	40958	1	26395	1	27771	1	27298	3	25247	216	26085	23	56831	0	1176
_	2:09:18 AM	10:40:01 PM	_	1	27412	9	35828	1	27164	1	40974	1	26330	1	27852	1	27164	3	25182	216	25290	23	53689	0	1152
_	2:09:18 AM	10:45:01 PM	_	1	27300	9	36178	1	27119	1	40848	1	26396	1	27884	1	27119	3	24855	216	25395	23	50240	0	1123
_	2:09:18 AM	10:50:01 PM	_	1	27413	9	36149	1	27187	1	40986	1	26323	1	27778	1	27187	3	27763	216	24906	23	46782	0	1161
_	2:09:18 AM	10:55:01 PM	_	1	27529	9	36589	1	27193	1	40941	1	26409	1	27720	1	27193	3	24474	216	24635	23	43094	0	1144
_	2:09:18 AM	11:00:01 PM	_	1	27494	9	36505	1	27182	1	40932	1	26275	1	27755	1	27182	3	25324	216	24075	23	39298	0	1176
_	2:09:18 AM	11:05:01 PM	_	1	27431	9	36596	1	27204	1	40952	1	26391	1	27723	1	27204	3	25955	216	24026	23	35169	0	1143
_	2:09:18 AM	11:10:01 PM	_	1	27314	9	36936	1	27210	1	40943	1	26227	1	27607	1	27210	3	24868	216	23578	23	30796	0	1149
_	2:09:18 AM	11:15:01 PM	_	1	27503	9	37336	1	27221	1	40929	1	26361	1	27698	1	27221	3	26456	216	23122	23	26603	0	1133
_	2:09:18 AM	11:20:01 PM	_	1	27752	9	37203	1	27152	1	40970	1	26346	1	27856	1	27152	3	29922	216	22848	23	22332	0	1143
_	2:09:18 AM	11:25:01 PM	_	1	27262	9	37395	1	27235	1	40924	1	26292	1	27752	1	27235	3	24887	216	22305	23	17980	0	1198
_	2:09:18 AM	11:30:01 PM	_	1	27417	9	37729	1	27134	1	41049	1	26225	1	28098	1	27134	3	25750	216	21762	23	13673	0	1143

_	2:09:18 AM	11:35:01 PM	_	1	27551	9	37913	1	27207	1	40932	1	26381	1	27790	1	27207	3	25158	216	21531	23	9501	0	1180
_	2:09:18 AM	11:40:01 PM	_	1	27163	9	38166	1	27321	1	40832	1	26308	1	27598	1	27321	3	25689	216	20802	23	5233	0	1186
_	2:09:18 AM	11:45:01 PM	_	1	27420	9	38292	1	27115	1	41053	1	26187	1	27677	1	27115	3	25879	216	20843	23	1120	0	1183
_	2:09:18 AM	11:50:01 PM	_	1	27497	9	38555	1	27109	1	40953	1	26327	1	27786	1	27109	3	24997	216	19851	22	62680	0	1118
_	2:09:18 AM	11:55:01 PM	_	1	27514	9	38435	1	27173	1	40950	1	26228	1	27831	1	27173	3	26446	216	19413	22	58963	0	1112
_	3:09:18 AM	12:00:01 AM	_	1	27412	9	38615	1	27083	1	40852	1	26309	1	27649	1	27083	3	26007	216	19405	22	55258	0	1176
_	3:09:18 AM	12:10:01 AM	_	1	27300	9	38924	1	27322	1	40958	1	26372	1	27709	1	27322	3	25557	216	17672	22	48359	0	1175
_	3:09:18 AM	12:15:01 AM	_	1	27494	9	39085	1	27037	1	41101	1	26236	1	27596	1	27037	3	26200	216	17327	22	44862	0	1170
_	3:09:18 AM	12:20:01 AM	_	1	27294	9	39210	1	27090	1	41090	1	26398	1	27791	1	27090	3	25175	216	17333	22	41573	0	1158
_	3:09:18 AM	12:25:01 AM	_	1	27513	9	39387	1	27135	1	40844	1	26302	1	27700	1	27135	3	25052	216	17429	22	38199	0	1178
_	3:09:18 AM	12:30:01 AM	_	1	27587	9	39396	1	27122	1	40874	1	26491	1	27858	1	27122	3	27439	216	16829	22	34966	0	1153
_	3:09:18 AM	12:35:01 AM	_	1	27483	9	39619	1	27118	1	40922	1	26267	1	27834	1	27118	3	26196	216	16346	22	31842	0	1120
_	3:09:18 AM	12:40:01 AM	_	1	27349	9	40009	1	27261	1	40969	1	26274	1	27761	1	27261	3	24962	216	16122	22	28655	0	1164
_	3:09:18 AM	12:45:01 AM	_	1	27361	9	40148	1	27114	1	40828	1	26308	1	27692	1	27114	3	24596	216	15668	22	25558	0	1144
_	3:09:18 AM	12:50:01 AM	_	1	27233	9	40240	1	27164	1	40973	1	26328	1	27757	1	27164	3	24867	216	15356	22	22498	0	1147
_	3:09:18 AM	12:55:01 AM	_	1	27420	9	40273	1	27115	1	40909	1	26300	1	27760	1	27115	3	24646	216	14867	22	19448	0	1181
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_	3:09:18 AM	1:05:01 AM	_	1	27435	9	40454	1	27252	1	41457	1	26225	1	27632	1	27252	3	27469	216	14061	22	13714	0	1157
_	3:09:18 AM	1:10:01 AM	_	1	27236	9	40962	1	27224	1	40819	1	26356	1	28822	1	27224	3	25459	216	13873	22	10732	0	1145
_	3:09:18 AM	1:15:01 AM	_	1	27469	9	41202	1	27246	1	40930	1	26323	1	27828	1	27246	3	25042	216	13802	22	7803	0	1140
_	3:09:18 AM	1:20:01 AM	_	1	27137	9	41172	1	27105	1	40848	1	26268	1	27649	1	27105	3	24934	216	13520	22	4937	0	1125
_	3:09:18 AM	1:25:01 AM	_	1	27382	9	41404	1	27235	1	40890	1	26297	1	28072	1	27235	3	24383	216	13316	22	2186	0	1162
_	3:09:18 AM	1:30:01 AM	_	1	27630	9	41339	1	27139	1	40763	1	26426	1	27620	1	27139	3	24856	216	12839	21	64994	0	1141
_	3:09:18 AM	1:35:01 AM	_	1	27228	9	42498	1	27067	1	40946	1	26352	1	27764	1	27067	3	25625	216	12495	21	62320	0	1142
_	3:09:18 AM	1:40:01 AM	_	1	27311	9	41700	1	27216	1	40959	1	26354	1	27707	1	27216	3	25293	216	11984	21	59640	0	1181
_	3:09:18 AM	1:45:01 AM	_	1	27647	9	41867	1	27037	1	40891	1	26188	1	27809	1	27037	3	25699	216	12065	21	56927	0	1214
_	3:09:18 AM	1:50:01 AM	_	1	27511	9	41611	1	27147	1	40923	1	26231	1	27850	1	27147	3	27210	216	11213	21	54256	0	1142
_	3:09:18 AM	1:55:01 AM	_	1	27609	9	42229	1	27094	1	40804	1	26285	1	27863	1	27094	3	24918	216	11055	21	51514	0	1188
_	3:09:18 AM	2:00:01 AM	_	1	27255	9	42203	1	27208	1	40930	1	26301	1	27621	1	27208	3	25974	216	10872	21	48920	0	1128
_	3:09:18 AM	2:05:01 AM	_	1	27359	9	42693	1	27167	1	40960	1	26301	1	27825	1	27167	3	25870	216	10584	21	46285	0	1161
_	3:09:18 AM	2:10:01 AM	_	1	27450	9	42605	1	27168	1	40852	1	26418	1	27729	1	27168	3	25649	216	9789	21	43758	0	1192
_	3:09:18 AM	2:15:01 AM	_	1	27438	9	42601	1	27158	1	40917	1	26346	1	27701	1	27158	3	25353	216	9296	21	41223	0	1202
_	3:09:18 AM	2:20:01 AM	_	1	27388	9	42957	1	27198	1	40932	1	26419	1	27646	1	27198	3	25429	216	9252	21	38724	0	1107
_	3:09:18 AM	2:25:01 AM	_	1	27349	9	42521	1	27177	1	40851	1	26358	1	27886	1	27177	3	26194	216	8653	21	36165	0	1204
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_	3:09:18 AM	2:35:01 AM	_	1	27236	9	43240	1	27160	1	40808	1	26371	1	27680	1	27160	3	25507	216	8013	21	31262	0	1171
_	3:09:18 AM	2:40:01 AM	_	1	27393	9	43395	1	27147	1	40859	1	26298	1	27582	1	27147	3	27482	216	7795	21	28755	0	1201
_	3:09:18 AM	2:45:01 AM	_	1	27380	9	43388	1	27205	1	40823	1	26354	1	27770	1	27205	3	25107	216	6997	21	26311	0	1170
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_	3:09:18 AM	11:45:01 AM	_	1	27308	10	7929	1	26972	1	41102	1	26314	1	27531	1	26972	3	22332	215	58393	23	58750	0	1164
_	3:09:18 AM	11:50:01 AM	_	1	27401	10	7220	1	27139	1	41073	1	26249	1	28068	1	27139	3	23873	215	58640	23	64032	0	1182
_	3:09:18 AM	11:55:01 AM	_	1	27261	10	8414	1	27243	1	41022	1	26531	1	27453	1	27243	3	22097	215	58552	24	1725	0	1160
_	3:09:18 AM	12:00:01 PM	_	1	27164	10	8228	1	27078	1	41181	1	26296	1	27537	1	27078	3	24103	215	58559	24	4132	0	1131
_	3:09:18 AM	12:05:01 PM	_	1	27394	10	8433	1	27240	1	41123	1	26320	1	27521	1	27240	3	22486	215	58795	24	6670	0	1154
_	3:09:18 AM	12:10:01 PM	_	1	27297	10	7458	1	27327	1	41246	1	26235	1	27463	1	27327	3	23013	215	58489	24	14410	0	1142
_	3:09:18 AM	12:15:01 PM	_	1	27355	10	8679	1	27145	1	41228	1	26341	1	27510	1	27145	3	21237	215	59009	24	18156	0	1157
_	3:09:18 AM	12:20:01 PM	_	1	27425	10	8893	1	27158	1	41320	1	26524	1	27458	1	27158	3	22593	215	58501	24	24304	0	1161
_	3:09:18 AM	12:25:01 PM	_	1	27577	10	9610	1	27231	1	41053	1	26341	1	27323	1	27231	3	21903	215	58900	24	27877	0	1155
_	3:09:18 AM	12:30:01 PM	_	1	27297	10	10164	1	27162	1	41301	1	26171	1	27463	1	27162	3	21983	215	58421	24	31441	0	1120
_	3:09:18 AM	12:35:01 PM	_	1	27175	10	11771	1	27133	1	41082	1	26312	1	27512	1	27133	3	27007	215	58546	24	34988	0	1121
_	3:09:18 AM	12:40:01 PM	_	1	27529	10	12739	1	27221	1	41274	1	26346	1	27184	1	27221	3	21804	215	58526	24	36515	0	1103
_	3:09:18 AM	12:45:01 PM	_	1	27404	10	15183	1	27172	1	41197	1	26339	1	27444	1	27172	3	21829	215	58574	24	39553	0	1143
_	3:09:18 AM	12:50:01 PM	_	1	27517	10	15604	1	27209	1	41217	1	26281	1	27961	1	27209	3	22418	215	58698	24	44221	0	1147
_	3:09:18 AM	12:55:01 PM	_	1	27477	10	17561	1	27248	1	41119	1	26374	1	27331	1	27248	3	27418	215	58661	24	46991	0	1141
_	3:09:18 AM	1:00:01 PM	_	1	27443	10	22071	1	27081	1	41430	1	26247	1	27269	1	27081	3	27356	215	58883	24	49424	0	1137
_	3:09:18 AM	1:05:01 PM	_	1	27180	10	25238	1	27120	1	41336	1	26410	1	27299	1	27120	3	25439	215	58624	24	51838	0	1118
_	3:09:18 AM	1:10:01 PM	_	1	27429	10	26958	1	27058	1	41250	1	26218	1	27374	1	27058	3	21202	215	58692	24	56203	0	1142
_	3:09:18 AM	1:15:01 PM	_	1	27289	10	26834	1	27099	1	41360	1	26429	1	27148	1	27099	3	23525	215	58491	24	60050	0	1149
_	3:09:18 AM	1:20:01 PM	_	1	27383	10	30585	1	27173	1	41560	1	26285	1	27655	1	27173	3	25200	215	58526	24	63533	0	1115
_	3:09:18 AM	1:25:01 PM	_	1	27613	10	33788	1	27228	1	41314	1	26376	1	27313	1	27228	3	22032	215	58500	24	60993	0	1059
_	3:09:18 AM	1:30:01 PM	_	1	27501	10	37689	1	27151	1	41470	1	26260	1	27221	1	27151	3	21443	215	58339	24	63889	0	1134
_	3:09:18 AM	1:35:01 PM	_	1	27433	10	38623	1	27213	1	41664	1	26367	1	27211	1	27213	3	22549	215	58502	24	65416	0	1146
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_	3:09:18 AM	1:45:01 PM	_	1	27177	10	42880	1	27125	1	41943	1	26309	1	27339	1	27125	3	23434	215	58352	25	5037	0	1160
_	3:09:18 AM	1:50:01 PM	_	1	27311	10	44746	1	27162	1	41647	1	26232	1	27504	1	27162	3	22647	215	58236	25	5742	0	1212
_	3:09:18 AM	1:55:01 PM	_	1	27328	10	47555	1	27302	1	41719	1	26340	1	27493	1	27302	3	21134	215	58210	25	11577	0	1105
_	3:09:18 AM	2:00:01 PM	_	1	27394	10	49791	1	27247	1	41728	1	26371	1	27445	1	27247	3	22444	215	58117	25	10144	0	1082
_	3:09:18 AM	2:05:01 PM	_	1	27348	10	50767	1	27276	1	41895	1	26257	1	27204	1	27276	3	21011	215	57893	25	14370	0	1109
_	3:09:18 AM	2:10:01 PM	_	1	27430	10	53288	1	27317	1	41860	1	26518	1	27246	1	27317	3	22429	215	57895	25	12505	0	1123
_	3:09:18 AM	2:15:00 PM	_	1	27860	10	55251	1	27130	1	41773	1	26327	1	27374	1	27130	3	21600	215	57532	25	11856	0	1134
_	3:09:18 AM	2:20:01 PM	_	1	27596	10	57974	1	27073	1	41829	1	26273	1	27430	1	27073	3	23564	215	56796	25	12372	0	1169
_	3:09:18 AM	2:25:01 PM	_	1	27610	10	59434	1	27190	1	41977	1	26271	1	27273	1	27190	3	30601	215	56778	25	13223	0	1093
_	3:09:18 AM	2:30:00 PM	_	1	27421	10	59929	1	27209	1	41852	1	26192	1	27678	1	27209	3	30424	215	56888	25	13675	0	1136
_	3:09:18 AM	2:35:01 PM	_	1	27480	10	62240	1	27173	1	41920	1	26250	1	27572	1	27173	3	33276	215	56423	25	17429	0	1108
_	3:09:18 AM	2:40:01 PM	_	1	27147	10	63513	1	27265	1	41859	1	26385	1	27390	1	27265	3	29059	215	56279	25	18900	0	1163
_	3:09:18 AM	2:45:01 PM	_	1	27578	11	3955	1	27189	1	42113	1	26391	1	27550	1	27189	3	25315	215	56115	25	16403	0	1147
_	3:09:18 AM	2:50:01 PM	_	1	27457	11	3808	1	27236	1	41969	1	26325	1	27261	1	27236	3	28540	215	56200	25	16912	0	1185
_	3:09:18 AM	2:55:01 PM	_	1	27360	11	7685	1	27088	1	42097	1	26309	1	27371	1	27088	3	25742	215	55955	25	17744	0	1071

_	3:09:18 AM	3:00:01 PM	_	1	27175	11	8793	1	27177	1	42147	1	26236	1	27490	1	27177	3	26981	215	55646	25	14819	0	1117
_	3:09:18 AM	3:05:01 PM	_	1	27515	11	9826	1	27150	1	42077	1	26300	1	27292	1	27150	3	24690	215	55571	25	12912	0	1115
_	3:09:18 AM	3:10:01 PM	_	1	27519	11	9873	1	27187	1	42111	1	26289	1	27622	1	27187	3	25347	215	55231	25	13163	0	1144
_	3:09:18 AM	3:15:01 PM	_	1	27335	11	10966	1	27152	1	42168	1	26244	1	27362	1	27152	3	24928	215	55239	25	12818	0	1129
_	3:09:18 AM	3:20:01 PM	_	1	27331	11	11854	1	27168	1	42076	1	26224	1	27366	1	27168	3	24526	215	54762	25	14662	0	1081
_	3:09:18 AM	3:25:01 PM	_	1	27223	11	14060	1	27122	1	42187	1	26222	1	27111	1	27122	3	24525	215	54641	25	13148	0	1138
_	3:09:18 AM	3:30:01 PM	_	1	27362	11	15437	1	27203	1	42056	1	26258	1	27302	1	27203	3	28362	215	54107	25	16913	0	1122
_	3:09:18 AM	3:35:01 PM	_	1	27370	11	18567	1	27185	1	42161	1	26256	1	27357	1	27185	3	24399	215	53906	25	23348	0	1092
_	3:09:18 AM	3:40:01 PM	_	1	27577	11	20361	1	27150	1	42056	1	26371	1	27317	1	27150	3	23783	215	53909	25	26868	0	1100
_	3:09:18 AM	3:45:01 PM	_	1	27632	11	22424	1	27201	1	42263	1	26238	1	27544	1	27201	3	24009	215	53215	25	29313	0	1138
_	3:09:18 AM	3:50:01 PM	_	1	27472	11	23076	1	27249	1	42165	1	26227	1	27545	1	27249	3	23461	215	53138	25	31788	0	1090
_	3:09:18 AM	3:55:01 PM	_	1	27121	11	24517	1	27201	1	42206	1	26379	1	27296	1	27201	3	23105	215	52375	25	33414	0	1155
_	3:09:18 AM	4:00:01 PM	_	1	27491	11	26334	1	27194	1	42304	1	26383	1	27346	1	27194	3	22883	215	52072	25	34981	0	1060
_	3:09:18 AM	4:05:00 PM	_	1	27502	11	27383	1	27132	1	42255	1	26364	1	27304	1	27132	3	24334	215	51885	25	38215	0	1091
_	3:09:18 AM	4:10:00 PM	_	1	27546	11	29321	1	27243	1	42581	1	26349	1	27217	1	27243	3	24351	215	51913	25	40115	0	1097
_	3:09:18 AM	4:15:01 PM	_	1	27420	11	31105	1	27069	1	42399	1	26313	1	27462	1	27069	3	24144	215	51348	25	41417	0	1153
_	3:09:18 AM	4:20:00 PM	_	1	27245	11	31726	1	27099	1	42241	1	26259	1	27286	1	27099	3	22645	215	51511	25	42322	0	1178
_	3:09:18 AM	4:25:01 PM	_	1	27656	11	33487	1	27208	1	42293	1	26326	1	27776	1	27208	3	23434	215	50781	25	43096	0	1055
_	3:09:18 AM	4:30:01 PM	_	1	27541	11	34032	1	27273	1	42379	1	26247	1	27195	1	27273	3	23884	215	50738	25	43540	0	1105
_	3:09:18 AM	4:35:01 PM	_	1	27501	11	34620	1	27152	1	42301	1	26392	1	27404	1	27152	3	23234	215	50360	25	44414	0	1165
_	3:09:18 AM	4:40:00 PM	_	1	27288	11	34569	1	27079	1	42352	1	26300	1	27288	1	27079	3	26733	215	50217	25	44988	0	1067
_	3:09:18 AM	4:45:01 PM	_	1	27494	11	36899	1	27132	1	42470	1	26360	1	27348	1	27132	3	23126	215	49877	25	44930	0	1139
_	3:09:18 AM	4:50:01 PM	_	1	27415	11	36498	1	27211	1	42417	1	26321	1	27374	1	27211	3	22962	215	49819	25	43225	0	1122
_	3:09:18 AM	4:55:01 PM	_	1	27289	11	34828	1	27169	1	42463	1	26227	1	27372	1	27169	3	26512	215	49731	25	42631	0	1142
_	3:09:18 AM	5:00:01 PM	_	1	27492	11	36579	1	27182	1	42340	1	26333	1	27422	1	27182	3	23971	215	49441	25	42375	0	1160
_	3:09:18 AM	5:05:01 PM	_	1	27400	11	37148	1	27164	1	42595	1	26289	1	27291	1	27164	3	25144	215	49415	25	42158	0	1139
_	3:09:18 AM	5:10:01 PM	_	1	27449	11	39855	1	27188	1	42548	1	26284	1	27285	1	27188	3	25245	215	48977	25	41165	0	1121
_	3:09:18 AM	5:15:01 PM	_	1	27457	11	40244	1	27196	1	42506	1	26258	1	27302	1	27196	3	25224	215	48502	25	40511	0	1083
_	3:09:18 AM	5:20:01 PM	_	1	27472	11	40216	1	27179	1	42428	1	26407	1	27359	1	27179	3	27742	215	48605	25	39334	0	1091
_	3:09:18 AM	5:25:01 PM	_	1	27371	11	41060	1	27232	1	42473	1	26260	1	27254	1	27232	3	25808	215	48566	25	39245	0	1083
_	3:09:18 AM	5:30:01 PM	_	1	27341	11	43577	1	27248	1	42663	1	26324	1	27180	1	27248	3	27900	215	47923	25	41277	0	1099
_	3:09:18 AM	5:35:01 PM	_	1	27360	11	46809	1	27115	1	42503	1	26365	1	27311	1	27115	3	25056	215	48116	25	42444	0	1118
_	3:09:18 AM	5:40:01 PM	_	1	27412	11	48544	1	27121	1	42280	1	26394	1	27570	1	27121	3	27659	215	47628	25	42958	0	1071
_	3:09:18 AM	5:45:01 PM	_	1	27328	11	48526	1	27214	1	42547	1	26288	1	27292	1	27214	3	24999	215	47287	25	43315	0	1114
_	3:09:18 AM	5:50:01 PM	_	1	27422	11	50605	1	27229	1	42730	1	26292	1	27449	1	27229	3	25273	215	46932	25	43420	0	1106
_	3:09:18 AM	5:55:01 PM	_	1	27423	11	50800	1	27122	1	42664	1	26334	1	27408	1	27122	3	25070	215	46555	25	43579	0	1132
_	3:09:18 AM	6:00:01 PM	_	1	27359	11	52683	1	27113	1	42616	1	26302	1	27392	1	27113	3	25073	215	46358	25	43868	0	1128
_	3:09:18 AM	6:05:01 PM	_	1	27500	11	54687	1	27301	1	42546	1	26363	1	27426	1	27301	3	28232	215	46001	25	44225	0	1089
_	3:09:18 AM	6:10:01 PM	_	1	27448	11	55384	1	27224	1	42853	1	26364	1	27559	1	27224	3	24721	215	45727	25	44436	0	1110
_	3:09:18 AM	6:15:01 PM	_	1	27394	11	56219	1	27250	1	42611	1	26374	1	27461	1	27250	3	26696	215	45538	25	44390	0	1114
_	3:09:18 AM	6:20:00 PM	_	1	27464	11	57321	1	27231	1	42711	1	26276	1	27547	1	27231	3	24362	215	45231	25	44175	0	1065
_	3:09:18 AM	6:25:01 PM	_	1	27462	11	57516	1	27269	1	42786	1	26305	1	27778	1	27269	3	25871	215	44803	25	44157	0	1095
_	3:09:18 AM	6:30:01 PM	_	1	27490	11	59151	1	27314	1	42748	1	26322	1	27452	1	27314	3	24778	215	44456	25	43951	0	1132
_	3:09:18 AM	6:35:01 PM	_	1	27583	11	60213	1	27192	1	42712	1	26260	1	27359	1	27192	3	26769	215	44203	25	43648	0	1079
_	3:09:18 AM	6:40:01 PM	_	1	27231	11	61396	1	27237	1	42716	1	26303	1	27370	1	27237	3	24057	215	43934	25	43320	0	1140
_	3:09:18 AM	6:45:01 PM	_	1	27375	11	62158	1	27059	1	42801	1	26279	1	27326	1	27059	3	25545	215	43666	25	42844	0	1107
_	3:09:18 AM	6:50:01 PM	_	1	27442	11	62927	1	27287	1	42674	1	26351	1	27548	1	27287	3	25273	215	43472	25	42031	0	1019
_	3:09:18 AM	6:55:01 PM	_	1	27501	11	63704	1	27126	1	42851	1	26230	1	27414	1	27126	3	24553	215	42982	25	41167	0	1100
_	3:09:18 AM	7:00:01 PM	_	1	27286	11	64780	1	27120	1	42949	1	26376	1	27726	1	27120	3	25654	215	42869	25	40153	0	1094
_	3:09:18 AM	7:05:01 PM	_	1	27392	11	64526	1	27117	1	42888	1	26381	1	27538	1	27117	3	32184	215	42282	25	39203	0	1122
_	3:09:18 AM	7:10:01 PM	_	1	27373	11	65044	1	27248	1	43131	1	26370	1	27382	1	27248	3	29962	215	42423	25	38342	0	1140
_	3:09:18 AM	7:15:01 PM	_	1	27391	12	96	1	27248	1	42818	1	26337	1	27977	1	27248	3	27442	215	42118	25	37380	0	1121
_	3:09:18 AM	7:20:01 PM	_	1	27414	12	86	1	27193	1	43121	1	26347	1	28302	1	27193	3	33879	215	41534	25	36630	0	1171
_	3:09:18 AM	7:25:01 PM	_	1	27325	11	65455	1	27210	1	43162	1	26265	1	27690	1	27210	3	35878	215	41293	25	35973	0	1112
_	3:09:18 AM	7:30:01 PM	_	1	27186	11	65474	1	27309	1	43028	1	26372	1	27626	1	27309	3	24258	215	40956	25	35111	0	1093
_	3:09:18 AM	7:35:01 PM	_	1	27294	12	397	1	27082	1	43152	1	26266	1	27512	1	27082	3	25435	215	40848	25	34287	0	1123
_	3:09:18 AM	7:40:01 PM	_	1	27408	12	135	1	27227	1	42731	1	26332	1	27509	1	27227	3	26402	215	40314	25	32919	0	1140
_	3:09:18 AM	7:45:01 PM	_	1	27358	12	2771	1	27226	1	42905	1	26355	1	27616	1	27226	3	29359	215	39913	25	31215	0	1121
_	3:09:18 AM	7:50:01 PM	_	1	27397	12	3056	1	27190	1	43009	1	26296	1	28003	1	27190	3	28419	215	39824	25	29659	0	1115
_	3:09:18 AM	7:55:01 PM	_	1	27408	12	5321	1	27268	1	43079	1	26273	1	27306	1	27268	3	25589	215	39780	25	27896	0	1102
_	3:09:18 AM	8:00:01 PM	_	1	27521	12	6402	1	27205	1	42964	1	26265	1	27773	1	27205	3	31369	215	39409	25	27066	0	1133
_	3:09:18 AM	8:05:01 PM	_	1	27327	12	8204	1	27165	1	43075	1	26366	1	28184	1	27165	3	26778	215	39200	25	27504	0	1125
_	3:09:18 AM	8:10:01 PM	_	1	27443	12	9901	1	27148	1	42858	1	26232	1	27554	1	27148	3	28355	215	38898	25	24197	0	1200
_	3:09:18 AM	8:15:01 PM	_	1	27379	12	10843	1	27256	1	43201	1	26301	1	27853	1	27256	3	28034	215	38340	25	20955	0	1064
_	3:09:18 AM	8:20:01 PM	_	1	27239	12	14686	1	27223	1	43055	1	26284	1	27438	1	27223	3	27432	215	38156	25	18675	0	1140
_	3:09:18 AM	8:25:01 PM	_	1	27520	12	15829	1	27260	1	43202	1	26391	1	27753	1	27260	3	26918	215	37724	25	17405	0	1039
_	3:09:18 AM	8:30:01 PM	_	1	27427	12	17607	1	27260	1	43199	1	26283	1	27856	1	27260	3	33122	215	37547	25	15657	0	1096
_	3:09:18 AM	8:35:01 PM	_	1	27413	12	20524	1	27214	1	42966	1	26259	1	27946	1	27214	3	28368	215	37406	25	16785	0	1122
_	3:09:18 AM	8:40:01 PM	_	1	27304	12	21962	1	27284	1	43178	1	26338	1	27518	1	27284	3	27547	215	36829	25	8179	0	1091
_	3:09:18 AM	8:45:01 PM	_	1	27162	12	24171	1	27116	1	42992	1	26262	1	27549	1	27116	3	28078	215	36596	24	63294	0	1091
_	3:09:18 AM	8:50:01 PM	_	1	27293	12	24724	1	27214	1	43316	1	26367	1	27712	1	27214	3	28720	215	36574	25	906	0	1131
_	3:09:18 AM	8:55:01 PM	_	1	27443	12	25791	1	27137	1	43429	1	26207	1	27746	1	27137	3	28229	215	36005	25	5934	0	1118
_	3:09:18 AM	9:00:01 PM	_	1	27166	12	25452	1	27193	1	43106	1	26388	1	27633	1	27193	3	29759	215	35999	25	7184	0	1141
_	3:09:18 AM	9:05:01 PM	_	1	27472	12	27470	1	27220	1	43046	1	26305	1	27860	1	27220	3	28530	215	35513	25	7152	0	1154
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_	3:09:18 AM	9:15:01 PM	_	1	27078	12	28109	1	27138	1	43502	1	26296	1	27877	1	27138	3	28786	215	34750	25	6591	0	1035
_	3:09:18 AM	9:20:01 PM	_	1	27463	12	30025	1	27205	1	43223	1	26374	1	27647	1	27205	3	26871	215	34482	25	6085	0	1145
_	3:09:18 AM	9:25:01 PM	_	1	27237	12	30354	1	27237	1	43249	1	26298	1	27530	1	27237	3	27758	215	34156	25	5491	0	1153
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_	3:09:18 AM	9:45:01 PM	_	1	27471	12	33872	1	27342	1	43222	1	26265	1	27547	1	27342	3	35287	215	33077	24	64659	0	1141
_	3:09:18 AM	9:50:01 PM	_	1	27390	12	34862	1	27216	1	43280	1	26238	1	27538	1	27216	3	29594	215	32736	24	63202	0	1154
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_	3:09:18 AM	10:10:01 PM	_	1	27442	12	36593	1	27167	1	43266	1	26329	1	27557	1	27167	3	27757	215	31555	24	55588	0	1117
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_	3:09:18 AM	10:55:01 PM	_	1	27263	12	45496	1	27184	1	43393	1	26319	1	27694	1	27184	3	26832	215	28803	24	31436	0	1128
_	3:09:18 AM	11:00:01 PM	_	1	27456	12	45621	1	27207	1	43336	1	26331	1	27716	1	27207	3	27956	215	28382	24	28518	0	1183
_	3:09:18 AM	11:05:01 PM	_	1	27413	12	48417	1	27145	1	43600	1	26179	1	28336	1	27145	3	28411	215	28127	24	25567	0	1154
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_	4:09:18 AM	12:00:01 AM	_	1	27454	12	64035	1	27165	1	43851	1	26388	1	27632	1	27165	3	28989	215	23873	24	1541	0	1157
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_	4:09:18 AM	12:20:01 AM	_	1	27457	13	6024	1	27098	1	43922	1	26362	1	27525	1	27098	3	29077	215	21411	23	58485	0	1161
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_	4:09:18 AM	4:20:01 AM	_	1	27418	15	26644	1	27140	1	45182	1	26262	1	27788	1	27140	3	30096	215	4946	22	19878	0	1107
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_	4:09:18 AM	5:00:01 AM	_	1	27333	15	38162	1	27135	1	45252	1	26255	1	27677	1	27135	3	31141	215	2220	22	3973	0	1089
_	4:09:18 AM	5:05:01 AM	_	1	27521	15	40075	1	27136	1	45432	1	26317	1	27697	1	27136	3	31013	215	2203	22	2284	0	1143
_	4:09:18 AM	5:10:01 AM	_	1	27368	15	41777	1	27228	1	45144	1	26360	1	27487	1	27228	3	29147	215	2049	22	260	0	1161
_	4:09:18 AM	5:15:01 AM	_	1	27359	15	43619	1	27183	1	45334	1	26348	1	27575	1	27183	3	29762	215	1436	21	63839	0	1117
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_	4:09:18 AM	5:25:01 AM	_	1	27402	15	47959	1	27210	1	45405	1	26237	1	27840	1	27210	3	30476	215	837	21	61229	0	1126
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_	4:09:18 AM	5:35:01 AM	_	1	27588	15	52886	1	27119	1	45363	1	26356	1	27624	1	27119	3	32228	215	29	21	59023	0	1161
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_	4:09:18 AM	5:50:01 AM	_	1	27382	15	57139	1	27094	1	45474	1	26059	1	27689	1	27094	3	30393	214	64675	21	55632	0	1158
_	4:09:18 AM	5:55:01 AM	_	1	27640	15	58833	1	27163	1	45383	1	26157	1	27907	1	27163	3	31027	214	64130	21	54751	0	1127
_	4:09:18 AM	6:00:01 AM	_	1	27084	15	57520	1	27201	1	45524	1	26291	1	27692	1	27201	3	30656	214	63930	21	54074	0	1174
_	4:09:18 AM	6:05:01 AM	_	1	27444	15	59431	1	27211	1	45631	1	26266	1	27872	1	27211	3	30880	214	63359	21	53197	0	1161
_	4:09:18 AM	6:10:01 AM	_	1	27823	15	61213	1	27212	1	45496	1	26287	1	27733	1	27212	3	31511	214	62998	21	54451	0	1166
_	4:09:18 AM	6:15:01 AM	_	1	27567	15	61557	1	27208	1	45535	1	26341	1	27733	1	27208	3	29320	214	62928	21	56405	0	1168
_	4:09:18 AM	6:20:01 AM	_	1	27493	15	61840	1	27220	1	45470	1	26248	1	27755	1	27220	3	32320	214	62623	21	58729	0	1183

