REDROW

Manchester Road, Rochdale

Flood Risk Assessment & Drainage Strategy

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Assessment | Modelling | Design

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Introduction

Waterco has been commissioned to undertake a Flood Risk Assessment and Drainage Strategy in relation to a proposed residential development at Manchester Road, Rochdale, M24 2SH.

The purpose of this report is to outline the potential flood risk to the site, the impact of the proposed development on flood risk elsewhere, and the proposed measures which could be incorporated to mitigate the identified risk. This report has been prepared in accordance with the guidance contained in the National Planning Policy Framework (NPPF) and the National Planning Practice Guidance (NPPG) Flood Risk and Coastal Change.

From April 2015, Rochdale Metropolitan Borough Council as Lead Local Flood Authority (LLFA) is a statutory consultee for major planning applications in relation to surface water drainage, requiring that all planning applications are accompanied by a Sustainable Drainage Strategy. The aim of the Sustainable Drainage Strategy is to identify water management measures, including Sustainable Drainage Systems (SuDS), to provide surface water runoff reduction and treatment.

Local guidance documents including the Bury, Rochdale and Oldham Strategic Flood Risk Assessment (SFRA) Level 1 (November 2009), the Rochdale Metropolitan Borough Council Preliminary Flood Risk Assessment (PFRA) (May 2011) and the Rochdale Borough's Strategy for Flood Risk Management 2014-2024 (March 2014) and its December 2017 addendum have been reviewed to inform this report.

Existing Conditions

The site covers an area of approximately 86ha and is located at National Grid Reference: 389126, 409314. A location plan and an aerial image are included in Appendix A.

Online mapping (including Google Maps / Google Streetview imagery, accessed April 2019) and OS mapping shows that the site is greenfield. The mapping shows several ponds across the site and an access track from the north to the centre of the site. Thornham New Road crosses the northern extent of the site. Thornham Lane crosses the southern extent of the site. The site is bordered by the M62 to the north, the A627(M) to the east and south and residential settlements of Castleton and Slattocks to the west. Key access points to the site are provided from Thornham New Road and Thornham Lane.

Local Topography

Topographic levels to metres Above Ordnance Datum (m AOD) have been derived from a 1m resolution Environment Agency (EA) composite 'Light Detecting and Ranging' (LiDAR) Digital Terrain Model (DTM). A

review of LiDAR data shows that the site and surrounding area generally slopes from east to west, with high points on site of approximately 180m AOD in the north-east and lows of 132m AOD in the south-western extent. A LiDAR extract is included in Appendix B.

Ground Conditions

Reference to the British Geological Survey (BGS) online mapping (1:50,000 scale) [accessed April 2019] indicates that the northern extent of the site is underlain by artificial deposit/infilled ground the BGS Lexicon describes the strata as consisting of variable composition of a man-made superficial deposit. The northern and eastern extents of the site are underlain by superficial Devensian Glaciofluvial Deposits generally comprising sands and gravels. The western and southern extents of the site are underlain by superficial deposits of Devensian Till generally comprising sandy, silty clay with pebbles, but can contain gravel-rich, or laminated sand layers. The superficial deposits are identified as being underlain by the Pennine Lower Coal Measures Formation consisting of interbedded mudstones, sandstones and siltstones with coal seams. The mapping also shows bands of Old Lawrence Rock – Sandstone (centre) and Royley Sandstone (south-west).

The geological mapping is available at a scale of 1:50,000 and as such may not be accurate on a site-specific basis.

According to the EA's Aquifer Designation data, obtained from MAGIC Map's online mapping [accessed April 2019], the Glaciofluvial Deposits, Devensian Till and the underlying bedrock are classified as a Secondary A Aquifer. Secondary A Aquifers are 'permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers'.

The map also shows isolated areas of Secondary Undifferentiated Aquifer towards the northern extent and south-eastern extents of the site however, it does not appear to correlate with the geological mapping. Secondary Undifferentiated Aquifers are assigned in 'cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type'.

The EA's 'Source Protection Zones' data, obtained from MAGIC Map's online mapping [accessed April 2019], indicates that the site is not located within a Groundwater Source Protection Zone.

The Cranfield University 'Soilscapes' map [accessed April 2019] indicates that the site is underlain by '*freely draining... sandy soils*'.

Local Drainage

Public sewer records have been obtained from United Utilities (UU) and are included in Appendix C. The UU sewer records show that there are sewers in built-up areas located adjacent to the western and south-western site boundaries and within Thornham New Road to the north-west and Thornham Lane to the south-west. Key sewers are discussed below.

There is a 300mm public combined sewer running westwards in Thornham Lane. The upstream extent of the

sewer starts at manhole 9801. However, the cover level and invert level have not been provided.

There is a 300mm public combined sewer located in Grange Road, adjacent to the western site boundary. The sewer flows westwards and joins a 225mm combined public sewer. The upstream extent of the starts at manhole 5810. Cover and invert levels have not been provided.

There is a 225mm public combined sewer located in Thornham New Road, flowing south-west in this location. The upstream extent of the starts at manhole 8701. The cover level of manhole 8701 is recorded as 158.36m AOD and the invert level is recorded as 156.73m AOD.

The site is greenfield, and it assumed the site currently drains freely through a series of land drains located across the site. The UU plans and the OS mapping show there are two collect features located in the western extent of the site, the land drains flow south-west toward the junction of Rochdale Road and Thornham lane following the local topography. It is assumed that the land drains are culverted in the south-western extent of the site and their wider connectivity is unknown. It is highly recommended that a survey of the onward land drainage to the south-west of the site is undertaken.

Development Proposals

The proposed development is for residential properties with associated infrastructure and landscaping. Proposed development plans are not available at this stage and this report is intended to aid with the master planning process.

The proposed development will introduce in hardstanding areas in the form of buildings and access. For the purpose of this assessment, it is assumed that hardstanding will comprise 34.4ha or 40% of the total site area. It is assumed that the remaining permeable, soft landscaped areas will occupy 51.6ha or 60% of the total site area.

Flood Zone Classification and Policy Context

The EA 'Flood Map for Planning' included in Appendix D shows that the site is located within an area outside of the extreme flood extent (Flood Zone 1), meaning it has a less than 0.1% annual probability of flooding.

In accordance with Table 2 of the NPPG: Flood Risk and Coastal Change, residential developments are considered to be 'more vulnerable'. Table 3 of the NPPG: Flood Risk and Coastal Change, states that 'more vulnerable' development is considered appropriate within Flood Zone 1. The development therefore passes the flood risk Sequential Test and the Exception Test does not need to be applied.

Local Policy

The Rochdale Adopted Core Strategy (October 2016) contains the following policy relating to flood risk and drainage;

G8 - Managing water resources and flood risk

'We will ensure that new development (including flood risk mitigation measures) does not lead to any form of increased flooding locally or further downstream, does not impede natural water and flood risk management, is not detrimental to existing or potential flood storage areas, contributes where possible to alleviating existing flood risk, is itself well protected from flood risk and ensures prudent use of water resources. We will require:

a) Compliance with a 'sequential' approach to new development and flood risk, directing development away from areas of high risk, in accordance with the National Planning Policy Framework;

b) Full regard to and compliance with the advice of the Environment Agency (or equivalent agency) and the objectives and priorities for flood risk management set out in the Local Flood Risk Management Strategy, including any mitigation measures recommended for particular sites;

c) Full regard to the published evidence of local flood risk and its significance as included In Strategic Flood Risk Assessments, Surface Water Management Plans and other recognised sources of flood risk data and the production of additional Flood Risk Assessments (FRAs) as appropriate;

d) Incorporation of appropriate measures for the management of surface and flood water, including flood storage areas, Sustainable Urban Drainage Systems (SUDS) and the protection of 'overland flow paths';

e) Compliance with any Surface Water Management Plan or drainage strategies produced, such as for the identified critical drainage areas of Littleborough and Heywood;

f) The avoidance of culverting, and support the opening up of existing culverts wherever possible;

g) The incorporation of measures for the conservation of water to minimise potable water consumption, including rainwater collection measures, which should be integral to the design of buildings and spaces;

h) Development that does not directly or indirectly lead to pollution of existing water resources such as watercourses and groundwater or the derogation of the quantity of groundwater;

i) The incorporation of measures to improve water quality; and

j) The taking of opportunities to improve the habitat value of watercourses and water bodies.

In addition, we will identify additional flood storage areas which will be protected from development.'

Following adoption of the Core Strategy (October 2016), some of the policies of the Unitary Development Plan have been saved. The Rochdale Unitary Development Plan was adopted in June 2006. The following policy extracts relate to flood risk and drainage:

Policy EM7 – Development and Flood Risk

'Development will not be permitted in areas identified as flood plains, or other areas where development could contribute to increased flood risk, unless an appropriate flood risk assessment has been carried out and all of the following criteria are met:

a) It will not increase the risk of flooding within the flood plain or in adjoining areas by reducing flood storage capacity, increasing flows within a flood plain or through the additional discharge of surface water;

b) It will not itself be at risk from flooding;

c) Appropriate sustainable drainage systems are used;

d) Adequate access adjacent to the water course for maintenance is provided;

e) Existing or proposed flood defences are protected;

f) It would not result in extensive culverting; and

g) Flood defence works required as a consequence of development are provided at the developer's expense.

Flood defences and related engineering works must also ensure that recognised ecological, geomorphological, archaeological, landscape and recreational interests associated with a water course or adjacent areas are fully taken into account and appropriate mitigation provided. The sequential test approach and principles set out in PPG 25 'Development and Flood Risk' will be followed in considering development proposals.'

Consultation

A pre-planning opinion request was submitted to the EA in April 2019. In their response included in Appendix D, the EA have stated that:

'The site is located within flood zone 1, and near an ordinary watercourse. Therefore, for any further information, you should contact the LLFA (Lead Local Flood Authority).'

A consultation request was submitted to the LLFA in April 2019. A response is included in Appendix E. The LLFA have stated:

'As far as the Flood Risk Assessment is concerned, we would ask that it covers to an appropriate level of detail the evidence to show that you have identified the risks of flooding from all sources and how these do/may impact the site, how these will be mitigated through drainage and flood resilience/alleviation measures as appropriate (which should be clearly set out and evidenced in terms of how they will address identified risks

and issues) and any residual risks and how they would be mitigated/managed i.e. to show that risk is not passed elsewhere.

As far as historic flooding records in this area are concerned, we do not have any records of flooding in this area although our records are not necessarily complete and you should also check with EA and United Utilities in terms of their records.

We would also like to make the following points:

a) The proposed development area straddles Thornham New Road and Thornham Road, neither of which are adopted. At the point that Thornham Road joins the main A664 road, gravel gets washed into gullies on the main road, causing blockage, and during rain events large puddles form on Thornham Road (due to poor surfacing) and on the main road (gully blockages).

b) A long stretch of Thornham New Road is not adopted. Further information on which parts are adopted / unadopted can be obtained from Rochdale's Highways team

c) There are several watercourses across the site, some of which may be drained / culverted. You will need to consult LLFA and Highways' Drainage Officer, but a site visit would be the best way forward after you have provided a topographical survey.'

A pre-development enquiry request was submitted to UU in April 2019. A response is included in Appendix C. UU have stated that:

'Foul will be allowed to drain to the public combined sewer network at an unrestricted rate. The connection(s) to the public sewer can be at a point(s) convenient to yourself

Surface water from this site should drain to either soak away or directly to watercourse. Discharge rates and consents must be discussed and agreed with all interested parties.'

The site is not located within an Internal Drainage Board (IDB) District.

Sources of Flooding and Probability

Fluvial

The Phase I Geo-Environmental Site Assessment produced by REC (dated April 2019), provided by the Client, includes a 'Watercourse Network and River Quality' map. The map identifies the route of two potential culverts onsite. The first potential culvert is associate with a land drain which issues east of the A627, the land drain is shown to flow north-westward before entering a culvert beneath the A627. The mapping contained within the REC report assumes the land drain is culverted beneath the north-eastern extent of the site before outfalling to the north of Thornham New Road. The second culvert is shown within the eastern

extent of the site and indicates that one of the land drains in this area is partially culverted within the site boundary.

The site is served by local land drainage (land drains) within the site. The land drains are classified as ordinary watercourses and have not been specifically modelled by the EA. However, flood risk from minor watercourses is often identified on surface water mapping, and this appears to be the case in this instance. There are two main surface water flow routes identified within the site boundary. The first flows from east to south west through the centre of the site, the second flows within the southern extent of the site from east to west, both follow the path of the land drainage in this area. The flood flow routes are identified as having a low (between 1% and 0.1% annual probability of flooding) to high (greater than 3.3% annual probability of flooding) risk of surface water flooding. Detailed online surface water flood mapping provided by the EA and reproduced as Figure 1 below indicate that flood depths are generally below 300mm with isolated areas (ponding) of +900mm.

Figure 1: EA Surface Water Flood Depth Mapping (Low Risk Scenario)

The catchment area of the land drainage is limited, restricted by the A627 to the east of the site and is therefore retained within the site boundary. Therefore, the potential flood risk associated with the land drains is considered to be low. The wider connectivity of the land drains when they enter culverts is not known. It is assumed, given the local topography that they either ultimately discharge to the Rochdale Canal, located 140m west of the site or Whit Brook which is located approximately 750m south of the site at its nearest point.

Other watercourses in the area include Whit Brook which is located approximately 750m south of the site at its nearest point and flows west in this location. Furthermore, Trub Brook is located approximately 950m

west of the site and flows south in this location joining Whit Brook, both Whit Brook and Trub Brook are Main Rivers. The site is situated entirely within Flood Zone 1 and therefore the site is considered to be at a low risk of fluvial flooding from the local Main Rivers.

The EA 'Historical Flood Map' (Appendix D) indicates that there are no records of historical flooding on the site.

The site is therefore considered to be at low risk of fluvial flooding with an isolated risk related to the existing local land drains.

Tidal

The site is situated at a minimum of approximately 132m AOD and is significantly above sea level. Therefore, there is no risk from tidal flooding.

Surface Water

Surface water flooding occurs when rainwater does not drain away through the normal drainage system or soak into the ground. It is usually associated with high intensity rainfall events but can also occur with lower intensity rainfall or melting snow where the ground is saturated, frozen or developed, resulting in overland flow and ponding in depressions in topography. Surface water flooding can occur anywhere without warning. However, flow paths can be determined by consideration of contours and relative levels.

The EA 'Flood Risk from Surface Water' map (Appendix D) indicates that the majority of site is at very low risk of surface water flooding, meaning it has a less than 0.1% annual probability of flooding.

The mapping identifies sporadic isolated areas of low to high risk of surface water flooding. These isolated areas correlate to local topographic low points. Detailed online surface water flood mapping provided by the EA indicate that areas which are predicted to flood predominantly have flood depths of less than 300mm, where flood depths increase to 300mm - +900mm correlate to local ponds.

The mapping identifies two distinct surface water flow routes located in the centre of the site flowing east and then south-west. The second surface water flow route crosses the southern extent of the site and flows west towards the reservoir before flowing off site. The surface water flow routes are correlated to the local land drains in these areas. This has been discussed in detail in the fluvial section above.

The SFRA mapping, provided in Appendix F, shows medium to low risk of surface flooding adjacent to the access road off Thornham New Road, in the centre of the site. The maps also show areas at low risk of surface water flooding in the western and south-western extents of the site.

Correspondence with the LLFA (Appendix E) indicates that where Thornham Lane joins the main A664 road, gravel gets washed into gullies on the main road, causing blockage, and during rain events large puddles form on Thornham Lane and on the main road. There is potential risk of flooding in the Thornham Lane which is shown as part of the site; however, the water is likely to contained within the kerb level.

Any potential surface water flooding arising at or near to the site would be directed west or south-west, away

from the site, following the local topography.

It can therefore be concluded that the site is at risk of surface water flooding.

Sewer

Flooding from sewers can occur when a sewer is overwhelmed by heavy rainfall, becomes blocked, is damaged, or is of inadequate capacity. Flooding is mostly applicable to combined and surface water sewers.

Any potential flooding arising from the 300mm sewers in Thornham Lane and Thornham New Road would be directed west, away from the site, following the topography of the roads.

It can therefore be concluded that the risk of sewer flooding is low.

Groundwater

Groundwater flooding occurs when water levels underneath the ground rise above normal levels. Prolonged heavy rainfall soaks into the ground and can cause the ground to become saturated. This results in rising groundwater levels which leads to flooding above ground.

The northern and eastern extents of the site are underlain by superficial Devensian Glaciofluvial Deposits generally comprising sands and gravels. The western and southern extents of the site are underlain by superficial deposits of Devensian Till.

From a review of freely available OS mapping no springs or other groundwater emergence features are apparent within the site or the immediate surrounding area.

The SFRA indicates that there are no records of groundwater flooding at or near to the site.

It can therefore be concluded that the risk of groundwater flooding is low.

Artificial Sources

The Rochdale Canal is located approximately 140m west of the site at its closest point. The canal is not elevated above surrounding ground in this location. Therefore, there is no risk of a breach. Canals are controlled watercourses; therefore, the risk of overtopping is minimal. However, in the unlikely event that there is overtopping, the site is situated at a minimum of 4m above the canal and local topography falls westward and away from the site. Therefore, there is no risk of overtopping affecting the site. The EA 'Flood Risk from Reservoirs' map (Appendix D) shows that the site is not at risk of flooding from reservoirs.

It can therefore be concluded that there is very low risk of flooding from artificial sources.

Summary of Potential Flooding and Mitigation

It can be concluded that the majority of the site is at low risk of flooding from all sources. However, there are areas of the site that are identified at risk of surface water flooding associated with the existing local land drains. Post development the catchment area of the local land drains will be built upon and replaced by an appropriately designed surface water drainage system, removing the flood risk associated with the local land

drains. Notwithstanding the above, the proposed development should seek to limit development outside of the areas identified at high risk of surface water flooding.

In accordance with Building Regulations the ground floor, finished floor level of the buildings should be set 150mm above surrounding ground levels.

Surface Water Management

The site currently comprises undeveloped land which is not formally drained and is therefore considered to be 100% permeable.

For the purpose of this report, it has been assumed the proposed development will introduce hardstanding that will occupy 40% (34.4ha) of the site through the introduction of buildings and access roads.

The introduction of hardstanding will result in an increase in surface water runoff rates and volumes. In order to ensure the proposed development will not increase flood risk elsewhere, surface water discharge from the site will be controlled.

The existing greenfield runoff rates have been estimated using the Revitalised Flood Hydrograph Model (ReFH2) method, provided as Appendix G. The existing 1 in 1 year event greenfield rate for the 86ha development site is 112.4 l/s.

Attenuation Storage

In order to achieve a discharge rate of 112.4 l/s, attenuation storage will be required. Storage estimates have been provided using MicroDrainage and are included in Appendix H. An estimated storage volume of 14,242m³ will be required for the 1 in 30 year event and 32,397m³ will be required to accommodate the 1 in 100 year plus 40% CC event. This equates to approximately 414m³ for the 1 in 30 year event and 942m³ for the 1 in 100 year plus 40% CC event per hectare of hardstanding. The storage estimates are based on a flow rate of 112.4 l/s, storage within a tank or pond structure, an impermeable drainage area of 34.4ha, a design head of 2.05m and hydro brake flow control.

The attenuation volumes are provided for indicative purposes only and should be verified at the detailed design stage.

Discharge Method

Paragraph 080 of the NPPG: Flood Risk and Coastal Change sets out the following hierarchy of drainage options: into the ground (infiltration); to a surface water body; to a surface water sewer, highway drain or another drainage system; to a combined sewer.

Infiltration

The first consideration for the disposal of surface water is infiltration (soakaways and permeable surfaces). As described above the majority of the site is underlain by superficial Glaciofluvial Deposits (sands and gravels) which are underlain by Pennine Lower Coal Measures Formation. It can be concluded that soakaways

may be suitable for the discharge of surface water runoff.

However soakaways are unlikely to be suitable in the area identified as being underlain by artificial deposits.

Infiltration tests should be undertaken in accordance with the BRE365 specification to determine the suitability of soakaways. Soakaways should be located a minimum of 5m from habitable dwellings.

Watercourse

Where soakaways are not suitable a connection to watercourse is the next consideration.

The nearest watercourses are the land drains which flow through the site. The wider connectivity of the local land drains is not clear and should be confirmed through survey. However, given the local topography it is assumed that they either ultimately discharge to the Rochdale Canal, located 140m west of the site or Whit Brook which is located approximately 750m south of the site at its nearest point. Discharge to the existing local land drains appears to be feasible. Surface water should discharge to the land drains at the greenfield run-off rate.

Sewer

As described above, a connection to the existing land drainage is likely to be feasible and therefore a connection to the public surface water sewer would not be required. Where disposal of surface water to watercourse is determined to not be feasible or desirable, a connection to the public sewer system is the final consideration. The public sewer network could accept part of the surface water runoff from the site. In this event, the discharge rate would be pro-rata based on the catchment areas within the site.

There are several 250mm and 300mm public combined sewers located adjacent to the western and south-western boundaries. A connection to the public sewer network in this location appears to be a feasible option.

Sustainable Drainage Systems

Attenuation storage should be provided in the form of Sustainable Drainage Systems (SuDS) where practical. The following SuDS options have been considered:

Soakaways

As described above, the use of soakaways should be determined by carrying out infiltration tests in accordance with the BRE 365 specification.

Swales, detention basins and ponds

Sufficient space is available on site to utilise open surface water attenuation features such as a ponds, basins and / or swales throughout the site. In order to facilitate gravity drainage, attenuation features should be located at the lower western or south-western extents of the site.

An open surface water attenuation feature such as a pond, basin or a swale in a residential area presents a safety risk; the hazards and appropriate mitigation should be considered at the detailed design stage.

Rainwater Harvesting

The attenuation benefits provided through the use of rainwater harvesting are considered to be limited and would only be realised when the tanks were not full. However, rainwater harvesting techniques could be incorporated within the final design.

Green Roofs

Given the nature of the proposed development, the significant additional cost involved in installing and maintaining green roofs and the additional works required to allow for the additional loading on the building, green roofs are not considered a practical option. The benefits achieved through installing a green roof would be disproportionate to the significant ongoing maintenance and construction costs involved.

Porous / Permeable Paving

Permeable paving could be incorporated within private roads and driveways. Storage would be provided within the sub-grade material prior to controlled release to ground or to the receiving watercourse or sewer.

The provision of storage within the sub-grade material would only be feasible in areas with a proposed gradient of <1 in 20 as detailed within CIRIA RP992/28 (Design Assessment Checklists for Permeable/Porous Pavement). Site gradients should be confirmed at the detailed design stage. The amount of storage provided within permeable paving is subject to sub-grade depth and gradient.

Underground Attenuation Tanks

Storage could be provided within underground attenuation tanks or within oversized pipes. Oversized pipes could be situated within access roads and areas of public open space. To facilitate gravity drainage to watercourse, locate in north, to facilitate gravity drainage to sewer locate in south.

Concept Surface Water Drainage Scheme

Based on the constraints identified onsite, the following discharge options appear to be available to the site. The following list is ordered by preference when considering the drainage hierarchy and the potential drainage outfall locations are identified on the Drainage Optioneering Sketch, provided as Appendix I:

1. Soakaway;
2. Culverted watercourse/land drains;
3. Rochdale Canal;
4. Public surface water sewer; and
5. Public combined sewer.

Soakaways will be used where practical. Where soakaways are not feasible, surface water runoff will be discharged to the land drains on site and ultimately to the local watercourses or Rochdale Canal, at a rate of 112.44 l/s.

Alternatively, surface water will be discharged to the public surface water sewer network, subject to third party agreement. Surface water runoff up to the 1 in 100 year plus 40% climate change allowance event will be attenuated on site. A total attenuation volume of 32,397m³ will be required to achieve the discharge rate and will be provided in the form of swale, detention basin, pond, permeable paving or an attenuation tank located in the western and / or south-western extent of the site.

The proposed surface water drainage scheme will ensure no increase in runoff over the lifetime of the development.

Exceedance Event

Storage will be provided for the 1 in 100 year plus 40% CC event. Storm events in excess of the 1 in 100 year plus 40% CC event should be permitted to produce temporary shallow depth flooding within the access road or landscaped areas. Finished floor levels will be set at a minimum of 150mm above surrounding ground levels ensuring exceedance flooding will not affect the buildings.

Surface Water Treatment

In accordance with the CIRIA C753 publication 'The SuDS Manual' (2015), residential roofs have a 'very low' pollution hazard level, with individual property driveways, residential car parks and low traffic roads classified as having a 'low' pollution hazard level. Table 1 below shows the pollution hazard indices for each land use.

Table 1 – Pollution Hazard Indices

Land Use	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Residential Roofs	Very Low	0.2*	0.2	0.05
Individual Property Driveways, Residential Car Parks and Low Traffic Roads	Low	0.5	0.4	0.4

Table extract taken from the CIRIA C753 publication 'The SuDS Manual' – Table 26.2

* Indices values range from 0-1.

Where practical, runoff from roofs and roads will be directed to detention basins, ponds, swales, permeable paving and/or below ground attenuation. Table 2 below demonstrates that detention basins, swales, ponds and permeable paving provide sufficient treatment.

Table 2 – SuDS Mitigation Indices

	Mitigation Indices		
Type of SuDS	**Total Suspended Solids (TSS)**	**Metals**	**Hydrocarbons**
Permeable Pavement	0.7	0.6	0.7
Detention basin	0.5	0.5	0.6
Pond	0.7	0.7	0.5
Swale	0.5	0.6	0.6

Table extract taken from the CIRIA C753 publication 'The SuDS Manual' – Table 26.3

It can be concluded that the inclusion of detention basins, ponds, swales and/or permeable paving will provide sufficient treatment. Where attenuation is provided in a below ground system (tank storage), treatment will need to be provided by a suitably sized separator.

Maintenance

Maintenance of communal drainage features such as detention basins, ponds, swales, permeable paving and attenuation tanks will be the responsibility of the site owner. Maintenance of shared surface water drainage systems can be arranged through appointment of a site management company.

Maintenance schedules for a soakaway, detention basin, pond, permeable paving, swale and attenuation tank are included in Appendix J. Maintenance of the separator will be as per the manufacturer's guidance.

Other Considerations

Maintenance access to the two collect features onsite should be retained. Maintenance access can be ensured by providing an 5m buffer either side of the watercourse or culverts.

Foul Drainage

Foul flows should be discharged to the 225mm and / or 300mm public combined sewers in Thornham Lane and Thornham New Road. A new connection should be agreed with United Utilities. Correspondence from UU states '*Foul will be allowed to drain to the public combined sewer network at an unrestricted rate. The connection(s) to the public sewer can be at a point(s) convenient to yourself*'.

A survey of the public combined sewer system to should be undertaken to determine invert levels and ensure a gravity connection can be achieved.

Conclusions

The proposal is understood to be for residential development.

The Environment Agency 'Flood Map for Planning' map shows that the site is located within an area outside of the extreme flood extent (Flood Zone 1), meaning it has a less than 0.1% annual probability of flooding.

The majority of the site is at low risk of flooding from all sources. However, there are areas of the site that are identified at risk of surface water flooding. This will be mitigated through the inclusion of an appropriately designed surface water drainage system

The proposed development will introduce impermeable drainage area through the introduction of buildings and access roads. This will result in an increase in surface water runoff. In order to ensure the increase in surface water runoff will not increase flood risk elsewhere, flow control will be used, and attenuation provided on site to accommodate storm events up to and including the 1 in 100 year plus 40% climate change event.

All methods of surface water discharge have been assessed. Where soakaways are not possible, discharge of surface water to the culverted watercourse/land drains at a rate of 112.4 l/s appears to be the most practical option. There is also potential for the use of soakaways subject to infiltration testing.

Attenuation can be provided within the sub-grade of permeable paving or in the form of ponds, swales, detention basins and attenuation tanks located in the western or south-western extents of the site.

Foul flows should be discharged to the 300mm public combined sewers in Thornham Lane and Thornham New Road. A new connection should be agreed with United Utilities.

A Concept Designer's Risk Assessment (cDRA) has been prepared to inform future designers of any identified hazards associated with the scheme. The cDRA has been included in Appendix K.

Recommendations

1. Consider and incorporate the recommendations within this Flood Risk Assessment and Drainage Strategy within the masterplan;
2. Finished floor levels should be set at a minimum of 150mm above surrounding ground levels.
3. Undertake BRE 365 infiltration testing to determine the suitability of infiltration techniques;
4. Undertake a survey of existing local drainage and adjacent public sewerage network;
5. Verify the attenuation volumes included in this report when undertaking detailed drainage design; and
6. Make provision for sustainable drainage features in the lower western and south-western extents of the site.

Appendix A Location Plan and Aerial Image

N

M62

Trub

Thornfields

Canal

Rochdale Canal

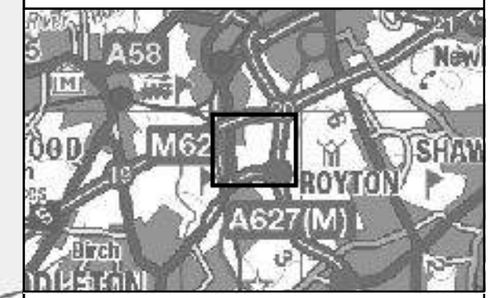
Thornham House

Education Facility

PW

A627(M)

0 50 100 200 300 400 500 m



NOTES:
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE

LEGEND

- Site Boundary
- Watercourses / Water Bodies

CLIENT:

REDROW

waterco

www.waterco.co.uk

SCHEME:

MANCHESTER ROAD, ROCHDALE

PLOT TITLE:

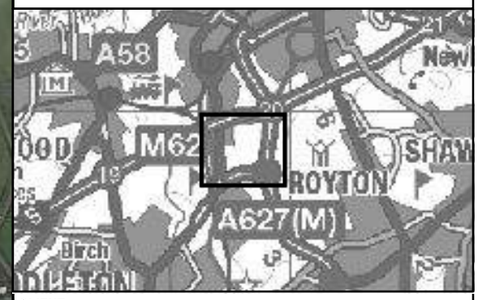
LOCATION PLAN

PLOT STATUS:			DATE:
FINAL			09/05/2019
DRAWN: CM	CHECKED: JR	APPROVED: VG	PLOT SCALE @ A3: 1:5,000 (UNLESS STATED OTHERWISE)
PLOT NAME: w10926-Location_Plan			REV: -

NOTES:
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE

LEGEND

Site Boundary



CLIENT:

REDROW

waterco

www.waterco.co.uk

SCHEME:

MANCHESTER ROAD, ROCHDALE

PLOT TITLE:

AERIAL PLAN

PLOT STATUS:	DATE:
FINAL	10/05/2019

DRAWN:	CHECKED:	APPROVED:	PLOT SCALE @ A3:
CM	JR	VG	1:5,000 (UNLESS STATED OTHERWISE)

PLOT NAME:	REV:
w10926-Aerial_Plan	-

Appendix B LIDAR Plan

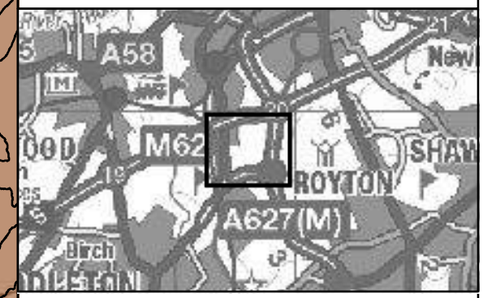
NOTES:
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE

LEGEND

- Site Boundary
- Site Levels

Ground Elevation (m AOD)

- < 130
- 130 - 145
- 145 - 160
- 160 - 175
- > 175



CLIENT:
REDROW

waterco
www.waterco.co.uk

SCHEME:
MANCHESTER ROAD, ROCHDALE

PLOT TITLE:
LIDAR ELEVATIONS
1m RESOLUTION

PLOT STATUS:	DATE:
FINAL	10/05/2019

DRAWN:	CHECKED:	APPROVED:	PLOT SCALE @ A3:
CM	JR	VG	1:5,000 (UNLESS STATED OTHERWISE)

PLOT NAME:	REV:
w10926-LiDAR	-

0 50 100 200 300 400 500 m

Appendix C Sewer Plan and Response

How to contact us:

United Utilities Water Limited
Property Searches
Haweswater House
Lingley Mere Business Park
Great Sankey
Warrington
WA5 3LP

Telephone: 0370 7510101

E-mail: propertysearches@uuplc.co.uk

Waterco

Lon Parcwr
Industrial Estate,
Ruthin,
LL15 1NJ

FAO:

Your Ref: w10926 Manchester Road
Our Ref: UUPS-ORD-96988
Date: 15/04/2019

Dear Sirs

Location: w10926 Manchester Road

I acknowledge with thanks your request dated 15/04/2019 for information on the location of our services.

Please find enclosed plans showing the approximate position of United Utilities' apparatus known to be in the vicinity of this site.

The enclosed plans are being provided to you subject to the United Utilities terms and conditions for both the wastewater and water distribution plans which are shown attached.

If you are planning works anywhere in the North West, please read United Utilities' access statement before you start work to check how it will affect our network. http://www.unitedutilities.com/work-near-asset.aspx .

I trust the above meets with your requirements and look forward to hearing from you should you need anything further.

If you have any queries regarding this matter please contact us .

Yours Faithfully,

[redacted]

United Utilities Water Limited
Registered In England & Wales No. 2366678
Registered Office Haweswater House, Lingley Mere Business Park,
Lingley Green Avenue, Great Sankey, Warrington, WA5 3LP

TERMS AND CONDITIONS - WASTEWATER AND WATER DISTRIBUTION PLANS

These provisions apply to the public sewerage, water distribution and telemetry systems (including sewers which are the subject of an agreement under Section 104 of the Water Industry Act 1991 and mains installed in accordance with the agreement for the self construction of water mains) (UUWL apparatus) of United Utilities Water Limited "(UUWL)".