_	4:09:18 AM	6:25:01 AM	_	1	27342	15	60940	1	27077	1	45596	1	26373	1	27717	1	27077	3	32621	214	62277	21	60580	0	1111
_	4:09:18 AM	6:30:01 AM	_	1	27427	15	63323	1	27138	1	45705	1	26338	1	27686	1	27138	3	30535	214	61930	21	62530	0	1141
_	4:09:18 AM	6:35:01 AM	_	1	27394	15	63934	1	27185	1	45492	1	26298	1	27844	1	27185	3	31233	214	61825	21	64619	0	1154
_	4:09:18 AM	6:40:01 AM	_	1	27701	15	63443	1	27096	1	45599	1	26334	1	28278	1	27096	3	30419	214	61486	22	936	0	1166
_	4:09:18 AM	6:45:01 AM	_	1	27311	15	63732	1	27250	1	45659	1	26262	1	27939	1	27250	3	31528	214	61455	22	3015	0	1135
_	4:09:18 AM	6:50:01 AM	_	1	27356	15	64028	1	27150	1	45511	1	26163	1	27822	1	27150	3	31604	214	61251	22	5215	0	1221
_	4:09:18 AM	6:55:01 AM	_	1	27572	15	64321	1	27193	1	45665	1	26390	1	27902	1	27193	3	33887	214	60805	22	7434	0	1126
_	4:09:18 AM	7:00:01 AM	_	1	27400	15	64706	1	27113	1	45771	1	26240	1	28695	1	27113	3	35278	214	60429	22	9825	0	1137
_	4:09:18 AM	7:05:01 AM	_	1	27365	15	63059	1	27118	1	45778	1	26194	1	27722	1	27118	3	33976	214	60705	22	10606	0	1164
_	4:09:18 AM	7:10:01 AM	_	1	27304	15	64765	1	27167	1	45561	1	26170	1	27770	1	27167	3	33760	214	59946	22	9013	0	1198
_	4:09:18 AM	7:15:01 AM	_	1	27246	15	64855	1	27195	1	45462	1	26242	1	28027	1	27195	3	35346	214	59549	22	11401	0	1140
_	4:09:18 AM	7:20:01 AM	_	1	27693	15	63629	1	27062	1	45513	1	26245	1	27702	1	27062	3	33698	214	59637	22	13142	0	1171
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_	4:09:18 AM	7:55:01 AM	_	1	27512	16	15921	1	27134	1	45857	1	26397	1	27783	1	27134	3	38421	214	58202	22	30798	0	1122
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_	4:09:18 AM	8:05:01 AM	_	1	27247	16	21176	1	27133	1	46163	1	26330	1	27917	1	27133	3	43942	214	57966	22	37864	0	1152
_	4:09:18 AM	8:10:01 AM	_	1	27413	16	21222	1	27234	1	46117	1	26225	1	27960	1	27234	3	39515	214	58040	22	38185	0	1196
_	4:09:18 AM	8:15:01 AM	_	1	27276	16	21950	1	27131	1	46147	1	26392	1	28148	1	27131	3	35037	214	58140	22	39495	0	1180
_	4:09:18 AM	8:20:01 AM	_	1	27689	16	23464	1	27243	1	46202	1	26265	1	28063	1	27243	3	36417	214	58237	22	41949	0	1128
_	4:09:18 AM	8:25:01 AM	_	1	27423	16	24029	1	27158	1	46373	1	26187	1	27749	1	27158	3	38432	214	58046	22	44567	0	1133
_	4:09:18 AM	8:30:01 AM	_	1	27279	16	24722	1	27065	1	46133	1	26230	1	27827	1	27065	3	38424	214	57784	22	47377	0	1094
_	4:09:18 AM	8:35:01 AM	_	1	27425	16	25342	1	27182	1	46577	1	26346	1	27878	1	27182	3	36990	214	57609	22	51645	0	1193
_	4:09:18 AM	8:40:01 AM	_	1	27479	16	30778	1	27220	1	46336	1	26361	1	27853	1	27220	3	37183	214	57485	22	55114	0	1152
_	4:09:18 AM	8:45:01 AM	_	1	27468	16	34996	1	27177	1	46344	1	26274	1	28042	1	27177	3	36677	214	57358	22	61248	0	1134
_	4:09:18 AM	8:50:01 AM	_	1	27267	16	37030	1	27168	1	46422	1	26329	1	28203	1	27168	3	37120	214	57525	23	2753	0	1155
_	4:09:18 AM	8:55:01 AM	_	1	27345	16	41033	1	27141	1	46406	1	26234	1	27929	1	27141	3	37223	214	57671	23	7829	0	1078
_	4:09:18 AM	9:00:01 AM	_	1	27248	16	42416	1	27214	1	46504	1	26298	1	27867	1	27214	3	36732	214	57587	23	14215	0	1183
_	4:09:18 AM	9:05:01 AM	_	1	27441	16	44164	1	27042	1	46430	1	26133	1	27690	1	27042	3	37307	214	57441	23	25988	0	1124
_	4:09:18 AM	9:10:01 AM	_	1	27298	16	45680	1	26997	1	46562	1	26385	1	28005	1	26997	3	40286	214	57375	23	29773	0	1152
_	4:09:18 AM	9:15:01 AM	_	1	27402	16	39143	1	27151	1	46419	1	26281	1	28060	1	27151	3	37959	214	57469	23	39324	0	1155
_	4:09:18 AM	9:20:01 AM	_	1	27272	16	39092	1	27077	1	46323	1	26180	1	27826	1	27077	3	36931	214	57106	23	41382	0	1166
_	4:09:18 AM	9:25:01 AM	_	1	27315	16	37599	1	27271	1	46712	1	26376	1	28026	1	27271	3	37352	214	57373	23	38814	0	1105
_	4:09:18 AM	9:30:01 AM	_	1	27526	16	34863	1	27108	1	46403	1	26478	1	27984	1	27108	3	38101	214	57536	23	42547	0	1133
_	4:09:18 AM	9:35:01 AM	_	1	27424	16	32787	1	27112	1	46305	1	26274	1	27900	1	27112	3	39304	214	57405	23	41134	0	1160
_	4:09:18 AM	9:40:01 AM	_	1	27242	16	29692	1	27266	1	46533	1	26239	1	27897	1	27266	3	39049	214	57684	23	49490	0	1113
_	4:09:18 AM	9:45:01 AM	_	1	27407	16	25549	1	27085	1	46045	1	26411	1	27730	1	27085	3	37719	214	57695	23	62680	0	1169
_	4:09:18 AM	9:50:01 AM	_	1	27324	16	21841	1	27207	1	46581	1	26232	1	27885	1	27207	3	42307	214	57867	24	3662	0	1169
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_	4:09:18 AM	10:00:01 AM	_	1	27292	16	21002	1	27215	1	46313	1	26339	1	27693	1	27215	3	41477	214	57580	24	19463	0	1149
_	4:09:18 AM	10:05:01 AM	_	1	27377	16	13090	1	27022	1	46116	1	26406	1	27722	1	27022	3	37764	214	57853	24	21607	0	1118
_	4:09:18 AM	10:10:01 AM	_	1	27434	16	4615	1	27093	1	46217	1	26361	1	27666	1	27093	3	34941	214	57860	24	28700	0	1105
_	4:09:18 AM	10:15:01 AM	_	1	27443	15	65279	1	27188	1	46092	1	26322	1	28821	1	27188	3	34166	214	58105	24	37791	0	1120
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_	4:09:18 AM	10:30:01 AM	_	1	27346	15	64203	1	27030	1	46016	1	26280	1	28650	1	27030	3	36464	214	58514	24	57782	0	1173
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_	4:09:18 AM	10:40:01 AM	_	1	27206	16	8111	1	27100	1	46111	1	26389	1	27763	1	27100	3	37073	214	58613	25	5989	0	1077
_	4:09:18 AM	10:45:01 AM	_	1	27530	16	12000	1	27248	1	46194	1	26321	1	27496	1	27248	3	37574	214	58836	25	13904	0	1133
_	4:09:18 AM	10:50:01 AM	_	1	27419	16	21752	1	27114	1	46398	1	26288	1	27490	1	27114	3	40484	214	58744	25	22614	0	1115
_	4:09:18 AM	10:55:01 AM	_	1	27424	16	28935	1	27211	1	46416	1	26312	1	27467	1	27211	3	33106	214	59079	25	29466	0	1095
_	4:09:18 AM	11:00:01 AM	_	1	27511	16	42683	1	27276	1	46501	1	26287	1	27891	1	27276	3	34127	214	59266	25	29904	0	1116
_	4:09:18 AM	11:05:01 AM	_	1	27405	16	54309	1	27263	1	46676	1	26315	1	27307	1	27263	3	31353	214	59100	25	35305	0	1154
_	4:09:18 AM	11:10:01 AM	_	1	27392	16	64176	1	27219	1	46607	1	26274	1	27535	1	27219	3	34351	214	59597	25	41306	0	1107
_	4:09:18 AM	11:15:01 AM	_	1	27399	17	10940	1	27237	1	47007	1	26186	1	27499	1	27237	3	35462	214	59407	25	46193	0	1080
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_	4:09:18 AM	11:25:01 AM	_	1	27803	17	30469	1	27125	1	47309	1	26279	1	27327	1	27125	3	34475	214	59479	25	53820	0	1134
_	4:09:18 AM	11:30:00 AM	_	1	27381	17	41077	1	27105	1	47314	1	26356	1	27280	1	27105	3	31957	214	59471	25	57549	0	1088
_	4:09:18 AM	11:35:01 AM	_	1	27372	17	46656	1	27186	1	47548	1	26364	1	27514	1	27186	3	46878	214	59125	25	61210	0	1114
_	4:09:18 AM	11:40:01 AM	_	1	27151	17	54001	1	27195	1	47715	1	26364	1	27494	1	27195	3	32454	214	59091	25	65368	0	1083
_	4:09:18 AM	11:45:01 AM	_	1	27104	17	63432	1	27128	1	47544	1	26111	1	27414	1	27128	3	32491	214	58911	26	3151	0	1113
_	4:09:18 AM	11:50:01 AM	_	1	27380	18	921	1	27218	1	48005	1	26320	1	27401	1	27218	3	32623	214	59099	26	6074	0	1065
_	4:09:18 AM	11:55:01 AM	_	1	27343	18	7128	1	27141	1	48071	1	26248	1	27332	1	27141	3	42813	214	58836	26	8980	0	1123
_	4:09:18 AM	12:00:00 PM	_	1	27369	18	11051	1	27224	1	48192	1	26379	1	27581	1	27224	3	38748	214	58966	26	11907	0	1063
_	4:09:18 AM	12:05:01 PM	_	1	27453	18	15788	1	27264	1	48084	1	26339	1	27412	1	27264	3	37094	214	58879	26	15102	0	1059
_	4:09:18 AM	12:10:00 PM	_	1	27220	18	23738	1	27212	1	48375	1	26343	1	27455	1	27212	3	31187	214	58888	26	16743	0	1138
_	4:09:18 AM	12:15:00 PM	_	1	27405	18	27091	1	27129	1	48191	1	26274	1	27633	1	27129	3	38400	214	59045	26	19346	0	1136
_	4:09:18 AM	12:20:00 PM	_	1	27474	18	24615	1	27233	1	48277	1	26296	1	27265	1	27233	3	33156	214	58986	26	20950	0	1109
_	4:09:18 AM	12:25:00 PM	_	1	27186	18	29901	1	27164	1	48701	1	26377	1	27358	1	27164	3	37624	214	58996	26	23469	0	1089
_	4:09:18 AM	12:30:00 PM	_	1	27345	18	28892	1	27256	1	48384	1	26263	1	27566	1	27256	3	36492	214	59174	26	25328	0	1125
_	4:09:18 AM	12:35:00 PM	_	1	27346	18	34980	1	27214	1	48382	1	26342	1	28383	1	27214	3	44092	214	59123	26	26309	0	1135
_	4:09:18 AM	12:40:00 PM	_	1	27494	18	36944	1	27217	1	48210	1	26374	1	27484	1	27217	3	35811	214	59023	26	27972	0	1070
_	4:09:18 AM	12:45:00 PM	_	1	27448	18	41362	1	27226	1	48340	1	26269	1	27276	1	27226	3	32805	214	58835	26	27480	0	1016
_	4:09:18 AM	12:50:00 PM	_	1	27424	18	45080	1	27045	1	48464	1	26284	1	27316	1	27045	3	43044	214	58835	26	29923	0	1126
_	4:09:18 AM	12:55:00 PM	_	1	27430	18	48850	1	27250	1	48772	1	26217	1	27216	1	27250	3	35924	214	58815	26	31626	0	1084
_	4:09:18 AM	1:00:00 PM	_	1	27385	18	45112	1	27160	1	48526	1	26236	1	27291	1	27160	3	42859	214	58779	26	32883	0	1072
_	4:09:18 AM	1:05:00 PM	_	1	27479	18	46773	1	27233	1	48726	1	26296	1	27329	1	27233	3	38451	214	58434	26	33674	0	1076
_	4:09:18 AM	1:10:00 PM	_	1	27412	18	52553	1	27222	1	48473	1	26326	1	27386	1	27222	3	38502	214	58186	26	35855	0	1122
_	4:09:18 AM	1:15:00 PM	_	1	27228	18	48992	1	27068	1	49107	1	26434	1	27369	1	27068	3	45508	214	58132	26	36140	0	1110
_	4:09:18 AM	1:20:00 PM	_	1	27323	18	57331	1	27102	1	49078	1	26320	1	27443	1	27102	3	45399	214	57903	26	36916	0	1036
_	4:09:18 AM	1:25:00 PM	_	1	27361	18	59452	1	27206	1	48930	1	26275	1	27287	1	27206	3	43168	214	58108	26	37627	0	1077
_	4:09:18 AM	1:30:00 PM	_	1	27461	18	60645	1	27124	1	48879	1	26338	1	27419	1	27124	3	41845	214	57716	26	38772	0	1079
_	4:09:18 AM	1:35:00 PM	_	1	27420	18	64992	1	27208	1	48948	1	26259	1	27423	1	27208	3	33637	214	57753	26	40008	0	1129
_	4:09:18 AM	1:40:00 PM	_	1	27528	19	1864	1	27202	1	49390	1	26352	1	27535	1	27202	3	35563	214	57587	26	41382	0	1113
_	4:09:18 AM	1:45:00 PM	_	1	27451	19	2212	1	27203	1	49426	1	26299	1	27337	1	27203	3	42606	214	57158	26	42634	0	1103
_	4:09:18 AM	1:50:00 PM	_	1	27285	19	464	1	27319	1	49109	1	26255	1	27639	1	27319	3	45138	214	56755	26	42061	0	1072
_	4:09:18 AM	1:55:00 PM	_	1	27495	19	5117	1	27217	1	48999	1	26308	1	27416	1	27217	3	43051	214	56868	26	42202	0	1048
_	4:09:18 AM	2:00:00 PM	_	1	27312	19	3334	1	27227	1	48911	1	26366	1	27560	1	27227	3	34699	214	56659	26	39884	0	1078

_	4:09:18 AM	2:05:00 PM	_	1	27401	19	10577	1	27326	1	49121	1	26389	1	27432	1	27326	3	36215	214	56258	26	41874	0	1029
_	4:09:18 AM	2:10:00 PM	_	1	27381	19	11768	1	27135	1	49054	1	26332	1	27548	1	27135	3	44285	214	55850	26	44690	0	1114
_	4:09:18 AM	2:15:00 PM	_	1	27482	19	9204	1	27157	1	49143	1	26353	1	27509	1	27157	3	39923	214	55866	26	44611	0	1103
_	4:09:18 AM	2:20:00 PM	_	1	27666	19	9672	1	27058	1	49280	1	26295	1	27453	1	27058	3	36859	214	55452	26	48608	0	1123
_	4:09:18 AM	2:25:00 PM	_	1	27426	19	11335	1	27223	1	49145	1	26252	1	27484	1	27223	3	40741	214	55217	26	52095	0	1150
_	4:09:18 AM	2:30:00 PM	_	1	27338	19	15971	1	27238	1	49359	1	26229	1	27612	1	27238	3	37933	214	55102	26	52019	0	1152
_	4:09:18 AM	2:35:00 PM	_	1	27458	19	18267	1	27174	1	49368	1	26283	1	27472	1	27174	3	42062	214	54660	26	52958	0	1101
_	4:09:18 AM	2:40:00 PM	_	1	27476	19	15062	1	27321	1	49106	1	26238	1	27380	1	27321	3	35342	214	54425	26	53066	0	1104
_	4:09:18 AM	2:45:00 PM	_	1	27523	19	19688	1	27278	1	49291	1	26286	1	27516	1	27278	3	36273	214	54026	26	53558	0	1141
_	4:09:18 AM	2:50:00 PM	_	1	27434	19	23163	1	27148	1	49389	1	26305	1	27450	1	27148	3	40613	214	54028	26	53729	0	1114
_	4:09:18 AM	2:55:00 PM	_	1	27537	19	27883	1	27092	1	49188	1	26234	1	27442	1	27092	3	38828	214	53558	26	54914	0	1148
_	4:09:18 AM	3:00:00 PM	_	1	27411	19	33045	1	27175	1	49237	1	26353	1	27537	1	27175	3	38874	214	53494	26	55691	0	1073
_	4:09:18 AM	3:05:00 PM	_	1	27535	19	31705	1	27091	1	49380	1	26350	1	27554	1	27091	3	35868	214	52867	26	57210	0	1120
_	4:09:18 AM	3:10:00 PM	_	1	27469	19	32374	1	27295	1	49557	1	26384	1	27752	1	27295	3	40111	214	52903	26	58041	0	1083
_	4:09:18 AM	3:15:00 PM	_	1	27362	19	46966	1	27270	1	49537	1	26389	1	27986	1	27270	3	36144	214	52652	26	60442	0	1085
_	4:09:18 AM	3:20:00 PM	_	1	27463	19	50885	1	27270	1	49651	1	26298	1	27852	1	27270	3	37374	214	52122	26	62982	0	1159
_	4:09:18 AM	3:25:00 PM	_	1	27471	19	51642	1	27236	1	50010	1	26383	1	27637	1	27236	3	52573	214	51701	26	64322	0	1128
_	4:09:18 AM	3:30:00 PM	_	1	27322	19	41465	1	27232	1	49995	1	26394	1	27874	1	27232	3	40364	214	51471	26	64700	0	1079
_	4:09:18 AM	3:35:00 PM	_	1	27576	19	47785	1	27272	1	50092	1	26248	1	27474	1	27272	3	44158	214	51271	26	60991	0	1091
_	4:09:18 AM	3:40:00 PM	_	1	27364	19	52768	1	27217	1	50222	1	26367	1	27534	1	27217	3	43457	214	51006	26	57832	0	1104
_	4:09:18 AM	3:45:00 PM	_	1	27341	19	56772	1	27301	1	49846	1	26347	1	27736	1	27301	3	40495	214	50462	26	56895	0	1075
_	4:09:18 AM	3:50:00 PM	_	1	27399	19	57037	1	27229	1	49885	1	26424	1	27455	1	27229	3	35920	214	50471	26	57056	0	1114
_	4:09:18 AM	3:55:00 PM	_	1	27441	19	64133	1	27195	1	50088	1	26196	1	27455	1	27195	3	37473	214	49827	26	57338	0	1088
_	4:09:18 AM	4:00:00 PM	_	1	27482	20	1355	1	27104	1	49871	1	26268	1	27373	1	27104	3	48343	214	49850	26	56716	0	1086
_	4:09:18 AM	4:05:00 PM	_	1	27361	20	2321	1	27134	1	50281	1	26328	1	27515	1	27134	3	38069	214	49713	26	57332	0	1042
_	4:09:18 AM	4:10:00 PM	_	1	27574	20	363	1	27217	1	49982	1	26283	1	27373	1	27217	3	40025	214	49317	26	58944	0	1108
_	4:09:18 AM	4:15:00 PM	_	1	27279	20	5879	1	27167	1	50304	1	26350	1	27595	1	27167	3	37565	214	48875	26	60001	0	1103
_	4:09:18 AM	4:20:00 PM	_	1	27418	20	11835	1	27297	1	50110	1	26365	1	27534	1	27297	3	46244	214	48778	26	61034	0	1141
_	4:09:18 AM	4:25:00 PM	_	1	27429	20	11343	1	27192	1	50196	1	26266	1	28120	1	27192	3	40451	214	48440	26	59205	0	1086
_	4:09:18 AM	4:30:00 PM	_	1	27503	20	17362	1	27198	1	50363	1	26254	1	27612	1	27198	3	40751	214	48084	26	60147	0	1071
_	4:09:18 AM	4:35:00 PM	_	1	27429	20	16071	1	27324	1	50225	1	26289	1	27588	1	27324	3	35898	214	47878	26	60307	0	1057
_	4:09:18 AM	4:40:00 PM	_	1	27608	20	19418	1	27178	1	50474	1	26208	1	27546	1	27178	3	39404	214	47587	26	59256	0	1092
_	4:09:18 AM	4:45:00 PM	_	1	27425	20	10695	1	27085	1	50058	1	26297	1	27420	1	27085	3	36314	214	47017	26	60718	0	1111
_	4:09:18 AM	4:50:00 PM	_	1	27589	20	7687	1	27246	1	50346	1	26383	1	27461	1	27246	3	45061	214	46932	26	59468	0	1112
_	4:09:18 AM	4:55:00 PM	_	1	27315	20	12875	1	27273	1	50098	1	26284	1	27468	1	27273	3	41368	214	46603	26	59079	0	1065
_	4:09:18 AM	5:00:00 PM	_	1	27193	20	14084	1	27075	1	50456	1	26316	1	27486	1	27075	3	41443	214	46444	26	58295	0	1114
_	4:09:18 AM	5:05:00 PM	_	1	27447	20	20209	1	27181	1	50428	1	26339	1	27513	1	27181	3	44154	214	46082	26	58496	0	1144
_	4:09:18 AM	5:10:00 PM	_	1	27391	20	14745	1	27247	1	50642	1	26294	1	27802	1	27247	3	45220	214	45687	26	56665	0	1076
_	4:09:18 AM	5:15:00 PM	_	1	27332	20	24541	1	27344	1	50404	1	26368	1	27509	1	27344	3	39424	214	45390	26	52777	0	1161
_	4:09:18 AM	5:20:00 PM	_	1	27434	20	27600	1	27296	1	50668	1	26323	1	27588	1	27296	3	45403	214	45098	26	50331	0	1121
_	4:09:18 AM	5:25:00 PM	_	1	27445	20	30118	1	27080	1	50631	1	26283	1	27584	1	27080	3	46497	214	44924	26	50447	0	1073
_	4:09:18 AM	5:30:00 PM	_	1	27360	20	30897	1	27183	1	50649	1	26354	1	27828	1	27183	3	42485	214	44712	26	50934	0	1141
_	4:09:18 AM	5:35:01 PM	_	1	27291	20	32716	1	27133	1	50775	1	26354	1	27529	1	27133	3	38525	214	44026	26	50939	0	1105
_	4:09:18 AM	5:40:01 PM	_	1	27388	20	36897	1	27188	1	50706	1	26289	1	27630	1	27188	3	38710	214	43829	26	50858	0	1090
_	4:09:18 AM	5:45:00 PM	_	1	27485	20	41303	1	27242	1	50536	1	26186	1	27716	1	27242	3	40150	214	43616	26	48850	0	1085
_	4:09:18 AM	5:50:00 PM	_	1	27224	20	43807	1	27264	1	50735	1	26278	1	27436	1	27264	3	39110	214	43201	26	48074	0	1108
_	4:09:18 AM	5:55:00 PM	_	1	27432	20	44464	1	27189	1	51013	1	26290	1	27613	1	27189	3	48571	214	43050	26	45362	0	1059
_	4:09:18 AM	6:00:00 PM	_	1	27465	20	47483	1	27214	1	51173	1	26396	1	27577	1	27214	3	40800	214	42668	26	43204	0	1038
_	4:09:18 AM	6:05:00 PM	_	1	27552	20	51278	1	27074	1	50997	1	26363	1	27677	1	27074	3	42024	214	41875	26	40542	0	1071
_	4:09:18 AM	6:10:01 PM	_	1	27450	20	47939	1	27201	1	51125	1	26293	1	27603	1	27201	3	43654	214	41890	26	38785	0	1113
_	4:09:18 AM	6:15:00 PM	_	1	27458	20	52512	1	27096	1	50766	1	26308	1	27653	1	27096	3	41783	214	41505	26	36487	0	1071
_	4:09:18 AM	6:20:01 PM	_	1	27411	20	47708	1	27168	1	51171	1	26236	1	27634	1	27168	3	46778	214	41232	26	34604	0	1162
_	4:09:18 AM	6:25:00 PM	_	1	27325	20	47682	1	27152	1	51225	1	26373	1	27837	1	27152	3	43595	214	40884	26	31553	0	1094
_	4:09:18 AM	6:30:00 PM	_	1	27485	20	49475	1	27152	1	51503	1	26288	1	27601	1	27152	3	41107	214	40544	26	29643	0	1072
_	4:09:18 AM	6:35:00 PM	_	1	27385	20	50617	1	27175	1	51049	1	26315	1	27676	1	27175	3	43260	214	40207	26	26865	0	1077
_	4:09:18 AM	6:40:00 PM	_	1	27441	20	50800	1	27115	1	50790	1	26270	1	27455	1	27115	3	42721	214	39872	26	23232	0	1142
_	4:09:18 AM	6:45:00 PM	_	1	27675	20	52132	1	27168	1	51193	1	26261	1	27684	1	27168	3	41989	214	39503	26	18877	0	1138
_	4:09:18 AM	6:50:00 PM	_	1	27387	20	55531	1	27368	1	51088	1	26255	1	28624	1	27368	3	46001	214	39513	26	14102	0	1121
_	4:09:18 AM	6:55:00 PM	_	1	27593	20	54692	1	27163	1	51037	1	26335	1	27535	1	27163	3	44656	214	38738	26	10814	0	1106
_	4:09:18 AM	7:00:01 PM	_	1	27140	20	57195	1	27066	1	51026	1	26388	1	27554	1	27066	3	46334	214	38333	26	3824	0	1013
_	4:09:18 AM	7:05:01 PM	_	1	27431	20	58539	1	27091	1	51349	1	26213	1	27687	1	27091	3	45663	214	38531	26	3688	0	1113
_	4:09:18 AM	7:10:01 PM	_	1	27473	20	62037	1	27095	1	51662	1	26294	1	27857	1	27095	3	46443	214	37755	26	3520	0	1074
_	4:09:18 AM	7:15:01 PM	_	1	27372	20	61020	1	27132	1	51320	1	26176	1	27659	1	27132	3	49651	214	37554	26	2622	0	1107
_	4:09:18 AM	7:20:01 PM	_	1	27460	20	60220	1	27131	1	51266	1	26318	1	28189	1	27131	3	46004	214	37094	26	1488	0	1075
_	4:09:18 AM	7:25:00 PM	_	1	27434	20	61934	1	27188	1	51317	1	26188	1	27646	1	27188	3	46211	214	36690	26	258	0	1088
_	4:09:18 AM	7:30:01 PM	_	1	27343	20	62680	1	27104	1	51162	1	26291	1	28100	1	27104	3	43118	214	36453	25	64293	0	1098
_	4:09:18 AM	7:35:01 PM	_	1	27478	20	64825	1	27156	1	51077	1	26394	1	28035	1	27156	3	44311	214	35841	25	63209	0	1131
_	4:09:18 AM	7:40:01 PM	_	1	27440	20	59636	1	27183	1	51557	1	26283	1	31969	1	27183	3	45797	214	35349	25	62016	0	1083
_	4:09:18 AM	7:45:01 PM	_	1	27397	20	61844	1	27054	1	51258	1	26473	1	27670	1	27054	3	46574	214	34991	25	60650	0	1105
_	4:09:18 AM	7:50:01 PM	_	1	27411	20	62033	1	27321	1	51710	1	26423	1	27598	1	27321	3	54723	214	34577	25	59375	0	1036
_	4:09:18 AM	7:55:01 PM	_	1	27308	20	61977	1	27166	1	51511	1	26334	1	27515	1	27166	3	53889	214	34188	25	57401	0	1117
_	4:09:18 AM	8:00:01 PM	_	1	27543	20	59808	1	27189	1	51255	1	26320	1	27715	1	27189	3	52265	214	33788	25	51962	0	1093
_	4:09:18 AM	8:05:01 PM	_	1	27475	20	58938	1	27244	1	51283	1	26321	1	27978	1	27244	3	46438	214	33798	25	48279	0	1070
_	4:09:18 AM	8:10:01 PM	_	1	27449	20	62192	1	27135	1	51550	1	26289	1	27809	1	27135	3	49933	214	33227	25	49909	0	1087
_	4:09:18 AM	8:15:01 PM	_	1	27358	20	61726	1	27001	1	51147	1	26373	1	27793	1	27001	3	46058	214	32910	25	50259	0	1092
_	4:09:18 AM	8:20:01 PM	_	1	27599	20	65059	1	27107	1	51387	1	26353	1	27601	1	27107	3	46978	214	32639	25	50508	0	1059
_	4:09:18 AM	8:25:01 PM	_	1	27300	20	60115	1	27191	1	51681	1	26307	1	27763	1	27191	3	47183	214	32044	25	47483	0	1082
_	4:09:18 AM	8:30:01 PM	_	1	27363	21	881	1	27243	1	51709	1	26171	1	28293	1	27243	3	48213	214	31712	25	47706	0	1087
_	4:09:18 AM	8:35:01 PM	_	1	27487	21	2182	1	27248	1	51743	1	26345	1	27793	1	27248	3	47155	214	31325	25	44355	0	1026
_	4:09:18 AM	8:40:01 PM	_	1	27284	21	565	1	27307	1	51612	1	26310	1	27602	1	27307	3	45564	214	30882	25	39683	0	1189
_	4:09:18 AM	8:45:01 PM	_	1	27450	21	1829	1	27199	1	51567	1	26346	1	27817	1	27199	3	47268	214	30655	25	36745	0	1090
_	4:09:18 AM	8:50:01 PM	_	1	27364	21	4145	1	27175	1	51655	1	26244	1	27541	1	27175	3	47996	214	30404	25	35840	0	1081
_	4:09:18 AM	8:55:01 PM	_	1	27317	21	6075	1	27283	1	51562	1	26262	1	27851	1	27283	3	50889	214	29770	25	33943	0	1094
_	4:09:18 AM	9:00:01 PM	_	1	27403	21	7086	1	27254	1	51675	1	26272	1	27670	1	27254	3	49894	214	29850	25	29019	0	1114
_	4:09:18 AM	9:05:01 PM	_	1	27410	21	8893	1	27171	1	51766	1	26298	1	27625	1	27171	3	59777	214	29182	25	32459	0	1052
_	4:09:18 AM	9:10:01 PM	_	1	27510	21	8306	1	27203	1	51567	1	26362	1	27699	1	27203	3	47174	214	28940	25	34180	0	1103
_	4:09:18 AM	9:15:01 PM	_	1	27393	21	7420	1	27251	1	51531	1	26359	1	27683	1	27251	3	45533	214	28632	25	33967	0	1104
_	4:09:18 AM	9:20:01 PM	_	1	27424	21	9278	1	27124	1	51729	1	26303	1	27830	1	27124	3	48224	214	28258	25	32626	0	1171
_	4:09:18 AM	9:25:01 PM	_	1	27400	21	11605	1	27104	1	51892	1	26403	1	27789	1	27104	3	51639	214	27653	25	31107	0	1093
_	4:09:18 AM	9:30:01 PM	_	1	27466	21	13348	1	27249	1	52033	1	26483	1	27830	1	27249	3	48422	214	27832	25	30120	0	1081
_	4:09:18 AM	9:35:01 PM	_	1	27405	21	16235	1	27353	1	51979	1	26253	1	27753	1	27353	3	50073	214	27371	25	28843	0	1134
_	4:09:18 AM	9:40:01 PM	_	1	27325	21	16672	1	27078	1	51950	1	26321	1	28033	1	27078	3	49578	214	27099	25	27122	0	1093

_	4:09:18 AM	9:45:01 PM	_	1	27367	21	19908	1	27285	1	51865	1	26158	1	27717	1	27285	3	46891	214	26625	25	24852	0	1099
_	4:09:18 AM	9:50:01 PM	_	1	27443	21	17477	1	27172	1	51967	1	26215	1	27857	1	27172	3	47526	214	26514	25	22871	0	1166
_	4:09:18 AM	9:55:01 PM	_	1	27627	21	19027	1	27215	1	52031	1	26289	1	28126	1	27215	3	47613	214	26015	25	20343	0	1137
_	4:09:18 AM	10:00:01 PM	_	1	27712	21	22927	1	27077	1	51916	1	26128	1	27890	1	27077	3	49129	214	25849	25	17923	0	1047
_	4:09:18 AM	10:05:01 PM	_	1	27436	21	23170	1	27125	1	51945	1	26370	1	27972	1	27125	3	49535	214	25204	25	15572	0	1095
_	4:09:18 AM	10:10:01 PM	_	1	27704	21	21886	1	27035	1	51920	1	26265	1	28073	1	27035	3	49408	214	25150	25	11343	0	1101
_	4:09:18 AM	10:15:01 PM	_	1	27632	21	22094	1	27286	1	52193	1	26338	1	27891	1	27286	3	50741	214	24698	25	7230	0	1149
_	4:09:18 AM	10:20:01 PM	_	1	27520	21	25412	1	27145	1	52209	1	26313	1	28040	1	27145	3	54389	214	24415	25	3562	0	1186
_	4:09:18 AM	10:25:01 PM	_	1	27475	21	26195	1	27178	1	52084	1	26269	1	27967	1	27178	3	51186	214	24234	25	260	0	1120
_	4:09:18 AM	10:30:01 PM	_	1	27609	21	27194	1	27180	1	52020	1	26319	1	28071	1	27180	3	52045	214	23965	24	62243	0	1145
_	4:09:18 AM	10:35:01 PM	_	1	27423	21	28969	1	27134	1	52212	1	26294	1	28422	1	27134	3	52910	214	23382	24	58370	0	1122
_	4:09:18 AM	10:40:01 PM	_	1	27197	21	31391	1	27204	1	52088	1	26336	1	27826	1	27204	3	56300	214	23234	24	53656	0	1067
_	4:09:18 AM	10:45:01 PM	_	1	27523	21	28418	1	27170	1	52119	1	26390	1	27922	1	27170	3	52302	214	23004	24	49351	0	1114
_	4:09:18 AM	10:50:01 PM	_	1	27324	21	31494	1	27226	1	52060	1	26364	1	28010	1	27226	3	50863	214	22298	24	45140	0	1184
_	4:09:18 AM	10:55:01 PM	_	1	27321	21	35330	1	27184	1	52126	1	26243	1	27801	1	27184	3	51801	214	21784	24	40956	0	1098
_	4:09:18 AM	11:00:01 PM	_	1	27321	21	36006	1	27147	1	52145	1	26264	1	27906	1	27147	3	51957	214	21605	24	36551	0	1118
_	4:09:18 AM	11:05:01 PM	_	1	27364	21	38053	1	27240	1	52396	1	26240	1	27975	1	27240	3	50353	214	21576	24	31986	0	1153
_	4:09:18 AM	11:10:01 PM	_	1	27491	21	39611	1	27115	1	52173	1	26234	1	27887	1	27115	3	49591	214	20964	24	28040	0	1093
_	4:09:18 AM	11:15:01 PM	_	1	27171	21	41141	1	27174	1	52068	1	26261	1	27700	1	27174	3	49390	214	20534	24	23968	0	1067
_	4:09:18 AM	11:20:01 PM	_	1	27255	21	45288	1	27125	1	52526	1	26251	1	28098	1	27125	3	50347	214	20089	24	20810	0	1168
_	4:09:18 AM	11:25:01 PM	_	1	27293	21	46077	1	27086	1	52178	1	26414	1	28263	1	27086	3	48690	214	19449	24	17580	0	1058
_	4:09:18 AM	11:30:01 PM	_	1	27456	21	51614	1	27163	1	52315	1	26329	1	28035	1	27163	3	51227	214	19233	24	13715	0	1104
_	4:09:18 AM	11:35:01 PM	_	1	27172	21	54855	1	27207	1	52371	1	26245	1	27895	1	27207	3	49530	214	18893	24	9678	0	1207
_	4:09:18 AM	11:40:01 PM	_	1	27566	21	60112	1	27192	1	52509	1	26326	1	28094	1	27192	3	48105	214	18224	24	7492	0	1112
_	4:09:18 AM	11:45:01 PM	_	1	27346	21	64783	1	27189	1	52387	1	26228	1	27886	1	27189	3	49331	214	17714	24	4131	0	1169
_	4:09:18 AM	11:50:01 PM	_	1	27396	22	5357	1	27104	1	52623	1	26279	1	27916	1	27104	3	49495	214	17457	24	358	0	1157
_	4:09:18 AM	11:55:01 PM	_	1	27310	22	11472	1	27211	1	52596	1	26450	1	28056	1	27211	3	52171	214	17481	23	62560	0	1101
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_	5:09:18 AM	8:55:01 AM	_	1	27375	26	39917	1	27099	1	57191	1	26246	1	28639	1	27099	4	40992	213	50519	23	47575	0	1177
_	5:09:18 AM	9:00:01 AM	_	1	27472	26	36393	1	27280	1	57176	1	26293	1	28596	1	27280	4	43537	213	50527	23	52222	0	1134
_	5:09:18 AM	9:05:01 AM	_	1	27347	26	35648	1	27124	1	57080	1	26299	1	28731	1	27124	4	44434	213	50385	23	61796	0	1108
_	5:09:18 AM	9:10:01 AM	_	1	27430	26	29100	1	27007	1	57034	1	26356	1	29025	1	27007	4	42232	213	50825	24	3344	0	1134
_	5:09:18 AM	9:15:01 AM	_	1	27469	26	15208	1	27206	1	57111	1	26309	1	28869	1	27206	4	47037	213	50920	24	12920	0	1118
_	5:09:18 AM	9:20:01 AM	_	1	27508	26	11190	1	27182	1	57155	1	26347	1	28705	1	27182	4	43304	213	51179	24	18558	0	1090
_	5:09:18 AM	9:25:01 AM	_	1	27301	26	13071	1	27184	1	57157	1	26250	1	28545	1	27184	4	41932	213	50958	24	29234	0	1178
_	5:09:18 AM	9:30:01 AM	_	1	27376	26	6840	1	27115	1	57102	1	26345	1	28720	1	27115	4	38757	213	51531	24	37142	0	1111
_	5:09:18 AM	9:35:01 AM	_	1	27576	26	754	1	27291	1	57137	1	26265	1	28696	1	27291	4	38317	213	51500	24	44047	0	1165
_	5:09:18 AM	9:40:01 AM	_	1	27631	25	55952	1	27230	1	56972	1	26349	1	28676	1	27230	4	32885	213	51697	24	47348	0	1152
_	5:09:18 AM	9:45:01 AM	_	1	27163	25	50950	1	27198	1	56695	1	26217	1	28350	1	27198	4	31594	213	52159	24	54754	0	1085
_	5:09:18 AM	9:50:01 AM	_	1	27545	25	48752	1	27152	1	56753	1	26215	1	28424	1	27152	4	28662	213	52318	24	61103	0	1096
_	5:09:18 AM	9:55:01 AM	_	1	27647	25	55638	1	27142	1	56794	1	26268	1	28503	1	27142	4	30555	213	52289	25	5149	0	1121
_	5:09:18 AM	10:00:01 AM	_	1	27647	25	61221	1	27299	1	57013	1	26373	1	28381	1	27299	4	29208	213	52675	25	14530	0	1138
_	5:09:18 AM	10:05:01 AM	_	1	27201	26	7067	1	27201	1	57187	1	26398	1	28486	1	27201	4	31907	213	52640	25	23255	0	1135
_	5:09:18 AM	10:10:01 AM	_	1	27625	26	16785	1	27104	1	57163	1	26248	1	28276	1	27104	4	30851	213	52721	25	31358	0	1159
_	5:09:18 AM	10:15:01 AM	_	1	27572	26	32641	1	27147	1	57200	1	26169	1	28347	1	27147	4	30980	213	53098	25	39366	0	1078
_	5:09:18 AM	10:20:01 AM	_	1	27305	26	53846	1	27241	1	57582	1	26339	1	28458	1	27241	4	38860	213	52988	25	47649	0	1154
_	5:09:18 AM	10:25:01 AM	_	1	27095	27	2816	1	27221	1	57898	1	26356	1	28379	1	27221	4	39046	213	53381	25	54587	0	1151
_	5:09:18 AM	10:30:01 AM	_	1	27407	27	31010	1	27240	1	58562	1	26235	1	28105	1	27240	4	48019	213	53515	25	61271	0	1112
_	5:09:18 AM	10:35:00 AM	_	1	27458	27	56583	1	27308	1	58581	1	26326	1	28648	1	27308	4	53679	213	53871	26	1884	0	1091
_	5:09:18 AM	10:40:00 AM	_	1	27390	28	9509	1	27244	1	59033	1	26219	1	28390	1	27244	4	62566	213	54121	26	8440	0	1083
_	5:09:18 AM	10:45:01 AM	_	1	27390	28	34656	1	27299	1	59354	1	26290	1	28069	1	27299	4	65029	213	54373	26	14415	0	1120
_	5:09:18 AM	10:50:00 AM	_	1	27442	28	46904	1	27130	1	59863	1	26408	1	28029	1	27130	5	3590	213	54614	26	20527	0	1139
_	5:09:18 AM	10:55:00 AM	_	1	27516	29	2707	1	27288	1	60110	1	26333	1	28452	1	27288	5	11463	213	54524	26	25992	0	1045
_	5:09:18 AM	11:00:01 AM	_	1	27406	29	16063	1	27141	1	60504	1	26286	1	28165	1	27141	5	11822	213	54998	26	29873	0	1086
_	5:09:18 AM	11:05:00 AM	_	1	27352	29	28847	1	27250	1	60558	1	26340	1	28256	1	27250	5	21031	213	55070	26	33334	0	1110
_	5:09:18 AM	11:10:00 AM	_	1	27496	29	40670	1	27275	1	60778	1	26324	1	28250	1	27275	5	16556	213	54988	26	38541	0	1095
_	5:09:18 AM	11:15:00 AM	_	1	27505	29	48308	1	27194	1	60819	1	26300	1	28095	1	27194	5	18915	213	55462	26	40374	0	1086
_	5:09:18 AM	11:20:01 AM	_	1	27320	29	56082	1	27172	1	61021	1	26351	1	28312	1	27172	5	21998	213	55514	26	42955	0	1062
_	5:09:18 AM	11:25:00 AM	_	1	27290	30	815	1	27174	1	61130	1	26285	1	28370	1	27174	5	19405	213	55673	26	45684	0	1135
_	5:09:18 AM	11:30:00 AM	_	1	27215	30	10505	1	27143	1	61399	1	26308	1	28190	1	27143	5	21702	213	55564	26	47296	0	1102
_	5:09:18 AM	11:35:00 AM	_	1	27455	30	17818	1	27323	1	61687	1	26240	1	28188	1	27323	5	25417	213	56000	26	50497	0	1140
_	5:09:18 AM	11:40:00 AM	_	1	27318	30	21765	1	27252	1	61716	1	26441	1	28339	1	27252	5	21900	213	55980	26	52235	0	1085
_	5:09:18 AM	11:45:00 AM	_	1	27388	30	21694	1	27223	1	61469	1	26346	1	28449	1	27223	5	27358	213	55846	26	52101	0	1150
_	5:09:18 AM	11:50:00 AM	_	1	27423	30	35192	1	27263	1	61856	1	26333	1	28147	1	27263	5	22507	213	55957	26	52928	0	1103
_	5:09:18 AM	11:55:00 AM	_	1	27349	30	34391	1	27230	1	61949	1	26347	1	28428	1	27230	5	20357	213	56244	26	53008	0	1070
_	5:09:18 AM	12:00:00 PM	_	1	27338	30	39550	1	27315	1	61875	1	26450	1	28198	1	27315	5	19934	213	55852	26	53229	0	1093
_	5:09:18 AM	12:05:00 PM	_	1	27589	30	46956	1	27192	1	62244	1	26239	1	28686	1	27192	5	18469	213	56041	26	53798	0	1147
_	5:09:18 AM	12:10:00 PM	_	1	27435	30	50480	1	27193	1	62004	1	26103	1	28307	1	27193	5	17402	213	55839	26	54185	0	1109
_	5:09:18 AM	12:15:00 PM	_	1	27452	30	56684	1	27176	1	62144	1	26279	1	28200	1	27176	5	15887	213	55884	26	52477	0	1120
_	5:09:18 AM	12:20:00 PM	_	1	27576	30	62309	1	27290	1	62355	1	26334	1	28327	1	27290	5	15225	213	56012	26	53297	0	1100
_	5:09:18 AM	12:25:00 PM	_	1	27535	31	2428	1	27227	1	62201	1	26362	1	28148	1	27227	5	12560	213	55802	26	56236	0	1128
_	5:09:18 AM	12:30:00 PM	_	1	27614	31	3969	1	27120	1	62281	1	26435	1	28217	1	27120	5	13097	213	55922	26	56839	0	1120
_	5:09:18 AM	12:35:00 PM	_	1	27400	31	17178	1	27115	1	62434	1	26342	1	28393	1	27115	5	8776	213	55720	26	57195	0	1086
_	5:09:18 AM	12:40:00 PM	_	1	27410	31	21307	1	27283	1	62721	1	26382	1	28163	1	27283	5	7035	213	55722	26	57886	0	1097
_	5:09:18 AM	12:45:00 PM	_	1	27358	31	22455	1	27197	1	62513	1	26331	1	28256	1	27197	5	3834	213	55366	26	57962	0	1015
_	5:09:18 AM	12:50:00 PM	_	1	27288	31	46944	1	27188	1	62887	1	26255	1	28175	1	27188	5	148	213	54957	26	57267	0	1128
_	5:09:18 AM	12:55:00 PM	_	1	27190	31	51031	1	27152	1	62775	1	26359	1	28207	1	27152	5	4273	213	55156	26	56135	0	1056
_	5:09:18 AM	1:00:00 PM	_	1	27992	31	60943	1	27304	1	62697	1	26189	1	28195	1	27304	5	3806	213	54925	26	56667	0	1153
_	5:09:18 AM	1:05:00 PM	_	1	27616	32	7384	1	27228	1	63161	1	26297	1	28177	1	27228	4	57601	213	54444	26	57491	0	1064