TERMS AND CONDITIONS:

- This Map and any information supplied with it is issued subject to the provisions contained below, to the exclusion of all others and no party relies upon any representation, warranty, collateral contract or other assurance of any person (whether party to this agreement or not) that is not set out in this agreement or the documents referred to in it.
- This Map and any information supplied with it is provided for general guidance only and no representation, undertaking or warranty as to its accuracy, completeness or being up to date is given or implied.
- In particular, the position and depth of any UUWL apparatus shown on the Map are approximate only. UUWL strongly recommends that a comprehensive survey is undertaken in addition to reviewing this Map to determine and ensure the precise location of any UUWL apparatus. The exact location, positions and depths should be obtained by excavation trial holes.
- The location and position of private drains, private sewers and service pipes to properties are not normally shown on this Map but their presence must be anticipated and accounted for and you are strongly advised to carry out your own further enquiries and investigations in order to locate the same.
- The position and depth of UUWL apparatus is subject to change and therefore this Map is issued subject to any removal or change in location of the same. The onus is entirely upon you to confirm whether any changes to the Map have been made subsequent to issue and prior to any works being carried out.
- This Map and any information shown on it or provided with it must not be relied upon in the event of any development, construction or other works (including but not limited to any excavations) in the vicinity of UUWL apparatus or for the purpose of determining the suitability of a point of connection to the sewerage or other distribution systems.
- No person or legal entity, including any company shall be relieved from any liability howsoever and whensoever arising for any damage caused to UUWL apparatus by reason of the actual position and/or depths of UUWL apparatus being different from those shown on the Map and any information supplied with it.
- If any provision contained herein is or becomes legally invalid or unenforceable, it will be taken to be severed from the remaining provisions which shall be unaffected and continue in full force and affect.
- This agreement shall be governed by English law and all parties submit to the exclusive jurisdiction of the English courts, save that nothing will prevent UUWL from bringing proceedings in any other competent jurisdiction, whether concurrently or otherwise.

United Utilities Water Limited
Registered In England & Wales No. 2366678
Registered Office Haweswater House, Lingley Mere Business Park,
Lingley Green Avenue, Great Sankey, Warrington, WA5 3LP

Refno Cover Func Invert Size.x Size.y Shape Mati Length Grad Refno Cover Func Invert Size.x Size.y Shape Mati Length Grad

WASTE WATER SYMBOLOGY

Foul Surface Combined Overflow

Manhole
Manhole, Side Entry
MainSewer, Public
MainSewer, Private
MainSewer, S104
Rising Main, Public
Rising Main, Private
Rising Main, S104
Highway Drain, Private

Foul Surface Combined

WW Site Termination
Air Valve
Cascade
Non Return Valve
Extent of Survey
Flow Meter
Gulley
Hatch Box
Head of System
Hydrobrake / Vortex
Inlet
Inspection Chamber
Bifurcation
Catchpit
Contaminated Surface Water
WW Pumping Station
Sludge Pumping Station
Sewer Overflow
TJunction/Saddle
LampHole
OilInterceptor
PenStock
Pump
RoddingEye
Soakaway
Summit
Valve
Valve Chamber
Washout Chamber
DropShaft
WW Treatment Works
Septic Tank
Vent Column
Network Storage Tank
Orifice Plate
Vortex Chamber
Penstock Chamber
Blind Manhole

Foul Surface Combined Overflow

Screen Chamber
Discharge Point
Outfall

Sludge Main, Public
Sludge Main, Private
Sludge Main, S104

ABANDONED PIPE

MainSewer
Rising Main
Highway Drain
Sludge Main

Control Kiosk
Unspecified

LEGEND

MANHOLE FUNCTION

FO	Foul
SW	Surface Water
CO	Combined
OV	Overflow

SEWER SHAPE

CI	Circular	TR	Trapezoidal
EG	Egg	AR	Arch
OV	Oval	BA	Barrel
FT	Flat Top	HO	HorseShoe
RE	Rectangular	UN	Unspecified
SQ	Square		

SEWER MATERIAL

AC	Asbestos Cement	DI	Ductile Iron
BR	Brick	PVC	Polyvinyl Chloride
PE	Polyethylene	CI	Cast Iron
RP	Reinforced Plastic Matrix	SI	Spun Iron
CO	Concrete	ST	Steel
CSB	Concrete Segment Bolted	VC	Vitrified Clay
CSU	Concrete Segment Unbolted	PP	Polypropylene
CC	Concrete Box Culverted	PF	Pitch Fibre
PSC	Plastic/Steel Composite	MAC	Masonry, Coursed
GRC	Glass Reinforced Concrete	MAR	Masonry, Random
GRP	Glass Reinforced Plastic	U	Unspecified

OS Sheet No: SD8909SW
Scale: 1:1250 Date: 15/04/2019
0 Nodes
Sheet 1 of 1

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SEWER RECORDS

OS Sheet No: SD8909SW

Scale: 1:1250 Date: 15/04/2019

Printed By: Property Searches

Refno Cover Func Invert Size.x Size.y Shape Mati Length Grad

Refno Cover Func Invert Size.x Size.y Shape Mati Length Grad

WASTE WATER SYMBOLOGY

Foul Surface Combined Overflow

- Manhole
- Manhole, Side Entry
- MainSewer, Public
- MainSewer, Private
- MainSewer, S104
- Rising Main, Public
- Rising Main, Private
- Rising Main, S104
- Highway Drain, Private

Foul Surface Combined

- WW Site Termination
- Air Valve
- Cascade
- Non Return Valve
- Extent of Survey
- Flow Meter
- Gulley
- Hatch Box
- Head of System
- Hydrobrake / Vortex
- Inlet
- Inspection Chamber
- Bifurcation
- Catchpit
- Contaminated Surface Water
- WW Pumping Station
- Sludge Pumping Station
- Sewer Overflow
- TJunction/Saddle
- LampHole
- OilInterceptor
- PenStock
- Pump
- RoddingEye
- Soakaway
- Summit
- Valve
- Valve Chamber
- Washout Chamber
- DropShaft
- WW Treatment Works
- Septic Tank
- Vent Column
- Network Storage Tank
- Orifice Plate
- Vortex Chamber
- Penstock Chamber
- Blind Manhole

Foul Surface Combined Overflow

- Screen Chamber
- Discharge Point
- Outfall
- Control Kiosk
- Unspecified

- Sludge Main, Public
- Sludge Main, Private
- Sludge Main, S104

ABANDONED PIPE

- MainSewer
- Rising Main
- Highway Drain
- Sludge Main

LEGEND

MANHOLE FUNCTION

FO	Foul
SW	Surface Water
CO	Combined
OV	Overflow

SEWER SHAPE

CI	Circular	TR	Trapezoidal
EG	Egg	AR	Arch
OV	Oval	BA	Barrel
FT	Flat Top	HO	HorseShoe
RE	Rectangular	UN	Unspecified
SQ	Square		

SEWER MATERIAL

AC	Asbestos Cement	DI	Ductile Iron
BR	Brick	PVC	Polyvinyl Chloride
PE	Polyethylene	CI	Cast Iron
RP	Reinforced Plastic Matrix	SI	Spun Iron
CO	Concrete	ST	Steel
CSB	Concrete Segment Bolted	VC	Vitrified Clay
CSU	Concrete Segment Unbolted	PP	Polypropylene
CC	Concrete Box Culverted	PF	Pitch Fibre
PSC	Plastic/Steel Composite	MAC	Masonry, Coursed
GRC	Glass Reinforced Concrete	MAR	Masonry, Random
GRP	Glass Reinforced Plastic	U	Unspecified

OS Sheet No: SD8909SE
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Sheet 1 of 1

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SEWER RECORDS

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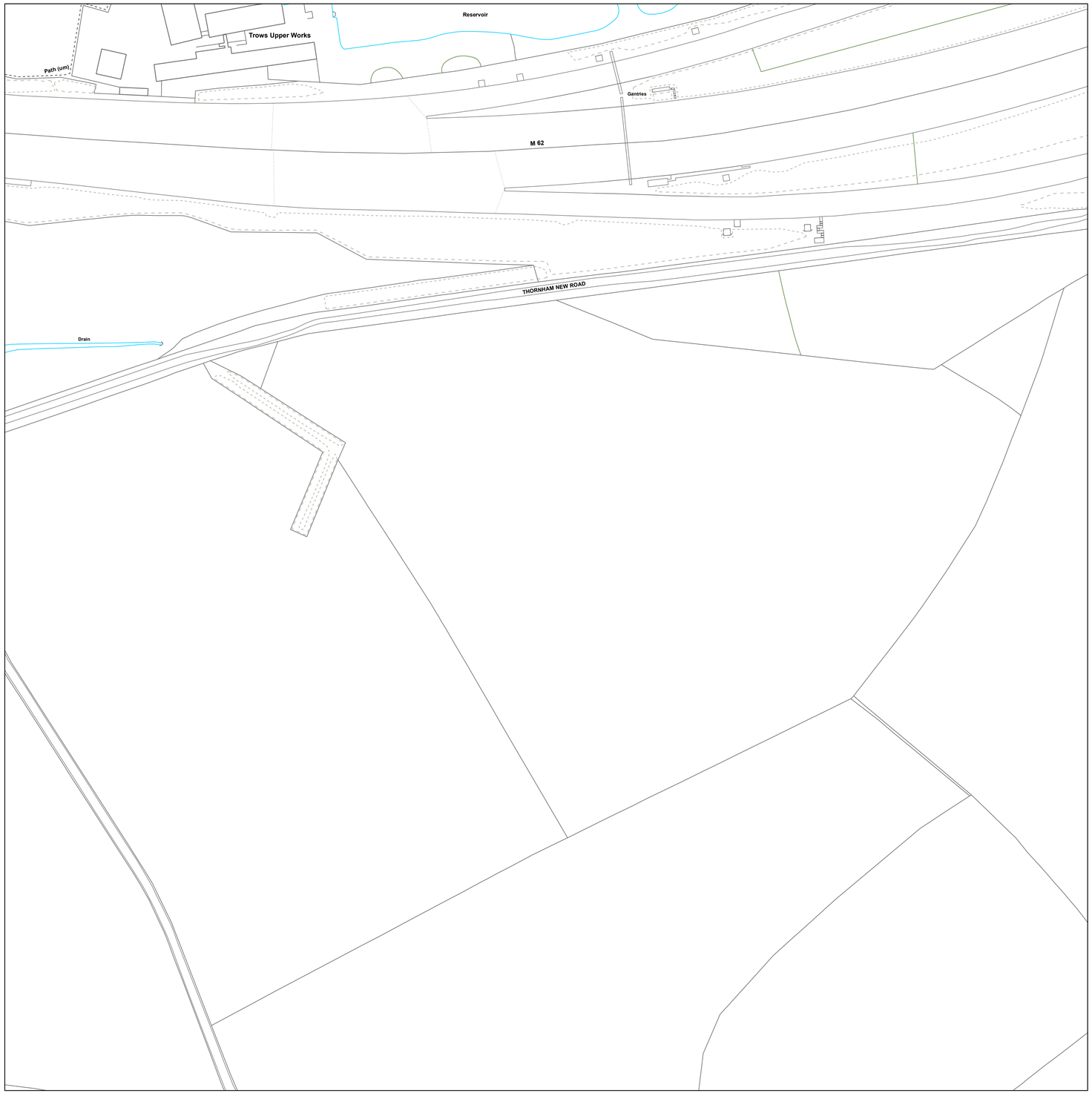
Scale: 1:1250 Date: 15/04/2019



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OS Sheet No: SD8909NW

Scale: 1:1250 Date: 15/04/2019

WASTE WATER SYMBOLOGY

Foul Surface Combined Overflow

Manhole
Manhole, Side Entry
MainSewer, Public
MainSewer, Private
MainSewer, S104
Rising Main, Public
Rising Main, Private
Rising Main, S104
Highway Drain, Private

Foul Surface Combined

WW Site Termination
Air Valve
Cascade
Non Return Valve
Extent of Survey
Flow Meter
Gulley
Hatch Box
Head of System
Hydrobrake / Vortex
Inlet
Inspection Chamber
Bifurcation
Catchpit
Contaminated Surface Water
WW Pumping Station
Sludge Pumping Station
Sewer Overflow
TJunction/Saddle
LampHole
OilInterceptor
PenStock
Pump
RoddingEye
Soakaway
Summit
Valve
Valve Chamber
Washout Chamber
DropShaft
WW Treatment Works
Septic Tank
Vent Column
Network Storage Tank
Orifice Plate
Vortex Chamber
Penstock Chamber
Blind Manhole
Screen Chamber
Discharge Point
Outfall
Control Kiosk
Unspecified

Sludge Main, Public
Sludge Main, Private
Sludge Main, S104

ABANDONED PIPE

MainSewer
Rising Main
Highway Drain
Sludge Main

LEGEND

MANHOLE FUNCTION

FO	Foul
SW	Surface Water
CO	Combined
OV	Overflow

SEWER SHAPE

CI	Circular	TR	Trapezoidal
EG	Egg	AR	Arch
OV	Oval	BA	Barrel
FT	Flat Top	HO	HorseShoe
RE	Rectangular	UN	Unspecified
SQ	Square		

SEWER MATERIAL

AC	Asbestos Cement	DI	Ductile Iron
BR	Brick	PVC	Polyvinyl Chloride
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RP	Reinforced Plastic Matrix	SI	Spun Iron
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CSB	Concrete Segment Bolted	VC	Vitrified Clay
CSU	Concrete Segment Unbolted	PP	Polypropylene
CC	Concrete Box Culverted	PF	Pitch Fibre
PSC	Plastic/Steel Composite	MAC	Masonry, Coursed
GRC	Glass Reinforced Concrete	MAR	Masonry, Random
GRP	Glass Reinforced Plastic	U	Unspecified

OS Sheet No: SD8909NW
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Sheet 1 of 1

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SEWER RECORDS

Refno Cover Func Invert Size.x Size.y Shape Mati Length Grad

Refno Cover Func Invert Size.x Size.y Shape Mati Length Grad

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Scale: 1:1250 Date: 15/04/2019

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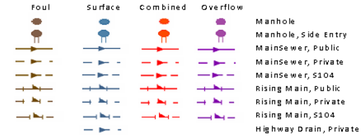
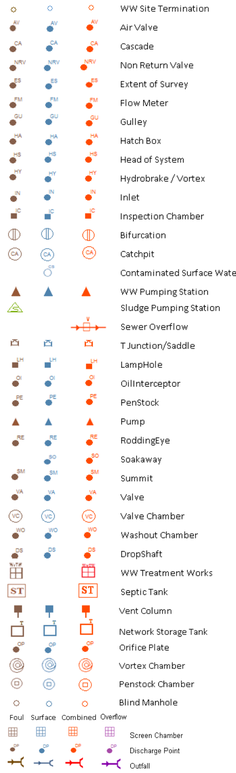
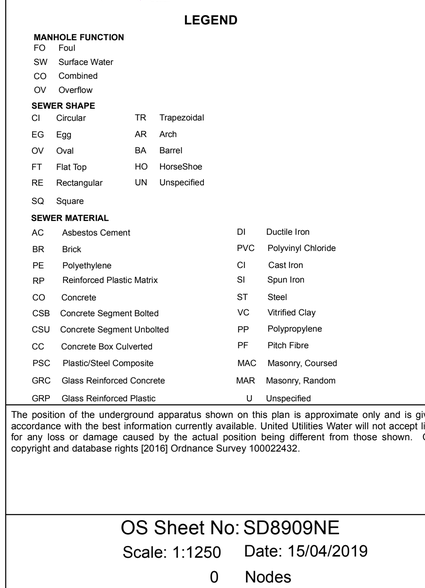
WASTE WATER SYMBOLOGY





ABANDONED PIPE



LEGEND

MANHOLE FUNCTION

FO	Foul
SW	Surface Water
CO	Combined
OV	Overflow

SEWER SHAPE

CI	Circular	TR	Trapezoidal
EG	Egg	AR	Arch
OV	Oval	BA	Barrel
FT	Flat Top	HO	HorseShoe
RE	Rectangular	UN	Unspecified
SQ	Square		

SEWER MATERIAL

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BR	Brick	PVC	Polyvinyl Chloride
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RP	Reinforced Plastic Matrix	SI	Spun Iron
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PSC	Plastic/Steel Composite	MAC	Masonry, Coursed
GRC	Glass Reinforced Concrete	MAR	Masonry, Random
GRP	Glass Reinforced Plastic	U	Unspecified

OS Sheet No: SD8909NE

Scale: 1:1250 Date: 15/04/2019

0 Nodes

Sheet 1 of 1

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SEWER RECORDS

Refno Cover Func Invert Size.x Size.y Shape Mati Length Grad

Refno Cover Func Invert Size.x Size.y Shape Mati Length Grad

OS Sheet No: SD8908NW

Scale: 1:1250 Date: 15/04/2019

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WASTE WATER SYMBOLOGY

Foul Surface Combined Overflow

Manhole
Manhole, Side Entry
MainSewer, Public
MainSewer, Private
MainSewer, S104
Rising Main, Public
Rising Main, Private
Rising Main, S104
Highway Drain, Private

Foul Surface Combined

WW Site Termination
Air Valve
Cascade
Non Return Valve
Extent of Survey
Flow Meter
Gulley
Hatch Box
Head of System
Hydrobrake / Vortex
Inlet
Inspection Chamber
Bifurcation
Catchpit
Contaminated Surface Water
WW Pumping Station
Sludge Pumping Station
Sewer Overflow
TJunction/Saddle
LampHole
OilInterceptor
PenStock
Pump
RoddingEye
Soakaway
Summit
Valve
Valve Chamber
Washout Chamber
DropShaft
WW Treatment Works
Septic Tank
Vent Column
Network Storage Tank
Orifice Plate
Vortex Chamber
Penstock Chamber
Blind Manhole