_	5:09:18 AM	1:10:00 PM	_	1	27632	32	12755	1	27208	1	63249	1	26274	1	28444	1	27208	4	58618	213	54500	26	56724	0	1164
_	5:09:18 AM	1:15:00 PM	_	1	27498	32	26689	1	27153	1	63577	1	26281	1	28266	1	27153	4	62541	213	54254	26	57357	0	1075
_	5:09:18 AM	1:20:00 PM	_	1	27523	32	29953	1	27226	1	63722	1	26244	1	28283	1	27226	4	59906	213	53823	26	57610	0	1131
_	5:09:18 AM	1:25:00 PM	_	1	27897	32	38681	1	27219	1	63291	1	26363	1	28355	1	27219	4	58392	213	53766	26	58063	0	1166
_	5:09:18 AM	1:30:00 PM	_	1	27318	32	49278	1	27323	1	63756	1	26167	1	28237	1	27323	4	61146	213	53238	26	59463	0	1120
_	5:09:18 AM	1:35:00 PM	_	1	28198	32	61136	1	27286	1	63780	1	26261	1	28065	1	27286	4	57086	213	53164	26	60085	0	1081
_	5:09:18 AM	1:40:00 PM	_	1	27388	32	60684	1	27160	1	64257	1	26267	1	28218	1	27160	4	59129	213	52672	26	59400	0	1079
_	5:09:18 AM	1:45:00 PM	_	1	27155	33	7273	1	27157	1	63951	1	26227	1	28278	1	27157	4	55741	213	52748	26	58915	0	1088
_	5:09:18 AM	1:50:00 PM	_	1	27461	33	18665	1	27250	1	63976	1	26211	1	28094	1	27250	4	55022	213	52427	26	59599	0	1062
_	5:09:18 AM	1:55:00 PM	_	1	27072	33	30465	1	27086	1	64327	1	26276	1	28227	1	27086	4	56224	213	52078	26	60667	0	1115
_	5:09:18 AM	2:00:00 PM	_	1	27314	33	29374	1	27116	1	64526	1	26364	1	28138	1	27116	4	51262	213	51385	26	61215	0	1096
_	5:09:18 AM	2:05:00 PM	_	1	27355	33	49096	1	27147	1	64633	1	26193	1	28113	1	27147	4	54686	213	51589	26	61367	0	1098
_	5:09:18 AM	2:10:00 PM	_	1	27512	33	52212	1	27243	1	64555	1	26377	1	28220	1	27243	4	50939	213	50810	26	63143	0	1078
_	5:09:18 AM	2:15:00 PM	_	1	27454	34	1260	1	27177	1	64884	1	26317	1	28316	1	27177	4	60980	213	50833	26	64108	0	1082
_	5:09:18 AM	2:20:00 PM	_	1	27562	34	13964	1	27063	1	64925	1	26212	1	28203	1	27063	4	53370	213	50858	26	63810	0	1056
_	5:09:18 AM	2:25:00 PM	_	1	27426	34	16645	1	27196	1	65110	1	26293	1	28145	1	27196	4	48743	213	50387	26	65164	0	1095
_	5:09:18 AM	2:30:00 PM	_	1	27578	34	19422	1	27228	1	65258	1	26312	1	28191	1	27228	4	48453	213	49872	27	574	0	1098
_	5:09:18 AM	2:35:00 PM	_	1	27450	34	29478	1	27115	1	65153	1	26304	1	28217	1	27115	4	43243	213	49382	27	3245	0	1118
_	5:09:18 AM	2:40:00 PM	_	1	27569	34	33486	1	27255	1	65090	1	26277	1	28448	1	27255	4	43879	213	49280	26	65392	0	1055
_	5:09:18 AM	2:45:00 PM	_	1	27280	34	31435	1	27214	2	13	1	26360	1	28158	1	27214	4	44988	213	49096	26	64893	0	983
_	5:09:18 AM	2:50:00 PM	_	1	27214	34	42986	1	27240	1	65465	1	26326	1	28204	1	27240	4	43906	213	48874	27	4283	0	1161
_	5:09:18 AM	2:55:00 PM	_	1	28145	34	60403	1	27170	1	65441	1	26260	1	28295	1	27170	4	43741	213	48516	27	8125	0	1046
_	5:09:18 AM	3:00:00 PM	_	1	27340	34	58199	1	27201	2	707	1	26255	1	28063	1	27201	4	48692	213	48105	27	6065	0	1128
_	5:09:18 AM	3:05:00 PM	_	1	27532	35	2717	1	27239	2	174	1	26354	1	28279	1	27239	4	39378	213	47511	27	6372	0	1081
_	5:09:18 AM	3:10:00 PM	_	1	27318	34	31146	1	27201	1	65492	1	26354	1	28372	1	27201	4	50050	213	47077	27	7599	0	1118
_	5:09:18 AM	3:15:00 PM	_	1	27391	34	18171	1	27146	2	65	1	26254	1	28122	1	27146	4	52176	213	46899	27	9074	0	1137
_	5:09:18 AM	3:20:00 PM	_	1	27541	33	56085	1	27177	1	65077	1	26335	1	28653	1	27177	4	55442	213	46670	27	8273	0	1091
_	5:09:18 AM	3:25:00 PM	_	1	27381	33	57189	1	27213	1	65363	1	26396	1	28511	1	27213	4	53418	213	46437	27	6012	0	1077
_	5:09:18 AM	3:30:00 PM	_	1	27403	34	12778	1	27143	1	65357	1	26211	1	28308	1	27143	4	62479	213	45913	27	5315	0	1120
_	5:09:18 AM	3:35:00 PM	_	1	27352	34	14844	1	27148	1	65404	1	26462	1	28449	1	27148	4	57104	213	45689	27	4344	0	1109
_	5:09:18 AM	3:40:00 PM	_	1	27418	34	14511	1	27205	1	65353	1	26373	1	28339	1	27205	4	55185	213	45408	27	4672	0	1110
_	5:09:18 AM	3:45:00 PM	_	1	27412	34	13418	1	27174	1	65402	1	26368	1	28481	1	27174	4	56720	213	45057	27	5353	0	1049
_	5:09:18 AM	3:50:00 PM	_	1	27478	34	25193	1	27221	1	65499	1	26407	1	28206	1	27221	4	53514	213	44859	27	7008	0	1145
_	5:09:18 AM	3:55:00 PM	_	1	27383	34	22287	1	27234	1	65432	1	26371	1	28405	1	27234	4	55572	213	44412	27	8466	0	1124
_	5:09:18 AM	4:00:00 PM	_	1	27362	34	17896	1	27137	1	65438	1	26355	1	28294	1	27137	4	58823	213	44305	27	9553	0	1098
_	5:09:18 AM	4:05:00 PM	_	1	27428	34	17981	1	27209	2	289	1	26229	1	28426	1	27209	4	64140	213	43929	27	9864	0	1059
_	5:09:18 AM	4:10:00 PM	_	1	27480	34	19580	1	27150	2	290	1	26324	1	28358	1	27150	5	7268	213	43609	27	10584	0	1074
_	5:09:18 AM	4:15:00 PM	_	1	27475	34	15765	1	27190	2	333	1	26278	1	28517	1	27190	5	635	213	43069	27	11547	0	1035
_	5:09:18 AM	4:20:00 PM	_	1	27416	34	18484	1	27154	2	658	1	26311	1	28534	1	27154	5	4986	217	36969	27	13078	0	1112
_	5:09:18 AM	4:25:00 PM	_	1	27517	34	24716	1	27024	2	661	1	26246	1	28601	1	27024	5	7244	217	9733	27	12204	0	1012
_	5:09:18 AM	4:30:00 PM	_	1	27398	34	23590	1	27313	2	294	1	26312	1	28410	1	27313	5	3403	216	61240	27	10842	0	1120
_	5:09:18 AM	4:35:00 PM	_	1	27464	34	17735	1	27262	2	332	1	26387	1	28523	1	27262	5	7783	216	54260	27	11508	0	1095
_	5:09:18 AM	4:40:00 PM	_	1	27688	34	17950	1	27245	2	369	1	26366	1	28737	1	27245	5	8712	216	50625	27	12495	0	1093
_	5:09:18 AM	4:45:00 PM	_	1	27416	34	20865	1	27085	2	416	1	26135	1	28383	1	27085	5	14063	216	48245	27	13002	0	1097
_	5:09:18 AM	4:50:00 PM	_	1	27690	34	22587	1	27200	2	375	1	26249	1	28864	1	27200	5	14011	216	46687	27	12438	0	1116
_	5:09:18 AM	4:55:00 PM	_	1	27436	34	22562	1	27147	2	501	1	26306	1	28571	1	27147	5	17855	216	45961	27	12163	0	1139
_	5:09:18 AM	5:00:00 PM	_	1	27340	34	23552	1	27187	2	530	1	26249	1	28525	1	27187	5	22991	216	44971	27	10211	0	1066
_	5:09:18 AM	5:05:00 PM	_	1	27337	34	31114	1	27148	2	920	1	26414	1	28838	1	27148	5	17370	216	44106	27	8917	0	1126
_	5:09:18 AM	5:10:00 PM	_	1	27451	34	32072	1	27366	2	888	1	26251	1	28763	1	27366	5	23440	216	43296	27	10240	0	1080
_	5:09:18 AM	5:15:00 PM	_	1	27468	34	33377	1	27269	2	543	1	26341	1	28517	1	27269	5	17718	216	42811	27	9433	0	1065
_	5:09:18 AM	5:20:00 PM	_	1	27512	34	38691	1	27219	2	818	1	26297	1	28683	1	27219	5	21003	216	42421	27	7818	0	1080
_	5:09:18 AM	5:25:00 PM	_	1	27498	34	42022	1	27281	2	774	1	26242	1	28458	1	27281	5	19541	216	41858	27	7668	0	1117
_	5:09:18 AM	5:30:00 PM	_	1	27408	34	50269	1	27202	2	1032	1	26225	1	28712	1	27202	5	26350	216	41502	27	7142	0	1102
_	5:09:18 AM	5:35:00 PM	_	1	27467	34	48658	1	27236	2	937	1	26280	1	28791	1	27236	5	25191	216	41208	27	6333	0	1136
_	5:09:18 AM	5:40:00 PM	_	1	27511	34	49466	1	27286	2	1056	1	26384	1	28456	1	27286	5	26118	216	40597	27	5259	0	1112
_	5:09:18 AM	5:45:00 PM	_	1	27366	34	52014	1	27317	2	1248	1	26324	1	28592	1	27317	5	27981	216	40105	27	4195	0	1119
_	5:09:18 AM	5:50:00 PM	_	1	27417	34	55340	1	27193	2	1043	1	26339	1	28676	1	27193	5	30491	216	39787	27	5399	0	1116
_	5:09:18 AM	5:55:00 PM	_	1	27492	34	60004	1	27207	2	1248	1	26238	1	28872	1	27207	5	34527	216	39481	27	5441	0	1108
_	5:09:18 AM	6:00:00 PM	_	1	27429	34	62233	1	27275	2	1183	1	26262	1	28933	1	27275	5	36750	216	39038	27	3390	0	1126
_	5:09:18 AM	6:05:00 PM	_	1	27311	34	63473	1	27225	2	1750	1	26402	1	28667	1	27225	5	40938	216	38499	27	774	0	1057
_	5:09:18 AM	6:10:00 PM	_	1	27499	35	5555	1	27103	2	1621	1	26322	1	28814	1	27103	5	42773	216	38060	26	64363	0	1134
_	5:09:18 AM	6:15:00 PM	_	1	27349	35	12007	1	27187	2	1701	1	26391	1	28787	1	27187	5	46123	216	37858	26	62319	0	1102
_	5:09:18 AM	6:20:00 PM	_	1	27445	35	16801	1	27104	2	1882	1	26350	1	28741	1	27104	5	51142	216	37361	26	64449	0	1090
_	5:09:18 AM	6:25:00 PM	_	1	27385	35	16903	1	27140	2	1844	1	26351	1	28746	1	27140	5	52044	216	37022	26	59121	0	1027
_	5:09:18 AM	6:30:00 PM	_	1	27423	35	17496	1	27049	2	2034	1	26442	1	29064	1	27049	5	49447	216	36625	26	55857	0	1183
_	5:09:18 AM	6:35:00 PM	_	1	27412	35	27563	1	27145	2	2125	1	26301	1	28579	1	27145	5	51586	216	35914	26	51308	0	1150
_	5:09:18 AM	6:40:01 PM	_	1	27456	35	36070	1	27145	2	2104	1	26416	1	28789	1	27145	5	54284	216	35634	26	53381	0	1127
_	5:09:18 AM	6:45:01 PM	_	1	27475	35	35898	1	27137	2	2213	1	26337	1	28939	1	27137	5	50570	216	35138	26	50967	0	1151
_	5:09:18 AM	6:50:00 PM	_	1	27357	35	35715	1	27086	2	2336	1	26325	1	29095	1	27086	5	51864	216	34702	26	47709	0	1117
_	5:09:18 AM	6:55:00 PM	_	1	27961	35	41782	1	27187	2	2301	1	26340	1	29236	1	27187	5	52278	216	34111	26	48408	0	1120
_	5:09:18 AM	7:00:00 PM	_	1	27613	35	39747	1	27293	2	2134	1	26332	1	28764	1	27293	5	49334	216	33698	26	48082	0	1119
_	5:09:18 AM	7:05:00 PM	_	1	27361	35	39317	1	27257	2	2184	1	26329	1	28770	1	27257	5	48028	216	33070	26	47831	0	1074
_	5:09:18 AM	7:10:01 PM	_	1	27361	35	40365	1	27088	2	2299	1	26274	1	29098	1	27088	5	57833	216	32787	26	47435	0	1119
_	5:09:18 AM	7:15:01 PM	_	1	27236	35	37675	1	27190	2	2267	1	26346	1	28932	1	27190	5	52757	216	32025	26	45972	0	1089
_	5:09:18 AM	7:20:00 PM	_	1	27495	35	42570	1	27124	2	2722	1	26200	1	28829	1	27124	5	52086	216	31700	26	44993	0	1074
_	5:09:18 AM	7:25:01 PM	_	1	27557	35	35426	1	27231	2	2111	1	26318	1	29018	1	27231	5	52335	216	31326	26	43527	0	1087
_	5:09:18 AM	7:30:01 PM	_	1	27507	35	36395	1	27126	2	2585	1	26305	1	28922	1	27126	5	49980	216	30546	26	42280	0	1101
_	5:09:18 AM	7:35:00 PM	_	1	27345	35	39702	1	27087	2	2448	1	26311	1	28997	1	27087	5	52005	216	29944	26	40757	0	1121
_	5:09:18 AM	7:40:00 PM	_	1	27449	35	42518	1	27187	2	2618	1	26434	1	28972	1	27187	5	55988	216	29699	26	38792	0	1098
_	5:09:18 AM	7:45:00 PM	_	1	27625	35	41289	1	27282	2	2331	1	26364	1	28848	1	27282	5	53336	216	29258	26	36947	0	1102
_	5:09:18 AM	7:50:01 PM	_	1	26957	35	44399	1	27169	2	2340	1	26182	1	29425	1	27169	5	53844	216	29034	26	35088	0	1091
_	5:09:18 AM	7:55:01 PM	_	1	27369	35	39808	1	27216	2	2615	1	26344	1	29244	1	27216	5	56616	216	28424	26	33334	0	1077
_	5:09:18 AM	8:00:01 PM	_	1	27360	35	36354	1	27213	2	2692	1	26453	1	28950	1	27213	5	54016	216	28145	26	30876	0	1177
_	5:09:18 AM	8:05:01 PM	_	1	27568	35	43213	1	27162	2	2544	1	26336	1	29033	1	27162	5	55689	216	27478	26	29656	0	1130
_	5:09:18 AM	8:10:01 PM	_	1	27156	35	43339	1	27180	2	2402	1	26319	1	29331	1	27180	5	54227	216	27317	26	30000	0	1106
_	5:09:18 AM	8:15:01 PM	_	1	27598	35	40297	1	27142	2	2567	1	26313	1	29003	1	27142	5	55363	216	26948	26	30001	0	1077
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_	5:09:18 AM	8:25:01 PM	_	1	27356	35	39457	1	27167	2	2817	1	26363	1	28990	1	27167	5	57229	216	25955	26	25127	0	1119
_	5:09:18 AM	8:30:01 PM	_	1	27365	35	38778	1	27189	2	2551	1	26175	1	29030	1	27189	5	52979	216	25615	26	23699	0	1139
_	5:09:18 AM	8:35:01 PM	_	1	27418	35	39473	1	27253	2	2807	1	26352	1	29137	1	27253	5	52381	216	24904	26	19400	0	1088
_	5:09:18 AM	8:40:01 PM	_	1	27327	35	43141	1	27280	2	2673	1	26169	1	29316	1	27280	5	54707	216	25048	26	18946	0	1069
_	5:09:18 AM	8:45:01 PM	_	1	27537	35	38348	1	27147	2	2728	1	26321	1	29236	1	27147	5	56881	216	24507	26	17055	0	1044

_	5:09:18 AM	8:50:01 PM	_	1	27471	35	35630	1	27168	2	2287	1	26322	1	28984	1	27168	5	59978	216	24036	26	14923	0	1093
_	5:09:18 AM	8:55:01 PM	_	1	27372	35	35730	1	27263	2	2460	1	26181	1	29000	1	27263	5	58810	216	23781	26	10901	0	1090
_	5:09:18 AM	9:00:01 PM	_	1	27353	35	33826	1	27270	2	2351	1	26297	1	29151	1	27270	5	51973	216	23542	26	7332	0	1075
_	5:09:18 AM	9:05:01 PM	_	1	27445	35	35480	1	27186	2	2140	1	26323	1	29354	1	27186	5	56997	216	23147	25	64899	0	1096
_	5:09:18 AM	9:10:01 PM	_	1	27349	35	31739	1	27278	2	2540	1	26374	1	29198	1	27278	5	58324	216	23136	25	60324	0	1162
_	5:09:18 AM	9:15:01 PM	_	1	27426	35	34522	1	27282	2	2671	1	26327	1	29360	1	27282	5	64533	216	22646	25	57107	0	1160
_	5:09:18 AM	9:20:01 PM	_	1	27369	35	33845	1	27064	2	2597	1	26273	1	29259	1	27064	6	167	216	22541	25	51337	0	1041
_	5:09:18 AM	9:25:01 PM	_	1	27324	35	32323	1	27296	2	2287	1	26292	1	29532	1	27296	6	1820	216	21952	25	45852	0	1109
_	5:09:18 AM	9:30:01 PM	_	1	27458	35	32346	1	27231	2	2423	1	26254	1	29080	1	27231	6	4781	216	21529	25	41490	0	1126
_	5:09:18 AM	9:35:01 PM	_	1	27389	35	33788	1	27175	2	2588	1	26313	1	28994	1	27175	6	7064	216	21531	25	39746	0	1076
_	5:09:18 AM	9:40:01 PM	_	1	27427	35	38333	1	27143	2	2441	1	26326	1	29141	1	27143	6	6257	216	20706	25	35758	0	1085
_	5:09:18 AM	9:45:01 PM	_	1	27457	35	35670	1	27120	2	2808	1	26302	1	29168	1	27120	6	7509	216	20295	25	29845	0	1084
_	5:09:18 AM	9:50:01 PM	_	1	27632	35	36156	1	27190	2	2531	1	26318	1	29300	1	27190	6	8770	216	19729	25	24966	0	1101
_	5:09:18 AM	9:55:01 PM	_	1	27583	35	33169	1	27194	2	2354	1	26300	1	29349	1	27194	6	8420	216	19808	25	21119	0	1098
_	5:09:18 AM	10:00:01 PM	_	1	27413	35	39979	1	27206	2	2762	1	26313	1	29556	1	27206	6	8589	216	19069	25	16677	0	1154
_	5:09:18 AM	10:05:01 PM	_	1	27336	35	39003	1	27118	2	2709	1	26232	1	29292	1	27118	6	8668	216	18731	25	10869	0	1102
_	5:09:18 AM	10:10:01 PM	_	1	27394	35	38644	1	27262	2	2713	1	26239	1	29041	1	27262	6	11518	216	18480	25	6287	0	1045
_	5:09:18 AM	10:15:01 PM	_	1	27471	35	40520	1	27154	2	3288	1	26380	1	29264	1	27154	6	12404	216	17832	25	3278	0	1130
_	5:09:18 AM	10:20:01 PM	_	1	27593	35	37201	1	27238	2	2782	1	26293	1	29383	1	27238	6	12348	216	17656	25	3402	0	1139
_	5:09:18 AM	10:25:01 PM	_	1	27543	35	42658	1	27269	2	2427	1	26295	1	29565	1	27269	6	14552	216	17159	25	9	0	1106
_	5:09:18 AM	10:30:01 PM	_	1	27462	35	41191	1	27223	2	2398	1	26114	1	29457	1	27223	6	12657	216	16334	24	60977	0	1076
_	5:09:18 AM	10:35:01 PM	_	1	27398	35	44100	1	27197	2	2954	1	26292	1	29405	1	27197	6	13577	216	15966	24	56986	0	1154
_	5:09:18 AM	10:40:01 PM	_	1	27388	35	43838	1	27164	2	2573	1	26259	1	29407	1	27164	6	13934	216	15601	24	54103	0	1072
_	5:09:18 AM	10:45:01 PM	_	1	27164	35	43932	1	27223	2	2498	1	26348	1	29480	1	27223	6	13471	216	14853	24	48068	0	1130
_	5:09:18 AM	10:50:01 PM	_	1	27328	35	43835	1	27269	2	2523	1	26472	1	29379	1	27269	6	14545	216	14655	24	42710	0	1115
_	5:09:18 AM	10:55:01 PM	_	1	27341	35	46517	1	27213	2	2558	1	26387	1	29321	1	27213	6	15326	216	14304	24	41783	0	1114
_	5:09:18 AM	11:00:01 PM	_	1	27515	35	49195	1	27212	2	2599	1	26329	1	29276	1	27212	6	17111	216	13740	24	39015	0	1098
_	5:09:18 AM	11:05:01 PM	_	1	27139	35	49815	1	27177	2	2560	1	26396	1	29472	1	27177	6	16390	216	12927	24	36464	0	1144
_	5:09:18 AM	11:10:01 PM	_	1	27600	35	48015	1	27234	2	2771	1	26202	1	29772	1	27234	6	21897	216	12175	24	32519	0	1141
_	5:09:18 AM	11:15:01 PM	_	1	27397	35	50786	1	27045	2	2678	1	26371	1	29272	1	27045	6	18244	216	12135	24	27249	0	1146
_	5:09:18 AM	11:20:01 PM	_	1	27213	35	52441	1	27065	2	2783	1	26252	1	29889	1	27065	6	18420	216	11146	24	23227	0	1207
_	5:09:18 AM	11:25:01 PM	_	1	27393	35	54458	1	27151	2	2870	1	26347	1	29597	1	27151	6	21893	216	10725	24	20834	0	1055
_	5:09:18 AM	11:30:01 PM	_	1	27280	35	53912	1	27237	2	2621	1	26309	1	29562	1	27237	6	17732	216	10360	24	19700	0	1126
_	5:09:18 AM	11:35:01 PM	_	1	27317	35	53403	1	27210	2	2648	1	26281	1	29456	1	27210	6	20548	216	9836	24	17535	0	1152
_	5:09:18 AM	11:40:01 PM	_	1	27366	35	57695	1	27083	2	2705	1	26381	1	29492	1	27083	6	18633	216	9505	24	14566	0	1147
_	5:09:18 AM	11:45:01 PM	_	1	27362	35	57152	1	27084	2	2743	1	26355	1	29451	1	27084	6	18533	216	8693	24	9396	0	1168
_	5:09:18 AM	11:50:01 PM	_	1	27669	35	60470	1	27191	2	2702	1	26270	1	29578	1	27191	6	19043	216	8331	24	4822	0	1142
_	5:09:18 AM	11:55:01 PM	_	1	27407	36	691	1	27169	2	2771	1	26276	1	29690	1	27169	6	16567	216	7850	24	1388	0	1152
_	6:09:18 AM	12:00:01 AM	_	1	27568	36	3102	1	27143	2	2802	1	26134	1	29608	1	27143	6	18764	216	7939	23	62928	0	1083
_	6:09:18 AM	12:10:01 AM	_	1	27443	36	10308	1	27167	2	3138	1	26336	1	30124	1	27167	6	20092	216	5942	23	59566	0	1160
_	6:09:18 AM	12:15:01 AM	_	1	27520	36	11874	1	27193	2	3079	1	26330	1	29630	1	27193	6	19045	216	5965	23	55717	0	1164
_	6:09:18 AM	12:20:01 AM	_	1	27178	36	19850	1	27267	2	3201	1	26301	1	29775	1	27267	6	26995	216	5728	23	54952	0	1170
_	6:09:18 AM	12:25:01 AM	_	1	27763	36	23252	1	27247	2	3323	1	26295	1	29688	1	27247	6	20003	216	5061	23	48641	0	1179
_	6:09:18 AM	12:30:01 AM	_	1	27463	36	28157	1	27160	2	3200	1	26317	1	29809	1	27160	6	23481	216	4878	23	44220	0	1108
_	6:09:18 AM	12:35:01 AM	_	1	27457	36	32551	1	27106	2	3085	1	26298	1	30141	1	27106	6	22512	216	4489	23	41420	0	1165
_	6:09:18 AM	12:40:01 AM	_	1	27438	36	35868	1	27209	2	3228	1	26372	1	29586	1	27209	6	20829	216	3792	23	40078	0	1156
_	6:09:18 AM	12:45:01 AM	_	1	27551	36	41981	1	27139	2	3303	1	26318	1	29719	1	27139	6	22238	216	3488	23	36222	0	1185
_	6:09:18 AM	12:50:01 AM	_	1	27290	36	47614	1	27148	2	3133	1	26240	1	29669	1	27148	6	20659	216	3043	23	32730	0	1176
_	6:09:18 AM	12:55:01 AM	_	1	27317	36	50450	1	27226	2	3279	1	26175	1	29554	1	27226	6	21766	216	2372	23	28323	0	1159
_	6:09:18 AM	1:00:01 AM	_	1	27456	36	58418	1	27156	2	3452	1	26328	1	29612	1	27156	6	21661	216	1949	23	26049	0	1180
_	6:09:18 AM	1:05:01 AM	_	1	27447	36	62061	1	27106	2	3481	1	26239	1	29835	1	27106	6	22534	216	1820	23	21362	0	1160
_	6:09:18 AM	1:10:01 AM	_	1	27501	37	5064	1	27150	2	3571	1	26144	1	29691	1	27150	6	26558	216	1142	23	18919	0	1131
_	6:09:18 AM	1:15:01 AM	_	1	27439	37	10363	1	27175	2	3543	1	26310	1	29779	1	27175	6	24376	216	750	23	15111	0	1179
_	6:09:18 AM	1:20:01 AM	_	1	27407	37	17410	1	27248	2	3650	1	26387	1	29669	1	27248	6	26648	215	65383	23	12737	0	1140
_	6:09:18 AM	1:25:01 AM	_	1	27222	37	22484	1	27142	2	4004	1	26210	1	29717	1	27142	6	26052	215	65062	23	8719	0	1153
_	6:09:18 AM	1:30:01 AM	_	1	27365	37	26368	1	27082	2	3935	1	26290	1	29589	1	27082	6	23490	215	65079	23	4507	0	1141
_	6:09:18 AM	1:35:01 AM	_	1	27485	37	35960	1	27232	2	4018	1	26306	1	29840	1	27232	6	27603	215	64238	23	461	0	1160
_	6:09:18 AM	1:40:01 AM	_	1	27404	37	39915	1	27181	2	4119	1	26225	1	29739	1	27181	6	26076	215	63927	22	62197	0	1152
_	6:09:18 AM	1:45:01 AM	_	1	27388	37	46429	1	27161	2	4388	1	26345	1	29810	1	27161	6	27747	215	63311	22	59700	0	1175
_	6:09:18 AM	1:50:01 AM	_	1	27490	37	49017	1	27177	2	4170	1	26351	1	29988	1	27177	6	27457	215	62481	22	57982	0	1195
_	6:09:18 AM	1:55:01 AM	_	1	27506	37	56536	1	27105	2	4294	1	26391	1	29784	1	27105	6	27706	215	62166	22	54412	0	1185
_	6:09:18 AM	2:00:01 AM	_	1	27348	37	61217	1	27152	2	4394	1	26231	1	29714	1	27152	6	27102	215	62019	22	49904	0	1151
_	6:09:18 AM	2:05:01 AM	_	1	27337	38	3326	1	27147	2	4277	1	26343	1	29569	1	27147	6	27279	215	61433	22	46977	0	1142
_	6:09:18 AM	2:10:01 AM	_	1	27678	38	10035	1	27201	2	4288	1	26172	1	29952	1	27201	6	29023	215	61332	22	43217	0	1182
_	6:09:18 AM	2:15:01 AM	_	1	27321	38	15419	1	27126	2	4590	1	26485	1	29691	1	27126	6	29789	215	60795	22	40369	0	1129
_	6:09:18 AM	2:20:01 AM	_	1	27406	38	20957	1	27234	2	4520	1	26313	1	29740	1	27234	6	29323	215	60314	22	37240	0	1168
_	6:09:18 AM	2:25:01 AM	_	1	27440	38	24199	1	27063	2	4607	1	26367	1	29968	1	27063	6	31007	215	59931	22	34983	0	1137
_	6:09:18 AM	2:30:01 AM	_	1	27559	38	33030	1	27234	2	4832	1	26390	1	29836	1	27234	6	29284	215	59507	22	32352	0	1085
_	6:09:18 AM	2:35:01 AM	_	1	27460	38	35229	1	27191	2	4754	1	26273	1	29594	1	27191	6	30865	215	58653	22	28875	0	1172
_	6:09:18 AM	2:40:01 AM	_	1	27432	38	43766	1	27207	2	4889	1	26382	1	30086	1	27207	6	30768	215	58243	22	25034	0	1119
_	6:09:18 AM	2:45:01 AM	_	1	27468	38	48908	1	27060	2	4946	1	26280	1	29771	1	27060	6	32853	215	57692	22	22563	0	1157
_	6:09:18 AM	2:50:01 AM	_	1	27260	38	54475	1	27150	2	4878	1	26282	1	30092	1	27150	6	35006	215	57818	22	20518	0	1132
_	6:09:18 AM	2:55:01 AM	_	1	27548	38	58523	1	27136	2	4943	1	26295	1	29950	1	27136	6	34219	215	57365	22	17663	0	1190
_	6:09:18 AM	3:00:01 AM	_	1	27275	38	64334	1	27085	2	5115	1	26326	1	29932	1	27085	6	35949	215	56841	22	14885	0	1171
_	6:09:18 AM	3:05:01 AM	_	1	27375	39	4427	1	27137	2	5359	1	26316	1	30073	1	27137	6	37135	215	56698	22	11314	0	1111
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_	6:09:18 AM	12:05:00 PM	_	1	27518	42	26812	1	27257	2	11155	1	26292	1	29641	1	27257	7	5689	215	59566	26	40876	0	1058
_	6:09:18 AM	12:10:00 PM	_	1	27503	42	36435	1	27253	2	10951	1	26232	1	29911	1	27253	7	6395	215	59915	26	42137	0	1071