Foul Surface Combined Overflow

Screen Chamber
Discharge Point
Outfall
Control Kiosk
Unspecified

Sludge Main, Public
Sludge Main, Private
Sludge Main, S104

ABANDONED PIPE

MainSewer
Rising Main
Highway Drain
Sludge Main

LEGEND

MANHOLE FUNCTION

FO	Foul
SW	Surface Water
CO	Combined
OV	Overflow

SEWER SHAPE

CI	Circular	TR	Trapezoidal
EG	Egg	AR	Arch
OV	Oval	BA	Barrel
FT	Flat Top	HO	HorseShoe
RE	Rectangular	UN	Unspecified
SQ	Square		

SEWER MATERIAL

AC	Asbestos Cement	DI	Ductile Iron
BR	Brick	PVC	Polyvinyl Chloride
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GRC	Glass Reinforced Concrete	MAR	Masonry, Random
GRP	Glass Reinforced Plastic	U	Unspecified

OS Sheet No: SD8908NW
Scale: 1:1250 Date: 15/04/2019
0 Nodes
Sheet 1 of 1

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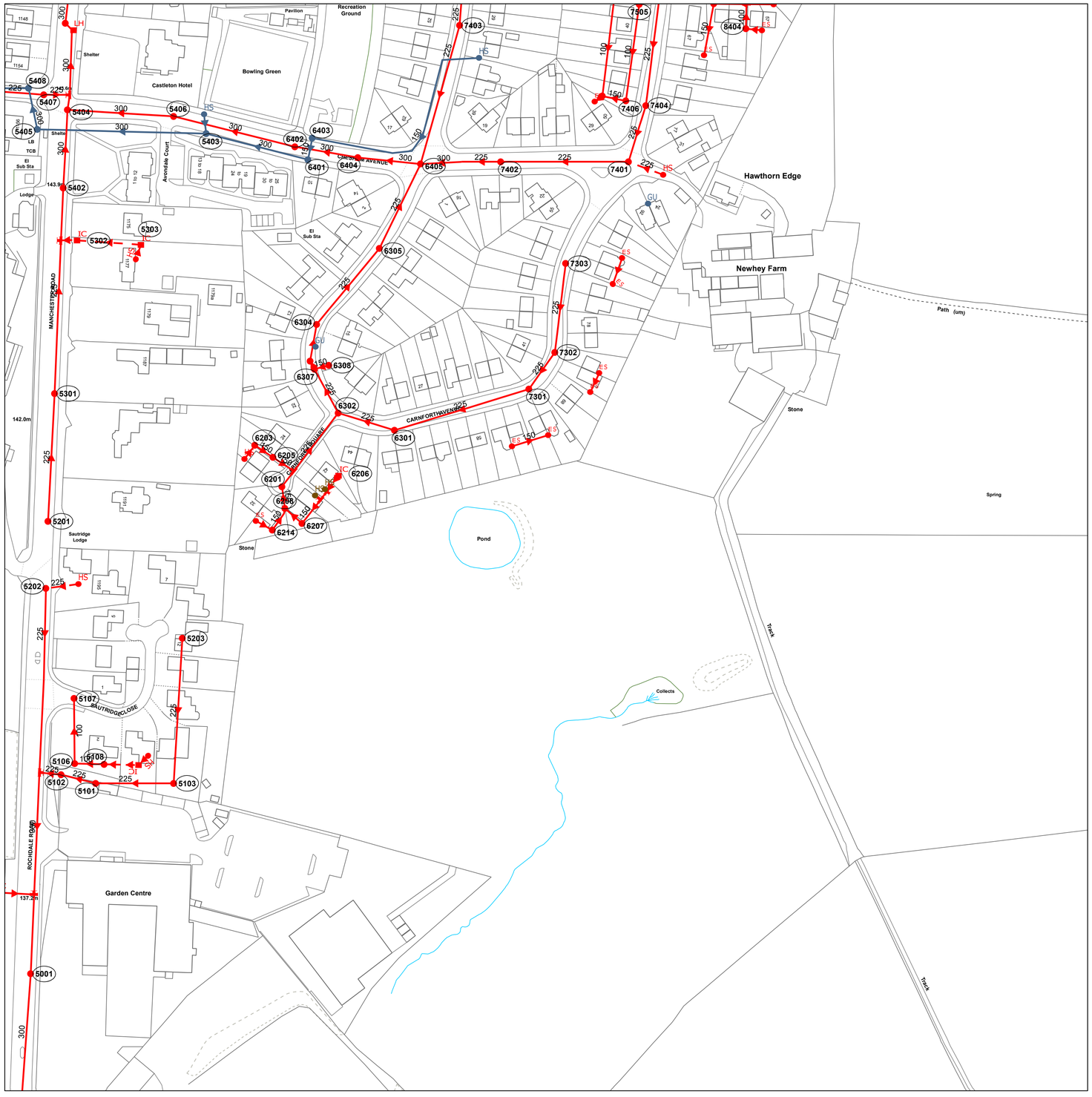
SEWER RECORDS



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5101		CO							
5102		CO							
5103		CO							
5106		CO							
5107		CO							
5108		CO							
5109		CO							
5201		CO							
5202		CO	0	225		CI	VC	42.01	
5203		CO	0	225		CI	VC	67.12	
5301		CO	0	225		CI	VC	95.08	
5302		CO							
5303		CO							
5402		CO	0	300		CI	VC	36.06	
5403	143.86	SW							
5404	143.45	CO							
5406	143.17	SW	0	300		CI	VC	19.42	
5407	143.64	CO							
5408	142.52	SW							
5409		CO							
6201		CO	0	225		CI	VC	42.8	
6203		CO		150		CI	VC	10.04	
6205		CO							
6206		CO							
6207		CO		150		CI	VC	10.56	
6208		CO							
6214		CO		150		CI	VC	11.75	
6301		CO							
6302		CO							
6303		CO	0	225		CI	VC	17.26	
6304		CO	0	225		CI	VC	45.45	
6305		CO							
6307		CO							
6308		CO		150		CI	VC	6.78	
6401	144.47	SW	0	300		CI	VC	48.51	
6402	144.38	CO	0	300		CI	VC	57.72	
6403	144.6	SW							
6404	144.78	CO							
6405	145.84	CO							
7301		CO	0	225		CI	VC	64.85	
7302		CO							
7303		CO							
7401		CO							
7402		CO							
7403		CO	0	225		CI	VC	66.48	
7404		CO	0	225		CI	VC	27.2	
7406		CO		150		CI	VC	11.02	
7408		CO		100		CI	VC	4.32	
8404		CO		100		CI	VC	11.4	
5105		CO							
5110		CO							
5111		CO							
5204		CO		225		CI	VC	15.13	
5304		CO							
5305		CO							
5411		SW	0	300		CI	VC	9.06	
6202		CO		150		CI	VC	7.92	
6209		CO							
6210		FO							
6211		FO							
6306		SW							
7405		SW	0	150		CI	VC	108.48	
7407		CO	0	300		CI	VC	19.03	
7410		SW							
8401		CO		225		CI	VC	17.09	
5002		CO							
5104		CO							
5306		CO							
5410		CO							
5412		CO							
6204		FO							
6212		CO		150		CI	VC	18.64	
6213		OV							

WASTE WATER SYMBOLOGY

Foul Surface Combined Overflow

Manhole
Manhole, Side Entry
MainSewer, Public
MainSewer, Private
MainSewer, S104
Rising Main, Public
Rising Main, Private
Rising Main, S104
Highway Drain, Private

Foul Surface Combined

WW Site Termination
Air Valve
Cascade
Non Return Valve
Extent of Survey
Flow Meter
Gulley
Hatch Box
Head of System
Hydrobrake / Vortex
Inlet
Inspection Chamber
Bifurcation
Catchpit
Contaminated Surface Water
WW Pumping Station
Sludge Pumping Station
Sewer Overflow
TJunction/Saddle
LampHole
OilInterceptor
PenStock
Pump
RoddingEye
Soakaway
Summit
Valve
Valve Chamber
Washout Chamber
DropShaft
WW Treatment Works
Septic Tank
Vent Column
Network Storage Tank
Orifice Plate
Vortex Chamber
Penstock Chamber
Blind Manhole

Foul Surface Combined Overflow

Screen Chamber
Discharge Point
Outfall

Control Kiosk
Unspecified

Sludge Main, Public
Sludge Main, Private
Sludge Main, S104

ABANDONED PIPE

MainSewer
Rising Main
Highway Drain
Sludge Main

LEGEND

MANHOLE FUNCTION

FO	Foul
SW	Surface Water
CO	Combined
OV	Overflow

SEWER SHAPE

CI	Circular	TR	Trapezoidal
EG	Egg	AR	Arch
OV	Oval	BA	Barrel
FT	Flat Top	HO	HorseShoe
RE	Rectangular	UN	Unspecified
SQ	Square		

SEWER MATERIAL

AC	Asbestos Cement	DI	Ductile Iron
BR	Brick	PVC	Polyvinyl Chloride
PE	Polyethylene	CI	Cast Iron
RP	Reinforced Plastic Matrix	SI	Spun Iron
CO	Concrete	ST	Steel
CSB	Concrete Segment Bolted	VC	Vitrified Clay
CSU	Concrete Segment Unbolted	PP	Polypropylene
CC	Concrete Box Culverted	PF	Pitch Fibre
PSC	Plastic/Steel Composite	MAC	Masonry, Coursed
GRC	Glass Reinforced Concrete	MAR	Masonry, Random
GRP	Glass Reinforced Plastic	U	Unspecified

OS Sheet No: SD8809SE
Scale: 1:1250 Date: 15/04/2019
75 Nodes
Sheet 1 of 1

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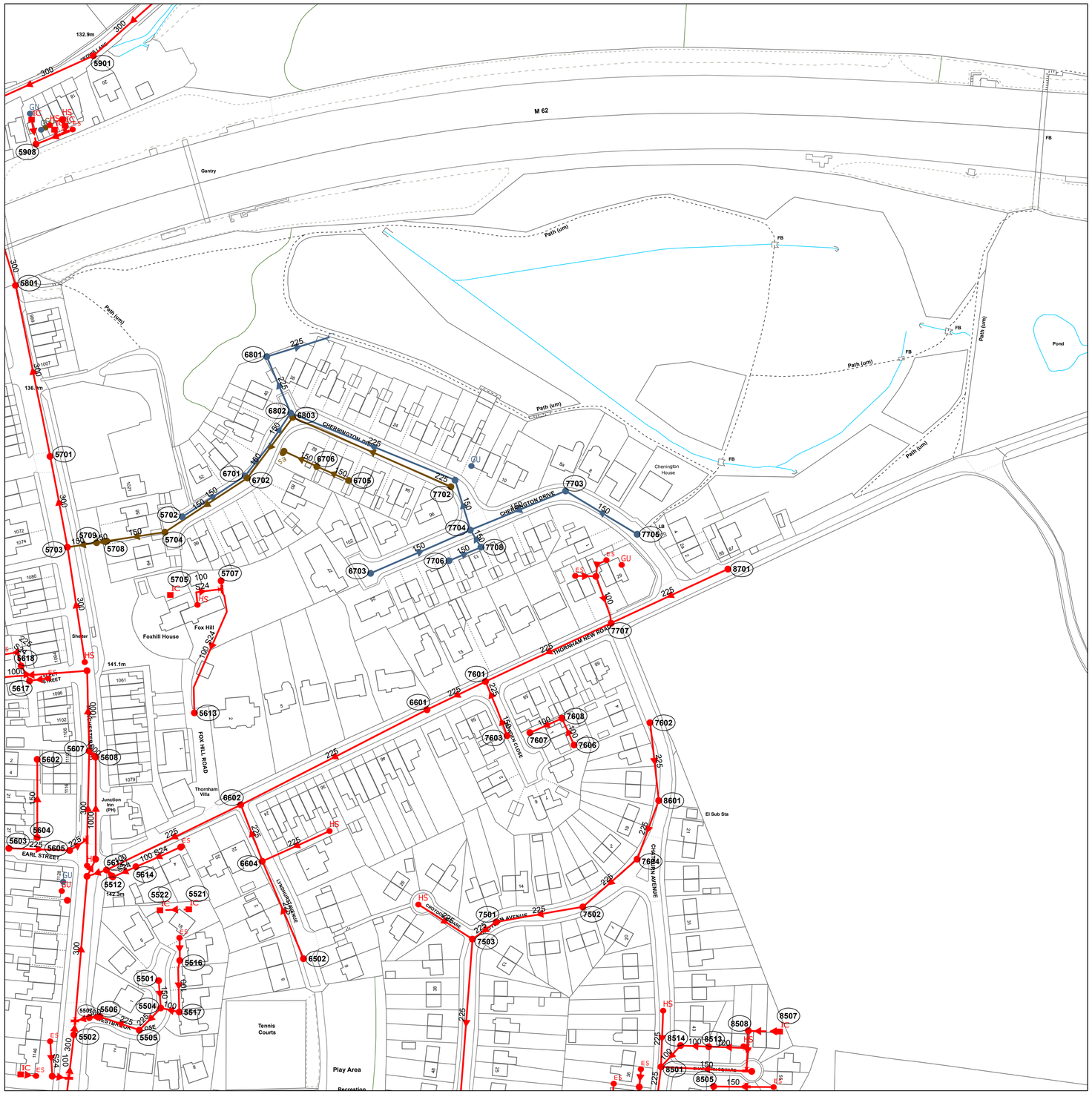
SEWER RECORDS

Printed By: Property Searches

OS Sheet No: SD8809SE

Scale: 1:1250 Date: 15/04/2019



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5504		CO							
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5507		CO							
5510		CO			150	CI	VC	7.85	
5512		CO							
5515		CO							
5516		CO			100	CI	VC	24.02	
5517		CO							
5519		CO							
5521		CO							
5522		CO							
5601	141.31	CO	134.76	1000		CI	CO	52.15	79
5602	141.39	CO							
5603		CO	0	225		CI	VC	28.02	
5604	141.49	CO	0	150		CI	VC	36	
5605		CO							
5606	141.99	CO	135.19	1000		CI	CO	47	115
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5608	141.35	CO							
5612		CO							
5613		CO							
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5615		CO							
5617		CO		150		CI	VC	7.92	
5618		CO							
5701		CO	0	300		CI	VC	80.6	
5702	149.07	SW							
5703		CO	0	300		CI	VC	42.76	
5704	148.82	FO							
5705		CO							
5707		CO		100		CI	VC	64.49	
5708		FO		150		CI	VC	4.71	
5709		FO							
5801		CO							
5901		CO							
5905		CO		0	300	CI	VC	65.8	
5906		CO							
5907		CO							
5908		CO							
6502		CO							
6601		CO	0	225		CI	VC	96.6	
6602		CO	0	225		CI	VC	68.88	
6604		CO							
6701	149.62	SW							
6702	149.61	FO	147.07	150		CI	VC	45.49	54
6703	151.76	SW	150.21	150		CI	VC	50.16	71
6705		FO		150		CI	VC	16.08	
6706		FO							
6707		FO							
6801		SW							
6802	150.03	SW							
6803		FO							
7501		CO							
7502		CO							
7503		CO							
7505		CO							
7601		CO							
7602		CO							
7603		CO							
7604		CO							
7606		CO		100		CI	VC	13.5	
7607		CO							
7608		CO							
7701	152.62	SW	149.14	225		CI	VC	82.08	43
7702	152.72	FO	149.91	225		CI	VC	79.71	
7703	154.74	SW							
7704	153.33	SW							
7705	155.96	SW	154.37	150		CI	VC	38.59	36
7706		SW		150		CI	VC	16.03	
7707	155.18	CO							
7708		SW		150		CI	VC	9.34	
7711		CO		100		CI	VC	22.72	
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8507		CO							
8508		CO		100		CI	VC	18.56	
8513		CO		100		CI	VC	12.96	
8514		CO							
8601		CO							
8701	158.36	CO	156.73	225		CI	VC	59.51	18
5513		CO							
5514		SW							
5609		CO	0	300		CI	VC	53.01	
5610		CO	0	300		CI	VC	53.6	
5706		CO		100		CI	VC	17.82	
5902		FO							
5903		SW							
5904		SW							
5909		CO							
5910		CO							
5911		CO							
5912		CO							
6503		CO							
6603		CO	0	225		CI	VC	34.01	
6704		SW	147.34	150		CI	VC	18.03	225
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7713		CO							
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5611		CO							
5914		CO							
5915		CO							
6709		CO							
8506		CO							
8509		CO							
8512		CO							

WASTE WATER SYMBOLOGY

Foul Surface Combined Overflow

Manhole
Manhole, Side Entry
MainSewer, Public
MainSewer, Private
MainSewer, S104
Rising Main, Public
Rising Main, Private
Rising Main, S104
Highway Drain, Private

Foul Surface Combined

WW Site Termination
Air Valve
Cascade
Non Return Valve
Extent of Survey
Flow Meter
Gulley
Hatch Box
Head of System
Hydrobrake / Vortex
Inlet
Inspection Chamber
Bifurcation
Catchpit
Contaminated Surface Water
WW Pumping Station
Sludge Pumping Station
Sewer Overflow
TJunction/Saddle
LampHole
OilInterceptor
PenStock
Pump
RoddingEye
Soakaway
Summit
Valve
Valve Chamber
Washout Chamber
DropShaft
WW Treatment Works
Septic Tank
Vent Column
Network Storage Tank
Orifice Plate
Vortex Chamber
Penstock Chamber
Blind Manhole

Foul Surface Combined Overflow

Screen Chamber
Discharge Point
Outfall

Control Kiosk
Unspecified

Sludge Main, Public
Sludge Main, Private
Sludge Main, S104

ABANDONED PIPE

MainSewer
Rising Main
Highway Drain
Sludge Main

LEGEND

MANHOLE FUNCTION

FO	Foul
SW	Surface Water
CO	Combined
OV	Overflow

SEWER SHAPE

CI	Circular	TR	Trapezoidal
EG	Egg	AR	Arch
OV	Oval	BA	Barrel
FT	Flat Top	HO	HorseShoe
RE	Rectangular	UN	Unspecified
SQ	Square		

SEWER MATERIAL

AC	Asbestos Cement	DI	Ductile Iron
BR	Brick	PVC	Polyvinyl Chloride
PE	Polyethylene	CI	Cast Iron
RP	Reinforced Plastic Matrix	SI	Spun Iron
CO	Concrete	ST	Steel
CSB	Concrete Segment Bolted	VC	Vitrified Clay
CSU	Concrete Segment Unbolted	PP	Polypropylene
CC	Concrete Box Culverted	PF	Pitch Fibre
PSC	Plastic/Steel Composite	MAC	Masonry, Coursed
GRC	Glass Reinforced Concrete	MAR	Masonry, Random
GRP	Glass Reinforced Plastic	U	Unspecified

OS Sheet No: SD8809NE
Scale: 1:1250 Date: 15/04/2019
115 Nodes
Sheet 1 of 1

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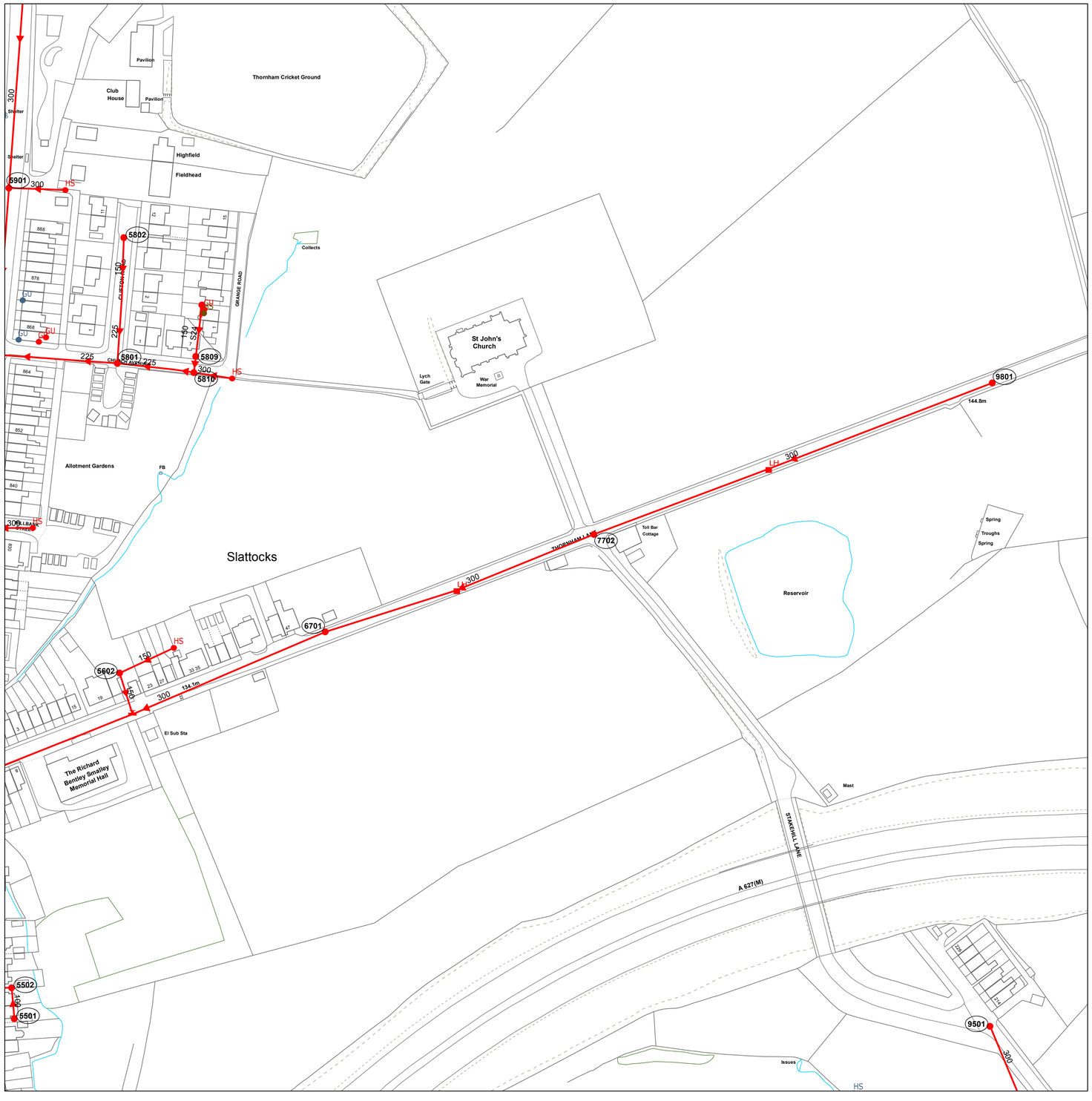
SEWER RECORDS

Printed By: Property Searches

OS Sheet No: SD8809NE

Scale: 1:1250 Date: 15/04/2019



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5602		CO		150		CI	VC	19.9	
5801	133.32	CO							
5802		CO							
5808		CO		150		CI	VC	23.94	
5809		CO		150		CI	VC	7.48	
5810		CO							
5901	134.83	CO		131.53	300	CI	VC	77.23	
6701		CO		0	300	CI	VC	180.71	
7702		CO							
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5701		CO		0	300	CI	VC	26	
5702		CO			150	CI	VC	27.68	
5803		CO		0	225	CI	VC	29.07	
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5806		CO							
5807		FO							
5813		CO							
5814		CO							
5815		SW							
5816		SW							
5902		CO		0	300	CI	VC	26.02	
6801		CO			300	CI	VC	17.87	
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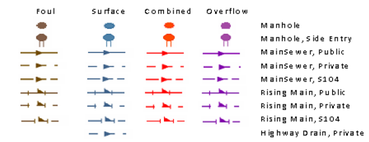
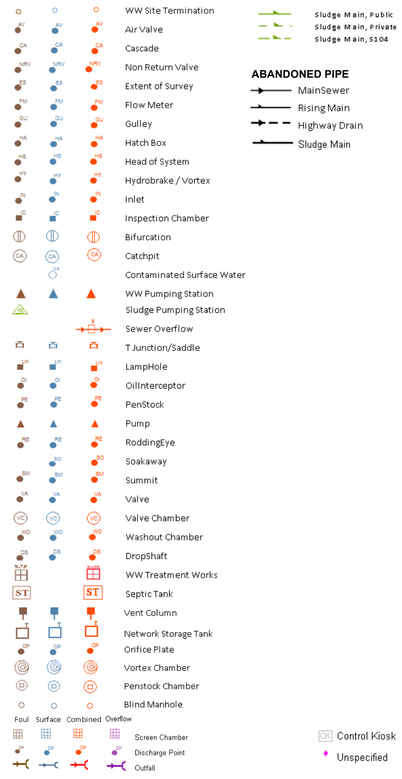
8701		CO							

WASTE WATER SYMBOLOGY





ABANDONED PIPE

- MainSewer
- Rising Main
- Highway Drain
- Sludge Main

LEGEND

MANHOLE FUNCTION

FO	Foul
SW	Surface Water
CO	Combined
OV	Overflow

SEWER SHAPE

CI	Circular	TR	Trapezoidal
EG	Egg	AR	Arch
OV	Oval	BA	Barrel
FT	Flat Top	HO	HorseShoe
RE	Rectangular	UN	Unspecified
SQ	Square		

SEWER MATERIAL

AC	Asbestos Cement	DI	Ductile Iron
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PE	Polyethylene	CI	Cast Iron
RP	Reinforced Plastic Matrix	SI	Spun Iron
CO	Concrete	ST	Steel
CSB	Concrete Segment Bolted	VC	Vitrified Clay
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CC	Concrete Box Culverted	PF	Pitch Fibre
PSC	Plastic/Steel Composite	MAC	Masonry, Coursed
GRC	Glass Reinforced Concrete	MAR	Masonry, Random
GRP	Glass Reinforced Plastic	U	Unspecified

OS Sheet No: SD8808NE
Scale: 1:1250 Date: 15/04/2019
31 Nodes
Sheet 1 of 1

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SEWER RECORDS

Printed By: Property Searches

OS Sheet No: SD8808NE

Scale: 1:1250 Date: 15/04/2019

Jennifer Gibson

From: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
Sent: 03 May 2019 10:27
To: Jennifer Gibson; Wastewater Developer Services
Subject: RE: w10926 - wastewater development enquiry - 4200025543

Categories: Information received

Dear Customer

We have carried out an assessment of your application which is based on the information provided; this pre development advice will be valid for 12 months

Foul will be allowed to drain to the public combined sewer network at an unrestricted rate. The connection(s) to the public sewer can be at a point(s) convenient to yourself

Surface water from this site should drain to either soak away or directly to watercourse. Discharge rates and consents must be discussed and agreed with all interested parties.

If you require any further guidance please follow http://www.unitedutilities.com/builders-developers.aspx

If you need a make further enquiry relating to this matter please send your enquiry to WastewaterDeveloperServices@uuplc.co.uk Please quote your DEXXXX/42XXXXXXX/GEXXXX reference number

Please Note:- enquiries sent to any other United Utilities e-mail address will be deleted.

Connection Application

Although we may discuss and agree discharge points & rates in principle, please be aware that you will have to apply for a formal sewer connection. This is so that we can assess the method of construction, Health & Safety requirements and to ultimatley inspect the connection when it is made. Details of the application process and the form itself can be obtained from our website by following the link below

http://www.unitedutilities.com/connecting-public-sewer.aspx

Please be aware that on site drainage must be designed in accordance with Building Regulations, National Planning Policy, Planning Conditions and local flood authority guidelines, we would recommend that you laise and make suitable agreements with the relevant statutory bodies.

Regards

Neil O'Brien

Developer Engineer
Developer Services and Planning

From: Jennifer Gibson [mailto:jennifer.gibson@waterco.co.uk]
Sent: 15 April 2019 13:43
To: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
Subject: w10926 - wastewater development enquiry

Please see attached the wastewater pre development form

Regards,

Jennifer Gibson BSc (Hons), MSc
Environmental Consultant

DDI: [redacted]
Teams: jennifer.gibson@waterco.co.uk

Waterco

Assessment, Modelling, Design

Ruthin - Chester - Manchester - London

Shortlisted for awards in the following categories;
'*Innovation in Project Management*' & '*Impact in Water*'

New Civil Engineer 100 COMPANIES OF THE YEAR 2019

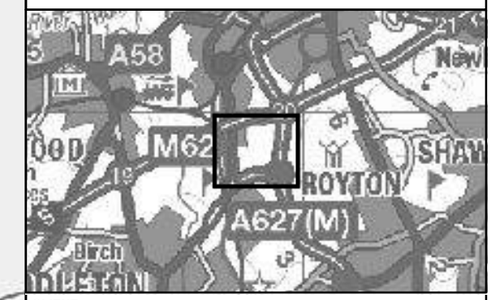
Appendix D Environment Agency Flood Maps

NOTES:
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE

LEGEND

- Site Boundary
- EA Main Rivers
- EA Flood Zone 3
- EA Flood Zone 2

FLOOD ZONE 1



0 50 100 200 300 400 500 m

CLIENT: REDROW

waterco
www.waterco.co.uk

SCHEME:
MANCHESTER ROAD, ROCHDALE

PLOT TITLE:
EA FLOOD MAP FOR PLANNING
APRIL 2019

PLOT STATUS:	DATE:
FINAL	10/05/2019

DRAWN:	CHECKED:	APPROVED:	PLOT SCALE @ A3:
CM	JR	VG	1:5,000 (UNLESS STATED OTHERWISE)

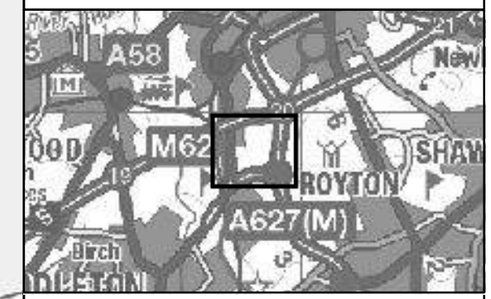
PLOT NAME:	REV:
w10926-EA_FZ	-

NOTES:
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE

LEGEND

- Site Boundary
- Historical Flood Map

No Records of Historical Flooding



0 50 100 200 300 400 500 m

CLIENT: REDROW

www.waterco.co.uk

SCHEME: MANCHESTER ROAD, ROCHDALE

PLOT TITLE: EA HISTORICAL FLOOD MAP

PLOT STATUS:	DATE:
FINAL	10/05/2019

DRAWN:	CHECKED:	APPROVED:	PLOT SCALE @ A3:
CM	JR	VG	1:5,000 (UNLESS STATED OTHERWISE)

PLOT NAME:	REV:
w10926-EA_HIST	-

N

Trub

Thornfields

Thornham House

Education Facility

PW

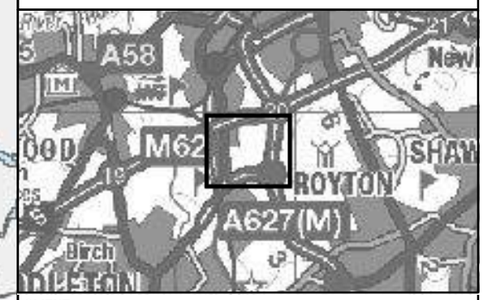
Gerrard Wood

0 50 100 200 300 400 500 m

NOTES:
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE

LEGEND

- Site Boundary
- Low (between 0.1% and 1.0%)
- Medium (between 1.0% and 3.3%)
- High (3.3% or greater)



CLIENT: REDROW

waterco
www.waterco.co.uk

SCHEME:
MANCHESTER ROAD, ROCHDALE

PLOT TITLE:
EA FLOOD RISK FROM SURFACE WATER
APRIL 2019

PLOT STATUS:	DATE:
FINAL	09/05/2019

DRAWN:	CHECKED:	APPROVED:	PLOT SCALE @ A3:
CM	JR	VG	1:5,000 (UNLESS STATED OTHERWISE)

PLOT NAME:	REV:
w10926-EA_SW	-

N

M62

Area at Low Risk

Thornfields

Thornham House

Education Facility

PW

A627(M)

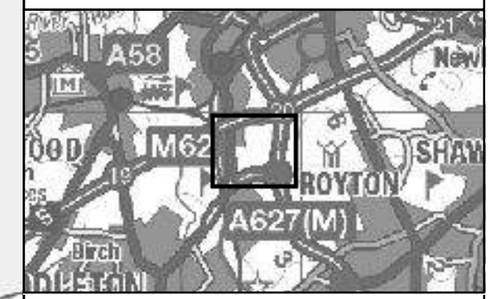
Canal

0 50 100 200 300 400 500 m

NOTES:
1) ALL DIMENSIONS ARE IN METRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS STATED OTHERWISE

LEGEND

- Site Boundary
- EA Reservoir Flood Map



CLIENT:

REDROW

waterco

www.waterco.co.uk

SCHEME:

MANCHESTER ROAD, ROCHDALE

PLOT TITLE:

EA FLOOD RISK FROM RESERVOIRS

APRIL 2019

PLOT STATUS:			DATE:
FINAL			10/05/2019
DRAWN: CM	CHECKED: JR	APPROVED: VG	PLOT SCALE @ A3: 1:5,000 (UNLESS STATED OTHERWISE)
PLOT NAME: w10926-EA_RES			REV: -

Jennifer Gibson

From: GMMC Info Requests <Inforequests.gmmc@environment-agency.gov.uk>
Sent: 16 April 2019 10:31
To: Jennifer Gibson
Subject: FW: 190413/DT03 FW: w10926 pre-planning opinion
Attachments: Manchester Road location plan.pdf

Categories: Information received

Dear Jennifer,

The site is located within flood zone 1, and near an ordinary watercourse. Therefore, for any further information, you should contact the LLFA (Lead Local Flood Authority).