_	6:09:18 AM	12:15:00 PM	_	1	27340	42	40333	1	27251	2	11182	1	26284	1	29780	1	27251	7	5373	215	59794	26	44099	0	1111
_	6:09:18 AM	12:20:00 PM	_	1	27376	42	46904	1	27233	2	11287	1	26111	1	30067	1	27233	7	7870	215	59966	26	46563	0	1017
_	6:09:18 AM	12:25:00 PM	_	1	27389	42	55645	1	27195	2	11440	1	26329	1	30161	1	27195	7	6609	215	59770	26	49681	0	1111
_	6:09:18 AM	12:30:00 PM	_	1	27107	42	60838	1	27193	2	11751	1	26409	1	30062	1	27193	7	10317	215	60068	26	53051	0	1165
_	6:09:18 AM	12:35:00 PM	_	1	27569	43	931	1	27069	2	11795	1	26436	1	29870	1	27069	7	8998	215	60144	26	55070	0	1071
_	6:09:18 AM	12:40:00 PM	_	1	27512	43	11141	1	27212	2	11982	1	26246	1	29946	1	27212	7	10601	215	60137	26	56879	0	1121
_	6:09:18 AM	12:45:00 PM	_	1	27330	43	15126	1	27260	2	12150	1	26195	1	30005	1	27260	7	10146	215	60094	26	57607	0	1095
_	6:09:18 AM	12:50:00 PM	_	1	27454	43	25881	1	27179	2	12187	1	26167	1	29876	1	27179	7	11765	215	60167	26	59096	0	1166
_	6:09:18 AM	12:55:00 PM	_	1	27270	43	27558	1	27220	2	12186	1	26330	1	30082	1	27220	7	12684	215	60155	26	59844	0	1056
_	6:09:18 AM	1:00:00 PM	_	1	27505	43	36063	1	27200	2	12396	1	26196	1	29806	1	27200	7	12422	215	60174	26	61289	0	1094
_	6:09:18 AM	1:05:00 PM	_	1	27419	43	28395	1	27177	2	12497	1	26299	1	30085	1	27177	7	16702	215	59902	26	61183	0	1159
_	6:09:18 AM	1:10:00 PM	_	1	27507	43	45763	1	27125	2	12626	1	26261	1	30037	1	27125	7	12423	215	59638	26	61660	0	1129
_	6:09:18 AM	1:15:00 PM	_	1	27378	43	48560	1	27121	2	12698	1	26323	1	29998	1	27121	7	13077	215	60065	26	61941	0	1129
_	6:09:18 AM	1:20:00 PM	_	1	27395	43	53269	1	27171	2	12776	1	26335	1	30581	1	27171	7	18078	215	59660	26	62982	0	1108
_	6:09:18 AM	1:25:00 PM	_	1	27468	43	57289	1	27300	2	12821	1	26379	1	29868	1	27300	7	15388	215	59463	26	64069	0	1075
_	6:09:18 AM	1:30:00 PM	_	1	27393	43	59336	1	27273	2	12817	1	26438	1	29781	1	27273	7	13836	215	59609	26	63711	0	1046
_	6:09:18 AM	1:35:00 PM	_	1	27308	43	61644	1	27315	2	12975	1	26392	1	29929	1	27315	7	14560	215	59531	27	1274	0	1170
_	6:09:18 AM	1:40:00 PM	_	1	27333	44	64640	1	27299	2	13236	1	26312	1	29836	1	27299	7	15207	215	59098	27	3827	0	1081
_	6:09:18 AM	1:45:00 PM	_	1	27459	44	1413	1	27186	2	13176	1	26283	1	29950	1	27186	7	16962	215	59084	27	5676	0	1104
_	6:09:18 AM	1:50:00 PM	_	1	27559	44	6667	1	27150	2	13340	1	26258	1	29952	1	27150	7	17399	215	58974	27	6067	0	1106
_	6:09:18 AM	1:55:00 PM	_	1	27619	44	10513	1	27312	2	13466	1	26122	1	30002	1	27312	7	15867	215	58809	27	5360	0	1091
_	6:09:18 AM	2:00:00 PM	_	1	27214	44	13996	1	27107	2	13406	1	26414	1	29856	1	27107	7	20214	215	58402	27	5587	0	1101
_	6:09:18 AM	2:05:00 PM	_	1	27244	44	18578	1	27092	2	13483	1	26297	1	29823	1	27092	7	19061	215	58162	27	7244	0	1105
_	6:09:18 AM	2:10:00 PM	_	1	27442	44	22589	1	27192	2	13703	1	26376	1	29952	1	27192	7	22692	215	58254	27	7493	0	1118
_	6:09:18 AM	2:15:00 PM	_	1	27446	44	25053	1	27325	2	13427	1	26198	1	29965	1	27325	7	19786	215	57962	27	7047	0	1112
_	6:09:18 AM	2:20:00 PM	_	1	27517	44	24586	1	27182	2	13474	1	26202	1	30134	1	27182	7	17253	215	57472	27	4736	0	1081
_	6:09:18 AM	2:25:00 PM	_	1	27672	44	31347	1	27284	2	13606	1	26397	1	30027	1	27284	7	22967	215	57334	27	4465	0	1022
_	6:09:18 AM	2:30:01 PM	_	1	27470	44	33155	1	27229	2	13679	1	26159	1	29828	1	27229	7	17868	215	57415	27	239	0	1118
_	6:09:18 AM	2:35:00 PM	_	1	27519	44	33249	1	27157	2	13776	1	26311	1	29937	1	27157	7	19780	215	56433	27	4336	0	1134
_	6:09:18 AM	2:40:00 PM	_	1	27394	44	35334	1	27142	2	13846	1	26378	1	30057	1	27142	7	22098	215	56623	27	7383	0	1140
_	6:09:18 AM	2:45:00 PM	_	1	27423	44	36386	1	27215	2	13819	1	26395	1	29934	1	27215	7	19637	215	56480	27	8353	0	1055
_	6:09:18 AM	2:50:00 PM	_	1	27345	44	37178	1	27166	2	14039	1	26327	1	30001	1	27166	7	22746	215	55998	27	12606	0	1066
_	6:09:18 AM	2:55:00 PM	_	1	27438	44	42077	1	27122	2	13962	1	26378	1	30067	1	27122	7	20246	215	55495	27	11760	0	1091
_	6:09:18 AM	3:00:00 PM	_	1	27380	44	38755	1	27252	2	13977	1	26332	1	30064	1	27252	7	20881	215	55258	27	15085	0	1155
_	6:09:18 AM	3:05:00 PM	_	1	27575	44	42336	1	27087	2	14181	1	26327	1	29865	1	27087	7	20778	215	54830	27	19445	0	1052
_	6:09:18 AM	3:10:00 PM	_	1	27432	44	45426	1	27203	2	14102	1	26318	1	29976	1	27203	7	19709	215	54636	27	24240	0	1127
_	6:09:18 AM	3:15:00 PM	_	1	27532	44	42197	1	27219	2	14309	1	26342	1	30000	1	27219	7	20064	215	54460	27	24684	0	1144
_	6:09:18 AM	3:20:00 PM	_	1	27546	44	47399	1	27148	2	14333	1	26239	1	30037	1	27148	7	24807	215	54064	27	24606	0	1029
_	6:09:18 AM	3:25:00 PM	_	1	27395	44	44157	1	27171	2	14161	1	26265	1	29834	1	27171	7	22081	215	53872	27	29928	0	1123
_	6:09:18 AM	3:30:00 PM	_	1	27379	44	42865	1	27214	2	14253	1	26366	1	29915	1	27214	7	25381	215	53331	27	31214	0	1098
_	6:09:18 AM	3:35:00 PM	_	1	27303	44	44815	1	27161	2	14350	1	26283	1	29745	1	27161	7	23120	215	53405	27	34171	0	1038
_	6:09:18 AM	3:40:00 PM	_	1	27487	44	44774	1	27177	2	14223	1	26376	1	29703	1	27177	7	20824	215	53076	27	36175	0	1136
_	6:09:18 AM	3:45:00 PM	_	1	27258	44	47623	1	27207	2	14399	1	26325	1	30186	1	27207	7	22163	215	52893	27	38502	0	1096
_	6:09:18 AM	3:50:00 PM	_	1	27279	44	47415	1	27209	2	14430	1	26282	1	29817	1	27209	7	20948	215	52763	27	41584	0	1081
_	6:09:18 AM	3:55:00 PM	_	1	27475	44	49106	1	27273	2	14542	1	26398	1	29970	1	27273	7	24322	215	52355	27	42301	0	1149
_	6:09:18 AM	4:00:00 PM	_	1	27407	44	48943	1	27260	2	14566	1	26315	1	29765	1	27260	7	22528	215	52122	27	44626	0	1149
_	6:09:18 AM	4:05:00 PM	_	1	27279	44	52786	1	27248	2	14533	1	26236	1	30023	1	27248	7	21720	215	51981	27	43709	0	1115
_	6:09:18 AM	4:10:00 PM	_	1	27091	44	49745	1	27203	2	14584	1	26304	1	29916	1	27203	7	20535	215	51601	27	44517	0	1073
_	6:09:18 AM	4:15:00 PM	_	1	27439	44	36633	1	27097	2	14411	1	26227	1	29938	1	27097	7	19392	215	51669	27	44828	0	1126
_	6:09:18 AM	4:20:00 PM	_	1	27264	44	33173	1	27207	2	14463	1	26305	1	30075	1	27207	7	23079	215	51457	27	46518	0	1085
_	6:09:18 AM	4:25:00 PM	_	1	27439	44	33461	1	27239	2	14513	1	26242	1	29595	1	27239	7	20987	215	51071	27	48847	0	1092
_	6:09:18 AM	4:30:00 PM	_	1	27326	44	34646	1	27239	2	14416	1	26311	1	29900	1	27239	7	17557	215	50779	27	51041	0	1058
_	6:09:18 AM	4:35:00 PM	_	1	27516	44	28989	1	27285	2	14366	1	26238	1	29659	1	27285	7	19054	215	50708	27	53320	0	1113
_	6:09:18 AM	4:40:00 PM	_	1	27385	44	28777	1	27307	2	14556	1	26240	1	29861	1	27307	7	16582	215	50348	27	56285	0	1143
_	6:09:18 AM	4:45:00 PM	_	1	27382	44	28032	1	27235	2	14408	1	26422	1	29981	1	27235	7	18764	215	50190	27	55712	0	1122
_	6:09:18 AM	4:50:00 PM	_	1	27464	44	29672	1	27214	2	14590	1	26241	1	29982	1	27214	7	20141	215	50274	27	56767	0	1120
_	6:09:18 AM	4:55:00 PM	_	1	27492	44	30106	1	27102	2	14464	1	26261	1	29573	1	27102	7	17682	215	49896	27	58436	0	1073
_	6:09:18 AM	5:00:00 PM	_	1	27585	44	26334	1	27217	2	14485	1	26312	1	29964	1	27217	7	17640	215	49499	27	59464	0	1083
_	6:09:18 AM	5:05:00 PM	_	1	27257	44	31576	1	27074	2	14610	1	26338	1	29700	1	27074	7	19890	215	49618	27	61114	0	1083
_	6:09:18 AM	5:10:00 PM	_	1	27521	44	33201	1	27163	2	14565	1	26247	1	29678	1	27163	7	19641	215	49298	27	63018	0	1170
_	6:09:18 AM	5:15:00 PM	_	1	27346	44	34368	1	27245	2	14727	1	26181	1	29791	1	27245	7	21250	215	49085	28	4017	0	1076
_	6:09:18 AM	5:20:00 PM	_	1	27355	44	34243	1	27201	2	14741	1	26309	1	29903	1	27201	7	19980	215	48873	28	2722	0	1098
_	6:09:18 AM	5:25:00 PM	_	1	27455	44	36032	1	27155	2	14648	1	26441	1	30109	1	27155	7	17581	215	48478	28	3411	0	1082
_	6:09:18 AM	5:30:00 PM	_	1	27628	44	34218	1	27245	2	14825	1	26318	1	29855	1	27245	7	25678	215	48396	28	5119	0	1102
_	6:09:18 AM	5:35:00 PM	_	1	27366	44	38890	1	27301	2	14830	1	26276	1	29686	1	27301	7	21838	215	48299	28	8113	0	1108
_	6:09:18 AM	5:40:00 PM	_	1	27455	44	37923	1	27253	2	15024	1	26390	1	29900	1	27253	7	21964	215	48005	28	8837	0	1037
_	6:09:18 AM	5:45:00 PM	_	1	27297	44	40666	1	27090	2	14891	1	26436	1	29594	1	27090	7	22236	215	47749	28	10357	0	1170
_	6:09:18 AM	5:50:00 PM	_	1	27474	44	40839	1	27264	2	15129	1	26364	1	29782	1	27264	7	22284	215	47529	28	12238	0	1119
_	6:09:18 AM	5:55:00 PM	_	1	27726	44	42756	1	27131	2	14941	1	26283	1	29677	1	27131	7	22673	215	47474	28	13274	0	1110
_	6:09:18 AM	6:00:00 PM	_	1	27473	44	43263	1	27322	2	15051	1	26273	1	29840	1	27322	7	22339	215	46988	28	15624	0	1147
_	6:09:18 AM	6:05:00 PM	_	1	27287	44	44420	1	27193	2	15130	1	26314	1	30047	1	27193	7	21212	215	46920	28	16808	0	1112
_	6:09:18 AM	6:10:00 PM	_	1	27432	44	45633	1	27269	2	15080	1	26171	1	29685	1	27269	7	22828	215	46759	28	17884	0	1114
_	6:09:18 AM	6:15:00 PM	_	1	27210	44	46900	1	27201	2	15145	1	26370	1	29571	1	27201	7	23429	215	46585	28	17604	0	1114
_	6:09:18 AM	6:20:00 PM	_	1	27420	44	48047	1	27144	2	15281	1	26243	1	30030	1	27144	7	23681	215	46216	28	19025	0	1143
_	6:09:18 AM	6:25:00 PM	_	1	27441	44	49260	1	27287	2	15316	1	26339	1	29728	1	27287	7	22351	215	46364	28	18429	0	1102
_	6:09:18 AM	6:30:00 PM	_	1	27415	44	46702	1	27233	2	15283	1	26267	1	29893	1	27233	7	21763	215	45942	28	18546	0	1152
_	6:09:18 AM	6:35:00 PM	_	1	27498	44	51537	1	27135	2	15477	1	26322	1	29815	1	27135	7	24602	215	45911	28	18985	0	1106
_	6:09:18 AM	6:40:00 PM	_	1	27536	44	47715	1	27233	2	15366	1	26202	1	29962	1	27233	7	24743	215	45665	28	19444	0	1113
_	6:09:18 AM	6:45:00 PM	_	1	27514	44	53498	1	27279	2	15377	1	26358	1	29874	1	27279	7	23980	215	45459	28	19121	0	1123
_	6:09:18 AM	6:50:00 PM	_	1	27367	44	54745	1	27169	2	15369	1	26346	1	29766	1	27169	7	25312	215	45256	28	19811	0	1069
_	6:09:18 AM	6:55:00 PM	_	1	27702	44	55177	1	27274	2	15427	1	26263	1	29697	1	27274	7	24683	215	45038	28	19963	0	1154
_	6:09:18 AM	7:00:00 PM	_	1	27303	44	57783	1	27153	2	15330	1	26264	1	29689	1	27153	7	23944	215	44809	28	19726	0	1144
_	6:09:18 AM	7:05:00 PM	_	1	27315	44	57457	1	27173	2	15699	1	26356	1	29682	1	27173	7	25571	215	44498	28	20157	0	1117
_	6:09:18 AM	7:10:00 PM	_	1	27058	44	58019	1	27236	2	15565	1	26265	1	29809	1	27236	7	25581	215	44463	28	20316	0	1143
_	6:09:18 AM	7:15:00 PM	_	1	27425	44	59133	1	27205	2	15559	1	26299	1	30263	1	27205	7	24679	215	44142	28	20722	0	1125
_	6:09:18 AM	7:20:00 PM	_	1	27411	44	57927	1	27281	2	15427	1	26282	1	29812	1	27281	7	27084	215	44057	28	20976	0	1099
_	6:09:18 AM	7:25:00 PM	_	1	27451	44	57661	1	27259	2	15446	1	26258	1	29718	1	27259	7	23521	215	43519	28	21428	0	1105
_	6:09:18 AM	7:30:00 PM	_	1	27460	44	59504	1	27083	2	15493	1	26201	1	29311	1	27083	7	23805	215	43221	28	21387	0	1108
_	6:09:18 AM	7:35:00 PM	_	1	27275	44	54463	1	27152	2	15524	1	26343	1	29872	1	27152	7	25630	215	43262	28	21610	0	1128
_	6:09:18 AM	7:40:00 PM	_	1	27361	44	58740	1	27140	2	15526	1	26399	1	30005	1	27140	7	23931	215	42886	28	21871	0	1105
_	6:09:18 AM	7:45:00 PM	_	1	27204	44	58390	1	27355	2	15521	1	26330	1	30238	1	27355	7	24226	215	42508	28	20894	0	1145
_	6:09:18 AM	7:50:00 PM	_	1	27435	44	60576	1	27310	2	15746	1	26247	1	29726	1	27310	7	25180	215	42181	28	19289	0	1064

_	6:09:18 AM	7:55:00 PM	_	1	27603	44	64276	1	27185	2	15745	1	26146	1	29625	1	27185	7	23830	215	43088	28	17396	0	1138
_	6:09:18 AM	8:00:00 PM	_	1	27410	44	63086	1	27180	2	15771	1	26384	1	29733	1	27180	7	25596	215	42797	28	17733	0	1091
_	6:09:18 AM	8:05:00 PM	_	1	27352	44	63164	1	27200	2	15688	1	26199	1	29748	1	27200	7	24915	215	42450	28	18109	0	1081
_	6:09:18 AM	8:10:00 PM	_	1	27439	44	63517	1	27126	2	15478	1	26289	1	29889	1	27126	7	24593	215	42288	28	18443	0	1112
_	6:09:18 AM	8:15:00 PM	_	1	27409	44	61925	1	27195	2	17579	1	26341	1	29747	1	27195	7	23975	215	41911	28	18546	0	1118
_	6:09:18 AM	8:20:00 PM	_	1	27482	44	60139	1	27301	2	15638	1	26239	1	29758	1	27301	7	23160	215	41703	28	18673	0	1062
_	6:09:18 AM	8:25:00 PM	_	1	27326	44	61082	1	27369	2	15808	1	26380	1	29727	1	27369	7	28006	215	41180	28	19060	0	1130
_	6:09:18 AM	8:30:00 PM	_	1	27502	44	60892	1	27333	2	15725	1	26420	1	29788	1	27333	7	25301	215	41117	28	19457	0	1066
_	6:09:18 AM	8:35:00 PM	_	1	27382	44	61936	1	27191	2	15899	1	26266	1	29696	1	27191	7	31251	215	40298	28	20457	0	1091
_	6:09:18 AM	8:40:00 PM	_	1	27420	44	60584	1	27145	2	15864	1	26327	1	29881	1	27145	7	26056	215	40127	28	20750	0	1161
_	6:09:18 AM	8:45:00 PM	_	1	27473	44	61180	1	27191	2	15691	1	26243	1	29687	1	27191	7	24855	215	39828	28	20111	0	1143
_	6:09:18 AM	8:50:00 PM	_	1	27477	44	59579	1	27231	2	15934	1	26293	1	29780	1	27231	7	24108	215	39663	28	19186	0	1152
_	6:09:18 AM	8:55:00 PM	_	1	27438	45	1529	1	27216	2	16014	1	26314	1	29950	1	27216	7	34672	215	39438	28	18987	0	1089
_	6:09:18 AM	9:00:00 PM	_	1	27517	44	57377	1	27193	2	15956	1	26338	1	30050	1	27193	7	31046	215	39022	28	18976	0	1115
_	6:09:18 AM	9:05:00 PM	_	1	27498	44	35063	1	27143	2	15998	1	26251	1	29717	1	27143	7	42007	215	38721	28	18621	0	1108
_	6:09:18 AM	9:10:00 PM	_	1	27360	44	54381	1	27291	2	15966	1	26317	1	29841	1	27291	7	29821	215	38434	28	16898	0	1054
_	6:09:18 AM	9:15:00 PM	_	1	27403	44	58896	1	27140	2	16154	1	26272	1	29853	1	27140	7	32052	215	38026	28	15449	0	1095
_	6:09:18 AM	9:20:00 PM	_	1	27376	44	60049	1	27250	2	15953	1	26316	1	29924	1	27250	7	30730	215	37892	28	14104	0	1109
_	6:09:18 AM	9:25:00 PM	_	1	27390	44	54560	1	27168	2	16001	1	26304	1	29891	1	27168	7	29027	215	37504	28	12987	0	1065
_	6:09:18 AM	9:30:00 PM	_	1	27407	44	56851	1	27215	2	15978	1	26232	1	30045	1	27215	7	30047	215	37053	28	13409	0	1090
_	6:09:18 AM	9:35:00 PM	_	1	27379	44	58186	1	27286	2	16003	1	26313	1	29748	1	27286	7	29542	215	37029	28	12419	0	1126
_	6:09:18 AM	9:40:00 PM	_	1	27473	44	51470	1	27183	2	16106	1	26378	1	30173	1	27183	7	29028	215	36643	28	10633	0	1146
_	6:09:18 AM	9:45:00 PM	_	1	27484	44	60208	1	27224	2	16176	1	26302	1	29985	1	27224	7	30358	215	36153	28	8397	0	1092
_	6:09:18 AM	9:50:00 PM	_	1	27411	44	61855	1	27152	2	16104	1	26262	1	30105	1	27152	7	30020	215	35813	28	6479	0	1105
_	6:09:18 AM	9:55:00 PM	_	1	27267	44	62970	1	27405	2	16060	1	26150	1	29741	1	27405	7	31403	215	35670	28	5216	0	1121
_	6:09:18 AM	10:00:00 PM	_	1	27237	44	63311	1	27199	2	16314	1	26238	1	29892	1	27199	7	33516	215	35247	28	3848	0	1134
_	6:09:18 AM	10:05:00 PM	_	1	27224	44	64117	1	27282	2	15995	1	26198	1	29949	1	27282	7	41271	215	34762	28	1845	0	1138
_	6:09:18 AM	10:10:00 PM	_	1	27228	45	2494	1	27368	2	16285	1	26333	1	29820	1	27368	7	38438	215	34600	27	64990	0	1098
_	6:09:18 AM	10:15:00 PM	_	1	27548	45	674	1	27210	2	16923	1	26289	1	29888	1	27210	7	35524	215	34228	27	63434	0	1085
_	6:09:18 AM	10:20:00 PM	_	1	27136	45	3891	1	27299	2	16402	1	26313	1	30111	1	27299	7	34540	215	33462	27	61059	0	1150
_	6:09:18 AM	10:25:00 PM	_	1	27576	45	7247	1	27356	2	16226	1	26340	1	30125	1	27356	7	34181	215	33195	27	58882	0	1129
_	6:09:18 AM	10:30:00 PM	_	1	27581	45	8179	1	27154	2	16230	1	26349	1	29937	1	27154	7	32564	215	32884	27	56580	0	1073
_	6:09:18 AM	10:35:00 PM	_	1	27426	45	11002	1	27259	2	16461	1	26252	1	29895	1	27259	7	37006	215	32533	27	54516	0	1082
_	6:09:18 AM	10:40:00 PM	_	1	27484	45	12009	1	27105	2	16454	1	26267	1	29999	1	27105	7	38170	215	32034	27	52295	0	1094
_	6:09:18 AM	10:45:00 PM	_	1	27489	45	13842	1	27274	2	16490	1	26355	1	29989	1	27274	7	36073	215	31489	27	49383	0	1109
_	6:09:18 AM	10:50:00 PM	_	1	27761	45	15124	1	27241	2	16337	1	26290	1	30124	1	27241	7	38243	215	31190	27	46867	0	1130
_	6:09:18 AM	10:55:00 PM	_	1	27513	45	16132	1	27126	2	16563	1	26354	1	29909	1	27126	7	35138	215	30755	27	44062	0	1068
_	6:09:18 AM	11:00:00 PM	_	1	27479	45	18792	1	27239	2	16646	1	26448	1	30003	1	27239	7	41467	215	30315	27	42304	0	1096
_	6:09:18 AM	11:05:00 PM	_	1	27331	45	19062	1	27142	2	16603	1	26215	1	30000	1	27142	7	43592	215	29832	27	40347	0	1064
_	6:09:18 AM	11:10:00 PM	_	1	27340	45	23444	1	27026	2	16665	1	26436	1	29921	1	27026	7	38263	215	29583	27	38831	0	1136
_	6:09:18 AM	11:15:00 PM	_	1	27421	45	24443	1	27231	2	16551	1	26208	1	30033	1	27231	7	38078	215	28945	27	36584	0	1110
_	6:09:18 AM	11:20:00 PM	_	1	27355	45	25720	1	27143	2	16610	1	26313	1	30526	1	27143	7	39027	215	28741	27	34580	0	1132
_	6:09:18 AM	11:25:00 PM	_	1	27556	45	22886	1	27168	2	16791	1	26264	1	30036	1	27168	7	39729	215	27947	27	32460	0	1143
_	6:09:18 AM	11:30:00 PM	_	1	27282	45	21721	1	27254	2	16765	1	26249	1	30350	1	27254	7	4533	215	27503	27	30274	0	1107
_	6:09:18 AM	11:35:00 PM	_	1	27487	45	28747	1	27181	2	16647	1	26298	1	29960	1	27181	7	36690	215	27067	27	27564	0	1099
_	6:09:18 AM	11:40:01 PM	_	1	27219	45	23391	1	27138	2	17040	1	26237	1	29992	1	27138	7	38394	215	26522	27	26179	0	1122
_	6:09:18 AM	11:45:00 PM	_	1	27497	45	31385	1	27256	2	16611	1	26283	1	30061	1	27256	7	37236	215	26436	27	24207	0	1154
_	6:09:18 AM	11:50:00 PM	_	1	27511	45	29765	1	27315	2	16702	1	26330	1	30106	1	27315	7	34301	215	25882	27	21884	0	1091
_	6:09:18 AM	11:55:01 PM	_	1	27276	45	35332	1	27151	2	16809	1	26382	1	30249	1	27151	7	37281	215	25486	27	20488	0	1120
_	7:09:18 AM	12:00:00 AM	_	1	27468	45	35925	1	27113	2	16979	1	26241	1	29981	1	27113	7	36661	215	25105	27	17255	0	1088
_	7:09:18 AM	12:10:00 AM	_	1	27367	45	39658	1	27188	2	16937	1	26327	1	30163	1	27188	7	36318	215	22539	27	11256	0	1057
_	7:09:18 AM	12:15:01 AM	_	1	27468	45	41144	1	27143	2	16791	1	26332	1	29972	1	27143	7	31302	215	22504	27	7310	0	1119
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_	7:09:18 AM	12:30:01 AM	_	1	27399	45	45342	1	27356	2	16813	1	26311	1	30723	1	27356	7	30274	215	21447	27	795	0	1079
_	7:09:18 AM	12:35:00 AM	_	1	27409	45	43911	1	27206	2	16734	1	26318	1	30124	1	27206	7	29827	215	20822	26	65402	0	1126
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_	7:09:18 AM	12:50:01 AM	_	1	27324	45	47899	1	27339	2	16888	1	26262	1	30385	1	27339	7	33224	215	19496	26	57114	0	1103
_	7:09:18 AM	12:55:01 AM	_	1	27516	45	51345	1	27226	2	16802	1	26322	1	30246	1	27226	7	33764	215	19067	26	53708	0	1072
_	7:09:18 AM	1:00:01 AM	_	1	27389	45	55221	1	27226	2	16813	1	26354	1	30012	1	27226	7	34433	215	18740	26	50914	0	1116
_	7:09:18 AM	1:05:01 AM	_	1	27161	45	56883	1	27244	2	17018	1	26268	1	30461	1	27244	7	34236	215	18472	26	50541	0	1076
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_	7:09:18 AM	1:25:01 AM	_	1	27344	45	63594	1	27168	2	17037	1	26241	1	30440	1	27168	7	38904	215	16336	26	44327	0	1045
_	7:09:18 AM	1:30:01 AM	_	1	27321	46	207	1	27192	2	17141	1	26302	1	30278	1	27192	7	38728	215	15937	26	42820	0	1132
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_	7:09:18 AM	1:40:01 AM	_	1	27266	46	5867	1	27134	2	17214	1	26331	1	30340	1	27134	7	38891	215	15154	26	39483	0	996
_	7:09:18 AM	1:45:01 AM	_	1	27370	46	4945	1	27234	2	17149	1	26394	1	30374	1	27234	7	34807	215	14613	26	37135	0	1071
_	7:09:18 AM	1:50:01 AM	_	1	27409	46	8024	1	27200	2	17695	1	26289	1	30276	1	27200	7	39552	215	14254	26	34989	0	1102
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_	7:09:18 AM	2:00:01 AM	_	1	27533	46	13146	1	27201	2	17288	1	26409	1	30311	1	27201	7	36108	215	13310	26	30385	0	1135
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_	7:09:18 AM	2:10:01 AM	_	1	27509	46	18030	1	27156	2	17304	1	26271	1	30214	1	27156	7	40103	215	12412	26	25068	0	1058
_	7:09:18 AM	2:15:01 AM	_	1	27477	46	22103	1	27185	2	17369	1	26433	1	30174	1	27185	7	38654	215	12268	26	21166	0	1173
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_	7:09:18 AM	2:45:01 AM	_	1	27294	46	34399	1	27144	2	17600	1	26375	1	30438	1	27144	7	42059	215	9547	26	4293	0	1182
_	7:09:18 AM	2:50:01 AM	_	1	27447	46	35400	1	27131	2	17602	1	26408	1	30321	1	27131	7	39621	215	8988	26	2624	0	1092
_	7:09:18 AM	2:55:01 AM	_	1	27546	46	37472	1	27180	2	17646	1	26316	1	30302	1	27180	7	42593	215	8621	26	913	0	1118
_	7:09:18 AM	3:00:01 AM	_	1	27369	46	39480	1	27111	2	17646	1	26333	1	30465	1	27111	7	41622	215	8526	25	63673	0	1117
_	7:09:18 AM	3:05:01 AM	_	1	27744	46	40816	1	27280	2	17589	1	26291	1	30587	1	27280	7	43291	215	8138	25	61825	0	1075
_	7:09:18 AM	3:10:01 AM	_	1	27377	46	43221	1	27272	2	17736	1	26294	1	30502	1	27272	7	43673	215	7532	25	58924	0	1160
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_	7:09:18 AM	3:20:01 AM	_	1	27550	46	46821	1	27274	2	17849	1	26241	1	30675	1	27274	7	44568	215	6678	25	51564	0	1119
_	7:09:18 AM	3:25:01 AM	_	1	27501	46	47915	1	27253	2	17772	1	26310	1	30519	1	27253	7	42250	215	6397	25	48506	0	1103
_	7:09:18 AM	3:30:01 AM	_	1	27502	46	49902	1	27229	2	17681	1	26223	1	30374	1	27229	7	46876	215	5927	25	45585	0	1040
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_	7:09:18 AM	3:40:01 AM	_	1	27338	46	51159	1	27265	2	17634	1	26283	1	30700	1	27265	7	46826	215	5146	25	40394	0	1151
_	7:09:18 AM	3:45:01 AM	_	1	27466	46	54437	1	27184	2	17696	1	26184	1	30467	1	27184	7	46453	215	4836	25	36934	0	1123
_	7:09:18 AM	3:50:01 AM	_	1	27472	46	56206	1	27237	2	17841	1	26342	1	30667	1	27237	7	45888	215	4287	25	33668	0	1113
_	7:09:18 AM	3:55:01 AM	_	1	27559	46	56933	1	27167	2	17701	1	26323	1	30552	1	27167	7	45972	215	3743	25	30758	0	1074
_	7:09:18 AM	4:00:01 AM	_	1	27277	46	59472	1	27177	2	17803	1	26342	1	30464	1	27177	7	44760	215	3562	25	29073	0	1117
_	7:09:18 AM	4:05:01 AM	_	1	27485	46	58664	1	27262	2	17929	1	26373	1	30675	1	27262	7	49003	215	2381	25	28252	0	1078
_	7:09:18 AM	4:10:01 AM	_	1	27389	46	62719	1	27275	2	17560	1	26199	1	30396	1	27275	7	46474	215	2464	25	27479	0	1114
_	7:09:18 AM	4:15:01 AM	_	1	27290	47	70	1	27180	2	17996	1	26330	1	30401	1	27180	7	46954	215	2162	25	24478	0	1115
_	7:09:18 AM	4:20:01 AM	_	1	27414	46	65531	1	27308	2	17836	1	26345	1	30788	1	27308	7	49162	215	1471	25	21903	0	1109
_	7:09:18 AM	4:25:01 AM	_	1	27514	47	2973	1	27221	2	17939	1	26367	1	30572	1	27221	7	51586	215	1153	25	18650	0	1064
_	7:09:18 AM	4:30:01 AM	_	1	27406	47	5664	1	27169	2	18029	1	26293	1	30679	1	27169	7	51465	215	656	25	16927	0	1116
_	7:09:18 AM	4:35:01 AM	_	1	27480	47	11587	1	27163	2	18076	1	26334	1	30512	1	27163	7	50199	215	186	25	15406	0	1151
_	7:09:18 AM	4:40:01 AM	_	1	27487	47	14711	1	27240	2	18002	1	26368	1	30713	1	27240	7	52853	214	65197	25	11743	0	1157
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_	7:09:18 AM	4:50:01 AM	_	1	27313	47	22026	1	27284	2	18141	1	26307	1	30712	1	27284	7	52317	214	64221	25	7604	0	1124
_	7:09:18 AM	4:55:01 AM	_	1	27457	47	24331	1	27100	2	18419	1	26257	1	30616	1	27100	7	54986	214	64296	25	5873	0	1108
_	7:09:18 AM	5:00:01 AM	_	1	27463	47	29981	1	27228	2	18117	1	26392	1	30636	1	27228	7	57848	214	63537	25	3279	0	1112
_	7:09:18 AM	5:05:01 AM	_	1	27452	47	33563	1	27153	2	18357	1	26316	1	30778	1	27153	7	57887	214	63200	25	1063	0	1089
_	7:09:18 AM	5:10:01 AM	_	1	27629	47	36885	1	27075	2	18394	1	26291	1	30727	1	27075	7	58129	214	62362	24	64120	0	1136
_	7:09:18 AM	5:15:01 AM	_	1	27613	47	40754	1	27197	2	18492	1	26223	1	30869	1	27197	7	56724	214	62686	24	60852	0	1149
_	7:09:18 AM	5:20:01 AM	_	1	27264	47	45068	1	27147	2	18524	1	26299	1	30586	1	27147	7	63362	214	62073	24	55700	0	1089
_	7:09:18 AM	5:25:01 AM	_	1	27278	47	51056	1	27176	2	18657	1	26278	1	31511	1	27176	7	60842	214	61367	24	56409	0	1120
_	7:09:18 AM	5:30:01 AM	_	1	27369	47	56286	1	27231	2	18666	1	26192	1	30699	1	27231	7	64605	214	61246	24	57755	0	1132
_	7:09:18 AM	5:35:01 AM	_	1	27492	47	59496	1	27250	2	18819	1	26269	1	30862	1	27250	7	62655	214	60426	24	56328	0	1128
_	7:09:18 AM	5:40:01 AM	_	1	27389	47	65218	1	27241	2	18886	1	26328	1	31037	1	27241	7	64195	214	60028	24	55134	0	1061
_	7:09:18 AM	5:45:01 AM	_	1	27324	48	3681	1	27133	2	18972	1	26358	1	31202	1	27133	7	65146	214	59806	24	54498	0	1134
_	7:09:18 AM	5:50:01 AM	_	1	27458	48	8249	1	27110	2	19358	1	26499	1	30998	1	27110	8	3722	214	58976	24	53540	0	1151
_	7:09:18 AM	5:55:01 AM	_	1	27623	48	11782	1	27135	2	19166	1	26326	1	31078	1	27135	7	65413	214	58257	24	52740	0	1137
_	7:09:18 AM	6:00:01 AM	_	1	27201	48	15352	1	27296	2	19310	1	26289	1	30974	1	27296	8	2560	214	58211	24	51334	0	1148
_	7:09:18 AM	6:05:01 AM	_	1	27504	48	19805	1	27144	2	19272	1	26292	1	31252	1	27144	8	7924	214	57892	24	50324	0	1155
_	7:09:18 AM	6:10:01 AM	_	1	27395	48	25135	1	27270	2	19346	1	26347	1	31093	1	27270	8	1943	214	57619	24	51604	0	1161
_	7:09:18 AM	6:15:01 AM	_	1	27624	48	24876	1	27049	2	19497	1	26335	1	31337	1	27049	8	9948	214	57013	24	54382	0	1124
_	7:09:18 AM	6:20:01 AM	_	1	27147	48	30796	1	27213	2	19608	1	26273	1	31198	1	27213	8	11889	214	56685	24	57204	0	1083
_	7:09:18 AM	6:25:01 AM	_	1	27394	48	31192	1	27191	2	19781	1	26261	1	31315	1	27191	8	11343	214	55935	24	59578	0	1122
_	7:09:18 AM	6:30:01 AM	_	1	27499	48	34349	1	27257	2	19802	1	26256	1	31294	1	27257	8	14273	214	55765	24	61199	0	1114
_	7:09:18 AM	6:35:01 AM	_	1	27409	48	35880	1	27165	2	19740	1	26258	1	31100	1	27165	8	11340	214	55458	24	62542	0	1079
_	7:09:18 AM	6:40:01 AM	_	1	27285	48	39773	1	27147	2	20005	1	26302	1	31761	1	27147	8	12373	214	54818	24	64016	0	1186
_	7:09:18 AM	6:45:01 AM	_	1	27490	48	42566	1	27200	2	19938	1	26320	1	31187	1	27200	8	11543	214	54513	25	375	0	1119
_	7:09:18 AM	6:50:01 AM	_	1	27666	48	46904	1	27218	2	20082	1	26307	1	31614	1	27218	8	12845	214	54087	25	2290	0	1130
_	7:09:18 AM	6:55:01 AM	_	1	27305	48	52289	1	27172	2	20090	1	26316	1	31429	1	27172	8	13636	214	54165	25	3660	0	1113
_	7:09:18 AM	7:00:01 AM	_	1	27646	48	58093	1	27215	2	20493	1	26303	1	31426	1	27215	8	14162	214	53733	25	5310	0	1084
_	7:09:18 AM	7:05:01 AM	_	1	27344	48	61862	1	27108	2	20426	1	26324	1	31422	1	27108	8	14717	214	53086	25	7129	0	1093
_	7:09:18 AM	7:10:01 AM	_	1	27312	49	9060	1	27174	2	20586	1	26201	1	31530	1	27174	8	15447	214	52982	25	8992	0	1126
_	7:09:18 AM	7:15:01 AM	_	1	27243	49	10826	1	27156	2	20645	1	26292	1	31623	1	27156	8	19433	214	52734	25	11239	0	1091
_	7:09:18 AM	7:20:01 AM	_	1	27341	49	17255	1	27270	2	20820	1	26304	1	31734	1	27270	8	18485	214	52303	25	11568	0	1104
_	7:09:18 AM	7:25:01 AM	_	1	27431	49	25924	1	27184	2	20743	1	26361	1	31395	1	27184	8	18603	214	52401	25	11192	0	1174
_	7:09:18 AM	7:30:01 AM	_	1	27409	49	32080	1	27256	2	20932	1	26311	1	31655	1	27256	8	19745	214	52091	25	10064	0	1083
_	7:09:18 AM	7:35:01 AM	_	1	27223	49	40785	1	27305	2	21415	1	26345	1	31925	1	27305	8	22399	214	52078	25	8873	0	1076
_	7:09:18 AM	7:40:01 AM	_	1	27557	49	36085	1	27148	2	21231	1	26333	1	31923	1	27148	8	40840	214	51887	25	8766	0	1053
_	7:09:18 AM	7:45:01 AM	_	1	27371	49	31484	1	27098	2	21450	1	26300	1	31809	1	27098	8	52665	214	51345	25	3000	0	1109
_	7:09:18 AM	7:50:01 AM	_	1	27596	49	34464	1	27226	2	21703	1	26429	1	32392	1	27226	8	56297	214	51248	25	8584	0	1115
_	7:09:18 AM	7:55:01 AM	_	1	27331	49	37382	1	27093	2	21608	1	26221	1	32168	1	27093	8	39050	214	51111	25	12331	0	1085
_	7:09:18 AM	8:00:01 AM	_	1	27547	49	49732	1	27230	2	21560	1	26338	1	31793	1	27230	8	40972	214	50849	25	15903	0	1130
_	7:09:18 AM	8:05:01 AM	_	1	27408	49	55117	1	27145	2	21584	1	26312	1	31835	1	27145	8	37271	214	50539	25	18132	0	1121
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_	7:09:18 AM	8:20:01 AM	_	1	26955	50	3175	1	27126	2	22088	1	26361	1	32192	1	27126	8	34159	214	49793	25	22862	0	1120
_	7:09:18 AM	8:25:01 AM	_	1	27529	50	6853	1	27286	2	21892	1	26345	1	32356	1	27286	8	25496	214	49777	25	23946	0	1096
_	7:09:18 AM	8:30:01 AM	_	1	27605	50	12199	1	27265	2	22247	1	26368	1	32739	1	27265	8	27457	214	49706	25	23410	0	1118
_	7:09:18 AM	8:35:01 AM	_	1	27546	50	11608	1	27164	2	22209	1	26223	1	32541	1	27164	8	29418	214	49335	25	23167	0	1116
_	7:09:18 AM	8:40:01 AM	_	1	27267	50	18113	1	27148	2	22187	1	26318	1	32707	1	27148	8	26163	214	48998	25	23246	0	1120
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_	7:09:18 AM	8:50:01 AM	_	1	27324	50	17844	1	27270	2	22204	1	26371	1	32576	1	27270	8	26962	214	48617	25	24983	0	1116
_	7:09:18 AM	8:55:01 AM	_	1	27281	50	21630	1	27152	2	22169	1	26339	1	32548	1	27152	8	23220	214	48496	25	27440	0	1118
_	7:09:18 AM	9:00:01 AM	_	1	27372	50	21172	1	27246	2	22411	1	26400	1	32757	1	27246	8	29900	214	48409	25	26829	0	1085
_	7:09:18 AM	9:05:01 AM	_	1	27221	50	23656	1	26995	2	22273	1	26366	1	32793	1	26995	8	26413	214	48183	25	25545	0	1172
_	7:09:18 AM	9:10:01 AM	_	1	27402	50	28428	1	27293	2	22537	1	26273	1	32166	1	27293	8	24304	214	47914	25	28025	0	1074
_	7:09:18 AM	9:15:01 AM	_	1	27532	50	31726	1	27249	2	22609	1	26291	1	32740	1	27249	8	24121	214	47733	25	30662	0	1133
_	7:09:18 AM	9:20:01 AM	_	1	27406	50	35360	1	27172	2	22663	1	26306	1	32435	1	27172	8	27332	214	47714	25	30703	0	1151
_	7:09:18 AM	9:25:01 AM	_	1	27379	50	37623	1	27060	2	22489	1	26285	1	32389	1	27060	8	22244	214	47294	25	32384	0	1145
_	7:09:18 AM	9:30:01 AM	_	1	27344	50	37499	1	27216	2	22857	1	26246	1	33028	1	27216	8	35688	214	47351	25	26883	0	1056
_	7:09:18 AM	9:35:01 AM	_	1	27359	50	42213	1	27083	2	22738	1	26289	1	32660	1	27083	8	26259	214	47002	25	23590	0	1156
_	7:09:18 AM	9:40:01 AM	_	1	27395	50	43371	1	27177	2	22687	1	26321	1	32569	1	27177	8	26914	214	47023	25	26294	0	1054
_	7:09:18 AM	9:45:01 AM	_	1	27404	50	35331	1	27090	2	22807	1	26245	1	33548	1	27090	8	23560	214	46449	25	33395	0	1143
_	7:09:18 AM	9:50:01 AM	_	1	27385	50	41055	1	27244	2	23093	1	26262	1	32661	1	27244	8	33444	214	46394	25	36263	0	1083
_	7:09:18 AM	9:55:01 AM	_	1	27550	50	48637	1	27152	2	22976	1	26249	1	32775	1	27152	8	17753	214	45968	25	38842	0	1124
_	7:09:18 AM	10:00:01 AM	_	1	27395	50	47284	1	27176	2	22949	1	26264	1	32575	1	27176	8	13117	214	45878	25	43559	0	1126
_	7:09:18 AM	10:05:01 AM	_	1	27425	50	51727	1	27069	2	23091	1	26345	1	32534	1	27069	8	13177	214	45762	25	48489	0	1141
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_	7:09:18 AM	10:20:01 AM	_	1	27322	50	59578	1	27228	2	23248	1	26284	1	32497	1	27228	8	11261	214	45198	25	59730	0	1134
_	7:09:18 AM	10:25:01 AM	_	1	27524	50	61376	1	27191	2	23230	1	26357	1	32439	1	27191	8	7480	214	44770	25	62715	0	1113
_	7:09:18 AM	10:30:01 AM	_	1	27456	51	11754	1	27274	2	23584	1	26208	1	32923	1	27274	8	15266	214	44689	26	974	0	1118
_	7:09:18 AM	10:35:01 AM	_	1	27370	51	21492	1	27246	2	23853	1	26342	1	32910	1	27246	8	13933	214	44766	25	63804	0	1110
_	7:09:18 AM	10:40:01 AM	_	1	27310	51	22811	1	27230	2	24045	1	26323	1	32845	1	27230	8	16570	214	44756	26	949	0	1132
_	7:09:18 AM	10:45:01 AM	_	1	27403	51	23820	1	27234	2	24073	1	26378	1	32758	1	27234	8	17492	214	44797	26	12016	0	1052
_	7:09:18 AM	10:50:01 AM	_	1	27198	51	25847	1	27126	2	23955	1	26314	1	32718	1	27126	8	8318	214	44554	26	14744	0	1086
_	7:09:18 AM	10:55:01 AM	_	1	27412	51	13528	1	27185	2	24016	1	26257	1	32856	1	27185	8	6164	214	44422	26	9682	0	1113
_	7:09:18 AM	11:00:01 AM	_	1	27590	51	15055	1	27179	2	23814	1	26285	1	33086	1	27179	8	6424	214	44466	26	9312	0	1090
_	7:09:18 AM	11:05:01 AM	_	1	27319	51	9996	1	27118	2	23808	1	26279	1	32694	1	27118	8	8453	214	44367	26	13536	0	1089
_	7:09:18 AM	11:10:01 AM	_	1	27482	51	5566	1	27251	2	23759	1	26308	1	32927	1	27251	8	4516	214	44401	26	12986	0	1127
_	7:09:18 AM	11:15:01 AM	_	1	27401	51	1411	1	27173	2	23575	1	26339	1	32805	1	27173	8	6687	214	44380	26	12652	0	1117

_	7:09:18 AM	11:20:01 AM	_	1	27441	50	60801	1	27166	2	23662	1	26368	1	32752	1	27166	8	6277	214	44152	26	14777	0	1076
_	7:09:18 AM	11:25:01 AM	_	1	27354	50	57359	1	27241	2	23380	1	26438	1	32521	1	27241	8	11713	214	43662	26	15239	0	1139
_	7:09:18 AM	11:30:01 AM	_	1	27676	50	57239	1	27133	2	23410	1	26342	1	32579	1	27133	8	5649	214	44184	26	16074	0	1097
_	7:09:18 AM	11:35:01 AM	_	1	27630	50	51968	1	27239	2	23267	1	26318	1	32468	1	27239	8	5253	214	43947	26	13783	0	1149
_	7:09:18 AM	11:40:01 AM	_	1	27278	50	53206	1	27092	2	23457	1	26150	1	32840	1	27092	8	11999	214	43927	26	19113	0	1125
_	7:09:18 AM	11:45:01 AM	_	1	27225	50	50907	1	27229	2	23395	1	26379	1	32140	1	27229	8	8524	214	43700	26	16611	0	1120
_	7:09:18 AM	11:50:01 AM	_	1	27333	50	51312	1	27237	2	23379	1	26280	1	32536	1	27237	8	12241	214	43285	26	18888	0	1105
_	7:09:18 AM	11:55:01 AM	_	1	27587	50	52560	1	27200	2	23384	1	26296	1	32882	1	27200	8	10655	214	43298	26	19336	0	1141
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_	7:09:18 AM	12:05:01 PM	_	1	27453	50	55712	1	27259	2	23540	1	26284	1	32900	1	27259	8	13886	214	42854	26	20802	0	1093
_	7:09:18 AM	12:10:01 PM	_	1	27358	50	56483	1	27241	2	23622	1	26218	1	32647	1	27241	8	15851	214	42674	26	20391	0	1110
_	7:09:18 AM	12:15:01 PM	_	1	27545	50	58042	1	27173	2	23707	1	26173	1	32559	1	27173	8	16554	214	42431	26	23006	0	1094
_	7:09:18 AM	12:20:01 PM	_	1	27513	50	61919	1	27247	2	23687	1	26296	1	32606	1	27247	8	15288	214	42078	26	20410	0	1092
_	7:09:18 AM	12:25:01 PM	_	1	27396	50	62877	1	27245	2	23819	1	26289	1	32494	1	27245	8	15202	214	41795	26	27026	0	1113
_	7:09:18 AM	12:30:01 PM	_	1	27395	51	1614	1	27285	2	23814	1	26352	1	32798	1	27285	8	14705	214	41700	26	29023	0	1118
_	7:09:18 AM	12:35:01 PM	_	1	27391	51	3442	1	27233	2	24001	1	26434	1	32495	1	27233	8	17408	214	41476	26	34588	0	1099
_	7:09:18 AM	12:40:01 PM	_	1	27401	51	4177	1	27174	2	23858	1	26396	1	32599	1	27174	8	12779	214	41338	26	37050	0	1119
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_	7:09:18 AM	12:50:01 PM	_	1	27324	51	7528	1	27205	2	24132	1	26338	1	32239	1	27205	8	16208	214	40952	26	40711	0	1106
_	7:09:18 AM	12:55:01 PM	_	1	27466	51	6095	1	27326	2	24218	1	26403	1	32381	1	27326	8	10907	214	40629	26	40396	0	1097
_	7:09:18 AM	1:00:01 PM	_	1	27380	51	9887	1	27202	2	24098	1	26349	1	32279	1	27202	8	8267	214	40639	26	40680	0	1074
_	7:09:18 AM	1:05:01 PM	_	1	27407	51	8214	1	27254	2	24358	1	26328	1	32311	1	27254	8	16615	214	40255	26	43853	0	1112
_	7:09:18 AM	1:10:01 PM	_	1	27482	51	11384	1	27171	2	24333	1	26448	1	32425	1	27171	8	13132	214	39898	26	39772	0	1050
_	7:09:18 AM	1:15:00 PM	_	1	27487	51	12459	1	27208	2	24306	1	26281	1	32385	1	27208	8	17730	214	39841	26	45956	0	1116
_	7:09:18 AM	1:20:01 PM	_	1	27644	51	12529	1	27279	2	24250	1	26183	1	32188	1	27279	8	18288	214	39637	26	48149	0	997
_	7:09:18 AM	1:25:01 PM	_	1	27425	51	12805	1	27088	2	24415	1	26250	1	32346	1	27088	8	19921	214	39570	26	47599	0	1115
_	7:09:18 AM	1:30:01 PM	_	1	27306	51	16058	1	27293	2	24405	1	26300	1	32237	1	27293	8	20255	214	39128	26	44492	0	1036
_	7:09:18 AM	1:35:00 PM	_	1	27307	51	21239	1	27253	2	24478	1	26201	1	32321	1	27253	8	14763	214	39331	26	42966	0	1100
_	7:09:18 AM	1:40:01 PM	_	1	27367	51	24040	1	27233	2	24711	1	26317	1	32143	1	27233	8	15726	214	39060	26	42725	0	1078
_	7:09:18 AM	1:45:00 PM	_	1	27218	51	26502	1	27178	2	24717	1	26315	1	32085	1	27178	8	21662	214	38771	26	38555	0	1153
_	7:09:18 AM	1:50:01 PM	_	1	27273	51	34647	1	27220	2	24798	1	26231	1	31903	1	27220	8	24774	214	38408	26	45375	0	1066
_	7:09:18 AM	1:55:00 PM	_	1	27307	51	36271	1	27181	2	24763	1	26320	1	32189	1	27181	8	23679	214	38231	26	49368	0	1124
_	7:09:18 AM	2:00:01 PM	_	1	27439	51	37836	1	27170	2	25064	1	26283	1	32237	1	27170	8	19497	214	38196	26	49847	0	1130
_	7:09:18 AM	2:05:00 PM	_	1	27239	51	38341	1	27195	2	24692	1	26222	1	31999	1	27195	8	25290	214	37851	26	49883	0	1132
_	7:09:18 AM	2:10:00 PM	_	1	27299	51	37464	1	27267	2	25095	1	26276	1	32299	1	27267	8	21559	214	37672	26	53941	0	1101
_	7:09:18 AM	2:15:00 PM	_	1	27415	51	51461	1	27354	2	24952	1	26443	1	32271	1	27354	8	26750	214	37800	26	55796	0	1094
_	7:09:18 AM	2:20:00 PM	_	1	27478	51	56606	1	27261	2	25179	1	26285	1	31982	1	27261	8	25993	214	37588	26	57705	0	1017
_	7:09:18 AM	2:25:01 PM	_	1	27465	51	63222	1	27136	2	25493	1	26398	1	32251	1	27136	8	33010	214	37015	26	49840	0	1046
_	7:09:18 AM	2:30:00 PM	_	1	27371	52	4448	1	27173	2	25467	1	26332	1	32264	1	27173	8	28439	214	36779	26	54664	0	1132
_	7:09:18 AM	2:35:00 PM	_	1	27204	52	5004	1	27122	2	25392	1	26354	1	32543	1	27122	8	30262	214	36829	26	52971	0	1154
_	7:09:18 AM	2:40:00 PM	_	1	27499	52	10385	1	27130	2	25620	1	26190	1	32308	1	27130	8	29741	214	36457	26	57221	0	1093
_	7:09:18 AM	2:45:00 PM	_	1	27606	52	15617	1	27178	2	25606	1	26168	1	32166	1	27178	8	41545	214	36191	26	56911	0	1129
_	7:09:18 AM	2:50:01 PM	_	1	27518	46	56812	1	27126	2	25590	1	26329	1	32824	1	27126	15	55935	214	36088	26	53617	0	1139
_	7:09:18 AM	2:55:00 PM	_	1	27438	50	55031	1	27161	2	25692	1	26379	1	32247	1	27161	10	5687	214	36029	26	52117	0	1099
_	7:09:18 AM	3:00:00 PM	_	1	27533	52	3061	1	27292	2	25941	1	26339	1	32541	1	27292	9	41249	214	36127	26	51148	0	1110
_	7:09:18 AM	3:05:00 PM	_	1	27369	52	3777	1	27050	2	26246	1	26351	1	32414	1	27050	9	14250	214	35528	26	55154	0	1127
_	7:09:18 AM	3:10:00 PM	_	1	27343	52	14247	1	27142	2	26012	1	26273	1	32247	1	27142	9	3217	214	35024	26	60724	0	1157
_	7:09:18 AM	3:15:01 PM	_	1	27239	52	25322	1	27083	2	26344	1	26222	1	32484	1	27083	9	7775	214	34771	26	59792	0	1177
_	7:09:18 AM	3:20:01 PM	_	1	27446	52	32367	1	27015	2	26073	1	26304	1	32515	1	27015	9	3110	214	34646	26	63703	0	1131
_	7:09:18 AM	3:25:01 PM	_	1	27478	52	29687	1	27329	2	26118	1	26300	1	32246	1	27329	8	49015	214	34158	26	65285	0	1090
_	7:09:18 AM	3:30:00 PM	_	1	27309	52	36152	1	27233	2	26260	1	26286	1	32455	1	27233	8	60496	214	34198	27	348	0	1096
_	7:09:18 AM	3:35:00 PM	_	1	27626	52	36864	1	27252	2	26215	1	26180	1	32097	1	27252	8	42722	214	33696	27	1797	0	1074
_	7:09:18 AM	3:40:01 PM	_	1	27466	52	37107	1	27115	2	26348	1	26279	1	32515	1	27115	8	46338	214	33426	27	5700	0	1061
_	7:09:18 AM	3:45:00 PM	_	1	27367	52	41415	1	27183	2	26241	1	26328	1	32407	1	27183	8	46478	214	33144	27	8708	0	1033
_	7:09:18 AM	3:50:00 PM	_	1	27510	52	41198	1	27189	2	26482	1	26283	1	32237	1	27189	8	45979	214	32555	27	10309	0	1108
_	7:09:18 AM	3:55:00 PM	_	1	27453	52	48532	1	27163	2	26657	1	26274	1	32113	1	27163	8	41328	214	32731	27	12494	0	1122
_	7:09:18 AM	4:00:01 PM	_	1	27282	52	41667	1	27112	2	26449	1	26395	1	32081	1	27112	8	37830	214	32382	27	14925	0	1041
_	7:09:18 AM	4:05:00 PM	_	1	27614	52	50473	1	27309	2	26529	1	26364	1	32361	1	27309	8	38211	214	32231	27	13132	0	1051
_	7:09:18 AM	4:10:00 PM	_	1	27406	52	50705	1	27115	2	26550	1	26231	1	32048	1	27115	8	33778	214	31866	27	15951	0	1059
_	7:09:18 AM	4:15:00 PM	_	1	27453	52	46350	1	27164	2	26533	1	26346	1	32293	1	27164	8	35406	214	31650	27	18569	0	1071
_	7:09:18 AM	4:20:00 PM	_	1	27478	52	47549	1	27204	2	26448	1	26342	1	32043	1	27204	8	36877	214	31520	27	20010	0	1082
_	7:09:18 AM	4:25:00 PM	_	1	27438	52	49408	1	27140	2	26428	1	26319	1	31916	1	27140	8	38918	214	31031	27	20721	0	1145
_	7:09:18 AM	4:30:00 PM	_	1	27321	52	48721	1	27295	2	26261	1	26302	1	31589	1	27295	8	35844	214	31249	27	21551	0	1078
_	7:09:18 AM	4:35:01 PM	_	1	27445	52	46602	1	27197	2	26538	1	26239	1	32152	1	27197	8	33088	214	30502	27	22290	0	1137
_	7:09:18 AM	4:40:00 PM	_	1	27431	52	43762	1	27198	2	26168	1	26264	1	31731	1	27198	8	36713	214	30549	27	24148	0	1064
_	7:09:18 AM	4:45:00 PM	_	1	27366	52	42311	1	27224	2	26267	1	26207	1	31695	1	27224	8	35185	214	30322	27	24400	0	1049
_	7:09:18 AM	4:50:00 PM	_	1	27773	52	42951	1	27161	2	26151	1	26345	1	32076	1	27161	8	33530	214	30392	27	23211	0	1074
_	7:09:18 AM	4:55:00 PM	_	1	27422	52	39529	1	27251	2	26128	1	26276	1	31627	1	27251	8	30715	214	30202	27	24163	0	1115
_	7:09:18 AM	5:00:00 PM	_	1	27479	52	41486	1	27145	2	26150	1	26372	1	31633	1	27145	8	33430	214	29867	27	25722	0	1091
_	7:09:18 AM	5:05:00 PM	_	1	27402	52	34786	1	27161	2	25974	1	26312	1	31736	1	27161	8	31882	214	29747	27	23477	0	1006
_	7:09:18 AM	5:10:00 PM	_	1	27268	52	38014	1	27091	2	26091	1	26264	1	31557	1	27091	8	33174	214	29406	27	22114	0	1131
_	7:09:18 AM	5:15:00 PM	_	1	27442	52	37650	1	27269	2	26290	1	26434	1	31786	1	27269	8	32600	214	29385	27	21439	0	1087
_	7:09:18 AM	5:20:00 PM	_	1	27451	52	37279	1	27254	2	26172	1	26210	1	31705	1	27254	8	33568	214	28895	27	19796	0	1102
_	7:09:18 AM	5:25:00 PM	_	1	27294	52	38039	1	27062	2	25960	1	26252	1	31347	1	27062	8	30867	214	29137	27	18165	0	1179
_	7:09:18 AM	5:30:00 PM	_	1	27312	52	35969	1	27172	2	25825	1	26294	1	31732	1	27172	8	29592	214	28886	27	12698	0	1110
_	7:09:18 AM	5:35:00 PM	_	1	27426	52	37460	1	27188	2	25886	1	26330	1	31167	1	27188	8	29710	214	28704	27	15734	0	1113
_	7:09:18 AM	5:40:00 PM	_	1	27306	52	37379	1	27281	2	26287	1	26285	1	31362	1	27281	8	29290	214	28273	27	16114	0	1137
_	7:09:18 AM	5:45:00 PM	_	1	27313	52	37569	1	27362	2	25880	1	26401	1	31461	1	27362	8	29328	214	28093	27	14447	0	1075
_	7:09:18 AM	5:50:00 PM	_	1	27291	52	37919	1	27279	2	25828	1	26383	1	31237	1	27279	8	26799	214	27612	27	13039	0	1102
_	7:09:18 AM	5:55:00 PM	_	1	27345	52	37145	1	27142	2	25850	1	26308	1	31175	1	27142	8	29953	214	27477	27	9710	0	1058
_	7:09:18 AM	6:00:00 PM	_	1	27258	52	36861	1	27094	2	25917	1	26488	1	31299	1	27094	8	31614	214	27277	27	10137	0	1095
_	7:09:18 AM	6:05:00 PM	_	1	27623	52	38814	1	27191	2	25821	1	26338	1	31118	1	27191	8	31766	214	26759	27	9534	0	1124
_	7:09:18 AM	6:10:00 PM	_	1	27430	52	38417	1	27161	2	25817	1	26282	1	31495	1	27161	8	29629	214	26519	27	7276	0	1096
_	7:09:18 AM	6:15:00 PM	_	1	27375	52	40013	1	27148	2	25877	1	26299	1	31185	1	27148	8	30064	214	26177	27	5001	0	1096
_	7:09:18 AM	6:20:00 PM	_	1	27522	52	40632	1	27173	2	25877	1	26218	1	31277	1	27173	8	32083	214	25975	27	2511	0	1047
_	7:09:18 AM	6:25:00 PM	_	1	27227	52	33353	1	27155	2	25854	1	26278	1	31413	1	27155	8	32438	214	25600	27	1917	0	1116
_	7:09:18 AM	6:30:00 PM	_	1	27331	52	42716	1	27275	2	25888	1	26311	1	31427	1	27275	8	33290	214	25109	26	64533	0	1124
_	7:09:18 AM	6:35:01 PM	_	1	27357	52	41179	1	27097	2	25726	1	26294	1	31197	1	27097	8	33667	214	24892	26	62317	0	1046
_	7:09:18 AM	6:40:00 PM	_	1	27232	52	40560	1	27074	2	25756	1	26309	1	31507	1	27074	8	30550	214	24381	26	58188	0	1068
_	7:09:18 AM	6:45:01 PM	_	1	27367	52	40862	1	27259	2	25875	1	26252	1	31444	1	27259	8	30529	214	23996	26	54860	0	1163
_	7:09:18 AM	6:50:00 PM	_	1	27518	52	44543	1	27169	2	25808	1	26187	1	31273	1	27169	8	35533	214	23721	26	51002	0	1090
_	7:09:18 AM	6:55:00 PM	_	1	27438	52	42066	1	27181	2	25824	1	26397	1	31227	1	27181	8	29580	214	23089	26	48239	0	1155

_	7:09:18 AM	7:00:00 PM	_	1	27421	52	45788	1	27266	2	25979	1	26297	1	31140	1	27266	8	29943	214	22770	26	44443	0	1111
_	7:09:18 AM	7:05:00 PM	_	1	27411	52	46471	1	27268	2	25818	1	26238	1	32839	1	27268	8	30962	214	22582	26	41741	0	1097
_	7:09:18 AM	7:10:00 PM	_	1	27282	52	45824	1	27122	2	25702	1	26358	1	31517	1	27122	8	30047	214	21971	26	37655	0	1075
_	7:09:18 AM	7:15:01 PM	_	1	27400	52	44009	1	27144	2	25777	1	26258	1	31410	1	27144	8	31918	214	21852	26	34681	0	1046
_	7:09:18 AM	7:20:01 PM	_	1	27477	52	47656	1	27188	2	25750	1	26237	1	31199	1	27188	8	29839	214	21299	26	31260	0	1083
_	7:09:18 AM	7:25:00 PM	_	1	27451	52	49313	1	27237	2	25622	1	26339	1	31226	1	27237	8	30202	214	20757	26	26773	0	1116
_	7:09:18 AM	7:30:01 PM	_	1	27261	52	50930	1	27229	2	25904	1	26182	1	31164	1	27229	8	35033	214	20379	26	21929	0	1098
_	7:09:18 AM	7:35:00 PM	_	1	27484	52	51077	1	27205	2	25578	1	26391	1	31785	1	27205	8	31632	214	19973	26	15817	0	1109
_	7:09:18 AM	7:40:01 PM	_	1	27402	52	51736	1	27198	2	25706	1	26319	1	31252	1	27198	8	32157	214	19342	26	9087	0	1125
_	7:09:18 AM	7:45:01 PM	_	1	27284	52	53084	1	27128	2	25597	1	26331	1	31366	1	27128	8	33811	214	19172	26	9192	0	1112
_	7:09:18 AM	7:50:00 PM	_	1	27541	52	54295	1	27257	2	25672	1	26262	1	31180	1	27257	8	32937	214	18594	26	7334	0	1072
_	7:09:18 AM	7:55:01 PM	_	1	27311	52	54731	1	27179	2	25675	1	26327	1	31509	1	27179	8	33938	214	19159	26	5099	0	1071
_	7:09:18 AM	8:00:01 PM	_	1	27376	52	57353	1	27146	2	25790	1	26350	1	31549	1	27146	8	33610	214	18627	26	4625	0	1080
_	7:09:18 AM	8:05:01 PM	_	1	27435	52	58303	1	27185	2	25742	1	26424	1	31521	1	27185	8	34398	214	18312	26	5394	0	1043
_	7:09:18 AM	8:10:01 PM	_	1	27317	52	58211	1	27060	2	25901	1	26207	1	31354	1	27060	8	33489	214	17617	26	5163	0	1088
_	7:09:18 AM	8:15:01 PM	_	1	27484	52	59094	1	27290	2	26097	1	26294	1	31596	1	27290	8	30931	214	17091	26	5794	0	1096
_	7:09:18 AM	8:20:01 PM	_	1	27085	52	63945	1	27147	2	25968	1	26071	1	31410	1	27147	8	30729	214	16706	26	6943	0	1083
_	7:09:18 AM	8:25:01 PM	_	1	27224	52	64572	1	27106	2	26037	1	26335	1	31237	1	27106	8	31222	214	16151	26	8389	0	1084
_	7:09:18 AM	8:30:01 PM	_	1	27329	53	2484	1	27173	2	26157	1	26185	1	31337	1	27173	8	26971	214	15644	26	8491	0	1092
_	7:09:18 AM	8:35:01 PM	_	1	27635	53	1534	1	27277	2	26102	1	26258	1	31492	1	27277	8	29303	214	15098	26	7910	0	1097
_	7:09:18 AM	8:40:01 PM	_	1	27341	53	3391	1	27124	2	26096	1	26377	1	31292	1	27124	8	26528	214	14892	26	2069	0	1138
_	7:09:18 AM	8:45:01 PM	_	1	27382	53	5364	1	27208	2	26020	1	26323	1	31433	1	27208	8	27320	214	14333	26	149	0	1142
_	7:09:18 AM	8:50:01 PM	_	1	27123	53	5268	1	27179	2	25975	1	26246	1	31444	1	27179	8	28980	214	14042	25	62530	0	1084
_	7:09:18 AM	8:55:01 PM	_	1	27439	52	47152	1	27256	2	25993	1	26340	1	32499	1	27256	8	44678	214	13565	25	61117	0	1067
_	7:09:18 AM	9:00:01 PM	_	1	27295	52	54850	1	27137	2	25804	1	26189	1	31571	1	27137	8	46218	214	13281	25	54981	0	1066
_	7:09:18 AM	9:05:01 PM	_	1	27329	52	55399	1	27122	2	25785	1	26294	1	31703	1	27122	8	58729	214	12920	25	53944	0	1126
_	7:09:18 AM	9:10:01 PM	_	1	27179	52	61102	1	27120	2	26084	1	26236	1	31828	1	27120	8	34078	214	12336	25	47608	0	1126
_	7:09:18 AM	9:15:01 PM	_	1	27386	53	1795	1	27090	2	26014	1	26342	1	31560	1	27090	8	38033	214	11938	25	44495	0	1109
_	7:09:18 AM	9:20:01 PM	_	1	27461	53	2130	1	27186	2	26091	1	26337	1	31407	1	27186	8	35810	214	11785	25	44636	0	1075
_	7:09:18 AM	9:25:01 PM	_	1	27308	52	51897	1	27122	2	26323	1	26245	1	31685	1	27122	8	37101	214	11137	25	46498	0	1139
_	7:09:18 AM	9:30:01 PM	_	1	27379	53	2858	1	27292	2	26073	1	26290	1	31828	1	27292	8	36635	214	10746	25	46603	0	1138
_	7:09:18 AM	9:35:01 PM	_	1	27347	53	3551	1	27156	2	26070	1	26225	1	32028	1	27156	8	32232	214	10383	25	45858	0	1135
_	7:09:18 AM	9:40:01 PM	_	1	27370	52	63428	1	27302	2	26044	1	26316	1	31679	1	27302	8	35406	214	9821	25	45038	0	1157
_	7:09:18 AM	9:45:01 PM	_	1	27692	53	10378	1	27211	2	26245	1	26248	1	31838	1	27211	8	31756	214	9532	25	40015	0	1111
_	7:09:18 AM	9:50:01 PM	_	1	27216	53	14116	1	27168	2	26175	1	26310	1	31486	1	27168	8	32247	214	8925	25	35824	0	1122
_	7:09:18 AM	9:55:01 PM	_	1	27294	53	17374	1	27176	2	26103	1	26250	1	31718	1	27176	8	32883	214	8351	25	32165	0	1018
_	7:09:18 AM	10:00:01 PM	_	1	27297	53	15280	1	27203	2	26485	1	26341	1	31779	1	27203	8	35532	214	8182	25	28943	0	1075
_	7:09:18 AM	10:05:01 PM	_	1	27422	53	19731	1	27339	2	26210	1	26379	1	31785	1	27339	8	30705	214	8090	25	25818	0	1109
_	7:09:18 AM	10:10:01 PM	_	1	27327	53	21419	1	27232	2	26205	1	26273	1	31521	1	27232	8	30687	214	7279	25	21722	0	1159
_	7:09:18 AM	10:15:01 PM	_	1	27323	53	23952	1	27135	2	26314	1	26427	1	31984	1	27135	8	33264	214	7089	25	16972	0	1089
_	7:09:18 AM	10:20:01 PM	_	1	27412	53	24825	1	27058	2	26285	1	26286	1	31456	1	27058	8	34450	214	6633	25	12653	0	1142
_	7:09:18 AM	10:25:01 PM	_	1	27510	53	24464	1	27154	2	26121	1	26359	1	31975	1	27154	8	33459	214	5994	25	9519	0	1103
_	7:09:18 AM	10:30:01 PM	_	1	27217	53	25138	1	27179	2	26473	1	26371	1	32522	1	27179	8	31382	214	5727	25	6578	0	1120
_	7:09:18 AM	10:35:01 PM	_	1	27429	53	28451	1	27190	2	26246	1	26332	1	32098	1	27190	8	30144	214	5243	25	2435	0	1118
_	7:09:18 AM	10:40:01 PM	_	1	27568	53	30448	1	27173	2	26020	1	26333	1	31959	1	27173	8	31734	214	4851	24	64799	0	1172
_	7:09:18 AM	10:45:01 PM	_	1	27458	53	31738	1	27148	2	26323	1	26291	1	31683	1	27148	8	30303	214	4488	24	61043	0	1150
_	7:09:18 AM	10:50:01 PM	_	1	27150	53	31358	1	27187	2	26237	1	26357	1	31861	1	27187	8	34819	214	3707	24	58072	0	1126
_	7:09:18 AM	10:55:01 PM	_	1	27467	53	34259	1	27240	2	26114	1	26405	1	31808	1	27240	8	31058	214	3302	24	52610	0	1087
_	7:09:18 AM	11:00:01 PM	_	1	27203	53	37111	1	27060	2	26166	1	26303	1	31598	1	27060	8	33248	214	2883	24	47545	0	1139
_	7:09:18 AM	11:05:01 PM	_	1	27470	53	38498	1	27194	2	26009	1	26193	1	31939	1	27194	8	37558	214	2353	24	44672	0	1107
_	7:09:18 AM	11:10:01 PM	_	1	27217	53	41141	1	27137	2	26310	1	26328	1	31803	1	27137	8	36588	214	1854	24	40619	0	1071
_	7:09:18 AM	11:15:01 PM	_	1	27216	53	41081	1	27205	2	26262	1	26305	1	31680	1	27205	8	34930	214	1218	24	35859	0	1157
_	7:09:18 AM	11:20:01 PM	_	1	27315	53	45046	1	27237	2	26221	1	26348	1	31590	1	27237	8	33769	214	418	24	31319	0	1139
_	7:09:18 AM	11:25:01 PM	_	1	27643	53	45616	1	27075	2	26324	1	26438	1	31554	1	27075	8	36874	214	391	24	27863	0	1066
_	7:09:18 AM	11:30:01 PM	_	1	27639	53	47459	1	27153	2	26405	1	26356	1	31918	1	27153	8	37437	213	65249	24	25955	0	1081
_	7:09:18 AM	11:35:01 PM	_	1	27471	53	48037	1	27306	2	26421	1	26310	1	31794	1	27306	8	34239	213	64848	24	21944	0	1130
_	7:09:18 AM	11:40:01 PM	_	1	27404	53	55460	1	27165	2	26346	1	26356	1	32103	1	27165	8	34846	213	64225	24	19307	0	1160
_	7:09:18 AM	11:45:01 PM	_	1	27482	53	56973	1	27125	2	26072	1	26287	1	32004	1	27125	8	38040	213	64251	24	16199	0	1127
_	7:09:18 AM	11:50:01 PM	_	1	27381	53	58347	1	27108	2	26330	1	26370	1	31865	1	27108	8	37033	213	63525	24	13218	0	1120
_	7:09:18 AM	11:55:01 PM	_	1	27454	53	61814	1	27255	2	26250	1	26417	1	32160	1	27255	8	36257	213	62668	24	10763	0	1112
_	8:09:18 AM	12:00:01 AM	_	1	27642	53	64661	1	27157	2	26257	1	26223	1	32046	1	27157	8	39317	213	61784	24	7911	0	1103
_	8:09:18 AM	12:10:01 AM	_	1	27409	54	4398	1	27190	2	26451	1	26327	1	32251	1	27190	8	39264	213	59207	23	63356	0	1095
_	8:09:18 AM	12:15:01 AM	_	1	27404	54	7895	1	27249	2	26754	1	26284	1	32317	1	27249	8	42418	213	58986	23	58292	0	1150
_	8:09:18 AM	12:20:01 AM	_	1	27378	54	9471	1	27189	2	26527	1	26378	1	32005	1	27189	8	44439	213	58344	23	54229	0	1164
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_	8:09:18 AM	9:15:01 AM	_	1	27276	55	19817	1	27162	2	28596	1	26216	1	32928	1	27162	8	60485	213	17836	23	64362	0	1165
_	8:09:18 AM	9:20:01 AM	_	1	27383	55	18758	1	27210	2	28699	1	26365	1	33056	1	27210	8	58622	213	18243	24	14614	0	1098
_	8:09:18 AM	9:25:01 AM	_	1	27574	55	15073	1	27230	2	28774	1	26430	1	33083	1	27230	8	58044	213	18388	24	17013	0	1175
_	8:09:18 AM	9:30:01 AM	_	1	27361	55	12715	1	27187	2	28774	1	26429	1	33026	1	27187	8	55246	213	18978	24	22908	0	1134
_	8:09:18 AM	9:35:01 AM	_	1	27339	55	9536	1	27124	2	28631	1	26276	1	32738	1	27124	8	53319	213	19273	24	28467	0	1161
_	8:09:18 AM	9:40:01 AM	_	1	27397	55	1721	1	27241	2	28475	1	26326	1	32594	1	27241	8	49169	213	19414	24	31454	0	1125
_	8:09:18 AM	9:45:01 AM	_	1	27555	55	2020	1	27098	2	28676	1	26232	1	32748	1	27098	8	53037	213	19421	24	38535	0	1119
_	8:09:18 AM	9:50:01 AM	_	1	27485	54	64961	1	27145	2	28586	1	26254	1	32628	1	27145	8	52568	213	19896	24	51249	0	1109
_	8:09:18 AM	9:55:01 AM	_	1	27191	54	63674	1	27137	2	28708	1	26308	1	32532	1	27137	8	51483	213	19905	24	58174	0	1097
_	8:09:18 AM	10:00:01 AM	_	1	27430	54	65090	1	27158	2	28872	1	26235	1	32258	1	27158	8	48655	213	20313	25	2426	0	1158
_	8:09:18 AM	10:05:01 AM	_	1	27436	54	62939	1	27213	2	28914	1	26179	1	32566	1	27213	8	46083	213	20261	25	11737	0	1132
_	8:09:18 AM	10:10:01 AM	_	1	27472	54	60649	1	27213	2	28765	1	26209	1	32379	1	27213	8	45665	213	20600	25	21174	0	1112
_	8:09:18 AM	10:15:01 AM	_	1	27441	54	57812	1	27162	2	28820	1	26436	1	32343	1	27162	8	46486	213	20773	25	26039	0	1158
_	8:09:18 AM	10:20:01 AM	_	1	27450	54	53470	1	27267	2	28816	1	26175	1	32370	1	27267	8	45714	213	21158	25	40143	0	1117

_	8:09:18 AM	10:25:01 AM	_	1	27592	54	52140	1	27247	2	28648	1	26427	1	32062	1	27247	8	44022	213	21463	25	39533	0	1066
_	8:09:18 AM	10:30:01 AM	_	1	27444	54	49442	1	27286	2	28906	1	26255	1	32100	1	27286	8	43448	213	21515	25	48513	0	1107
_	8:09:18 AM	10:35:01 AM	_	1	27461	54	53195	1	27220	2	28981	1	26356	1	31904	1	27220	8	44924	213	22066	25	50393	0	1100
_	8:09:18 AM	10:40:01 AM	_	1	26902	54	54380	1	27116	2	29010	1	26367	1	32086	1	27116	8	43417	213	22166	25	54496	0	1096
_	8:09:18 AM	10:45:01 AM	_	1	27408	54	56688	1	27177	2	29189	1	26369	1	31793	1	27177	8	50156	213	22349	25	59266	0	1089
_	8:09:18 AM	10:50:01 AM	_	1	27323	54	56977	1	27114	2	29313	1	26322	1	31995	1	27114	8	45964	213	22291	26	3138	0	1136
_	8:09:18 AM	10:55:00 AM	_	1	27376	54	55769	1	27223	2	29261	1	26291	1	31849	1	27223	8	45614	213	22700	26	9481	0	1084
_	8:09:18 AM	11:00:00 AM	_	1	27395	54	58599	1	27160	2	29121	1	26309	1	31998	1	27160	8	47982	213	22642	26	12797	0	1047
_	8:09:18 AM	11:05:01 AM	_	1	27322	54	60739	1	27277	2	29347	1	26290	1	31976	1	27277	8	48959	213	23103	26	13709	0	1088
_	8:09:18 AM	11:10:01 AM	_	1	27447	54	60483	1	27131	2	29238	1	26400	1	31879	1	27131	8	45598	213	22804	26	16153	0	1097
_	8:09:18 AM	11:15:00 AM	_	1	27356	54	63818	1	27073	2	29472	1	26341	1	31849	1	27073	8	49598	213	23367	26	15912	0	1113
_	8:09:18 AM	11:20:00 AM	_	1	27227	54	64159	1	27106	2	29327	1	26342	1	31609	1	27106	8	53192	213	23438	26	17551	0	1089
_	8:09:18 AM	11:25:00 AM	_	1	27290	55	1976	1	27218	2	29448	1	26318	1	32047	1	27218	8	50931	213	23519	26	22748	0	1101
_	8:09:18 AM	11:30:00 AM	_	1	27364	55	3692	1	27275	2	29374	1	26281	1	31859	1	27275	8	49868	213	23576	26	23473	0	1075
_	8:09:18 AM	11:35:00 AM	_	1	27501	55	6103	1	27207	2	29524	1	26321	1	31600	1	27207	8	49669	213	23627	26	24445	0	1109
_	8:09:18 AM	11:40:01 AM	_	1	27444	55	7633	1	27222	2	29499	1	26267	1	31523	1	27222	8	53175	213	23811	26	26018	0	1173
_	8:09:18 AM	11:45:00 AM	_	1	27135	55	9663	1	27198	2	29652	1	26293	1	31505	1	27198	8	53633	213	23593	26	24579	0	1027
_	8:09:18 AM	11:50:00 AM	_	1	27496	55	11802	1	27234	2	29737	1	26192	1	31711	1	27234	8	51355	213	23742	26	24986	0	1094
_	8:09:18 AM	11:55:00 AM	_	1	27386	55	13973	1	27254	2	29853	1	26231	1	31295	1	27254	8	52489	213	23857	26	26046	0	1084
_	8:09:18 AM	12:00:00 PM	_	1	27424	55	16972	1	27188	2	29819	1	26241	1	31337	1	27188	8	51404	213	23807	26	27306	0	1091
_	8:09:18 AM	12:05:00 PM	_	1	27293	55	19483	1	27179	2	29852	1	26154	1	31607	1	27179	8	55204	213	23414	26	24693	0	1115
_	8:09:18 AM	12:10:01 PM	_	1	27354	55	21413	1	27240	2	29772	1	26276	1	31549	1	27240	8	54853	213	23553	26	27963	0	1039
_	8:09:18 AM	12:15:00 PM	_	1	27240	55	23967	1	27269	2	30019	1	26221	1	31221	1	27269	8	58618	213	23869	26	23062	0	1152
_	8:09:18 AM	12:20:00 PM	_	1	27471	55	25422	1	27027	2	29831	1	26349	1	31529	1	27027	8	56596	213	23598	26	23606	0	1167
_	8:09:18 AM	12:25:00 PM	_	1	27390	55	28747	1	27179	2	29775	1	26282	1	31622	1	27179	8	57390	213	22740	26	25154	0	1101
_	8:09:18 AM	12:30:00 PM	_	1	27397	55	31282	1	27212	2	29945	1	26292	1	31170	1	27212	8	53755	213	23143	26	25739	0	1126
_	8:09:18 AM	12:35:00 PM	_	1	27345	55	34844	1	27199	2	30043	1	26355	1	31294	1	27199	8	54450	213	23091	26	27363	0	1087
_	8:09:18 AM	12:40:00 PM	_	1	27456	55	35859	1	27169	2	30285	1	26272	1	31261	1	27169	8	56398	213	22829	26	28336	0	1131
_	8:09:18 AM	12:45:00 PM	_	1	27374	55	41321	1	27188	2	30122	1	26224	1	31418	1	27188	8	56614	213	22543	26	26702	0	1108
_	8:09:18 AM	12:50:01 PM	_	1	27508	55	45284	1	27114	2	30235	1	26349	1	31402	1	27114	8	58538	213	22402	26	25795	0	1116
_	8:09:18 AM	12:55:01 PM	_	1	27341	55	49647	1	27080	2	30421	1	26204	1	31213	1	27080	8	56008	213	22305	26	27477	0	1004
_	8:09:18 AM	1:00:01 PM	_	1	27073	55	49086	1	27211	2	30389	1	26394	1	31523	1	27211	8	54221	213	21858	26	26024	0	1050
_	8:09:18 AM	1:05:00 PM	_	1	27594	55	54132	1	27160	2	30412	1	26285	1	31388	1	27160	8	54997	213	21474	26	26666	0	1093
_	8:09:18 AM	1:10:01 PM	_	1	27303	55	58714	1	27285	2	30339	1	26337	1	31304	1	27285	8	55232	213	21604	26	29941	0	1024
_	8:09:18 AM	1:15:00 PM	_	1	27166	55	59059	1	27244	2	30403	1	26292	1	31206	1	27244	8	56247	213	21041	26	30090	0	1102
_	8:09:18 AM	1:20:00 PM	_	1	27479	55	63133	1	27259	2	30442	1	26237	1	31161	1	27259	8	53287	213	20882	26	30361	0	1099
_	8:09:18 AM	1:25:00 PM	_	1	27471	56	299	1	27225	2	30612	1	26281	1	31136	1	27225	8	52536	213	20165	26	30736	0	1103
_	8:09:18 AM	1:30:01 PM	_	1	27141	56	3403	1	27205	2	30577	1	26174	1	31518	1	27205	8	52833	213	20430	26	28710	0	1116
_	8:09:18 AM	1:35:01 PM	_	1	27552	56	5701	1	27258	2	30641	1	26334	1	31392	1	27258	8	57648	213	20094	26	30472	0	1152
_	8:09:18 AM	1:40:00 PM	_	1	27512	56	6969	1	27175	2	30536	1	26242	1	31428	1	27175	8	55964	213	19549	26	31140	0	1118
_	8:09:18 AM	1:45:01 PM	_	1	27424	56	10562	1	27134	2	30761	1	26316	1	31381	1	27134	8	55727	213	19377	26	32312	0	1119
_	8:09:18 AM	1:50:00 PM	_	1	27422	56	12162	1	27272	2	30819	1	26253	1	31320	1	27272	8	54108	213	18950	26	33792	0	1122
_	8:09:18 AM	1:55:00 PM	_	1	27351	56	14568	1	27162	2	30552	1	26377	1	31242	1	27162	8	54442	213	18823	26	29906	0	1078
_	8:09:18 AM	2:00:00 PM	_	1	27353	56	16538	1	27233	2	30769	1	26493	1	31177	1	27233	8	52900	213	18377	26	28911	0	1100
_	8:09:18 AM	2:05:00 PM	_	1	27436	56	18919	1	27192	2	30806	1	26388	1	31173	1	27192	8	51907	213	18030	26	30506	0	1088
_	8:09:18 AM	2:10:00 PM	_	1	27228	56	20393	1	27121	2	31037	1	26283	1	31439	1	27121	8	51294	213	17874	26	31182	0	1029
_	8:09:18 AM	2:15:00 PM	_	1	27438	56	20602	1	27236	2	30810	1	26356	1	31223	1	27236	8	52090	213	17379	26	32869	0	1110
_	8:09:18 AM	2:20:00 PM	_	1	27303	56	21791	1	27276	2	30853	1	26381	1	30959	1	27276	8	53231	213	16987	26	33976	0	1064
_	8:09:18 AM	2:25:00 PM	_	1	27455	56	24611	1	27120	2	30930	1	26224	1	31238	1	27120	8	51549	213	16922	26	32815	0	1101
_	8:09:18 AM	2:30:00 PM	_	1	27460	56	24536	1	27136	2	30944	1	26351	1	31296	1	27136	8	54836	213	16604	26	34038	0	1040
_	8:09:18 AM	2:35:01 PM	_	1	27276	56	25339	1	27220	2	30896	1	26397	1	31120	1	27220	8	51575	213	15841	26	34690	0	1081
_	8:09:18 AM	2:40:00 PM	_	1	27335	56	31258	1	27264	2	30771	1	26414	1	31174	1	27264	8	54446	213	15917	26	30638	0	1073
_	8:09:18 AM	2:45:01 PM	_	1	27333	56	26952	1	27139	2	31045	1	26302	1	31634	1	27139	8	56597	213	15369	26	31558	0	1117
_	8:09:18 AM	2:50:00 PM	_	1	27370	56	27544	1	27125	2	30917	1	26271	1	32076	1	27125	8	54520	213	15431	26	30000	0	1087
_	8:09:18 AM	2:55:00 PM	_	1	27336	56	26001	1	27268	2	31344	1	26196	1	31289	1	27268	8	51827	213	14762	26	32606	0	1035
_	8:09:18 AM	3:00:01 PM	_	1	27303	56	21367	1	27168	2	30902	1	26292	1	31071	1	27168	8	58967	213	14632	26	35542	0	1131
_	8:09:18 AM	3:05:00 PM	_	1	27475	56	20891	1	27255	2	30961	1	26236	1	31064	1	27255	8	60059	213	14113	26	35937	0	1054
_	8:09:18 AM	3:10:01 PM	_	1	27420	56	15949	1	27141	2	30990	1	26287	1	31263	1	27141	8	62128	213	14180	26	35941	0	1155
_	8:09:18 AM	3:15:00 PM	_	1	27552	56	18505	1	27257	2	30959	1	26221	1	31128	1	27257	8	62102	213	13625	26	32529	0	1090
_	8:09:18 AM	3:20:01 PM	_	1	27357	56	16043	1	27062	2	31196	1	26316	1	31175	1	27062	8	64453	213	13141	26	34701	0	1123
_	8:09:18 AM	3:25:01 PM	_	1	27483	56	15053	1	27157	2	30968	1	26301	1	31279	1	27157	8	62889	213	13028	26	37360	0	1108
_	8:09:18 AM	3:30:00 PM	_	1	27338	56	18849	1	27332	2	31082	1	26259	1	31234	1	27332	8	62284	213	12480	26	39815	0	1085
_	8:09:18 AM	3:35:00 PM	_	1	27512	56	18534	1	27167	2	31077	1	26421	1	31291	1	27167	8	64396	213	12309	26	39340	0	1072
_	8:09:18 AM	3:40:00 PM	_	1	27400	56	21796	1	27238	2	31068	1	26399	1	31374	1	27238	8	60884	213	11761	26	39163	0	1097
_	8:09:18 AM	3:45:01 PM	_	1	27327	56	21517	1	27232	2	31217	1	26262	1	31126	1	27232	8	60676	213	11523	26	39922	0	1098
_	8:09:18 AM	3:50:00 PM	_	1	27498	56	22272	1	27203	2	31235	1	26320	1	31030	1	27203	9	201	213	11251	26	41666	0	1159
_	8:09:18 AM	3:55:00 PM	_	1	27431	56	23700	1	27250	2	31091	1	26287	1	31151	1	27250	8	60479	213	11072	26	43575	0	1072
_	8:09:18 AM	4:00:01 PM	_	1	27313	56	23341	1	27165	2	31358	1	26214	1	31346	1	27165	8	59496	213	10538	26	43363	0	1141
_	8:09:18 AM	4:05:00 PM	_	1	27261	56	25499	1	27212	2	31486	1	26214	1	31453	1	27212	8	56025	213	10038	26	45131	0	1082
_	8:09:18 AM	4:10:01 PM	_	1	27420	56	24632	1	27173	2	31408	1	26327	1	31238	1	27173	8	57136	213	9893	26	46306	0	1094
_	8:09:18 AM	4:15:00 PM	_	1	27450	56	26905	1	27155	2	31525	1	26343	1	31517	1	27155	8	58684	213	9618	26	46185	0	1094
_	8:09:18 AM	4:20:01 PM	_	1	27419	56	28246	1	27167	2	31473	1	26325	1	31460	1	27167	8	57742	213	9262	26	47044	0	1085
_	8:09:18 AM	4:25:00 PM	_	1	27272	55	60435	1	27241	2	31544	1	26312	1	31363	1	27241	8	56903	213	8614	26	47096	0	1143
_	8:09:18 AM	4:30:01 PM	_	1	27181	56	29297	1	27196	2	31406	1	26275	1	31452	1	27196	8	56833	213	8650	26	47335	0	1090
_	8:09:18 AM	4:35:01 PM	_	1	27422	56	31619	1	27249	2	31568	1	26308	1	31234	1	27249	8	55989	213	8325	26	46222	0	1081
_	8:09:18 AM	4:40:01 PM	_	1	27445	56	34535	1	27170	2	31571	1	26210	1	31449	1	27170	8	56442	213	7948	26	45068	0	1089
_	8:09:18 AM	4:45:01 PM	_	1	27511	56	36368	1	27189	2	31381	1	26358	1	31195	1	27189	8	55639	213	7336	26	46023	0	1098
_	8:09:18 AM	4:50:00 PM	_	1	27399	56	35592	1	27203	2	31513	1	26266	1	31481	1	27203	8	56648	213	7226	26	46053	0	1110
_	8:09:18 AM	4:55:01 PM	_	1	27424	56	37161	1	27134	2	31565	1	26482	1	31412	1	27134	8	53869	213	6752	26	46250	0	1105
_	8:09:18 AM	5:00:01 PM	_	1	27511	56	35219	1	27197	2	31673	1	26272	1	31350	1	27197	8	54454	213	6729	26	45522	0	1046
_	8:09:18 AM	5:05:00 PM	_	1	27274	56	38314	1	27232	2	31651	1	26457	1	31247	1	27232	8	51346	213	6161	26	44546	0	1102
_	8:09:18 AM	5:10:00 PM	_	1	27505	56	38410	1	27272	2	31612	1	26411	1	31243	1	27272	8	54539	213	5634	26	44075	0	1052
_	8:09:18 AM	5:15:01 PM	_	1	27453	56	39341	1	27044	2	31554	1	26384	1	31245	1	27044	8	53783	213	5535	26	42726	0	1101
_	8:09:18 AM	5:20:01 PM	_	1	27321	56	39389	1	27246	2	31689	1	26377	1	31469	1	27246	8	53996	213	5214	26	43148	0	1178
_	8:09:18 AM	5:25:00 PM	_	1	27537	56	40165	1	27161	2	32055	1	26421	1	31285	1	27161	8	51341	213	4757	26	43600	0	1110
_	8:09:18 AM	5:30:01 PM	_	1	27521	56	40660	1	27227	2	31703	1	26282	1	31234	1	27227	8	50079	213	4627	26	44135	0	1153
_	8:09:18 AM	5:35:00 PM	_	1	27410	56	41166	1	27060	2	31710	1	26294	1	31041	1	27060	8	51249	213	4149	26	43189	0	1139
_	8:09:18 AM	5:40:00 PM	_	1	27368	56	41850	1	27197	2	31618	1	26272	1	31376	1	27197	8	50283	213	3833	26	42218	0	1080
_	8:09:18 AM	5:45:01 PM	_	1	27368	56	41674	1	27222	2	31611	1	26206	1	31582	1	27222	8	50245	213	3653	26	40746	0	1052
_	8:09:18 AM	5:50:00 PM	_	1	27383	56	40452	1	27258	2	31843	1	26272	1	31321	1	27258	8	49524	213	3557	26	39560	0	1097
_	8:09:18 AM	5:55:01 PM	_	1	27405	56	43387	1	27260	2	31627	1	26391	1	31208	1	27260	8	48363	213	2971	26	37682	0	1032
_	8:09:18 AM	6:00:01 PM	_	1	27418	56	45289	1	27067	2	31471	1	26286	1	31318	1	27067	8	48463	213	2687	26	37015	0	1131