Kind regards,

Anne
Anne Ball - Customer and Engagement Officer
Greater Manchester, Merseyside and Cheshire
[redacted]
Direct email: **Inforequests.GMMC@environment-agency.gov.uk**
Office address: Richard Fairclough House, Knutsford Road, Latchford, Warrington, WA4 1HT

From: Enquiries, Unit
Sent: 13 April 2019 08:22
To: jennifer.gibson@waterco.co.uk
Subject: ref:190413/DT03 FW: w10926 pre-planning opinion

Dear Jennifer

I have passed your e-mail to the local customer team who will deal with your request.

The Freedom of Information Act and Environmental Information Regulations state that a public authority must respond to requests for information within 20 working days, but we aim to respond to all enquiries as quickly as we can.

You can find more information about our service commitment by clicking on the link below:

https://www.gov.uk/government/publications/environment-agency-customer-service-commitment

You can contact our customer team directly on the contact details below, or call the National Customer Contact Centre on 03708 506506 who will transfer you to the area team.

Please quote your enquiry reference 190413/DT03 in any correspondence with us regarding this matter.

Customers and Engagement
Environment Agency
Greater Manchester, Merseyside and Cheshire Area
Richard Fairclough House
Knutsford Road
Latchford
Warrington
WA4 1HT

Darren Turner

Customer Service Adviser - National Customer Contact Centre

Operations: Regulation, Monitoring and Customer
Environment Agency

(Tel: 03708 506 506
: Web Site: www.gov.uk/environment-agency

Click an icon to keep in touch with us:-

From: Jennifer Gibson [mailto:jennifer.gibson@waterco.co.uk]
Sent: 09 April 2019 14:09
To: Enquiries, Unit <enquiries@environment-agency.gov.uk>
Subject: w10926 pre-planning opinion

Site at Manchester Road, Rochdale, M24 2SA. National Grid Reference: 389126, 409144

Please can you provide me with a pre-planning opinion for the proposed development at the above site. A site location plan is attached. The proposed development will be for residential development however, no development plans are available at present.

We note that the site is located within Flood Zone 1. However, please could you advise if there have been any historic flood events that should be considered and if there are any specific requirements for a Flood Risk Assessment and drainage strategy at this site.

If you have any questions or require any further information to process my request please don't hesitate to contact me.

Kind Regards,

Jennifer Gibson BSc (Hons), MSc
Environmental Consultant

DDI: [redacted]
Teams: jennifer.gibson@waterco.co.uk

Waterco
Assessment, Modelling, Design
Ruthin - Chester - Manchester - London

Shortlisted for awards in the following categories;
'Innovation in Project Management' & *'Impact in Water'*

New Civil Engineer 100 COMPANIES OF THE YEAR 2019

Appendix E LLFA Response

Jennifer Gibson

From: Andrew Eadie <Andrew.Eadie@Rochdale.Gov.UK>
Sent: 17 April 2019 12:43
To: Jennifer Gibson
Cc: Francis Comyn
Subject: W10926 LLFA Opinion

Site at Manchester Road, Rochdale, M24 2SA. National Grid Reference: 389126, 40914

Dear Jennifer,

Further to your email of 9th April, please find below the following comments from Strategic Planning and the Drainage and Flooding Engineer:

As far as the Flood Risk Assessment is concerned, we would ask that it covers to an appropriate level of detail the evidence to show that you have identified the risks of flooding from all sources and how these do/may impact the site, how these will be mitigated through drainage and flood resilience/alleviation measures as appropriate (which should be clearly set out and evidenced in terms of how they will address identified risks and issues) and any residual risks and how they would be mitigated/managed i.e. to show that risk is not passed elsewhere.

Drainage Guidance is provided by United Utilities and Rochdale Council on their websites:-

https://www.unitedutilities.com/services/builders-developers/pre-development/site-drainage/

http://www.rochdale.gov.uk/pdf/2016-01-25-GM-SuDs-Advice.pdf

In terms of Climate Change allowance, up-to-date Guidance suggests that 40% Climate Change allowance should be used:- https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

As far as historic flooding records in this area are concerned, we do not have any records of flooding in this area although our records are not necessarily complete and you should also check with EA and United Utilities in terms of their records.

We would also like to make the following points :

a) The proposed development area straddles Thornham New Road and Thornham Road, neither of which are adopted. At the point that Thornham Road joins the main A664 road, gravel gets washed into gullies on the main road, causing blockage, and during rain events large puddles form on Thornham Road (due to poor surfacing) and on the main road (gully blockages).

b) A long stretch of Thornham New Road is not adopted. Further information on which parts are adopted / unadopted can be obtained from Tracey Lynam in Rochdale's Highways team (tracey.lynam@rochdale.gov.uk).

c) There are several watercourses across the site, some of which may be drained / culverted. You will need to consult LLFA and Highways' Drainage Officer, but a site visit would be the best way forward after you have provided a topographical survey.

I hope this is useful.

Many thanks

Andrew Eadie
Principal Planning Officer
Planning

ROCHDALE
BOROUGH COUNCIL

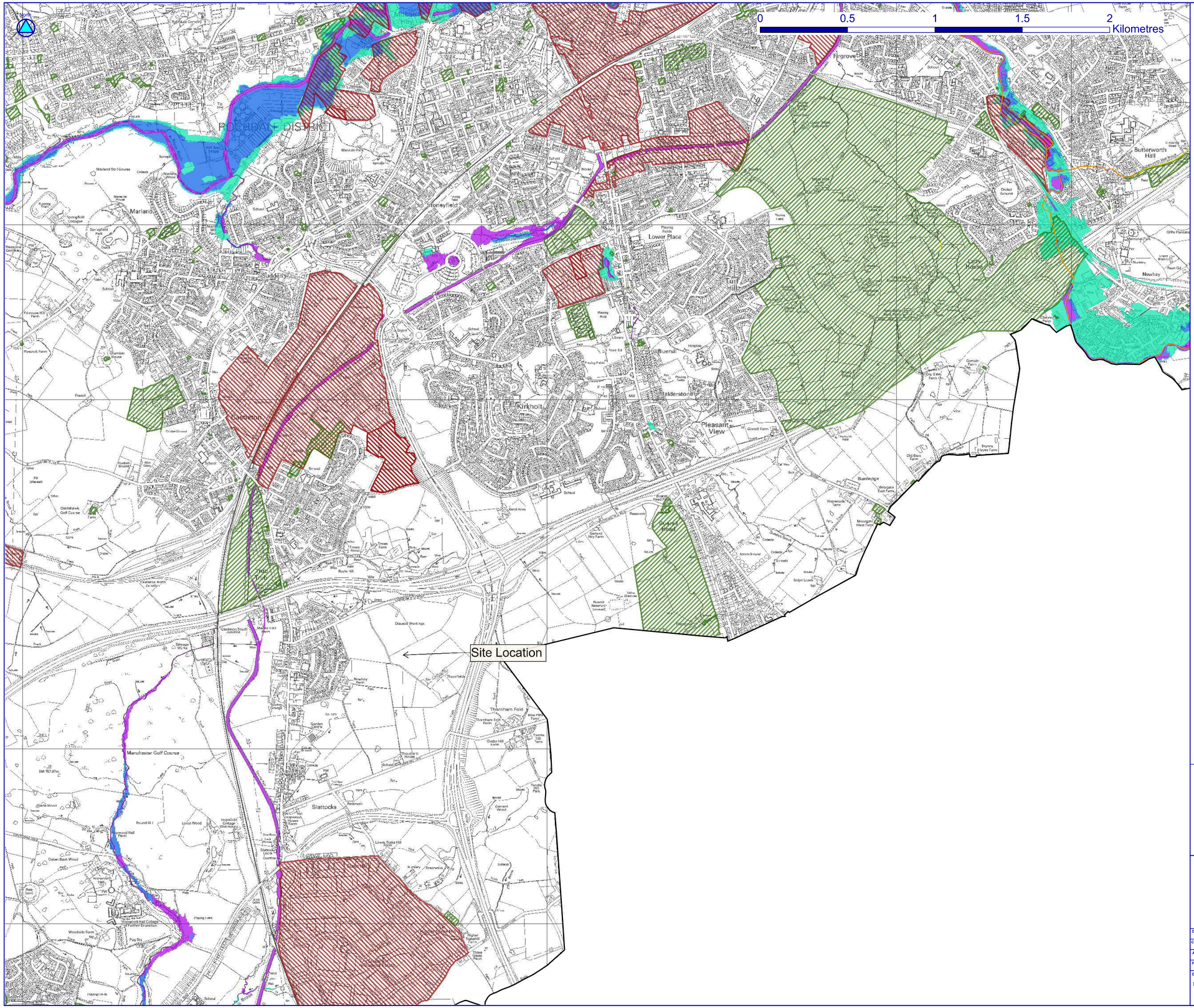
01706 924371
andrew.eadie@rochdale.gov.uk

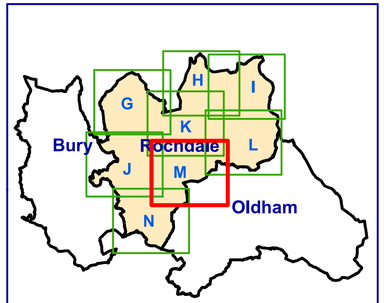
Rochdale Borough Council
Floor 3, Number One Riverside
Smith Street, Rochdale, OL16 1XU

To access our services go to www.rochdale.gov.uk
For news and social media updates go to www.rochdale.gov.uk/news

Please consider the environment before printing this email.

Appendix F SFRA Maps





National Centrelines (v7)

Ordinary Watercourses

Residential Sites

Employment Sites

Historic Flooding Zones

Flood Zone 3b (Functional)

Flood Zone 3a (v3-13)

Flood Zone 2 (v3-13)

This plan has been produced in accordance with PPS25: Development and Flood Risk and its Practice Guide.

It is a Level 1 SFRA key output which shows the LPA area, Main Rivers, ordinary watercourses and flood zones, including the functional floodplain (as defined in annex D table D.1 of PPS25), across the local authority area, as well as all previously allocated development sites (or sites to be considered in the future).

PPS25 divides the country into three basic Flood Zones; Flood Zones 1, 2 and 3, corresponding to areas of low, medium and high flood risk, respectively. The Flood Zones provided are based upon the Environment Agency's Flood Map (version 3.12 issued in January 2009). Therefore they refer to the probability of flooding from rivers, the sea and tidal sources and ignore the presence of defences, because these can be breached, overtopped and may not be in existence for the lifetime of the development. They do not consider other forms of flooding and do not take account of climate change.

This plan should be used to facilitate the undertaking of the Sequential Test by planners and developers according to PPS25 and the Sequential Test sieving process.

The Bury Rochdale and Oldham Level 1 SFRA has produced a further suite of flood risk maps following its assessment of other sources of flooding and the implications of climate change and these should be used in conjunction with the this map and not as an alternative. In time this map is likely to be updated by outputs from this and other studies.

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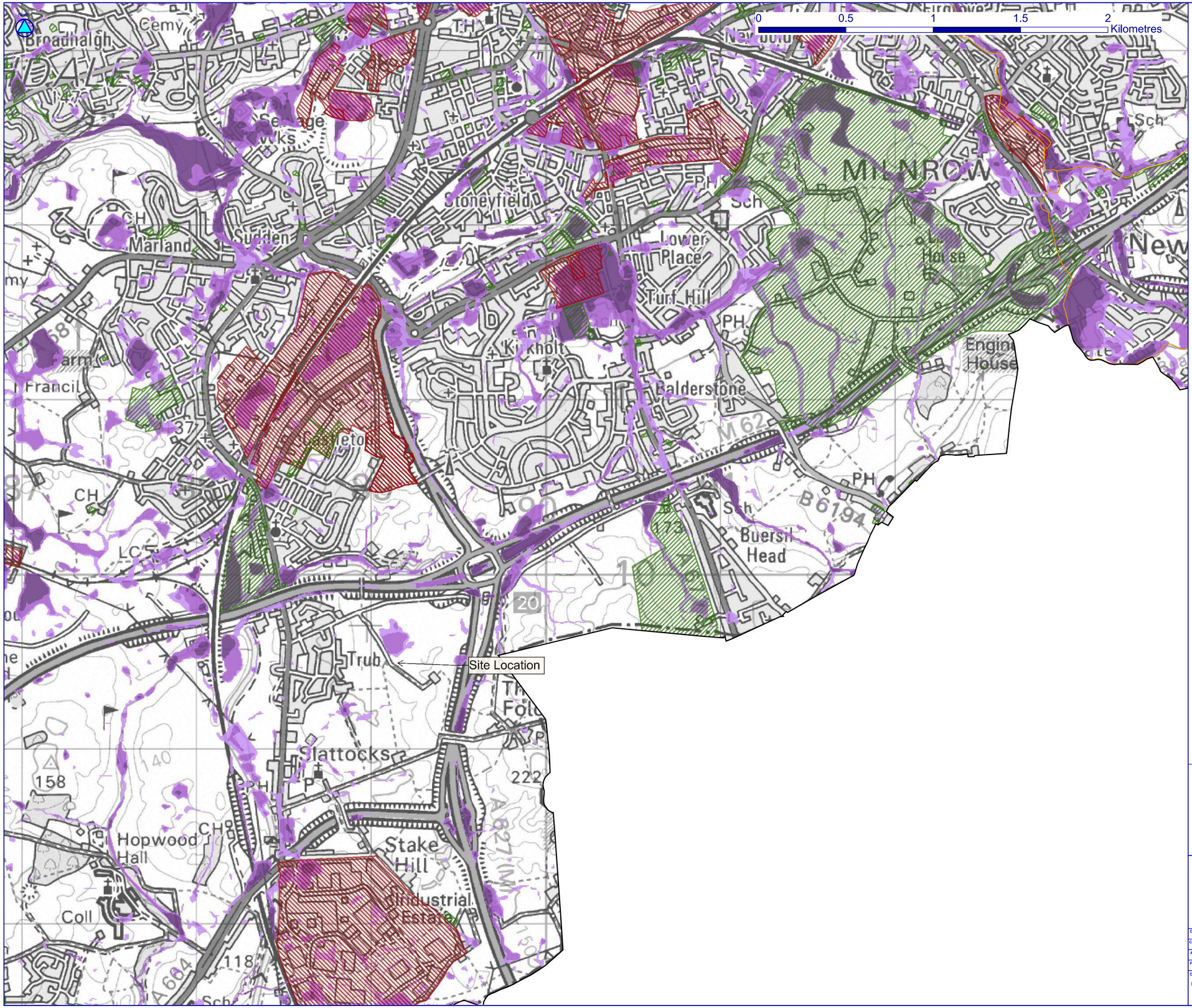
for

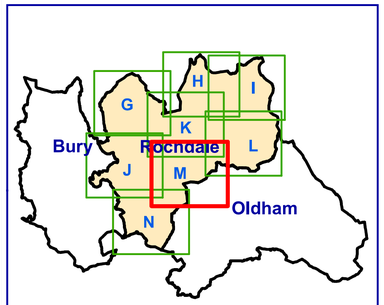
Bury, Rochdale & Oldham Strategic Flood Risk Assessment

Rochdale: Flood Zones and Historic Flooding

Drawn by: P Grace	Date: 08-Aug-2009		
Checked by: C Isherwood	Date: 08-Aug-2009		
Approved by: H O'Callaghan	Date: 08-Aug-2009		
File Name: ..\ArcView\Mapping\Rochdale_Floodzone_Map.mxd			
Drawing Number: Map 1.2 M (Rochdale)	Status: FINAL	Scale: 1:10,000	

Original @ A1





National Centrelines (v7)

Ordinary Watercourses

Residential Sites

Employment Sites

High Susceptibility to Surface Water Flooding

Medium Susceptibility to Surface Water Flooding

Low Susceptibility to Surface Water Flooding

This plan has been produced in accordance with PPS25: Development and Flood Risk and its Practice Guide.

"Surface water flooding frequently develops quickly and is difficult to predict. It occurs when natural and man-made drainage systems have insufficient capacity to deal with the volume of rainfall. The critical factors for surface water flooding are the volume of rainfall, its intensity, where it falls and the permeability of the surface it falls onto. In urban areas sudden and intense rainfall cannot drain away as quickly as it can in rural areas where vegetation and soil can slow down the process of run-off." PPS26 Practice Guide pg.87

Without detailed sewer models, alternative approaches are required to assess the potential scale and extent of surface water flooding. A 2D modelling software JFLOW has been used to derive the results, which is driven primarily by topography. The model works by evenly distributing a 200 year rainfall event over a digital ground model, which is cell-based. The rainfall inputs convert to flows which flow from higher cells to lower ones. The drainage system is presumed to be at capacity.

The results of the modelling have been divided into the zones; less, intermediate and more representing the susceptible of surface water flooding across the local authority area. This map should be used to assess other sources of flooding within Bury Rochdale and Oldham as illustrated within the Sequential Test sieving process and should be used in conjunction with the PPS25 Flood Zone Map and not as an alternative

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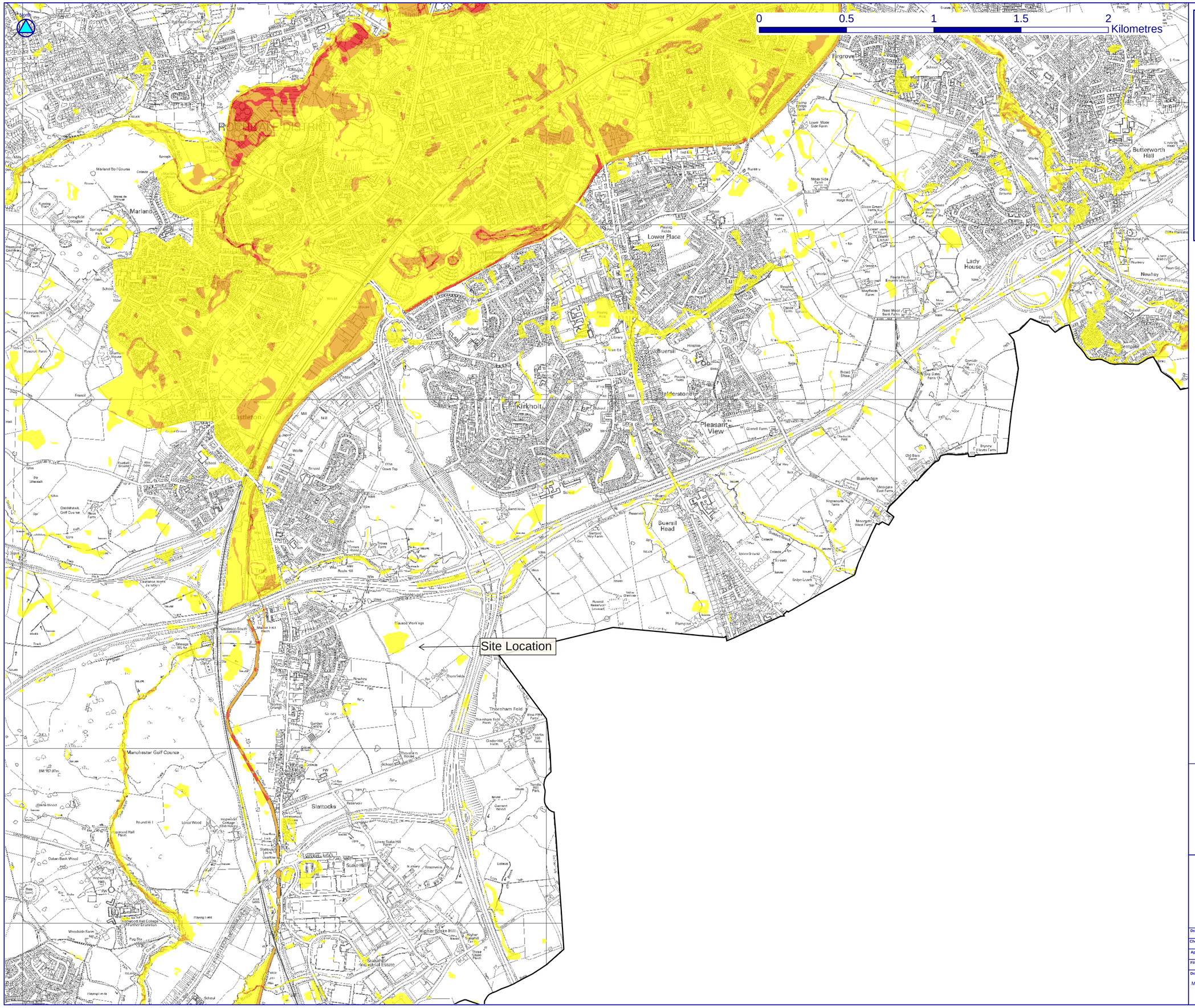
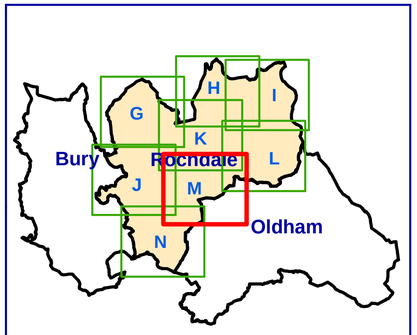
Bury, Rochdale & Oldham Strategic Flood Risk Assessment

Rochdale: Surface Water Flooding

Drawn by: P Grace	Date: 10-Aug-2009		
Checked by: C Isherwood	Date: 10-Aug-2009		
Approved by: H O'Callaghan	Date: 10-Aug-2009		
File Name: ArcView\Mapping\Rochdale_SWF_Map.mxd			
Drawing Number: Map 1.4 M (Rochdale)	Status: FINAL	Scale: 1:10,000	

Original @ A1





1 Source of Flooding

2 Sources of Flooding

3 Sources of Flooding

This map has been produced in addition to the requirements in PPS25: Development and Flood Risk and its Practice Guide for a Level 2 SFRA.

The map shows areas that could be at risk from multiple sources of flooding (river, surface water and canals) and highlights those areas that are at risk from all three, two or just one source.

This map should be used to assess flood risk within Bury Rochdale and Oldham as part of the Sequential Test sieving process.

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for

Bury, Rochdale & Oldham Strategic Flood Risk Assessment

Rochdale: Flooding from Multiple Sources

Drawn by: P Grace	Date: 10-Oct-2009		
Checked by: C Isherwood	Date: 10-Oct-2009		
Approved by: H O'Callaghan	Date: 10-Oct-2009		
File Name: ..ArcView\Mapping\Rochdale_Flooding_From_Multiple_Sources_Map.mxd			
Drawing Number: Map 7.2 M (Rochdale)	Status: FINAL	Scale: 1:10,000	Original @ A1

Appendix G ReFH2 Runoff Rates

DOCUMENT VERIFICATION RECORD	
Project:	Manchester Road, Rochdale
Client:	Redrow Homes Limited
Report Title:	Flood Risk Assessment & Drainage Strategy
Date:	15th April 2019

DOCUMENT REVIEW & APPROVAL	
Author:	Jennifer Gibson BSc (Hons) MSc FGS
Checker:	Josh Rigby BSc (Hons) MCIWEM
Approver:	Victoria Griffin BSc (Hons) MSc MIEnvSc CEnv

ReFH2 RUNOFF RATES*	
Return Period (Years)	**As-rural Peak Flow (l/s)**
1	112.4449
2	128.4579
5	185.14
10	230.079
30	314.7979
50	363.3818
75	407.9559
100	443.4032
200	543.1029
1000	854.5284

*Runoff Rates printed from the ReFH Flood Modelling software package

Appendix H MicroDrainage Storage Volumes

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	100.298	0.298	109.1	4282.4	O K
30 min Summer	100.406	0.406	109.1	5842.8	O K
60 min Summer	100.528	0.528	109.1	7585.9	O K
120 min Summer	100.622	0.622	109.1	8947.2	O K
180 min Summer	100.679	0.679	109.1	9769.4	O K
240 min Summer	100.719	0.719	109.1	10341.7	O K
360 min Summer	100.771	0.771	109.1	11088.9	O K
480 min Summer	100.802	0.802	109.1	11531.2	O K
600 min Summer	100.820	0.820	109.1	11786.3	O K
720 min Summer	100.829	0.829	109.1	11912.9	O K
960 min Summer	100.829	0.829	109.1	11916.3	O K
1440 min Summer	100.825	0.825	109.1	11858.0	O K
2160 min Summer	100.820	0.820	109.1	11786.4	O K
2880 min Summer	100.809	0.809	109.1	11636.0	O K
4320 min Summer	100.772	0.772	109.1	11094.7	O K
5760 min Summer	100.726	0.726	109.1	10432.5	O K
7200 min Summer	100.677	0.677	109.1	9727.7	O K
8640 min Summer	100.627	0.627	109.1	9011.9	O K
10080 min Summer	100.576	0.576	109.1	8287.1	O K
15 min Winter	100.336	0.336	109.1	4824.9	O K
30 min Winter	100.458	0.458	109.1	6586.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	69.703	0.0	4488.0	34
30 min Summer	47.605	0.0	6131.4	48
60 min Summer	31.250	0.0	8051.1	78
120 min Summer	18.971	0.0	9784.1	136
180 min Summer	14.188	0.0	10972.0	194
240 min Summer	11.557	0.0	11924.7	252
360 min Summer	8.673	0.0	13417.8	370
480 min Summer	7.086	0.0	14616.9	488
600 min Summer	6.062	0.0	15628.2	604
720 min Summer	5.338	0.0	16525.3	722
960 min Summer	4.370	0.0	17881.9	924
1440 min Summer	3.299	0.0	17552.6	1162
2160 min Summer	2.500	0.0	23205.8	1564
2880 min Summer	2.057	0.0	25455.8	1976
4320 min Summer	1.561	0.0	28987.1	2820
5760 min Summer	1.286	0.0	31829.9	3640
7200 min Summer	1.109	0.0	34312.4	4472
8640 min Summer	0.983	0.0	36528.3	5280
10080 min Summer	0.888	0.0	38504.7	6064
15 min Winter	69.703	0.0	5027.3	34
30 min Winter	47.605	0.0	6871.3	48

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	100.595	0.595	109.1	8560.8	O K
120 min Winter	100.705	0.705	109.1	10141.0	O K
180 min Winter	100.773	0.773	109.1	11115.8	O K
240 min Winter	100.822	0.822	109.1	11812.3	O K
360 min Winter	100.887	0.887	109.3	12757.6	O K
480 min Winter	100.929	0.929	110.5	13362.1	O K
600 min Winter	100.957	0.957	111.2	13757.1	O K
720 min Winter	100.975	0.975	111.7	14012.1	O K
960 min Winter	100.991	0.991	112.1	14241.5	O K
1440 min Winter	100.980	0.980	111.9	14092.7	O K
2160 min Winter	100.964	0.964	111.4	13865.5	O K
2880 min Winter	100.942	0.942	110.8	13542.3	O K
4320 min Winter	100.870	0.870	109.1	12507.2	O K
5760 min Winter	100.786	0.786	109.1	11297.9	O K
7200 min Winter	100.700	0.700	109.1	10068.8	O K
8640 min Winter	100.614	0.614	109.1	8830.3	O K
10080 min Winter	100.529	0.529	109.1	7601.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	31.250	0.0	9020.3	76
120 min Winter	18.971	0.0	10950.4	134
180 min Winter	14.188	0.0	12294.2	190
240 min Winter	11.557	0.0	13348.1	248
360 min Winter	8.673	0.0	15026.1	364
480 min Winter	7.086	0.0	16366.3	478
600 min Winter	6.062	0.0	17513.9	592
720 min Winter	5.338	0.0	17903.2	706
960 min Winter	4.370	0.0	17883.3	926
1440 min Winter	3.299	0.0	17880.4	1334
2160 min Winter	2.500	0.0	26002.7	1672
2880 min Winter	2.057	0.0	28513.9	2140
4320 min Winter	1.561	0.0	32426.2	3072
5760 min Winter	1.286	0.0	35648.2	3944
7200 min Winter	1.109	0.0	38430.9	4832
8640 min Winter	0.983	0.0	40906.2	5704
10080 min Winter	0.888	0.0	43120.6	6480

Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	30	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 389142 409310	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 34.400

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	6.880	8	12	6.880	16	20	6.880
4	8	6.880	12	16	6.880			

Model Details

Storage is Online Cover Level (m) 102.000

Tank or Pond Structure

Invert Level (m) 100.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	14378.0	0.700	14378.0	1.400	0.0	2.100	0.0
0.100	14378.0	0.800	14378.0	1.500	0.0	2.200	0.0
0.200	14378.0	0.900	14378.0	1.600	0.0	2.300	0.0
0.300	14378.0	1.000	14378.0	1.700	0.0	2.400	0.0
0.400	14378.0	1.100	0.0	1.800	0.0	2.500	0.0
0.500	14378.0	1.200	0.0	1.900	0.0		
0.600	14378.0	1.300	0.0	2.000	0.0		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0401-1124-2050-1124
Design Head (m)	2.050
Design Flow (l/s)	112.4
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	401
Invert Level (m)	98.950
Minimum Outlet Pipe Diameter (mm)	450
Suggested Manhole Diameter (mm)	Site Specific Design (Contact Hydro International)

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.050	112.4
Flush-Flo™	0.691	112.3
Kick-Flo®	1.453	95.1
Mean Flow over Head Range	-	94.7

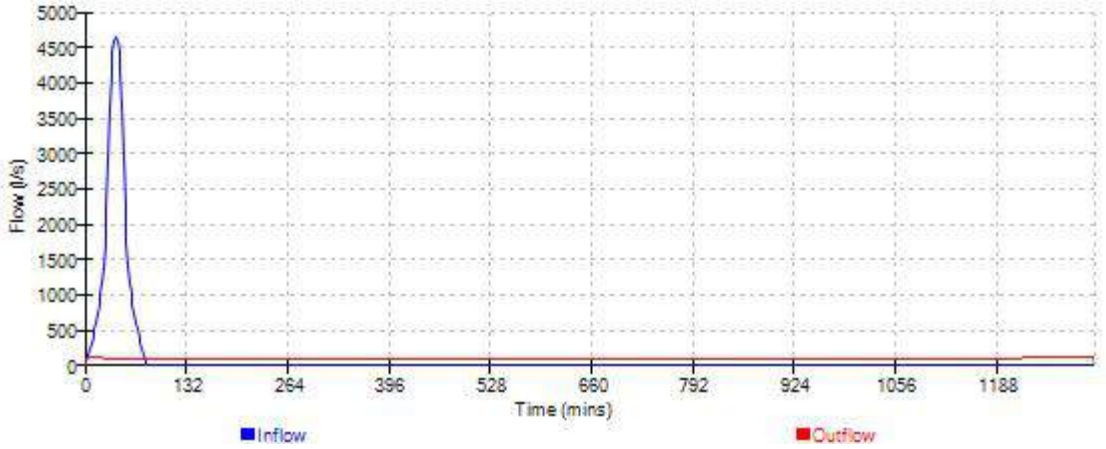
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

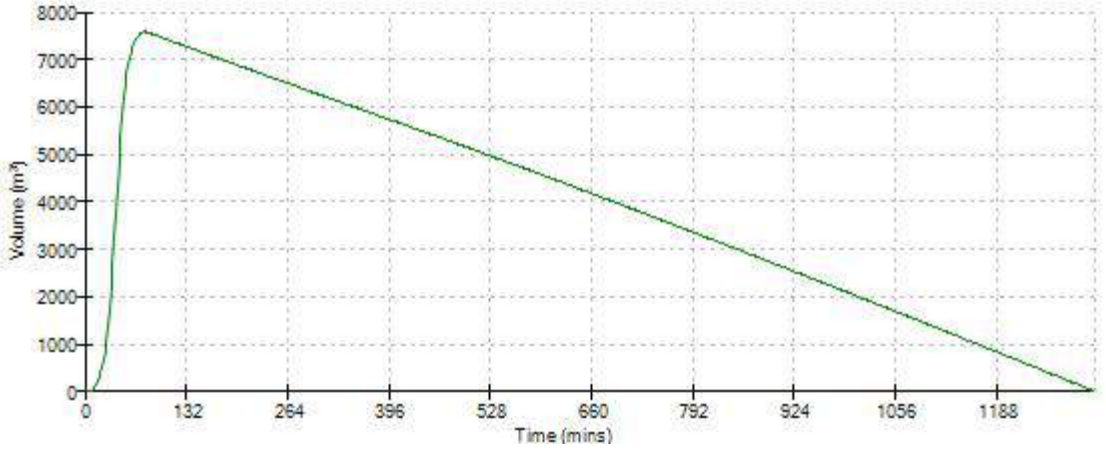
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	11.0	1.000	109.8	2.400	121.3	5.500	181.9
0.200	39.5	1.200	106.2	2.600	126.2	6.000	189.8
0.300	76.3	1.400	98.6	3.000	135.3	6.500	197.3
0.400	106.7	1.600	99.6	3.500	145.8	7.000	204.6
0.500	110.2	1.800	105.5	4.000	155.6	7.500	211.7
0.600	111.9	2.000	111.0	4.500	164.9	8.000	218.5
0.800	111.8	2.200	116.3	5.000	173.6	8.500	225.1