_	8:09:18 AM	6:05:01 PM	_	1	27568	56	45991	1	27179	2	31684	1	26258	1	31356	1	27179	8	47843	213	2292	26	36102	0	1101
_	8:09:18 AM	6:10:01 PM	_	1	27379	56	45850	1	27220	2	31658	1	26337	1	31045	1	27220	8	52889	213	1782	26	34829	0	1029
_	8:09:18 AM	6:15:01 PM	_	1	27382	56	42323	1	27214	2	31605	1	26343	1	31154	1	27214	8	46206	213	1727	26	33520	0	1153
_	8:09:18 AM	6:20:01 PM	_	1	27475	56	46315	1	27111	2	31652	1	26252	1	31138	1	27111	8	47398	213	1378	26	32086	0	1083
_	8:09:18 AM	6:25:01 PM	_	1	27370	56	46451	1	27225	2	31564	1	26252	1	31369	1	27225	8	46292	213	783	26	30466	0	1099
_	8:09:18 AM	6:30:01 PM	_	1	27433	56	48828	1	27288	2	31693	1	26400	1	31261	1	27288	8	46071	213	392	26	29449	0	1027
_	8:09:18 AM	6:35:01 PM	_	1	27405	56	49295	1	27164	2	31527	1	26303	1	31203	1	27164	8	47390	213	202	26	29603	0	1105
_	8:09:18 AM	6:40:01 PM	_	1	27360	56	49891	1	27204	2	31851	1	26404	1	30917	1	27204	8	47219	212	65238	26	26561	0	1077
_	8:09:18 AM	6:45:01 PM	_	1	27475	56	47542	1	27236	2	31631	1	26320	1	31227	1	27236	8	46507	212	64999	26	25757	0	1145
_	8:09:18 AM	6:50:01 PM	_	1	27456	56	52878	1	27229	2	31880	1	26316	1	32239	1	27229	8	46835	212	64292	26	24737	0	1085
_	8:09:18 AM	6:55:01 PM	_	1	27239	56	50953	1	27259	2	31665	1	26278	1	31311	1	27259	8	46597	212	64083	26	22984	0	1077
_	8:09:18 AM	7:00:01 PM	_	1	27240	56	56131	1	27168	2	31765	1	26368	1	31367	1	27168	8	47069	212	63817	26	21156	0	1085
_	8:09:18 AM	7:05:01 PM	_	1	27352	56	56411	1	27233	2	31713	1	26368	1	31156	1	27233	8	49000	212	63263	26	19426	0	1075
_	8:09:18 AM	7:10:01 PM	_	1	27598	56	60733	1	27214	2	31825	1	26297	1	31418	1	27214	8	49336	212	62864	26	17429	0	1077
_	8:09:18 AM	7:15:01 PM	_	1	27300	56	61581	1	27210	2	31910	1	26271	1	31243	1	27210	8	50719	212	62475	26	15449	0	1140
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_	8:09:18 AM	7:25:01 PM	_	1	27486	56	62887	1	27205	2	31925	1	26407	1	31444	1	27205	8	49422	212	61736	26	11566	0	1125
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_	8:09:18 AM	7:35:01 PM	_	1	27492	56	63538	1	27291	2	31615	1	26234	1	31441	1	27291	8	55010	212	60779	26	8068	0	1019
_	8:09:18 AM	7:40:01 PM	_	1	27331	56	63626	1	27188	2	31709	1	26323	1	31422	1	27188	8	53697	212	60143	26	5568	0	1144
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_	8:09:18 AM	7:55:01 PM	_	1	27444	57	3455	1	27282	2	31816	1	26275	1	31579	1	27282	8	53645	212	60396	25	63674	0	1100
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_	8:09:18 AM	8:05:01 PM	_	1	27391	57	9932	1	27221	2	31917	1	26383	1	31439	1	27221	8	53861	212	59037	25	61813	0	1074
_	8:09:18 AM	8:10:01 PM	_	1	27493	57	11214	1	27287	2	31870	1	26196	1	31267	1	27287	8	53976	212	58978	25	61257	0	1147
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_	8:09:18 AM	8:25:01 PM	_	1	27391	57	14864	1	26987	2	31929	1	26276	1	31454	1	26987	8	53733	212	57143	25	59497	0	1092
_	8:09:18 AM	8:30:01 PM	_	1	27335	57	11574	1	27198	2	32013	1	26286	1	31452	1	27198	8	51720	212	57015	25	59453	0	1109
_	8:09:18 AM	8:35:01 PM	_	1	27464	57	14439	1	27241	2	31919	1	26306	1	31364	1	27241	8	56010	212	56387	25	59285	0	1105
_	8:09:18 AM	8:40:01 PM	_	1	27425	57	16514	1	27099	2	31980	1	26332	1	31326	1	27099	8	50933	212	56009	25	59234	0	1047
_	8:09:18 AM	8:45:01 PM	_	1	27317	57	17860	1	27248	2	31932	1	26330	1	31593	1	27248	8	50316	212	55453	25	51541	0	1114
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_	8:09:18 AM	8:55:01 PM	_	1	27352	57	11035	1	27174	2	31818	1	26204	1	31632	1	27174	8	55831	212	54818	25	35394	0	1070
_	8:09:18 AM	9:00:01 PM	_	1	27471	57	5473	1	27205	2	31591	1	26220	1	31491	1	27205	8	60199	212	54758	25	32255	0	1101
_	8:09:18 AM	9:05:01 PM	_	1	27464	57	2884	1	27212	2	31400	1	26219	1	31567	1	27212	8	64420	212	54057	25	26537	0	1112
_	8:09:18 AM	9:10:01 PM	_	1	27483	57	2052	1	27278	2	31510	1	26318	1	32030	1	27278	8	58488	212	53489	25	20296	0	1162
_	8:09:18 AM	9:15:01 PM	_	1	27309	57	719	1	27380	2	31211	1	26325	1	31802	1	27380	8	60551	212	53361	25	15113	0	1139
_	8:09:18 AM	9:20:01 PM	_	1	27460	56	60968	1	27206	2	31340	1	26318	1	31551	1	27206	8	59460	212	53199	25	7538	0	1094
_	8:09:18 AM	9:25:01 PM	_	1	27413	57	1491	1	27192	2	31402	1	26194	1	31944	1	27192	8	59293	212	52355	25	13913	0	1138
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_	8:09:18 AM	9:35:01 PM	_	1	27471	57	3652	1	27169	2	31303	1	26339	1	31521	1	27169	8	57507	212	51238	25	11604	0	1131
_	8:09:18 AM	9:40:01 PM	_	1	27395	57	3997	1	27191	2	31422	1	26346	1	31853	1	27191	8	55874	212	51060	25	9670	0	1157
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_	8:09:18 AM	9:50:01 PM	_	1	27500	57	6143	1	27200	2	31248	1	26280	1	31782	1	27200	8	58156	212	49756	25	5242	0	1104
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_	8:09:18 AM	10:00:01 PM	_	1	27396	57	4766	1	27149	2	31180	1	26333	1	31673	1	27149	8	57948	212	48666	24	65042	0	1140
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_	8:09:18 AM	10:10:01 PM	_	1	27311	57	1616	1	27197	2	31113	1	26334	1	31623	1	27197	8	56092	212	47947	24	57327	0	1102
_	8:09:18 AM	10:15:01 PM	_	1	27399	56	64385	1	27106	2	31058	1	26295	1	31694	1	27106	8	54705	212	47240	24	50601	0	1100
_	8:09:18 AM	10:20:01 PM	_	1	27285	56	58910	1	27367	2	30897	1	26347	1	31254	1	27367	8	56035	212	46921	24	45015	0	1094
_	8:09:18 AM	10:25:01 PM	_	1	27150	56	59701	1	27101	2	30822	1	26384	1	31524	1	27101	8	51598	212	46601	24	39162	0	1068
_	8:09:18 AM	10:30:01 PM	_	1	27399	56	62841	1	27238	2	30570	1	26308	1	31594	1	27238	8	50896	212	46009	24	33377	0	1114
_	8:09:18 AM	10:35:01 PM	_	1	27292	56	62299	1	27169	2	30493	1	26271	1	31258	1	27169	8	49277	212	45835	24	27648	0	1069
_	8:09:18 AM	10:40:01 PM	_	1	27238	56	59758	1	27345	2	30567	1	26209	1	31343	1	27345	8	49452	212	45166	24	22026	0	1168
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_	8:09:18 AM	10:50:01 PM	_	1	27633	56	57018	1	27186	2	30266	1	26268	1	31335	1	27186	8	46775	212	43935	24	9791	0	1114
_	8:09:18 AM	10:55:01 PM	_	1	27473	56	56692	1	27185	2	30300	1	26359	1	31602	1	27185	8	47073	212	43452	24	5195	0	1098
_	8:09:18 AM	11:00:01 PM	_	1	27348	56	55749	1	27086	2	30315	1	26281	1	31281	1	27086	8	44911	212	42787	23	64357	0	1152
_	8:09:18 AM	11:05:01 PM	_	1	27251	56	53971	1	27156	2	30000	1	26367	1	31548	1	27156	8	43797	212	42207	23	60443	0	1090
_	8:09:18 AM	11:10:01 PM	_	1	27295	56	57147	1	27129	2	30409	1	26320	1	31438	1	27129	8	40350	212	41468	23	56316	0	1161
_	8:09:18 AM	11:15:01 PM	_	1	27481	56	58210	1	27220	2	30139	1	26370	1	31303	1	27220	8	43998	212	41255	23	51593	0	1123
_	8:09:18 AM	11:20:01 PM	_	1	27346	56	58792	1	27215	2	29908	1	26346	1	31318	1	27215	8	41170	212	40640	23	46230	0	1093
_	8:09:18 AM	11:25:01 PM	_	1	27481	56	61322	1	27197	2	29895	1	26317	1	31259	1	27197	8	43375	212	40122	23	41618	0	1128
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_	8:09:18 AM	11:45:01 PM	_	1	27367	56	59348	1	27168	2	29784	1	26283	1	31468	1	27168	8	36014	212	37215	23	26642	0	1107
_	8:09:18 AM	11:50:01 PM	_	1	27742	56	65147	1	27096	2	29996	1	26308	1	31566	1	27096	8	39432	212	36775	23	23853	0	1132
_	8:09:18 AM	11:55:01 PM	_	1	27309	56	63605	1	27227	2	29760	1	26265	1	31292	1	27227	8	36955	212	36277	23	21106	0	1107
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_	9:09:18 AM	12:10:01 AM	_	1	27395	56	63385	1	27154	2	29781	1	26321	1	31599	1	27154	8	36343	212	32194	23	13643	0	1156
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_	9:09:18 AM	12:20:01 AM	_	1	27139	57	2019	1	27104	2	29688	1	26310	1	31560	1	27104	8	32265	212	31552	23	7642	0	1136
_	9:09:18 AM	12:25:01 AM	_	1	27363	57	813	1	27207	2	29695	1	26279	1	31442	1	27207	8	32262	212	31019	23	4885	0	1151
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_	9:09:18 AM	12:55:01 AM	_	1	27327	57	3898	1	27151	2	29425	1	26408	1	31670	1	27151	8	33496	212	27031	22	55863	0	1122
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_	9:09:18 AM	1:05:01 AM	_	1	27296	57	5510	1	27082	2	29440	1	26289	1	31671	1	27082	8	32209	212	26438	22	50268	0	1110
_	9:09:18 AM	1:10:01 AM	_	1	27345	57	6449	1	27099	2	29566	1	26215	1	31527	1	27099	8	33216	212	26169	22	47962	0	1086
_	9:09:18 AM	1:15:01 AM	_	1	27363	57	5729	1	27222	2	29427	1	26338	1	31653	1	27222	8	31138	212	25514	22	45551	0	1161
_	9:09:18 AM	1:20:01 AM	_	1	27380	57	7466	1	27102	2	29429	1	26260	1	31726	1	27102	8	31552	212	24717	22	43124	0	1129
_	9:09:18 AM	1:25:01 AM	_	1	27367	57	6931	1	27170	2	29534	1	26386	1	31492	1	27170	8	33049	212	24366	22	40765	0	1184
_	9:09:18 AM	1:30:01 AM	_	1	27425	57	7975	1	27138	2	29353	1	26221	1	31794	1	27138	8	33611	212	23389	22	38478	0	1116
_	9:09:18 AM	1:35:01 AM	_	1	27273	57	7320	1	27133	2	29395	1	26336	1	31411	1	27133	8	30723	212	22745	22	36478	0	1137
_	9:09:18 AM	1:40:01 AM	_	1	27232	57	8754	1	27116	2	29369	1	26258	1	31858	1	27116	8	30975	212	22351	22	34031	0	1112
_	9:09:18 AM	1:45:01 AM	_	1	27380	57	8509	1	27235	2	29314	1	26189	1	31654	1	27235	8	30221	212	22156	22	31755	0	1096

_	9:09:18 AM	1:50:01 AM	_	1	27370	57	9298	1	27102	2	29354	1	26334	1	31537	1	27102	8	34320	212	21353	22	29368	0	1151
_	9:09:18 AM	1:55:01 AM	_	1	27457	57	9353	1	27121	2	29485	1	26207	1	31533	1	27121	8	30503	212	21068	22	26978	0	1138
_	9:09:18 AM	2:00:01 AM	_	1	27423	57	12246	1	27156	2	29242	1	26274	1	31682	1	27156	8	32202	212	20295	22	24556	0	1149
_	9:09:18 AM	2:05:01 AM	_	1	27459	57	11275	1	27127	2	29290	1	26244	1	31654	1	27127	8	35880	212	20340	22	22552	0	1162
_	9:09:18 AM	2:10:01 AM	_	1	27565	57	13465	1	27178	2	29292	1	26334	1	31764	1	27178	8	30688	212	19701	22	20997	0	1194
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_	9:09:18 AM	2:20:01 AM	_	1	27585	57	14025	1	27092	2	29171	1	26300	1	31706	1	27092	8	30940	212	18874	22	16103	0	1139
_	9:09:18 AM	2:25:01 AM	_	1	27310	57	13499	1	27201	2	29099	1	26349	1	31688	1	27201	8	31866	212	18396	22	13397	0	1154
_	9:09:18 AM	2:30:01 AM	_	1	27447	57	14545	1	27258	2	29254	1	26331	1	31820	1	27258	8	32394	212	17863	22	10924	0	1126
_	9:09:18 AM	2:35:01 AM	_	1	27216	57	16242	1	27246	2	29218	1	26383	1	31784	1	27246	8	31436	212	17322	22	8537	0	1147
_	9:09:18 AM	2:40:01 AM	_	1	27559	57	18359	1	27240	2	29243	1	26291	1	31856	1	27240	8	30850	212	17057	22	6217	0	1168
_	9:09:18 AM	2:45:01 AM	_	1	27409	57	16791	1	27148	2	29122	1	26364	1	31898	1	27148	8	31331	212	16304	22	3709	0	1126
_	9:09:18 AM	2:50:01 AM	_	1	27256	57	21244	1	27099	2	28995	1	26355	1	31761	1	27099	8	30592	212	15751	22	1212	0	1154
_	9:09:18 AM	2:55:01 AM	_	1	27439	57	21886	1	27170	2	29106	1	26270	1	31879	1	27170	8	33397	212	15461	21	64289	0	1169
_	9:09:18 AM	3:00:01 AM	_	1	27360	57	19327	1	27190	2	29093	1	26296	1	31794	1	27190	8	32687	212	15121	21	61829	0	1139
_	9:09:18 AM	3:05:01 AM	_	1	27443	57	23202	1	27136	2	28904	1	26317	1	31849	1	27136	8	30690	212	14622	21	59350	0	1185
_	9:09:18 AM	3:10:01 AM	_	1	27463	57	24158	1	27280	2	28851	1	26303	1	32231	1	27280	8	31451	212	14086	21	56642	0	1146
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_	9:09:18 AM	3:20:01 AM	_	1	27232	57	22345	1	27217	2	28911	1	26471	1	31814	1	27217	8	33307	212	12671	21	51798	0	1102
_	9:09:18 AM	3:25:01 AM	_	1	27295	57	25892	1	27094	2	28989	1	26181	1	31671	1	27094	8	32241	212	12238	21	49337	0	1155
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_	9:09:18 AM	12:20:01 PM	_	1	27398	55	65401	1	27172	2	28237	1	26212	1	30397	1	27172	7	63812	211	55568	25	9703	0	1069
_	9:09:18 AM	12:25:01 PM	_	1	27145	55	60193	1	27161	2	28280	1	26307	1	30109	1	27161	7	61874	211	55336	25	14129	0	1156
_	9:09:18 AM	12:30:01 PM	_	1	27636	55	60074	1	27209	2	28176	1	26301	1	30229	1	27209	7	64625	211	55089	25	18450	0	1078
_	9:09:18 AM	12:35:01 PM	_	1	27426	55	58208	1	27193	2	28131	1	26360	1	30264	1	27193	7	64049	211	55080	25	21216	0	1087
_	9:09:18 AM	12:40:01 PM	_	1	27397	55	55514	1	27290	2	28114	1	26400	1	30176	1	27290	7	64808	211	55374	25	23368	0	1126
_	9:09:18 AM	12:45:01 PM	_	1	27471	55	54245	1	27161	2	28131	1	26375	1	30302	1	27161	7	61451	211	55026	25	25719	0	1095
_	9:09:18 AM	12:50:01 PM	_	1	27498	55	53467	1	27198	2	28273	1	26449	1	29933	1	27198	7	63925	211	55516	25	28215	0	1102
_	9:09:18 AM	12:55:01 PM	_	1	27463	55	53572	1	27164	2	28155	1	26258	1	30391	1	27164	7	62092	211	54861	25	32194	0	1121
_	9:09:18 AM	1:00:01 PM	_	1	27622	55	57455	1	27111	2	28187	1	26298	1	30048	1	27111	7	53489	211	54872	25	35820	0	1058
_	9:09:18 AM	1:05:01 PM	_	1	27604	55	55632	1	27183	2	28174	1	26501	1	30159	1	27183	7	55611	211	54922	25	39489	0	1133
_	9:09:18 AM	1:10:01 PM	_	1	27434	55	52344	1	27254	2	28092	1	26290	1	29965	1	27254	7	62602	211	54989	25	42364	0	1071
_	9:09:18 AM	1:15:01 PM	_	1	27308	55	50390	1	27155	2	28252	1	26368	1	30120	1	27155	7	54468	211	54479	25	44031	0	1135
_	9:09:18 AM	1:20:01 PM	_	1	27362	55	46502	1	27221	2	28089	1	26403	1	30238	1	27221	7	55690	211	54613	25	48773	0	1127
_	9:09:18 AM	1:25:01 PM	_	1	27295	55	29689	1	27074	2	28160	1	26328	1	30077	1	27074	7	59638	211	54407	25	50657	0	1072
_	9:09:18 AM	1:30:01 PM	_	1	27222	55	40961	1	27268	2	28075	1	26201	1	30027	1	27268	7	56139	211	54457	25	52651	0	1069
_	9:09:18 AM	1:35:01 PM	_	1	27536	55	45395	1	27220	2	28192	1	26347	1	30057	1	27220	7	57235	211	54300	25	53074	0	1025
_	9:09:18 AM	1:40:00 PM	_	1	27389	55	43362	1	27291	2	28141	1	26354	1	30243	1	27291	7	62457	211	53862	25	55550	0	1035
_	9:09:18 AM	1:45:00 PM	_	1	27386	55	44732	1	27321	2	28220	1	26207	1	29887	1	27321	7	54728	211	54044	25	58001	0	1124
_	9:09:18 AM	1:50:01 PM	_	1	27403	55	43128	1	27210	2	28126	1	26412	1	29852	1	27210	7	54192	211	53734	25	59847	0	1122
_	9:09:18 AM	1:55:01 PM	_	1	27210	55	42625	1	27169	2	28134	1	26317	1	29854	1	27169	7	53505	211	53651	25	61659	0	1076
_	9:09:18 AM	2:00:01 PM	_	1	27569	55	40877	1	27214	2	28196	1	26268	1	29832	1	27214	7	51516	211	53658	25	63757	0	1032
_	9:09:18 AM	2:05:01 PM	_	1	27398	55	38804	1	27316	2	28129	1	26427	1	30335	1	27316	7	51946	211	53628	26	683	0	1112
_	9:09:18 AM	2:10:00 PM	_	1	27264	55	44587	1	27239	2	28094	1	26339	1	29938	1	27239	7	41673	211	53269	26	2634	0	1108
_	9:09:18 AM	2:15:01 PM	_	1	27452	55	41186	1	27144	2	28233	1	26204	1	29792	1	27144	7	50305	211	53179	26	4166	0	1063
_	9:09:18 AM	2:20:01 PM	_	1	27444	55	40753	1	27242	2	28025	1	26335	1	29882	1	27242	7	51212	211	52922	26	5283	0	1096
_	9:09:18 AM	2:25:01 PM	_	1	27407	55	39765	1	27192	2	28148	1	26383	1	30088	1	27192	7	49140	211	52762	26	6810	0	1113
_	9:09:18 AM	2:30:00 PM	_	1	27375	55	38271	1	27341	2	28230	1	26413	1	30473	1	27341	7	48196	211	52913	26	7842	0	1070
_	9:09:18 AM	2:35:01 PM	_	1	27444	55	40262	1	27192	2	28144	1	26326	1	29995	1	27192	7	45335	211	48849	26	8010	0	1077
_	9:09:18 AM	2:40:01 PM	_	1	27400	55	44349	1	27162	2	28093	1	26293	1	30151	1	27162	7	46418	220	54523	26	11352	0	1165
_	9:09:18 AM	2:45:00 PM	_	1	27442	55	34714	1	27294	2	28143	1	26303	1	30141	1	27294	7	42023	220	2011	26	14561	0	1043
_	9:09:18 AM	2:50:00 PM	_	1	27565	55	41728	1	27241	2	28304	1	26300	1	29875	1	27241	7	44865	219	32125	26	16651	0	1079
_	9:09:18 AM	2:55:00 PM	_	1	27553	55	43665	1	27302	2	28268	1	26405	1	29875	1	27302	7	49762	219	8459	26	20328	0	1105
_	9:09:18 AM	3:00:00 PM	_	1	27520	55	43058	1	27159	2	28175	1	26369	1	29818	1	27159	7	46548	218	58606	26	20826	0	1109
_	9:09:18 AM	3:05:00 PM	_	1	27348	55	42709	1	27186	2	28271	1	26403	1	29862	1	27186	7	49783	218	50511	26	23949	0	1157
_	9:09:18 AM	3:10:00 PM	_	1	27324	55	42171	1	27211	2	28362	1	26275	1	29937	1	27211	7	45726	218	43403	26	24242	0	1093
_	9:09:18 AM	3:15:00 PM	_	1	27454	55	42024	1	27349	2	28340	1	26447	1	29930	1	27349	7	45428	218	37754	26	24454	0	1060
_	9:09:18 AM	3:20:00 PM	_	1	27619	55	46849	1	27158	2	28567	1	26283	1	29763	1	27158	7	45270	218	33910	26	27377	0	1135
_	9:09:18 AM	3:25:00 PM	_	1	27359	39	44207	1	27140	2	29593	1	26298	1	31941	1	27140	8	20840	218	30640	26	32652	0	1156
_	9:09:18 AM	3:30:00 PM	_	1	27390	45	31750	1	27235	2	29898	1	26313	1	31388	1	27235	8	55571	218	27452	26	37916	0	1108
_	9:09:18 AM	3:35:01 PM	_	1	27407	50	34153	1	27059	2	29989	1	26351	1	31358	1	27059	8	50944	218	25016	26	40967	0	1077
_	9:09:18 AM	3:40:00 PM	_	1	27581	52	32851	1	27026	2	30217	1	26257	1	31050	1	27026	8	43753	218	22667	26	41613	0	1087
_	9:09:18 AM	3:45:00 PM	_	1	27361	53	39016	1	27157	2	30120	1	26215	1	30873	1	27157	8	34506	218	20900	26	41667	0	1121
_	9:09:18 AM	3:50:00 PM	_	1	27258	52	13858	1	27286	2	30226	1	26233	1	30933	1	27286	8	30483	218	18590	26	41953	0	1109
_	9:09:18 AM	3:55:00 PM	_	1	27476	54	5009	1	27292	2	30421	1	26296	1	30887	1	27292	8	24048	218	16872	26	43061	0	1093
_	9:09:18 AM	4:00:00 PM	_	1	27625	53	31452	1	27155	2	30069	1	26250	1	30815	1	27155	8	23488	218	15368	26	43531	0	1072
_	9:09:18 AM	4:05:00 PM	_	1	27462	53	36849	1	27207	2	30325	1	26242	1	30578	1	27207	8	23122	218	13958	26	43746	0	1067
_	9:09:18 AM	4:10:00 PM	_	1	27313	54	65348	1	27125	2	30363	1	26299	1	30845	1	27125	8	17883	218	12384	26	44734	0	1101
_	9:09:18 AM	4:15:00 PM	_	1	27400	53	30862	1	27318	2	30275	1	26452	1	30513	1	27318	8	20295	218	11072	26	45703	0	1100
_	9:09:18 AM	4:20:00 PM	_	1	27403	55	6702	1	27318	2	30364	1	26253	1	30651	1	27318	8	21425	218	9425	26	47008	0	1057
_	9:09:18 AM	4:25:00 PM	_	1	27356	55	12158	1	27126	2	30452	1	26241	1	30673	1	27126	8	23305	218	8353	26	48427	0	1108
_	9:09:18 AM	4:30:00 PM	_	1	27580	55	31917	1	27229	2	30335	1	26370	1	30711	1	27229	8	18609	218	6885	26	49075	0	1124
_	9:09:18 AM	4:35:00 PM	_	1	27439	55	61712	1	27142	2	30348	1	26319	1	30471	1	27142	8	14579	218	5845	26	49288	0	1155
_	9:09:18 AM	4:40:00 PM	_	1	27394	54	40954	1	27248	2	30466	1	26346	1	30367	1	27248	8	8349	218	4513	26	48427	0	1129
_	9:09:18 AM	4:45:01 PM	_	1	27476	55	59191	1	27155	2	30421	1	26400	1	30658	1	27155	8	9867	218	3221	26	46036	0	1108
_	9:09:18 AM	4:50:00 PM	_	1	27508	56	5437	1	27266	2	30493	1	26264	1	30647	1	27266	8	6644	218	2253	26	42570	0	1111
_	9:09:18 AM	4:55:01 PM	_	1	27467	55	63996	1	27132	2	30289	1	26280	1	30546	1	27132	8	7972	218	1303	26	43953	0	1149
_	9:09:18 AM	5:00:01 PM	_	1	27468	56	7580	1	27159	2	30320	1	26302	1	30327	1	27159	8	8571	217	65516	26	44070	0	1102
_	9:09:18 AM	5:05:00 PM	_	1	27419	55	59990	1	27215	2	30377	1	26382	1	30277	1	27215	8	7112	217	64450	26	43752	0	1134

_	9:09:18 AM	5:10:01 PM	_	1	27501	56	5763	1	27179	2	30410	1	26356	1	30268	1	27179	8	8770	217	63452	26	42611	0	1104
_	9:09:18 AM	5:15:01 PM	_	1	27263	56	12279	1	27120	2	30339	1	26373	1	30567	1	27120	8	3895	217	62443	26	42212	0	1039
_	9:09:18 AM	5:20:00 PM	_	1	27489	55	59641	1	27049	2	30333	1	26422	1	30381	1	27049	8	5696	217	61176	26	41407	0	1160
_	9:09:18 AM	5:25:01 PM	_	1	27428	56	11479	1	27184	2	30251	1	26377	1	30330	1	27184	8	4513	217	60405	26	39848	0	1099
_	9:09:18 AM	5:30:01 PM	_	1	27567	55	61879	1	27198	2	30244	1	26195	1	30000	1	27198	8	7680	217	59443	26	38339	0	1149
_	9:09:18 AM	5:35:01 PM	_	1	27297	56	5300	1	27229	2	30273	1	26388	1	30302	1	27229	8	6537	217	58082	26	37408	0	1101
_	9:09:18 AM	5:40:01 PM	_	1	27434	56	13462	1	27272	2	30231	1	26282	1	30089	1	27272	8	5439	217	57131	26	36937	0	1092
_	9:09:18 AM	5:45:01 PM	_	1	27450	56	1445	1	27313	2	30312	1	26259	1	30225	1	27313	8	1776	217	56403	26	36363	0	1139
_	9:09:18 AM	5:50:00 PM	_	1	27455	56	8393	1	27132	2	30107	1	26367	1	30106	1	27132	8	3460	217	55470	26	35804	0	1168
_	9:09:18 AM	5:55:00 PM	_	1	27409	56	12379	1	27173	2	30174	1	26272	1	30319	1	27173	8	5152	217	54469	26	35034	0	1113
_	9:09:18 AM	6:00:01 PM	_	1	27387	56	5769	1	27161	2	30198	1	26462	1	30337	1	27161	8	3802	217	53504	26	33979	0	1026
_	9:09:18 AM	6:05:01 PM	_	1	27655	56	10660	1	27226	2	30199	1	26305	1	30404	1	27226	8	3429	217	52144	26	32981	0	1175
_	9:09:18 AM	6:10:00 PM	_	1	27406	56	4709	1	27186	2	30245	1	26340	1	30087	1	27186	8	6662	217	51727	26	32219	0	1137
_	9:09:18 AM	6:15:01 PM	_	1	27434	56	9107	1	27261	2	30208	1	26317	1	30174	1	27261	8	4922	217	50482	26	30803	0	1135
_	9:09:18 AM	6:20:01 PM	_	1	27384	56	14672	1	27195	2	30188	1	26299	1	30206	1	27195	8	8061	217	49720	26	29976	0	1073
_	9:09:18 AM	6:25:01 PM	_	1	27452	56	7584	1	27288	2	30281	1	26298	1	30214	1	27288	8	6159	217	48694	26	29448	0	1057
_	9:09:18 AM	6:30:01 PM	_	1	27264	56	11391	1	27170	2	30122	1	26439	1	30302	1	27170	8	6802	217	47625	26	28455	0	1153
_	9:09:18 AM	6:35:00 PM	_	1	27477	56	11608	1	27145	2	29936	1	26287	1	30253	1	27145	8	9519	217	46884	26	27588	0	1081
_	9:09:18 AM	6:40:01 PM	_	1	27571	56	6984	1	27059	2	30016	1	26358	1	30114	1	27059	8	6450	217	45990	26	26719	0	1063
_	9:09:18 AM	6:45:00 PM	_	1	27380	56	10385	1	27191	2	30273	1	26221	1	30231	1	27191	8	6343	217	45321	26	25466	0	1162
_	9:09:18 AM	6:50:00 PM	_	1	27419	56	4329	1	27315	2	29992	1	26153	1	29999	1	27315	8	6313	217	44553	26	24299	0	1072
_	9:09:18 AM	6:55:00 PM	_	1	27364	56	10722	1	27126	2	30112	1	26173	1	30304	1	27126	8	5949	217	43531	26	22938	0	1095
_	9:09:18 AM	7:00:01 PM	_	1	27282	56	16328	1	27166	2	30137	1	26264	1	30347	1	27166	8	5382	217	42540	26	21619	0	1138
_	9:09:18 AM	7:05:00 PM	_	1	27306	56	11040	1	27154	2	29975	1	26354	1	30002	1	27154	8	6234	217	41923	26	19661	0	1138
_	9:09:18 AM	7:10:00 PM	_	1	27495	56	14072	1	27222	2	30066	1	26125	1	30141	1	27222	8	5910	217	41135	26	18266	0	1126
_	9:09:18 AM	7:15:01 PM	_	1	27502	56	5994	1	27168	2	30069	1	26395	1	29945	1	27168	8	6087	217	40033	26	16734	0	1117
_	9:09:18 AM	7:20:01 PM	_	1	27536	56	12503	1	27223	2	30156	1	26192	1	30073	1	27223	8	6557	217	39313	26	14808	0	1135
_	9:09:18 AM	7:25:01 PM	_	1	27404	56	14831	1	27292	2	30026	1	26326	1	30090	1	27292	8	9644	217	38747	26	13408	0	1155
_	9:09:18 AM	7:30:01 PM	_	1	27487	56	11158	1	27264	2	30170	1	26341	1	30220	1	27264	8	6101	217	37630	26	13068	0	1094
_	9:09:18 AM	7:35:01 PM	_	1	27430	56	13507	1	27233	2	30048	1	26361	1	29943	1	27233	8	6609	217	37407	26	11793	0	1109
_	9:09:18 AM	7:40:01 PM	_	1	27454	56	3503	1	27310	2	30063	1	26333	1	30028	1	27310	8	5817	217	36210	26	10431	0	1191
_	9:09:18 AM	7:45:01 PM	_	1	27403	56	12005	1	27211	2	30098	1	26316	1	30042	1	27211	8	5559	217	35431	26	8882	0	1143
_	9:09:18 AM	7:50:01 PM	_	1	27792	56	13211	1	27110	2	30103	1	26233	1	30092	1	27110	8	7532	217	34792	26	7259	0	1141
_	9:09:18 AM	7:55:01 PM	_	1	27261	56	10661	1	27174	2	30025	1	26300	1	30106	1	27174	8	7243	217	33950	26	7055	0	1099
_	9:09:18 AM	8:00:01 PM	_	1	27335	56	13542	1	27188	2	29985	1	26326	1	29932	1	27188	8	6840	217	33061	26	7411	0	1066
_	9:09:18 AM	8:05:01 PM	_	1	27497	56	6159	1	27178	2	30032	1	26298	1	29970	1	27178	8	5042	217	32471	26	7435	0	1128
_	9:09:18 AM	8:10:01 PM	_	1	27463	56	11029	1	27189	2	29956	1	26344	1	30064	1	27189	8	4058	217	31721	26	7544	0	1129
_	9:09:18 AM	8:15:01 PM	_	1	27235	56	16106	1	27234	2	30055	1	26339	1	30173	1	27234	8	1502	217	31060	26	7897	0	1120
_	9:09:18 AM	8:20:01 PM	_	1	27390	56	11936	1	27159	2	30081	1	26341	1	29790	1	27159	8	3913	217	30405	26	7966	0	1102
_	9:09:18 AM	8:25:01 PM	_	1	27531	56	15260	1	27095	2	30220	1	26342	1	30300	1	27095	8	3971	217	29480	26	7470	0	1107
_	9:09:18 AM	8:30:01 PM	_	1	27316	56	8707	1	27117	2	30135	1	26302	1	30094	1	27117	8	5575	217	29121	26	6283	0	1072
_	9:09:18 AM	8:35:01 PM	_	1	27444	56	9126	1	27167	2	30022	1	26308	1	30180	1	27167	8	3508	217	28201	26	6255	0	1162
_	9:09:18 AM	8:40:01 PM	_	1	27315	56	16263	1	27112	2	29929	1	26298	1	30252	1	27112	8	2810	217	27786	25	64050	0	1094
_	9:09:18 AM	8:45:01 PM	_	1	27426	56	8153	1	27267	2	30017	1	26344	1	29942	1	27267	8	4475	217	26878	25	63785	0	1133
_	9:09:18 AM	8:50:01 PM	_	1	27294	56	11834	1	27209	2	29878	1	26323	1	29955	1	27209	8	2433	217	26204	25	62470	0	1107
_	9:09:18 AM	8:55:01 PM	_	1	27358	56	3104	1	27200	2	30144	1	26368	1	29976	1	27200	8	7006	217	25280	25	54705	0	1113
_	9:09:18 AM	9:00:01 PM	_	1	27357	56	964	1	27245	2	29964	1	26191	1	29964	1	27245	8	4932	217	25333	25	48568	0	1150
_	9:09:18 AM	9:05:01 PM	_	1	27393	56	8337	1	27095	2	29741	1	26381	1	30019	1	27095	8	5648	217	24409	25	42879	0	1129
_	9:09:18 AM	9:10:01 PM	_	1	27195	55	63382	1	27161	2	29725	1	26223	1	30151	1	27161	8	6323	217	23811	25	37636	0	1110
_	9:09:18 AM	9:15:01 PM	_	1	27341	55	63376	1	27337	2	29638	1	26224	1	30046	1	27337	8	12448	217	23103	25	38375	0	1080
_	9:09:18 AM	9:20:01 PM	_	1	27339	56	1306	1	27103	2	29804	1	26393	1	30027	1	27103	8	11923	217	22438	25	41006	0	1134
_	9:09:18 AM	9:25:01 PM	_	1	27365	55	64965	1	27068	2	29706	1	26263	1	29804	1	27068	8	7034	217	22014	25	40434	0	1117
_	9:09:18 AM	9:30:01 PM	_	1	27347	55	63748	1	27172	2	29734	1	26369	1	30041	1	27172	8	8770	217	21452	25	39217	0	1154
_	9:09:18 AM	9:35:01 PM	_	1	27619	55	61201	1	27175	2	29625	1	26268	1	30001	1	27175	8	9476	217	20881	25	37331	0	1103
_	9:09:18 AM	9:40:01 PM	_	1	27436	55	58868	1	27165	2	29722	1	26302	1	30148	1	27165	8	12835	217	19816	25	35309	0	1122
_	9:09:18 AM	9:45:01 PM	_	1	27464	55	64844	1	27133	2	29715	1	26349	1	29786	1	27133	8	11699	217	19482	25	33241	0	1076
_	9:09:18 AM	9:50:01 PM	_	1	27440	55	59286	1	27268	2	29565	1	26376	1	29859	1	27268	8	10649	217	18871	25	30785	0	1131
_	9:09:18 AM	9:55:01 PM	_	1	27376	55	60829	1	27260	2	29635	1	26226	1	29985	1	27260	8	14330	217	18149	25	28115	0	1177
_	9:09:18 AM	10:00:01 PM	_	1	27380	55	57946	1	27242	2	29692	1	26318	1	30052	1	27242	8	14537	217	17772	25	24837	0	1133
_	9:09:18 AM	10:05:01 PM	_	1	27380	55	58976	1	27185	2	29586	1	26281	1	29876	1	27185	8	14010	217	16894	25	22595	0	1103
_	9:09:18 AM	10:10:01 PM	_	1	27184	55	43911	1	27069	2	29582	1	26241	1	29987	1	27069	8	13706	217	16403	25	19483	0	1146
_	9:09:18 AM	10:15:01 PM	_	1	27288	55	59113	1	27203	2	29666	1	26331	1	29796	1	27203	8	11959	217	15579	25	15819	0	1098
_	9:09:18 AM	10:20:01 PM	_	1	27383	55	62827	1	27179	2	29562	1	26411	1	29908	1	27179	8	6508	217	15156	25	12396	0	1099
_	9:09:18 AM	10:25:01 PM	_	1	27186	55	59002	1	27157	2	29479	1	26347	1	29909	1	27157	8	4330	217	14296	25	8571	0	1093
_	9:09:18 AM	10:30:01 PM	_	1	27431	55	62724	1	27171	2	29547	1	26260	1	30247	1	27171	8	3816	217	13891	25	4634	0	1145
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_	9:09:18 AM	10:40:01 PM	_	1	27396	55	65276	1	27150	2	29340	1	26385	1	29983	1	27150	7	64763	217	12270	24	62322	0	1140
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_	9:09:18 AM	10:50:01 PM	_	1	27472	55	63733	1	27309	2	29349	1	26277	1	29890	1	27309	7	59382	217	11311	24	53180	0	1136
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_	9:09:18 AM	11:00:01 PM	_	1	27417	55	63633	1	27155	2	29108	1	26258	1	30194	1	27155	7	54855	217	9783	24	44507	0	1189
_	9:09:18 AM	11:05:01 PM	_	1	27441	55	61142	1	27218	2	29050	1	26341	1	30165	1	27218	7	53725	217	8725	24	40500	0	1079
_	9:09:18 AM	11:10:01 PM	_	1	27482	55	59733	1	27320	2	29083	1	26360	1	29937	1	27320	7	54807	217	8198	24	36414	0	1106
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_	9:09:18 AM	11:50:01 PM	_	1	27420	55	55275	1	27183	2	28649	1	26358	1	29963	1	27183	7	49613	217	2690	24	2250	0	1127
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_	10:09:18 AM	12:00:01 AM	_	1	27186	55	52235	1	27121	2	28594	1	26222	1	30368	1	27121	7	50097	217	732	23	58767	0	1169
_	10:09:18 AM	12:10:01 AM	_	1	27317	55	50092	1	27104	2	28388	1	26336	1	29858	1	27104	7	51145	216	64354	23	50706	0	1140
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_	10:09:18 AM	12:20:01 AM	_	1	27362	55	49602	1	27294	2	28479	1	26356	1	30076	1	27294	7	46165	216	63542	23	43143	0	1158
_	10:09:18 AM	12:25:01 AM	_	1	27409	55	51564	1	27122	2	28394	1	26377	1	30078	1	27122	7	46746	216	62882	23	39337	0	1174
_	10:09:18 AM	12:30:01 AM	_	1	27305	55	53548	1	27070	2	28344	1	26323	1	30106	1	27070	7	43749	216	62416	23	35612	0	1172
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_	10:09:18 AM	12:55:01 AM	_	1	27556	55	54313	1	27198	2	28302	1	26317	1	29870	1	27198	7	50456	216	58773	23	21425	0	1140
_	10:09:18 AM	1:00:01 AM	_	1	27427	55	45305	1	27232	2	28261	1	26362	1	29923	1	27232	7	47294	216	58022	23	18606	0	1180
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_	10:09:18 AM	1:15:01 AM	_	1	27338	55	48154	1	27273	2	28284	1	26219	1	29821	1	27273	7	46704	216	56077	23	11341	0	1195
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_	10:09:18 AM	2:00:01 AM	_	1	27397	55	47820	1	27211	2	27987	1	26334	1	30229	1	27211	7	46276	216	50124	22	54942	0	1178
_	10:09:18 AM	2:05:01 AM	_	1	27484	55	44032	1	27089	2	27995	1	26501	1	29893	1	27089	7	42745	216	49847	22	52536	0	1195
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_	10:09:18 AM	2:55:01 AM	_	1	27276	55	46630	1	27011	2	27902	1	26229	1	29949	1	27011	7	47828	216	44080	22	29104	0	1129
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_	10:09:18 AM	3:45:01 AM	_	1	27403	55	37630	1	27189	2	27651	1	26382	1	29839	1	27189	7	46838	216	38634	22	5710	0	1177
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_	10:09:18 AM	4:00:01 AM	_	1	27244	55	37092	1	27206	2	27454	1	26383	1	29954	1	27206	7	45586	216	37380	21	64338	0	1112
_	10:09:18 AM	4:05:01 AM	_	1	27441	55	40581	1	27118	2	27242	1	26303	1	30004	1	27118	7	45644	216	36784	21	62082	0	1160
_	10:09:18 AM	4:10:01 AM	_	1	27351	55	33254	1	27112	2	27532	1	26307	1	29723	1	27112	7	46302	216	36021	21	59841	0	1116
_	10:09:18 AM	4:15:01 AM	_	1	27214	55	36059	1	27068	2	27466	1	26359	1	29728	1	27068	7	47362	216	35195	21	57471	0	1194
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_	10:09:18 AM	4:25:01 AM	_	1	27591	55	31635	1	27105	2	27362	1	26307	1	29784	1	27105	7	46562	216	33869	21	54334	0	1174
_	10:09:18 AM	4:30:01 AM	_	1	27693	55	37803	1	27154	2	27243	1	26237	1	29742	1	27154	7	42872	216	33256	21	52483	0	1106
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_	10:09:18 AM	4:50:01 AM	_	1	27336	55	31472	1	27003	2	27239	1	26341	1	29837	1	27003	7	42970	216	31620	21	44338	0	1159
_	10:09:18 AM	4:55:01 AM	_	1	27417	55	32444	1	27063	2	27284	1	26400	1	29908	1	27063	7	48345	216	30935	21	42191	0	1182
_	10:09:18 AM	5:00:01 AM	_	1	27322	55	29410	1	27203	2	27059	1	26243	1	29701	1	27203	7	44039	216	31001	21	40077	0	1159
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_	10:09:18 AM	5:15:01 AM	_	1	27299	55	31837	1	27210	2	27040	1	26258	1	29819	1	27210	7	39012	216	29205	21	33917	0	1154
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_	10:09:18 AM	5:25:01 AM	_	1	27559	55	27363	1	27125	2	26985	1	26227	1	29544	1	27125	7	39446	216	28072	21	29773	0	1153
_	10:09:18 AM	5:30:01 AM	_	1	27563	55	29624	1	27108	2	26885	1	26227	1	29839	1	27108	7	38535	216	27749	21	27615	0	1142
_	10:09:18 AM	5:35:01 AM	_	1	27411	55	33912	1	27146	2	26881	1	26328	1	29794	1	27146	7	39336	216	27339	21	25746	0	1122
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_	10:09:18 AM	5:45:01 AM	_	1	27366	55	27381	1	27110	2	26783	1	26280	1	30040	1	27110	7	41620	216	26281	21	21799	0	1182
_	10:09:18 AM	5:50:01 AM	_	1	27244	55	25852	1	27110	2	26711	1	26292	1	29773	1	27110	7	34849	216	26120	21	19836	0	1135
_	10:09:18 AM	5:55:01 AM	_	1	27472	55	21546	1	27250	2	26677	1	26246	1	29772	1	27250	7	34030	216	25259	21	17821	0	1139
_	10:09:18 AM	6:00:01 AM	_	1	27296	55	28707	1	27184	2	26791	1	26208	1	29913	1	27184	7	39021	216	24887	21	15989	0	1164
_	10:09:18 AM	6:05:01 AM	_	1	27471	55	22359	1	27216	2	26732	1	26237	1	29753	1	27216	7	37208	216	24392	21	14505	0	1181
_	10:09:18 AM	6:10:01 AM	_	1	27363	55	23595	1	27124	2	26657	1	26263	1	29808	1	27124	7	38713	216	23859	21	14920	0	1165
_	10:09:18 AM	6:15:01 AM	_	1	27493	55	23516	1	27131	2	26784	1	26303	1	29849	1	27131	7	37084	216	23916	21	16323	0	1129
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_	10:09:18 AM	6:25:01 AM	_	1	27420	55	25404	1	27148	2	26762	1	26314	1	29926	1	27148	7	38313	216	22639	21	19460	0	1179
_	10:09:18 AM	6:30:01 AM	_	1	27329	55	18657	1	27213	2	26720	1	26395	1	29592	1	27213	7	34561	216	22318	21	21450	0	1144
_	10:09:18 AM	6:35:01 AM	_	1	27443	55	19859	1	27172	2	26718	1	26280	1	29845	1	27172	7	36525	216	21656	21	23439	0	1132
_	10:09:18 AM	6:40:01 AM	_	1	27517	55	21434	1	27185	2	26914	1	26327	1	29881	1	27185	7	38217	216	21316	21	25498	0	1179
_	10:09:18 AM	6:45:01 AM	_	1	27378	55	18468	1	27017	2	26965	1	26306	1	29875	1	27017	7	37713	216	21222	21	27672	0	1223
_	10:09:18 AM	6:50:01 AM	_	1	27430	55	24461	1	27145	2	27007	1	26306	1	29796	1	27145	7	39458	216	20485	21	30064	0	1195
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_	10:09:18 AM	7:00:01 AM	_	1	27337	55	23837	1	27284	2	27080	1	26325	1	29792	1	27284	7	34119	216	19955	21	35034	0	1136
_	10:09:18 AM	7:05:01 AM	_	1	27506	55	27480	1	27110	2	27202	1	26279	1	30102	1	27110	7	38142	216	19802	21	38073	0	1197
_	10:09:18 AM	7:10:01 AM	_	1	27338	55	23486	1	27125	2	27304	1	26255	1	30031	1	27125	7	35352	216	19025	21	40035	0	1174
_	10:09:18 AM	7:15:01 AM	_	1	27674	55	30043	1	27043	2	27355	1	26334	1	29969	1	27043	7	39086	216	18856	21	42667	0	1180
_	10:09:18 AM	7:20:01 AM	_	1	27360	55	26597	1	27104	2	27423	1	26216	1	30085	1	27104	7	37028	216	18701	21	45445	0	1160
_	10:09:18 AM	7:25:01 AM	_	1	27557	55	27755	1	27198	2	27478	1	26389	1	29950	1	27198	7	34680	216	18257	21	48794	0	1144
_	10:09:18 AM	7:30:01 AM	_	1	27441	55	15399	1	27081	2	27260	1	26331	1	30177	1	27081	7	39413	216	17430	21	52898	0	1170
_	10:09:18 AM	7:35:01 AM	_	1	27448	55	7384	1	27187	2	27302	1	26415	1	30184	1	27187	7	47356	216	17137	21	57673	0	1143
_	10:09:18 AM	7:40:01 AM	_	1	27521	55	14410	1	27224	2	27314	1	26134	1	30051	1	27224	7	50258	216	17116	21	60979	0	1106
_	10:09:18 AM	7:45:01 AM	_	1	27545	55	11998	1	27074	2	27574	1	26465	1	30152	1	27074	7	44372	216	17347	21	63364	0	1119
_	10:09:18 AM	7:50:01 AM	_	1	27448	55	14778	1	27283	2	27556	1	26257	1	30529	1	27283	7	45780	216	17630	22	460	0	1131
_	10:09:18 AM	7:55:01 AM	_	1	27297	55	13358	1	27145	2	27617	1	26376	1	30362	1	27145	7	43320	216	17508	22	4999	0	1119
_	10:09:18 AM	8:00:01 AM	_	1	27473	55	15860	1	27078	2	27616	1	26253	1	30169	1	27078	7	41122	216	17669	22	10395	0	1182
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_	10:09:18 AM	8:10:01 AM	_	1	27251	55	18675	1	27069	2	27541	1	26393	1	30144	1	27069	7	34941	216	16977	22	14062	0	1157
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_	10:09:18 AM	8:30:01 AM	_	1	27376	55	29867	1	27156	2	27910	1	26315	1	30261	1	27156	7	18801	216	16384	22	42315	0	1166

_	10:09:18 AM	8:35:01 AM	_	1	27507	55	26818	1	27269	2	28047	1	26453	1	30119	1	27269	7	12689	216	16580	22	51042	0	1152
_	10:09:18 AM	8:40:01 AM	_	1	27557	55	30029	1	27044	2	27982	1	26335	1	30255	1	27044	7	9723	216	16527	22	57829	0	1198
_	10:09:18 AM	8:45:01 AM	_	1	27361	55	41914	1	27175	2	28054	1	26206	1	30173	1	27175	7	3137	216	16230	23	1458	0	1179
_	10:09:18 AM	8:50:01 AM	_	1	27465	55	38380	1	27095	2	28074	1	26289	1	30031	1	27095	6	63947	216	16287	23	6475	0	1146
_	10:09:18 AM	8:55:01 AM	_	1	27369	55	40636	1	27161	2	28057	1	26283	1	30385	1	27161	6	59214	216	16683	23	16115	0	1159
_	10:09:18 AM	9:00:01 AM	_	1	27394	55	38486	1	27196	2	28101	1	26405	1	30104	1	27196	6	56099	216	16669	23	21567	0	1162
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_	10:09:18 AM	9:10:01 AM	_	1	27419	55	41940	1	27127	2	28281	1	26392	1	30360	1	27127	6	47342	216	17171	23	42756	0	1194
_	10:09:18 AM	9:15:01 AM	_	1	27318	55	41295	1	27155	2	28306	1	26187	1	30228	1	27155	6	41030	216	17249	23	56264	0	1159
_	10:09:18 AM	9:20:01 AM	_	1	27430	55	42685	1	27198	2	28667	1	26390	1	30411	1	27198	6	40173	216	17009	24	2309	0	1140
_	10:09:18 AM	9:25:01 AM	_	1	27281	55	46687	1	27156	2	28724	1	26364	1	30271	1	27156	6	36569	216	17851	24	11153	0	1137
_	10:09:18 AM	9:30:01 AM	_	1	27396	55	40603	1	27199	2	28562	1	26355	1	30162	1	27199	6	35023	216	17322	24	18391	0	1120
_	10:09:18 AM	9:35:01 AM	_	1	27665	55	38585	1	27186	2	28609	1	26345	1	30191	1	27186	6	35551	216	18136	24	22816	0	1160
_	10:09:18 AM	9:40:01 AM	_	1	27261	55	34574	1	27203	2	28528	1	26233	1	30055	1	27203	6	32996	216	18129	24	29923	0	1168
_	10:09:18 AM	9:45:01 AM	_	1	27571	55	37224	1	27166	2	28750	1	26340	1	30090	1	27166	6	35472	216	17931	24	41801	0	1122
_	10:09:18 AM	9:50:01 AM	_	1	27352	55	47628	1	27247	2	28783	1	26222	1	30137	1	27247	6	26340	216	18293	24	48559	0	1180
_	10:09:18 AM	9:55:01 AM	_	1	27282	55	46593	1	27146	2	28883	1	26224	1	30338	1	27146	6	27532	216	18518	24	50416	0	1134
_	10:09:18 AM	10:00:01 AM	_	1	27348	55	51884	1	27136	2	29095	1	26338	1	30197	1	27136	6	26347	216	18431	24	53295	0	1112
_	10:09:18 AM	10:05:01 AM	_	1	27219	55	45219	1	27182	2	29131	1	26280	1	30172	1	27182	6	27024	216	19116	24	60426	0	1139
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_	10:09:18 AM	10:35:01 AM	_	1	27371	55	28901	1	27177	2	28715	1	26379	1	30204	1	27177	6	30336	216	19908	25	7859	0	1163
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_	10:09:18 AM	10:55:01 AM	_	1	27341	55	27210	1	27230	2	28869	1	26408	1	29693	1	27230	6	27777	216	19917	25	23106	0	1152
_	10:09:18 AM	11:00:01 AM	_	1	27476	55	27604	1	27014	2	28672	1	26317	1	29950	1	27014	6	25173	216	20005	25	27053	0	1163
_	10:09:18 AM	11:05:01 AM	_	1	27337	55	36871	1	27263	2	28758	1	26318	1	30088	1	27263	6	29294	216	20125	25	30907	0	1091
_	10:09:18 AM	11:10:01 AM	_	1	27562	55	37034	1	27224	2	28721	1	26343	1	29859	1	27224	6	29031	216	20157	25	32995	0	1179
_	10:09:18 AM	11:15:01 AM	_	1	27297	55	41216	1	27267	2	29043	1	26417	1	30055	1	27267	6	26696	216	20167	25	34415	0	1102
_	10:09:18 AM	11:20:01 AM	_	1	27455	55	38720	1	27211	2	28887	1	26265	1	29795	1	27211	6	31715	216	20139	25	35603	0	1096
_	10:09:18 AM	11:25:01 AM	_	1	27458	55	43826	1	27217	2	28920	1	26336	1	30067	1	27217	6	32239	216	20115	25	38052	0	1106
_	10:09:18 AM	11:30:01 AM	_	1	27371	55	51470	1	27221	2	29069	1	26292	1	30016	1	27221	6	30421	216	19998	25	40046	0	1167
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_	10:09:18 AM	11:50:01 AM	_	1	27353	55	59200	1	27064	2	29398	1	26211	1	30101	1	27064	6	28065	216	19654	25	58084	0	1120
_	10:09:18 AM	11:55:01 AM	_	1	27429	56	3995	1	27259	2	29647	1	26363	1	29901	1	27259	6	26072	216	19857	25	61796	0	1053
_	10:09:18 AM	12:00:01 PM	_	1	27192	56	1806	1	27140	2	29756	1	26213	1	30095	1	27140	6	27406	216	19737	25	65001	0	1084
_	10:09:18 AM	12:05:01 PM	_	1	27195	56	4040	1	27179	2	29689	1	26345	1	30014	1	27179	6	25034	216	19366	26	2453	0	1110
_	10:09:18 AM	12:10:01 PM	_	1	27529	56	6325	1	27212	2	29609	1	26304	1	29903	1	27212	6	24021	216	19294	26	5808	0	1112
_	10:09:18 AM	12:15:01 PM	_	1	27379	56	5479	1	27225	2	29803	1	26428	1	29959	1	27225	6	22980	216	19515	26	8752	0	1154
_	10:09:18 AM	12:20:01 PM	_	1	27317	56	13543	1	27176	2	29881	1	26230	1	29966	1	27176	6	22378	216	19005	26	10657	0	1094
_	10:09:18 AM	12:25:01 PM	_	1	27316	56	10634	1	27331	2	29794	1	26271	1	29737	1	27331	6	22233	216	19279	26	13412	0	1085
_	10:09:18 AM	12:30:01 PM	_	1	27355	56	11741	1	27212	2	29952	1	26237	1	30207	1	27212	6	22277	216	19075	26	15184	0	1174
_	10:09:18 AM	12:35:01 PM	_	1	27463	56	7443	1	27177	2	29935	1	26327	1	29705	1	27177	6	19785	216	19181	26	16604	0	1063
_	10:09:18 AM	12:40:00 PM	_	1	27417	56	11473	1	27110	2	29992	1	26373	1	29857	1	27110	6	21382	216	19218	26	18989	0	1134
_	10:09:18 AM	12:45:01 PM	_	1	27327	56	14313	1	27107	2	29915	1	26287	1	29686	1	27107	6	20330	216	18890	26	20896	0	1076
_	10:09:18 AM	12:50:00 PM	_	1	27451	56	8274	1	27341	2	29983	1	26305	1	30479	1	27341	6	18559	216	19007	26	23921	0	1031
_	10:09:18 AM	12:55:00 PM	_	1	27365	56	11337	1	27385	2	29902	1	26249	1	29915	1	27385	6	18899	216	19081	26	26036	0	1086
_	10:09:18 AM	1:00:01 PM	_	1	27585	56	8525	1	27165	2	30215	1	26373	1	29774	1	27165	6	19168	216	18934	26	28264	0	1040
_	10:09:18 AM	1:05:01 PM	_	1	27350	56	12859	1	27157	2	30197	1	26401	1	30003	1	27157	6	18017	216	18556	26	30078	0	1054
_	10:09:18 AM	1:10:01 PM	_	1	27237	56	23190	1	27210	2	30489	1	26284	1	29765	1	27210	6	16614	216	18629	26	34447	0	1117
_	10:09:18 AM	1:15:00 PM	_	1	27267	56	21769	1	27240	2	30286	1	26340	1	29868	1	27240	6	16088	216	18317	26	38368	0	1075
_	10:09:18 AM	1:20:00 PM	_	1	27501	56	22556	1	27139	2	30240	1	26339	1	29718	1	27139	6	16997	216	18475	26	38598	0	1083
_	10:09:18 AM	1:25:00 PM	_	1	27550	56	26858	1	27173	2	30495	1	26403	1	29569	1	27173	6	15307	216	18511	26	37566	0	1090
_	10:09:18 AM	1:30:01 PM	_	1	27295	56	21432	1	27385	2	30630	1	26229	1	29728	1	27385	6	15146	216	18080	26	41807	0	1111
_	10:09:18 AM	1:35:01 PM	_	1	27313	56	29400	1	27119	2	30558	1	26183	1	29720	1	27119	6	14758	216	18174	26	45188	0	1125
_	10:09:18 AM	1:40:01 PM	_	1	27384	56	25860	1	27288	2	30599	1	26223	1	29891	1	27288	6	14875	216	17713	26	46907	0	1035
_	10:09:18 AM	1:45:00 PM	_	1	27413	56	26306	1	27303	2	30673	1	26346	1	29679	1	27303	6	13649	216	17659	26	53918	0	1063
_	10:09:18 AM	1:50:00 PM	_	1	27435	56	31972	1	27253	2	30730	1	26236	1	29598	1	27253	6	13958	216	17485	26	55096	0	1074
_	10:09:18 AM	1:55:01 PM	_	1	27437	56	31567	1	27142	2	30868	1	26408	1	29760	1	27142	6	16681	216	17208	26	56433	0	1102
_	10:09:18 AM	2:00:01 PM	_	1	27345	56	36599	1	27135	2	30737	1	26212	1	29888	1	27135	6	12961	216	17079	26	57182	0	1092
_	10:09:18 AM	2:05:01 PM	_	1	27465	56	30680	1	27157	2	30825	1	26321	1	29867	1	27157	6	13054	216	17150	26	61457	0	1172
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_	10:09:18 AM	2:15:00 PM	_	1	27735	56	35642	1	27151	2	30871	1	26233	1	29576	1	27151	6	12979	216	16956	26	64465	0	1021
_	10:09:18 AM	2:20:00 PM	_	1	27384	56	36845	1	27204	2	30852	1	26353	1	29842	1	27204	6	12915	216	16550	27	389	0	1032
_	10:09:18 AM	2:25:00 PM	_	1	27379	56	42537	1	27152	2	31152	1	26411	1	29663	1	27152	6	13652	216	16731	27	1538	0	1097
_	10:09:18 AM	2:30:00 PM	_	1	27373	56	39160	1	27236	2	31105	1	26329	1	29495	1	27236	6	13458	216	16348	27	2761	0	1196
_	10:09:18 AM	2:35:01 PM	_	1	27493	56	36584	1	27046	2	30955	1	26236	1	29715	1	27046	6	13089	216	16193	27	3506	0	1076
_	10:09:18 AM	2:40:00 PM	_	1	27657	56	39451	1	27095	2	30854	1	26238	1	29722	1	27095	6	13319	216	16043	27	4751	0	1154
_	10:09:18 AM	2:45:00 PM	_	1	27365	56	33104	1	27126	2	30942	1	26375	1	29644	1	27126	6	13988	216	16101	27	6144	0	1054
_	10:09:18 AM	2:50:00 PM	_	1	27369	56	37907	1	27206	2	30903	1	26362	1	29685	1	27206	6	15174	216	15898	27	5283	0	1110
_	10:09:18 AM	2:55:00 PM	_	1	27438	56	20153	1	27224	2	30535	1	26313	1	29680	1	27224	6	12509	216	15582	27	5750	0	1128
_	10:09:18 AM	3:00:00 PM	_	1	27361	53	54945	1	27092	2	30037	1	26281	1	29905	1	27092	9	16546	216	15650	27	6579	0	1105
_	10:09:18 AM	3:05:00 PM	_	1	27385	55	62812	1	27198	2	30447	1	26399	1	29658	1	27198	6	37584	216	15383	27	3136	0	1129
_	10:09:18 AM	3:10:00 PM	_	1	27337	55	56895	1	27198	2	30045	1	26420	1	29607	1	27198	6	41025	216	15138	27	2985	0	1087
_	10:09:18 AM	3:15:00 PM	_	1	27312	55	49193	1	27069	2	30007	1	26373	1	29713	1	27069	6	24674	216	15066	27	2515	0	1050
_	10:09:18 AM	3:20:00 PM	_	1	27275	55	59203	1	27313	2	29723	1	26399	1	29530	1	27313	6	27304	216	14628	27	3803	0	1076
_	10:09:18 AM	3:25:00 PM	_	1	27333	55	57714	1	27252	2	29786	1	26314	1	29681	1	27252	6	22554	216	14656	27	4580	0	1112
_	10:09:18 AM	3:30:00 PM	_	1	27289	56	931	1	27172	2	29925	1	26354	1	29638	1	27172	6	16221	216	14175	27	5202	0	1162
_	10:09:18 AM	3:35:00 PM	_	1	27367	55	51967	1	27219	2	29591	1	26278	1	29392	1	27219	6	19587	216	13953	27	3895	0	1129
_	10:09:18 AM	3:40:00 PM	_	1	27385	55	60984	1	27084	2	29646	1	26333	1	29469	1	27084	6	18421	216	13931	27	1440	0	1001
_	10:09:18 AM	3:45:00 PM	_	1	27317	55	54811	1	27136	2	29655	1	26345	1	29368	1	27136	6	13195	216	13657	27	1609	0	1174
_	10:09:18 AM	3:50:00 PM	_	1	27278	55	52180	1	27200	2	29580	1	26347	1	29406	1	27200	6	13852	216	13364	26	64667	0	1079
_	10:09:18 AM	3:55:00 PM	_	1	27396	55	54249	1	27272	2	29378	1	26313	1	29582	1	27272	6	14045	216	13104	26	61715	0	1142
_	10:09:18 AM	4:00:00 PM	_	1	27403	55	55264	1	27112	2	29556	1	26327	1	29391	1	27112	6	14392	216	12825	26	63625	0	1114
_	10:09:18 AM	4:05:00 PM	_	1	27406	55	47963	1	27326	2	29502	1	26367	1	29586	1	27326	6	17430	216	12789	26	64361	0	1047
_	10:09:18 AM	4:10:00 PM	_	1	27446	55	61592	1	27178	2	29618	1	26314	1	29525	1	27178	6	12200	216	12493	26	64866	0	1120

_	10:09:18 AM	4:15:00 PM	_	1	27410	55	56168	1	27196	2	29786	1	26168	1	29528	1	27196	6	8518	216	12027	26	65462	0	1065
_	10:09:18 AM	4:20:00 PM	_	1	27505	56	10449	1	27156	2	29724	1	26165	1	29391	1	27156	6	10511	216	11957	27	631	0	1098
_	10:09:18 AM	4:25:00 PM	_	1	27446	56	7931	1	27207	2	29815	1	26290	1	29261	1	27207	6	10445	216	11390	27	1044	0	1163
_	10:09:18 AM	4:30:00 PM	_	1	27330	56	6717	1	27160	2	29696	1	26277	1	29351	1	27160	6	8043	216	11058	27	1597	0	1149
_	10:09:18 AM	4:35:00 PM	_	1	27376	56	16427	1	27312	2	29873	1	26282	1	29403	1	27312	6	7196	216	10741	27	2269	0	1096
_	10:09:18 AM	4:40:00 PM	_	1	27541	56	13283	1	27170	2	29822	1	26379	1	29246	1	27170	6	6387	216	10593	27	3108	0	1086
_	10:09:18 AM	4:45:00 PM	_	1	27371	56	15668	1	27134	2	29921	1	26378	1	29265	1	27134	6	5171	216	10085	27	3622	0	1116
_	10:09:18 AM	4:50:00 PM	_	1	27424	56	19122	1	27240	2	29850	1	26197	1	29545	1	27240	6	4293	216	9982	27	4637	0	1132
_	10:09:18 AM	4:55:00 PM	_	1	27480	56	23702	1	27138	2	30040	1	26349	1	29172	1	27138	6	1655	216	9371	27	5133	0	1085
_	10:09:18 AM	5:00:00 PM	_	1	27461	56	26813	1	27153	2	30037	1	26273	1	29265	1	27153	6	1065	216	9157	27	5108	0	1148
_	10:09:18 AM	5:05:00 PM	_	1	27443	56	28315	1	27152	2	30139	1	26364	1	29371	1	27152	6	1934	216	8639	27	5303	0	1130
_	10:09:18 AM	5:10:00 PM	_	1	27495	56	32188	1	27254	2	30155	1	26418	1	29262	1	27254	6	3748	216	8599	27	6071	0	1070
_	10:09:18 AM	5:15:00 PM	_	1	27372	56	37409	1	27188	2	30270	1	26326	1	29407	1	27188	6	4643	216	8295	27	6397	0	1095
_	10:09:18 AM	5:20:00 PM	_	1	27411	56	35634	1	27227	2	30203	1	26277	1	29204	1	27227	6	2576	216	7895	27	6098	0	1121
_	10:09:18 AM	5:25:00 PM	_	1	27356	56	39722	1	27248	2	30198	1	26221	1	29286	1	27248	6	3019	216	7490	27	7688	0	1102
_	10:09:18 AM	5:30:00 PM	_	1	27393	56	36107	1	27247	2	30220	1	26316	1	29173	1	27247	6	474	216	6985	27	7260	0	1130
_	10:09:18 AM	5:35:00 PM	_	1	27626	56	43301	1	27243	2	30300	1	26280	1	29239	1	27243	5	64504	216	6926	27	7141	0	1058
_	10:09:18 AM	5:40:00 PM	_	1	27465	56	37030	1	27152	2	30330	1	26298	1	29230	1	27152	5	62403	216	6672	27	6907	0	1104
_	10:09:18 AM	5:45:01 PM	_	1	27484	56	36698	1	27389	2	30279	1	26356	1	29366	1	27389	5	60679	216	6547	27	6627	0	1099
_	10:09:18 AM	5:50:00 PM	_	1	27363	56	45956	1	27126	2	30455	1	26379	1	29187	1	27126	5	59892	216	6266	27	6067	0	1113
_	10:09:18 AM	5:55:00 PM	_	1	27236	56	46857	1	27123	2	30491	1	26271	1	29364	1	27123	5	59969	216	6062	27	5359	0	1036
_	10:09:18 AM	6:00:01 PM	_	1	27394	56	48397	1	27142	2	30601	1	26263	1	29431	1	27142	5	59959	216	5455	27	4537	0	1105
_	10:09:18 AM	6:05:00 PM	_	1	27345	56	39953	1	27284	2	30305	1	26225	1	29155	1	27284	5	59989	216	5500	27	3803	0	1088
_	10:09:18 AM	6:10:01 PM	_	1	27399	56	38710	1	27125	2	30256	1	26372	1	29422	1	27125	5	58069	216	5288	27	2809	0	1138
_	10:09:18 AM	6:15:00 PM	_	1	27342	56	46764	1	27211	2	30650	1	26237	1	29273	1	27211	5	60884	216	4806	27	2087	0	1108
_	10:09:18 AM	6:20:00 PM	_	1	27388	56	37891	1	27162	2	30413	1	26287	1	29143	1	27162	5	56467	216	4329	27	1041	0	1084
_	10:09:18 AM	6:25:00 PM	_	1	27546	56	37362	1	27207	2	30262	1	26243	1	29165	1	27207	5	56047	216	4337	26	65259	0	1071
_	10:09:18 AM	6:30:00 PM	_	1	27367	56	38949	1	27115	2	30285	1	26244	1	29212	1	27115	5	55795	216	4000	26	62241	0	1108
_	10:09:18 AM	6:35:00 PM	_	1	27384	56	35704	1	27163	2	30260	1	26397	1	29117	1	27163	5	56095	216	3777	26	59568	0	1114
_	10:09:18 AM	6:40:00 PM	_	1	27381	56	37556	1	27111	2	30282	1	26339	1	29140	1	27111	5	54779	216	3357	26	58174	0	1147
_	10:09:18 AM	6:45:00 PM	_	1	27459	56	37268	1	27266	2	30286	1	26342	1	29012	1	27266	5	53306	216	3137	26	56184	0	1093
_	10:09:18 AM	6:50:00 PM	_	1	27499	56	37764	1	27143	2	30200	1	26363	1	29188	1	27143	5	54009	216	2887	26	54075	0	1093
_	10:09:18 AM	6:55:01 PM	_	1	27399	56	38856	1	27115	2	30182	1	26328	1	29185	1	27115	5	52082	216	2575	26	51962	0	1090
_	10:09:18 AM	7:00:01 PM	_	1	27376	56	37680	1	27135	2	30399	1	26255	1	29133	1	27135	5	55340	216	2197	26	49901	0	1095
_	10:09:18 AM	7:05:00 PM	_	1	27574	56	39993	1	27110	2	30175	1	26316	1	29022	1	27110	5	53095	216	2081	26	47519	0	1192
_	10:09:18 AM	7:10:00 PM	_	1	27352	56	39419	1	27275	2	30289	1	26229	1	29123	1	27275	5	52953	216	1747	26	45397	0	1054
_	10:09:18 AM	7:15:00 PM	_	1	27464	56	35404	1	27198	2	30192	1	26221	1	29237	1	27198	5	51775	216	1455	26	42271	0	1149
_	10:09:18 AM	7:20:00 PM	_	1	27338	56	36466	1	27091	2	30004	1	26385	1	29185	1	27091	5	52265	216	1241	26	39029	0	1097
_	10:09:18 AM	7:25:01 PM	_	1	27229	56	35845	1	27191	2	30262	1	26293	1	29251	1	27191	5	55159	216	938	26	36636	0	1072
_	10:09:18 AM	7:30:01 PM	_	1	27319	56	37959	1	27223	2	30200	1	26287	1	29092	1	27223	5	52049	216	588	26	34380	0	1053
_	10:09:18 AM	7:35:01 PM	_	1	27333	56	40910	1	27165	2	30278	1	26347	1	29334	1	27165	5	52241	216	215	26	31689	0	1077
_	10:09:18 AM	7:40:01 PM	_	1	27425	56	36257	1	27117	2	30127	1	26389	1	29075	1	27117	5	51638	216	93	26	30335	0	1085
_	10:09:18 AM	7:45:01 PM	_	1	27366	56	37899	1	27268	2	30266	1	26308	1	29213	1	27268	5	50926	215	65321	26	29082	0	1058
_	10:09:18 AM	7:50:00 PM	_	1	27565	56	35942	1	27252	2	30356	1	26288	1	29238	1	27252	5	53281	215	64684	26	27347	0	1068
_	10:09:18 AM	7:55:01 PM	_	1	27503	56	35314	1	27181	2	30394	1	26409	1	28833	1	27181	5	50648	215	64720	26	25500	0	1048
_	10:09:18 AM	8:00:01 PM	_	1	27416	56	35186	1	27226	2	30295	1	26358	1	29114	1	27226	5	50277	215	64365	26	22651	0	1155
_	10:09:18 AM	8:05:01 PM	_	1	27196	56	31224	1	27256	2	30260	1	26300	1	29186	1	27256	5	50424	215	64372	26	19385	0	1150
_	10:09:18 AM	8:10:01 PM	_	1	27555	56	31321	1	27184	2	30249	1	26357	1	29074	1	27184	5	50863	215	63831	26	17374	0	1126
_	10:09:18 AM	8:15:01 PM	_	1	27412	56	27055	1	27293	2	30126	1	26297	1	29235	1	27293	5	49935	215	63695	26	15413	0	1065
_	10:09:18 AM	8:20:01 PM	_	1	27386	56	26466	1	27125	2	30179	1	26231	1	29068	1	27125	5	48797	215	63355	26	12285	0	1085
_	10:09:18 AM	8:25:00 PM	_	1	27475	55	54423	1	27203	2	30092	1	26352	1	29338	1	27203	5	61755	215	63059	25	62150	0	1114
_	10:09:18 AM	8:30:01 PM	_	1	27395	56	5185	1	27189	2	29830	1	26395	1	29167	1	27189	5	61671	215	62886	25	57388	0	1078
_	10:09:18 AM	8:35:01 PM	_	1	27443	55	62058	1	27282	2	29917	1	26299	1	29230	1	27282	5	63343	215	62505	25	56806	0	1078
_	10:09:18 AM	8:40:01 PM	_	1	27454	55	60679	1	27137	2	29756	1	26382	1	29144	1	27137	5	60079	215	62533	25	52921	0	1116
_	10:09:18 AM	8:45:00 PM	_	1	27472	56	3577	1	27229	2	29705	1	26205	1	29296	1	27229	5	58681	215	62261	25	49543	0	1099
_	10:09:18 AM	8:50:01 PM	_	1	27384	56	12624	1	27089	2	29910	1	26352	1	29026	1	27089	5	59047	215	61876	25	47452	0	1068
_	10:09:18 AM	8:55:01 PM	_	1	27517	55	61466	1	27064	2	29844	1	26177	1	29176	1	27064	5	61151	215	61390	25	49869	0	1117
_	10:09:18 AM	9:00:01 PM	_	1	27463	55	49111	1	27216	2	29367	1	26246	1	29239	1	27216	5	64724	215	61315	25	44552	0	1077
_	10:09:18 AM	9:05:01 PM	_	1	28094	55	38377	1	27271	2	29483	1	26372	1	29464	1	27271	6	12937	215	60717	25	45777	0	1158
_	10:09:18 AM	9:10:01 PM	_	1	27448	55	51510	1	27232	2	29404	1	26225	1	29280	1	27232	5	65374	215	60294	25	44926	0	1094
_	10:09:18 AM	9:15:01 PM	_	1	27441	55	58377	1	27193	2	29474	1	26283	1	29211	1	27193	5	64868	215	60007	25	37487	0	1117
_	10:09:18 AM	9:20:01 PM	_	1	27303	55	49443	1	27213	2	29513	1	26244	1	29092	1	27213	6	3020	215	59577	25	30855	0	1121
_	10:09:18 AM	9:25:01 PM	_	1	27381	55	61439	1	27227	2	29714	1	26215	1	29233	1	27227	5	63043	215	59288	25	28667	0	1040
_	10:09:18 AM	9:30:01 PM	_	1	27525	55	50107	1	27187	2	29456	1	26247	1	29399	1	27187	6	58	215	58960	25	24075	0	1113
_	10:09:18 AM	9:35:01 PM	_	1	27459	55	52627	1	27312	2	29604	1	26181	1	29773	1	27312	5	63437	215	58887	25	21188	0	1066
_	10:09:18 AM	9:40:01 PM	_	1	27474	56	1309	1	27196	2	29408	1	26325	1	29206	1	27196	6	8	215	58290	25	17489	0	1126
_	10:09:18 AM	9:45:01 PM	_	1	27338	55	52818	1	27151	2	29340	1	26271	1	29313	1	27151	5	63452	215	57850	25	13222	0	1113
_	10:09:18 AM	9:50:01 PM	_	1	27511	55	58218	1	27072	2	29428	1	26287	1	29319	1	27072	6	665	215	57214	25	10407	0	1107
_	10:09:18 AM	9:55:01 PM	_	1	27262	55	51517	1	27189	2	29405	1	26238	1	29211	1	27189	6	1349	215	56926	25	7361	0	1068
_	10:09:18 AM	10:00:01 PM	_	1	27425	55	56524	1	27189	2	29408	1	26316	1	29252	1	27189	6	2048	215	56334	25	3135	0	1080
_	10:09:18 AM	10:05:01 PM	_	1	27377	56	3886	1	27300	2	29459	1	26226	1	29319	1	27300	6	1340	215	56385	25	594	0	1147
_	10:09:18 AM	10:10:01 PM	_	1	27264	55	58213	1	27158	2	29365	1	26241	1	28922	1	27158	5	65494	215	55745	24	62854	0	1131
_	10:09:18 AM	10:15:01 PM	_	1	27544	55	60414	1	27277	2	29377	1	26382	1	29239	1	27277	6	30	215	55118	24	59419	0	1194
_	10:09:18 AM	10:20:01 PM	_	1	27352	55	55319	1	27164	2	29361	1	26288	1	29241	1	27164	5	64953	215	54895	24	55933	0	1071
_	10:09:18 AM	10:25:01 PM	_	1	27314	55	59073	1	27103	2	29297	1	26390	1	29378	1	27103	6	671	215	54627	24	53498	0	1131
_	10:09:18 AM	10:30:01 PM	_	1	27578	56	4074	1	27196	2	29218	1	26293	1	29209	1	27196	6	1379	215	53947	24	48544	0	1150
_	10:09:18 AM	10:35:01 PM	_	1	27566	55	54890	1	27136	2	29052	1	26316	1	29236	1	27136	6	2695	215	53568	24	46459	0	1161
_	10:09:18 AM	10:40:01 PM	_	1	27426	55	59853	1	27192	2	29137	1	26349	1	29164	1	27192	5	65466	215	53360	24	43990	0	1157
_	10:09:18 AM	10:45:01 PM	_	1	27412	55	52839	1	27132	2	29204	1	26209	1	29189	1	27132	6	686	215	52916	24	39970	0	1085
_	10:09:18 AM	10:50:01 PM	_	1	27472	55	57051	1	27334	2	29149	1	26256	1	29201	1	27334	6	1799	215	52405	24	37602	0	1134
_	10:09:18 AM	10:55:01 PM	_	1	27392	56	3441	1	27110	2	29166	1	26208	1	29040	1	27110	6	1084	215	51793	24	36057	0	1100
_	10:09:18 AM	11:00:01 PM	_	1	27172	55	57064	1	27092	2	29114	1	26377	1	29212	1	27092	5	64425	215	51493	24	32037	0	1098
_	10:09:18 AM	11:05:01 PM	_	1	27476	55	58773	1	27070	2	29127	1	26244	1	29037	1	27070	6	941	215	50867	24	31133	0	1123
_	10:09:18 AM	11:10:01 PM	_	1	27733	55	45951	1	27108	2	28916	1	26290	1	29168	1	27108	5	64166	215	50343	24	28662	0	1091
_	10:09:18 AM	11:15:01 PM	_	1	27536	55	49513	1	27102	2	28953	1	26337	1	29134	1	27102	6	703	215	49930	24	24486	0	1144
_	10:09:18 AM	11:20:01 PM	_	1	27372	55	50022	1	27036	2	28843	1	26230	1	29150	1	27036	5	62852	215	49756	24	23279	0	1231
_	10:09:18 AM	11:25:01 PM	_	1	27446	55	42946	1	27142	2	29076	1	26334	1	28961	1	27142	5	64004	215	49352	24	21720	0	1114
_	10:09:18 AM	11:30:01 PM	_	1	27406	55	46690	1	27081	2	28945	1	26268	1	29098	1	27081	5	62096	215	48647	24	17507	0	1157
_	10:09:18 AM	11:35:01 PM	_	1	27432	55	42992	1	27208	2	29017	1	26283	1	28972	1	27208	5	63598	215	48229	24	16950	0	1098
_	10:09:18 AM	11:40:01 PM	_	1	27307	55	39500	1	27181	2	28778	1	26487	1	29142	1	27181	5	62910	215	48100	24	15261	0	1065
_	10:09:18 AM	11:45:01 PM	_	1	27368	55	44771	1	27163	2	28934	1	26326	1	29134	1	27163	5	61243	215	47631	24	12450	0	1161
_	10:09:18 AM	11:50:01 PM	_	1	27485	55	38969	1	27173	2	28892	1	26264	1	29119	1	27173	5	62841	215	46742	24	10191	0	1160

_	10:09:18 AM	11:55:01 PM	_	1	27453	55	42206	1	27136	2	28725	1	26355	1	29212	1	27136	5	60938	215	46323	24	9719	0	1192
_	11:09:18 AM	12:00:01 AM	_	1	27527	55	51771	1	27178	2	28849	1	26254	1	29264	1	27178	5	61041	215	45878	24	10179	0	1171
_	11:09:18 AM	12:10:01 AM	_	1	27598	55	32054	1	27150	2	28534	1	26235	1	29365	1	27150	5	60558	215	43837	24	7712	0	1119
_	11:09:18 AM	12:15:01 AM	_	1	27499	55	35820	1	27169	2	28761	1	26243	1	29196	1	27169	5	60352	215	44154	24	2503	0	1089
_	11:09:18 AM	12:20:01 AM	_	1	27331	55	39969	1	27107	2	28610	1	26098	1	29154	1	27107	5	61357	215	44270	24	3536	0	1165
_	11:09:18 AM	12:25:01 AM	_	1	27149	55	44744	1	27198	2	28617	1	26263	1	29225	1	27198	5	60921	215	43424	24	1354	0	1108
_	11:09:18 AM	12:30:01 AM	_	1	27300	55	43937	1	27194	2	28621	1	26279	1	29020	1	27194	5	61947	215	42965	23	63029	0	1182
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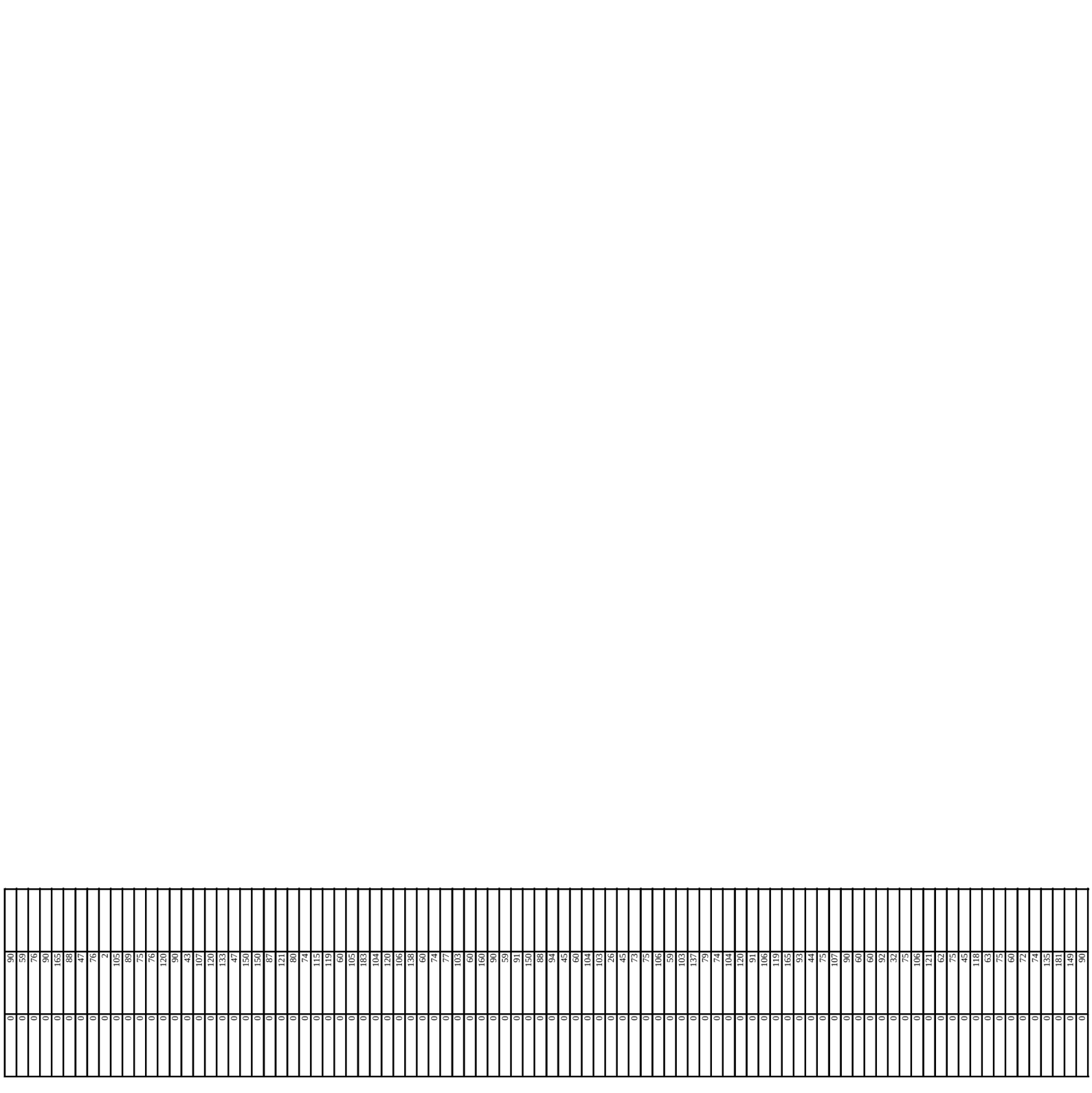
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0	73	
0	101	
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0	90	
0	101	
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90	0
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116	0
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104	0
105	0
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134	0
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210	0
90	0
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43	0
136	0
118	0
61	0
90	0
77	0
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75	0
61	0
150	0
45	0
91	0
75	0
121	0
180	0
223	0
91	0
166	0
90	0
118	0
90	0
62	0
90	0
31	0
118	0
60	0
90	0
102	0
46	0
73	0
106	0
151	0
90	0
58	0
121	0
147	0
151	0
75	0
29	0
131	0
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96	0
59	0
102	0
135	0
19	0
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46	0
51	0
135	0
123	0
15	0
59	0
118	0
105	0
90	0
122	0
45	0
105	0
135	0
29	0
89	0
60	0
132	0
102	0
90	0
128	0
60	0
77	0
91	0
120	0
105	0
80	0
135	0
75	0
151	0
90	0
137	0
122	0
89	0
60	0
100	0
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134	0
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117	0
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165	0
31	0
104	0
134	0
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197	0
57	0
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87	0
106	0
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151	0
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164	0
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119	0
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163	0
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108	0
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76	0
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33	0
165	0
105	0
118	0

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0	64
0	13
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0	75
0	164
0	120
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0	120
0	177
0	47
0	107
0	59
0	66

Appendix K

Step-change data for benzoate

Date and Time	Concentration of Benzoate (mg/L)
2018/09/02 16:35	
2018/09/03 7:20	0.17
2018/09/03 14:41	4.90
2018/09/03 20:22	5.81
2018/09/04 7:28	9.44
2018/09/04 15:24	1.43
2018/09/04 20:39	8.76
2018/09/05 8:14	11.03
2018/09/05 15:16	36.08
2018/09/05 20:38	27.94
2018/09/06 7:28	27.95
2018/09/06 15:03	26.42
2018/09/06 20:50	30.71
2018/09/07 7:31	27.12
2018/09/07 14:40	33.81
2018/09/07 20:45	31.26
2018/09/08 7:05	43.63
2018/09/08 14:53	56.37
2018/09/08 20:51	52.62
2018/09/09 15:14	52.35
2018/09/09 20:50	58.99
2018/09/10 7:19	48.38
2018/09/10 14:53	55.11
2018/09/10 20:36	50.68
2018/09/11 7:10	55.37
2018/09/14 11:00	176.34

Appendix L

The code used to run the non-linear least squares regression analysis for uranine and benzoate and generate Figure 7.7 a) , Figure 7.7 b) and Figure 7.8 a) and the hydraulic parameters presented in Section 7.3.

```
library(readxl) #read excel files
library(readr) #read csv files
library(ggplot2)
library(pracma)
library(dgof)
library(scales)
library(gridExtra)
library(viridis)
library(extrafont)
loadfonts(device='win')

getwd()
setwd("C:\\Users\\User\\OneDrive\\2019\\PhD 2018\\UFZ\\Experimental
data\\Step change September 2018")
WL3_Sept_2018<- read.csv2("625_11_September.txt", sep = " ", header =
FALSE)
WL3_Cali_2018<-read.csv("625 2 September Calibration.txt",sep=" ",header =
FALSE)
WL3<-read_excel("WL3 September.xlsx")

#Calibration data
Cal_S2018<-(as.numeric(unlist(WL3_Cali_2018$V8))*(2^16)+
              as.numeric(unlist(WL3_Cali_2018$V9)))*2500/2^24
Cal_time_S2018<-strptime(paste(as.character(WL3_Cali_2018$V2),
                               as.character(WL3_Cali_2018$V3)),
                         "%d:%m:%y %H:%M:%S")
Cal_mv_S2018<-c(mean(c(Cal_S2018[4:9])),mean(c(Cal_S2018[11:16])),
                mean(c(Cal_S2018[19:23])))
PPB<-c(0,25,50)
DF_625_S2018<-data.frame(x=PPB,y=Cal_mv_S2018)
lm_625_S2018<-lm(y~x,data=DF_625_S2018)
summary(lm_625_S2018)
m_625_S2018<-summary(lm_625_S2018)$coef[2,1]
c_625_S2018<-summary(lm_625_S2018)$coef[1,1]
Flouro_PPB_S2018<-((((as.numeric(WL3_Sept_2018$V8)*(2^16)+
                        as.numeric(WL3_Sept_2018$V9)))*2500/2^24)
                    -c_625_S2018)/m_625_S2018
Flouro_Time_S2018<-strptime(paste(as.character(WL3_Sept_2018$V2),
                                  as.character(WL3_Sept_2018$V3)),
                            "%d:%m:%y %H:%M:%S")

Flouro_PPB_S2018_N<-Flouro_PPB_S2018-min(Flouro_PPB_S2018)
Ft_S2018<-Flouro_PPB_S2018_N[8:2501]/max(Flouro_PPB_S2018_N)
DT_S2018<-as.numeric(difftime(Flouro_Time_S2018[8:2501],
                              "2018-09-02 16:35:00 UCT",units="hours"))

y1<-Ft_S2018
C1<-Ft_S2018[1]
```

```
Cin<-1
u<-0.05
x<-DT_S2018
R_start<-6.9
D_start<-0.01201

Model_tracer<-nls(y1~C1+(Cin-C1)*
                    (1/2*erfc((a-u*x)/(2*(b*a*x)^(1/2)))+
                       (((u^2)*x)/(pi*b*a))^(1/2)*
                       exp(-((a-u*x)^2)/(4*b*a*x))-
                       (1/2)*(1+(u/b)+(((u^2)*x)/(b*a)))*
                       exp(u/b)*erfc((a+u*x)/(2*(b*a*x)^(1/2)))),
                  start=list(a=R_start,b=D_start))
#a is the replacement for R
#b is the replacment for D

Tracer_model<-data.frame(Time=c(DT_S2018,x),
                         Response=c(Ft_S2018,predict(Model_tracer)),
                         Source=c(c(rep("Measured outlet of uranine",
                                        times=length(Ft_S2018))),
                                  c(rep("Model predicted outlet of
uranine",
                                        times=length(x)))))

Tracer_model_plot<-ggplot(data=Tracer_model,

aes(x=Time,y=Response,linetype=Source,color=Source))+
                  geom_line(size=4)+
                  scale_x_continuous(limits=c(0,220))+
                  scale_y_continuous(limits=c(0,1))+
                  labs(x=expression("Delta t (hours)"),
                  y=expression(C/C[inlet] ("-")))+
                  theme_bw()+
                  scale_color_manual(values=c("#9400D3","#4B0082"))+
                  theme(legend.title = element_blank(),
                        text=element_text(family="Times New
Roman",size=40),
                        axis.title.y = element_text(colour="black", size =
40),
                        axis.title.x = element_text( colour="black", size =
40),
                        axis.text.x=element_text(colour="black", size= 36),
                        axis.text.y=element_text( colour="black", size =
36),
                        legend.text=element_text( size=40),
                        legend.position = "bottom")
plot(Tracer_model_plot)
ggsave(filename = "Uranine model and data thesis.jpg",
       plot = Tracer_model_plot,units="mm",device='jpeg',
       width=550,height=260,dpi=500,limitsize = FALSE)



#Benzoate values determination

WL3_DT<-as.numeric(difftime(WL3$`Date and Time
S1`[c(seq(from=1,to=25,by=1))],
                            "2018-09-02 16:35:00 UTC",tz="UCT",
                            units="hours"))
BZ_response<-
(as.numeric(WL3$bZ[c(seq(from=1,to=25,by=1))],na.rm=TRUE))/82.1
```

```
y2<-BZ_response[2:length(BZ_response)]
C1<-Ft_S2018[1]
Cin<-1
u<-0.05
xt<-WL3_DT[2:length(WL3_DT)]
R_start_B<-4
D_start_B<-0.00014
g<-0
mu<-0.01
G1<-C1
Gin<-1
#v<-(u*(1+((4*mu*D_G)/(u^2)))^0.5)
xc<-1

#a is the replacement for R
#b is the replacment for D

Model_benzoate<-nls(y2~(Gin-(g/Bmu))*
                      ((u/((u*(1+((4*Bmu*b)/(u^2)))^0.5)+u))*
                         exp(((u-(u*(1+((4*Bmu*b)/(u^2)))^0.5))*xc)/(2*b))*
                         erfc((a*xc-(u*(1+((4*Bmu*b)/(u^2)))^0.5)*xt)/
                                (2*(b*a*xt)^(1/2)))+
                         (u/(u-(u*(1+((4*Bmu*b)/(u^2)))^0.5)))*
                         exp(((u+(u*(1+((4*Bmu*b)/(u^2)))^0.5))*xc)/(2*b))*
                         erfc((a*xc+(u*(1+((4*Bmu*b)/(u^2)))^0.5)*xt)/
                                (2*(b*a*xt)^(1/2)))+
                         (u^2/(2*Bmu*b))*
                         exp(((u*xc)/(b))-((Bmu*xt)/a))*
                         erfc((a*xc+u*xt)/(2*(b*a*xt)^(1/2))))+
                      ((g/Bmu)-G1)*exp(-(Bmu*xt)/a)*
                      (0.5*erfc((a*xc-u*xt)/(2*(b*a*xt)^(1/2)))+
                         ((u^2*xt)/(pi*a*b))^(1/2)*
                         exp(-(a*xc-u*xt)^2/(4*b*a*xt))-
                         0.5*(1+(u*xc/b)+((u^2)*xt)/(b*a))*
                         exp(u*xc/b)*
                         erfc((a*xc+u*xt)/(2*(b*a*xt)^(1/2))))+
                      (g/Bmu)+(G1-(g/Bmu))*
                      exp(-((Bmu*xt)/(a)))
                    ,start=list(a=5.1,b=0.015,Bmu=0.01),trace=TRUE)

Benzoate_model<-data.frame(Time=c(xt,WL3_DT),
                           Response=c(predict(Model_benzoate),BZ_response),
                           Source=c(c(rep("Model predicted outlet of
benzoate",
                                          times=length(xt))),
                                    c(rep("Measured outlet of benzoate",
                                          times=length(WL3_DT)))))

Benzoate_model_plot<-ggplot(data=Benzoate_model,

aes(x=Time,y=Response,shape=Source,color=Source))+
                    geom_line(size=3)+
                    geom_point(size=8)+
                    scale_x_continuous(limits=c(0,220))+
                    scale_y_continuous(limits=c(0,1))+
                    scale_color_manual(values=c("orangered1","red3"))+
                    labs(x=expression("Delta t (hours)"),
                      y=expression(C/C[inlet] ("-")))+
                    theme_bw()+
                    theme(legend.title = element_blank(),
```

```
                            text=element_text(family="Times New
Roman",size=40),
                            axis.title.y = element_text(colour="black", size
= 40),
                            axis.title.x = element_text( colour="black", size
= 40),
                            axis.text.x=element_text(colour="black", size=
36),
                            axis.text.y=element_text( colour="black", size =
36),
                            legend.text=element_text( size=40),
                            legend.position = "bottom")
plot(Benzoate_model_plot)

ggsave(filename = "Benzoate model and data thesis.jpg",
       plot = Benzoate_model_plot,units="mm",
       width=550,height=260,dpi=500,limitsize = FALSE)

cor(y2,predict(Model_benzoate))

Response_comp<-data.frame(Time=c(DT_S2018,WL3_DT),
                          Response=c(Ft_S2018,BZ_response),
                          Source=c(c(rep("Conservative tracer",
                                         times=length(DT_S2018))),
                                   c(rep("Non-conservative tracer",
                                         times=length(WL3_DT)))))
Response_comp_plot<-ggplot(data=Response_comp,
                           aes(x=Time,y=Response,shape=Source))+
                    geom_line()+
                    geom_point(size=2)+
                    scale_x_continuous(limits=c(0,220))+
                    scale_y_continuous(limits=c(0,1))+
                    labs(x=expression("Delta t (hours)"),
                    y=expression(F(t)))+
                    theme_bw()+
                    theme(legend.title = element_blank())
plot(Response_comp_plot)

Response_comp_colour_plot<-ggplot(data=Response_comp,
                           aes(x=Time,y=Response,color=Source))+
                           geom_line(size=2.5)+
                           geom_point(size=5)+
                           scale_x_continuous(limits=c(0,220))+
                           scale_y_continuous(limits=c(0,1))+
                           labs(x=expression("Delta t (hours)"),
                                    y=expression(F(t)))+
                           theme_bw()+
                           scale_color_manual(values=c("#4B0082","red3"))+
                           theme(legend.title = element_blank(),
                                 text=element_text(family="Times New
Roman"),
                                 axis.title.y =
element_text(colour="black", size = 40),
                                 axis.title.x = element_text(
colour="black", size = 40),
                                 axis.text.x=element_text(colour="black",
size= 36),
                                 axis.text.y=element_text( colour="black",
size = 36),
                                 legend.text=element_text( size=40),
                                 legend.position = "bottom")
```

```
plot(Response_comp_colour_plot)
ggsave(filename = "Intial data colour 1 thesis.jpg",
       plot = Response_comp_colour_plot,
       units="mm",width=550,height=260,dpi=500,limitsize = FALSE)



#tracer
Tracer_tm<-trapz(DT_S2018,(1-Ft_S2018))
Tracer_model_tm<-trapz(DT_S2018,(1-predict(Model_tracer)))
Tracer_var<-2*(trapz(DT_S2018,(DT_S2018*(1-Ft_S2018))))-(Tracer_tm)^2
Tracer_model_var<-2*(trapz(DT_S2018,(DT_S2018*(1-predict(Model_tracer)))))-
(Tracer_model_tm)^2
Tracer_e<-Tracer_tm/72
Tracer_model_e<-Tracer_model_tm/72
Tracer_N<-(Tracer_tm^2)/(Tracer_var)
Tracer_model_N<-(Tracer_model_tm^2)/Tracer_model_var
Tracer_Pe=0.05*1/0.005961
Tracer_h<-Tracer_e*(1-(1/Tracer_N))
Tracer_model_h<-Tracer_model_e*(1-(1/Tracer_model_N))


#bezoate
Benzoate_tm<-trapz(xt,1-y2)
Benzoate_model_tm<-trapz(xt,1-predict(Model_benzoate))
Benzoate_var<-2*(trapz(xt,(xt*(1-y2))))-(Benzoate_tm)^2
Benzoate_model_var<-2*(trapz(xt,(xt*(1-predict(Model_benzoate)))))-
(Benzoate_model_tm)^2
Benzoate_e<-Benzoate_tm/72
Benzoate_model_e<-Benzoate_model_tm/72
Benzoate_N<-(Benzoate_tm^2)/Benzoate_var
Benzoate_model_N<-(Benzoate_model_tm^2)/Benzoate_model_var
Benzoate_Pe<-0.05*1/0.021036
Benzoate_h<-Benzoate_e*(1-(1/Benzoate_N))
Benzoate_model_h<-Benzoate_model_e*(1-(1/Benzoate_model_N))
```

Appendix M

The code used to generate Figure 7.9 to Figure 7.11 and the associated hydraulic parameters.

```
library(pracma)
library(ggplot2)
library(extrafont)
library(dgof)
library(scales)
font_import()
loadfonts(device="win")       #Register fonts for Windows bitmap output
fonts()
#Conservative tracer 'C'

C1<-0.00272253 #initial concentration
Cin<-1 #inlet concentration
R_C<-3.550119 #retardation factor from data (another script)
D_C<-0.005961 #hydrodynamic dispersion from data (another script)
u<-0.05 #fluid velocity (m/hour)
t<-c(seq(from=0,to=220,by=5)) #time

Tracer_out<-C1+(Cin-C1)*
       (1/2*erfc((R_C-u*t)/(2*(D_C*R_C*t)^(1/2)))+
       (((u^2)*t)/(pi*D_C*R_C))^(1/2)*
       exp(-((R_C-u*t)^2)/(4*D_C*R_C*t))-
       (1/2)*(1+(u/D_C)+(((u^2)*t)/(D_C*R_C)))*
       exp(u/D_C)*erfc((R_C+u*t)/(2*(D_C*R_C*t)^(1/2))))

plot(t,Tracer_out)

#Benzoate as a tracer
R_B<-5.448779 #retardation factor from another script
D_B<-0.021036 #retardation factor from another script
g<-0 #assuming no production
muB<-0.004949 #decay from data in another script
v<-u*(1+((4*muB*D_B)/(u^2)))^0.5
x<-1
B1<-C1
Bin<-1
Benzoate_out<-(Bin-(g/muB))*
       ((u/(v+u))*exp(((u-v)*x)/(2*D_B))*
       erfc((R_B*x-v*t)/(2*(D_B*R_B*t)^(1/2)))+
       (u/(u-v))*exp(((u+v)*x)/(2*D_B))*
       erfc((R_B*x+v*t)/(2*(D_B*R_B*t)^(1/2)))+
       (u^2/(2*muB*D_B))*
       exp(((u*x)/(D_B))-((muB*t)/R_B))*
       erfc((R_B*x+u*t)/(2*(D_B*R_B*t)^(1/2))))+
       ((g/muB)-B1)*exp(-(muB*t)/R_B)*
       (0.5*erfc((R_B*x-u*t)/(2*(D_B*R_B*t)^(1/2)))+
       ((u*t)/(pi*R_B*D_B))^(1/2)*
       exp(-(R_B*x-u*t)^2/(4*D_B*R_B*t))-
       0.5*(1+(u*x/D_B)+((u^2)*t)/(D_B*R_B))*
       exp(u*x/D_B)*
       erfc(u*x/D_B)*
       erfc((R_B*x+u*t)/(2*(D_B*R_B*t)^(1/2))))+
```

```
       (g/muB)+(B1-(g/muB))*
       exp(-((muB*t)/(R_B)))

plot(t,Benzoate_out)

#Compare plots and manipulation

#Original of each plot
Initial<-data.frame(Time=c(t,t),
                    Response=c(Tracer_out,Benzoate_out),
                    Source=c(c(rep("Consevative
tracer",times=length(Tracer_out))),
                                c(rep('Non-Conservative
tracer',times=length(Benzoate_out)))))


#dev.off()

Initial_plot<-ggplot(data=Initial,aes(x=Time,y=Response,color=Source))+
              geom_line(size=1)+
              geom_point(size=4)+
              scale_x_continuous(limits=c(0,220))+
              scale_y_continuous(limits=c(0,1))+
              labs(x=expression("Delta t (hours)"),
              y=expression(F(t)))+
              theme_bw()+
              scale_color_manual(values=c("#4B0082","red3"))+
              theme(legend.title = element_blank(),
                    text=element_text(family="Times New Roman"),
                    axis.title.y = element_text(colour="black", size = 40),
                    axis.title.x = element_text( colour="black", size =
40),
                    axis.text.x=element_text(colour="black", size= 36),
                    axis.text.y=element_text( colour="black", size = 36),
                    legend.text=element_text( size=40),
                    legend.position = "bottom")
#tiff("Initial_compare.tiff", units="px", width=500, height=60, res=300)
plot(Initial_plot)
ggsave(filename = "Intial compare colour thesis.jpg",
       plot = Initial_plot,units="mm",
       width=560,height=240,dpi=500,limitsize = FALSE) #height = 13, width
= 325
#Attempt 1
 #Divide by Maximum outlet of model

Benzoate_out_1<-Benzoate_out/max(Benzoate_out)

Attempt_1<-data.frame(Time=c(t,t),
                      Response=c(Tracer_out,Benzoate_out_1),
                      Source=c(c(rep("Consevative
tracer",times=length(Tracer_out))),
                                  c(rep('Non-Conservative
tracer',times=length(Benzoate_out_1)))))

Attempt_1_plot<-ggplot(data=Attempt_1,aes(x=Time,y=Response,color=Source))+
                geom_line()+
                geom_point(size=4)+
                scale_x_continuous(limits=c(0,220))+
                scale_y_continuous(limits=c(0,1))+
                labs(x=expression("Delta t (hours)"),
                y=expression(F(t)))+
                scale_color_manual(values=c("#4B0082","red3"))+
```

```
                theme_bw()+
                theme(legend.title = element_blank(),
                      text=element_text(family="Times New Roman"),
                      axis.title.y = element_text(colour="black", size =
36),
                      axis.title.x = element_text( colour="black", size =
36),
                      axis.text.x=element_text(colour="black", size= 28),
                      axis.text.y=element_text( colour="black", size = 28),
                      legend.text=element_text( size=36),
                      legend.position = "bottom")

plot(Attempt_1_plot)
ggsave(filename = "Attempt 1 color thesis.jpg",
       plot = Attempt_1_plot,units="mm",
       width=560,height=240,dpi=300,limitsize = FALSE)

#Attempt 1 hydraulic parameters:bezoate
B_1_tm<-trapz(t,1-Benzoate_out_1)
B_1_var<-2*(trapz(t,(t*(1-Benzoate_out_1))))-(B_1_tm)^2
B_1_e<-B_1_tm/72
B_1_N<-(B_1_tm^2)/B_1_var

#Attempt 2
#use hydrodynamic dispersion of benzoate (keep same)
#use retardation factor of uranine

D_2<-D_B
R_2<-R_C
Benzoate_out_2A<-((Bin-(g/muB))*
         ((u/(v+u))*exp(((u-v)*x)/(2*D_2))*
         erfc((R_2*x-v*t)/(2*(D_2*R_2*t)^(1/2)))+
         (u/(u-v))*exp(((u+v)*x)/(2*D_2))*
         erfc((R_2*x+v*t)/(2*(D_2*R_2*t)^(1/2)))+
        (u^2/(2*muB*D_2))*
        exp(((u*x)/(D_2))-((muB*t)/R_2))*
        erfc((R_2*x+u*t)/(2*(D_2*R_2*t)^(1/2))))+
        ((g/muB)-B1)*exp(-(muB*t)/R_2)*
        (0.5*erfc((R_2*x-u*t)/(2*(D_2*R_2*t)^(1/2)))+
        ((u*t)/(pi*R_2*D_2))^(1/2)*
        exp(-(R_2*x-u*t)^2/(4*D_2*R_2*t))-
        0.5*(1+(u*x/D_2)+((u^2)*t)/(D_2*R_2))*
        exp(u*x/D_2)*
        erfc(u*x/D_2)*
        erfc((R_2*x+u*t)/(2*(D_2*R_2*t)^(1/2))))+
        (g/muB)+(B1-(g/muB))*
        exp(-((muB*t)/(R_2))))

Attempt_2A<-data.frame(Time=c(t,t),
                       Response=c(Tracer_out,Benzoate_out_2A),
                       Source=c(c(rep("Consevative
tracer",times=length(Tracer_out))),
                                c(rep('Non-Conservative
tracer',times=length(Benzoate_out)))))

Attempt_2A_plot<-
ggplot(data=Attempt_2A,aes(x=Time,y=Response,color=Source))+
  geom_line()+
  geom_point(size=4)+
  scale_x_continuous(limits=c(0,220))+
  scale_y_continuous(limits=c(0,1))+
  labs(x=expression("Delta t (hours)"),
```

```
       y=expression(F(t)))+
  scale_color_manual(values=c("#4B0082","red3"))+
  theme_bw()+
  theme(legend.title = element_blank(),
        text=element_text(family="Times New Roman"),
        axis.title.y = element_text(colour="black", size = 36),
        axis.title.x = element_text( colour="black", size = 36),
        axis.text.x=element_text(colour="black", size= 28),
        axis.text.y=element_text( colour="black", size = 28),
        legend.text=element_text( size=36),
        legend.position = "bottom")

plot(Attempt_2A_plot)
ggsave(filename = "Attempt 2 thesis.jpg",
       plot = Attempt_2A_plot,units="mm",
       width=560,height=240,dpi=300,limitsize = FALSE)

cor(Tracer_out,Benzoate_out_2A)

Benzoate_out_2B<-Benzoate_out_2A/max(Benzoate_out_2A)

Attempt_2B<-data.frame(Time=c(t,t),
                       Response=c(Tracer_out,Benzoate_out_2B),
                       Source=c(c(rep("Consevative
tracer",times=length(Tracer_out))),
                                c(rep('Non-Conservative
tracer',times=length(Benzoate_out)))))

Attempt_2B_plot<-
ggplot(data=Attempt_2B,aes(x=Time,y=Response,color=Source))+
  geom_point(size=4)+
  geom_line(size=1)+
  scale_x_continuous(limits=c(0,220))+
  scale_y_continuous(limits=c(0,1))+
  labs(x=expression("Delta t (hours)"),
       y=expression(F(t)))+
  scale_color_manual(values=c("#4B0082","red3"))+
  theme_bw()+
  theme(legend.title = element_blank(),
        text=element_text(family="Times New Roman"),
        axis.title.y = element_text(colour="black", size = 36),
        axis.title.x = element_text( colour="black", size = 36),
        axis.text.x=element_text(colour="black", size= 28),
        axis.text.y=element_text( colour="black", size = 28),
        legend.text=element_text( size=36),
        legend.position = "bottom")

plot(Attempt_2B_plot)
ggsave(filename = "Attempt 2B colour thesis.jpg",
       plot = Attempt_2B_plot,units="mm",
       width=560,height=240,dpi=300,limitsize = FALSE)

cor(Tracer_out,Benzoate_out_2B)


B_2_tm<-trapz(t,1-Benzoate_out_2B)
B_2_var<-2*(trapz(t,(t*(1-Benzoate_out_2B))))-(B_2_tm)^2
B_2_e<-B_2_tm/72
B_2_N<-(B_2_tm^2)/B_2_var
B_2_h<-B_2_e*(1-(1/B_2_N))
```

```
Benzoate_out_3<-nls(Benzoate_out_2~((Bin-(g/muB))*
                                    ((u/(v+u))*exp(((u-v)*x)/(2*D_3))*
                                       erfc((R_3*x-
v*t)/(2*(D_3*R_3*t)^(1/2)))+
                                       (u/(u-v))*exp(((u+v)*x)/(2*D_3))*

erfc((R_3*x+v*t)/(2*(D_3*R_3*t)^(1/2)))+
                                       (u^2/(2*muB*D_3))*
                                       exp(((u*x)/(D_3))-((muB*t)/R_3))*

erfc((R_3*x+u*t)/(2*(D_3*R_3*t)^(1/2))))+
                                    ((g/muB)-B1)*exp(-(muB*t)/R_3)*
                                    (0.5*erfc((R_3*x-
u*t)/(2*(D_3*R_3*t)^(1/2)))+
                                       ((u*t)/(pi*R_3*D_3))^(1/2)*
                                       exp(-(R_3*x-u*t)^2/(4*D_3*R_3*t))-

0.5*(1+(u*x/D_3)+((u^2)*t)/(D_3*R_3))*
                                       exp(u*x/D_3)*
                                       erfc(u*x/D_3)*

erfc((R_3*x+u*t)/(2*(D_3*R_3*t)^(1/2))))+
                                    (g/muB)+(B1-(g/muB))*
                                    exp(-((muB*t)/(R_3)))))/
                        (max(Benzoate_out)),start=list(R_3=R_2,D_3=0.01))
```