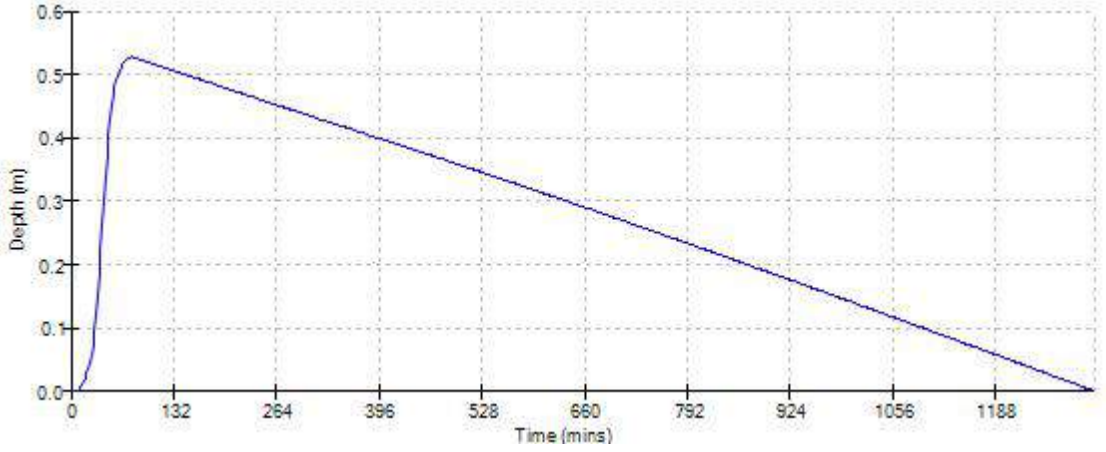
Hydro-Brake® Optimum Outflow Control

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
9.000	231.5	9.500	237.7				

Event: 60 min Summer







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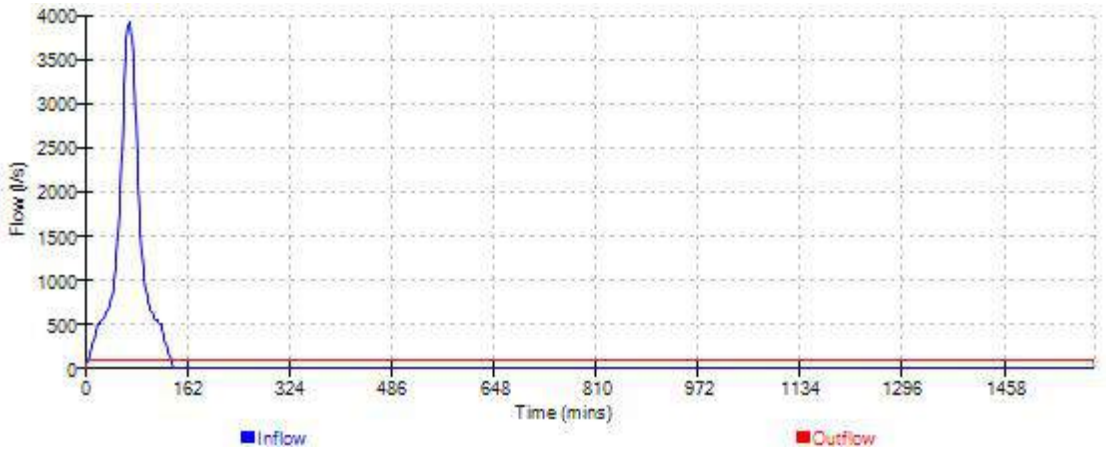

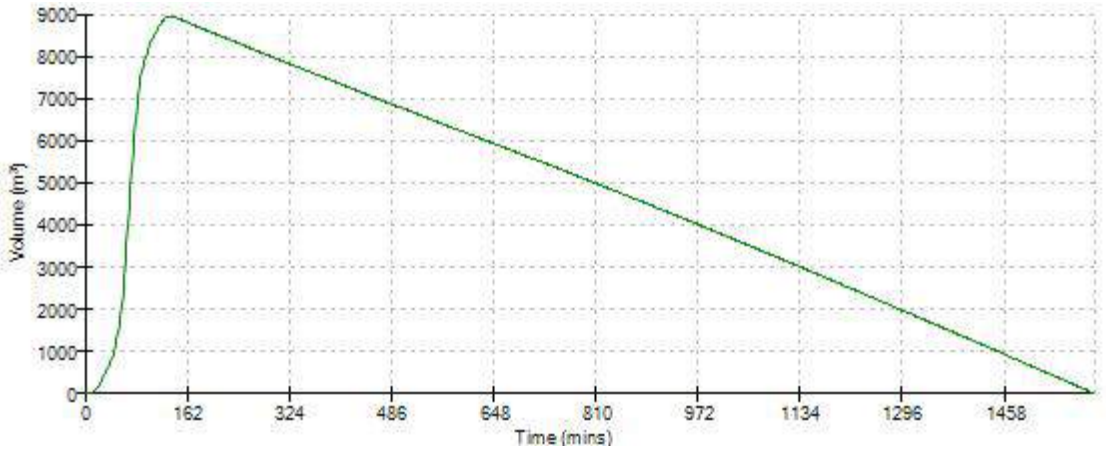

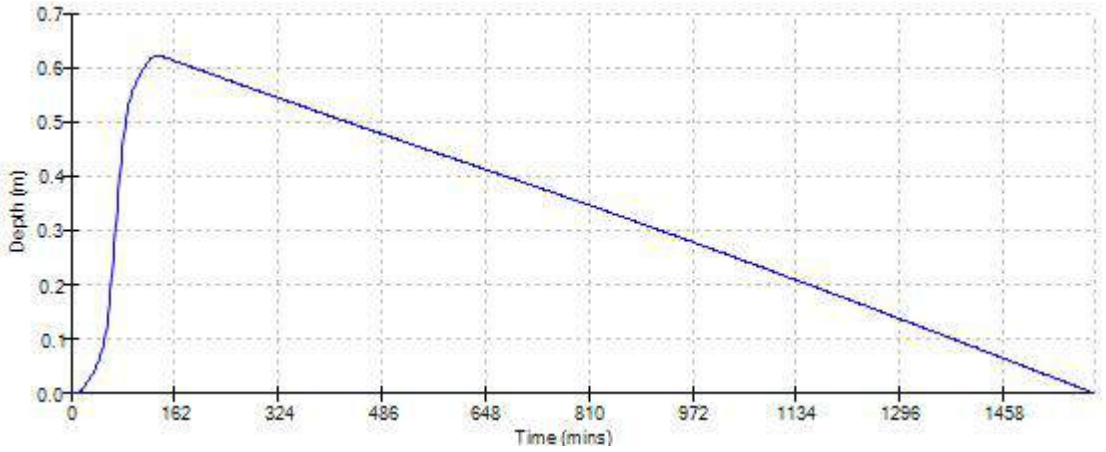

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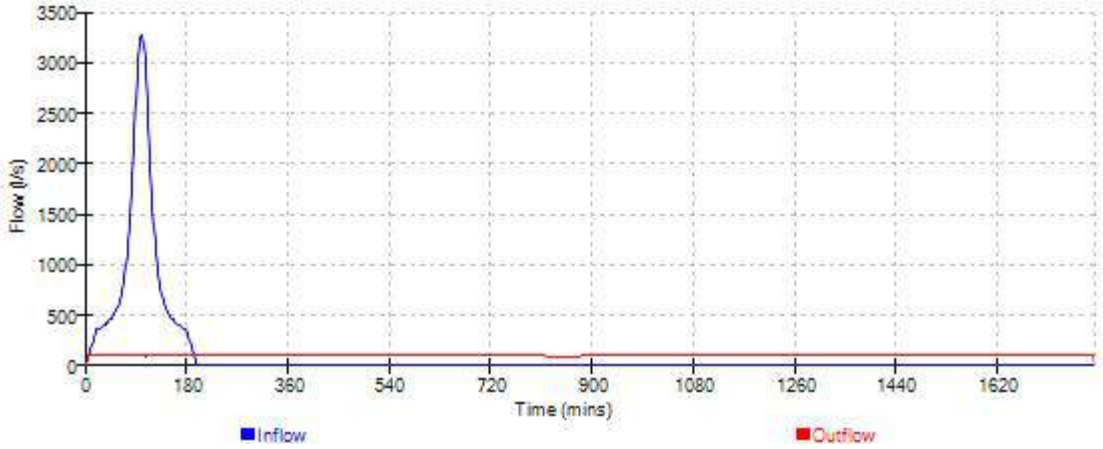

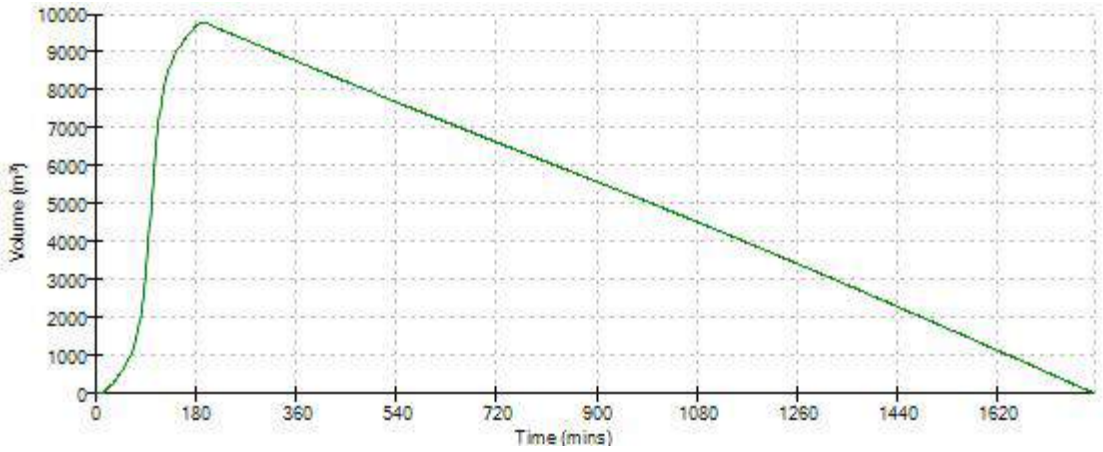

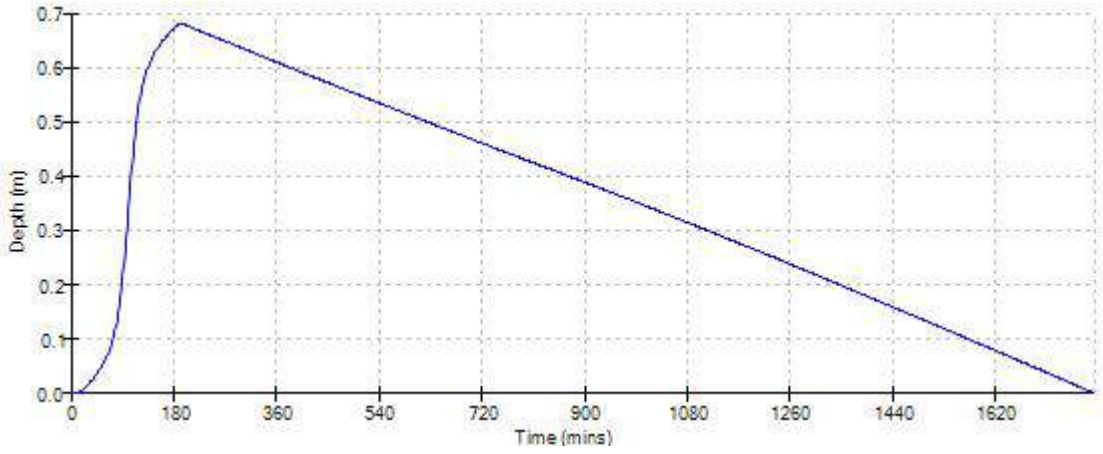

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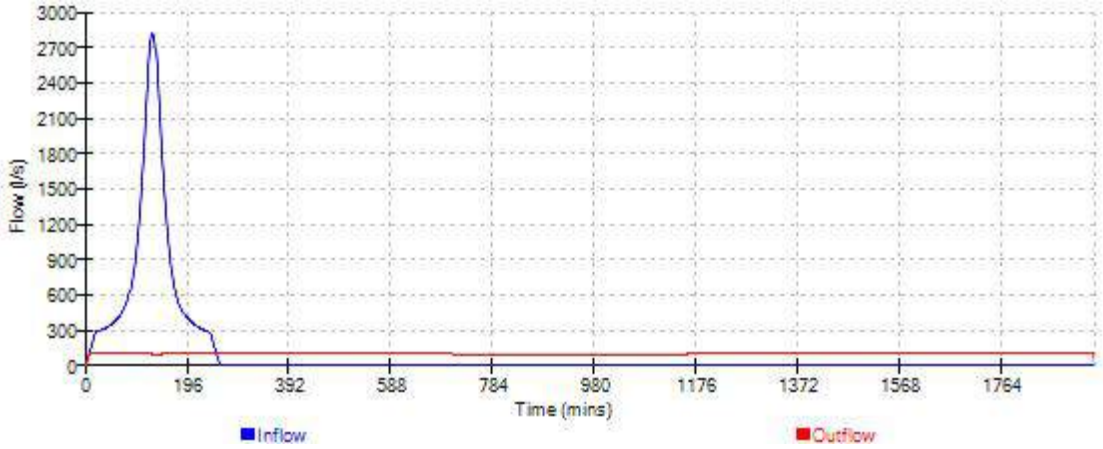

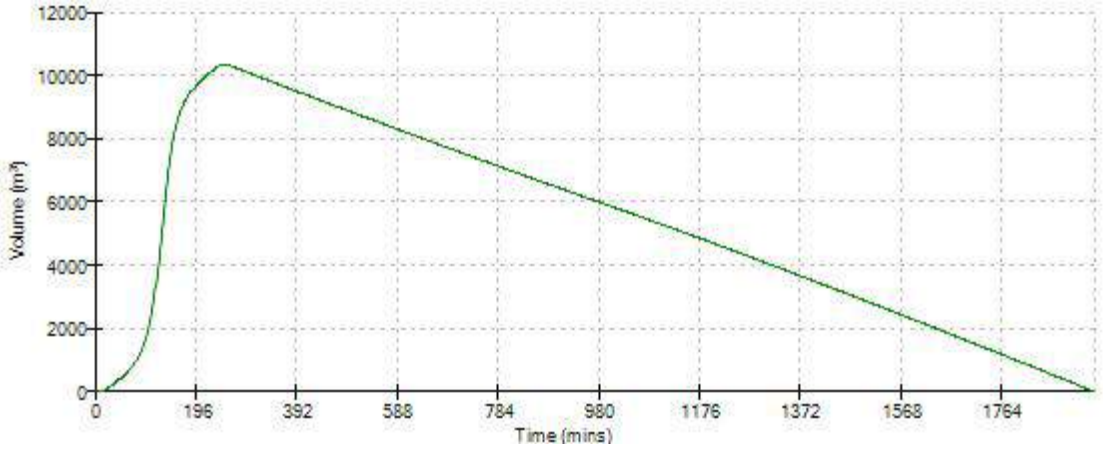

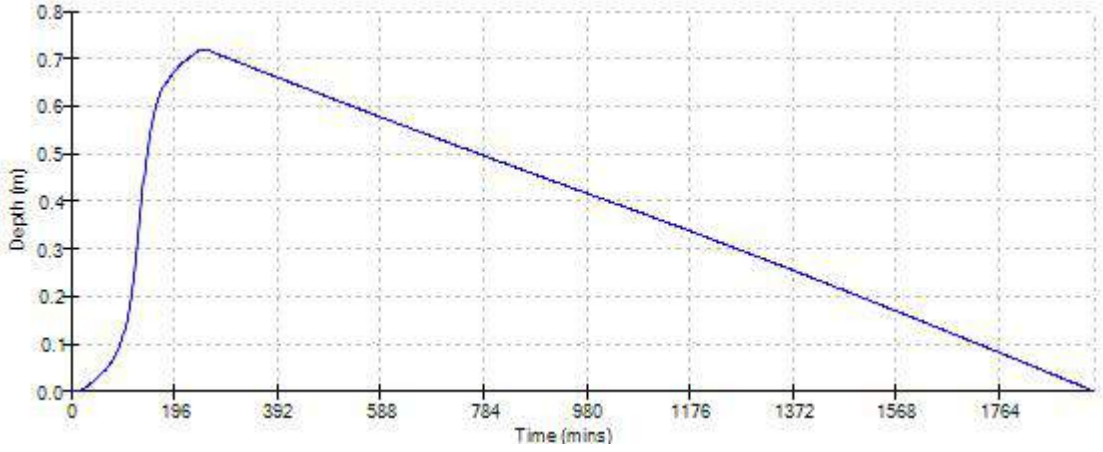

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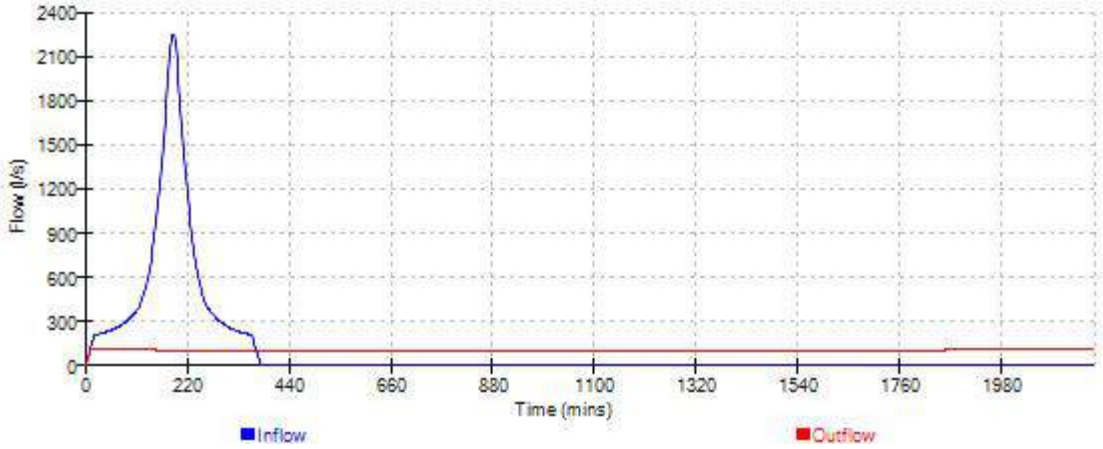

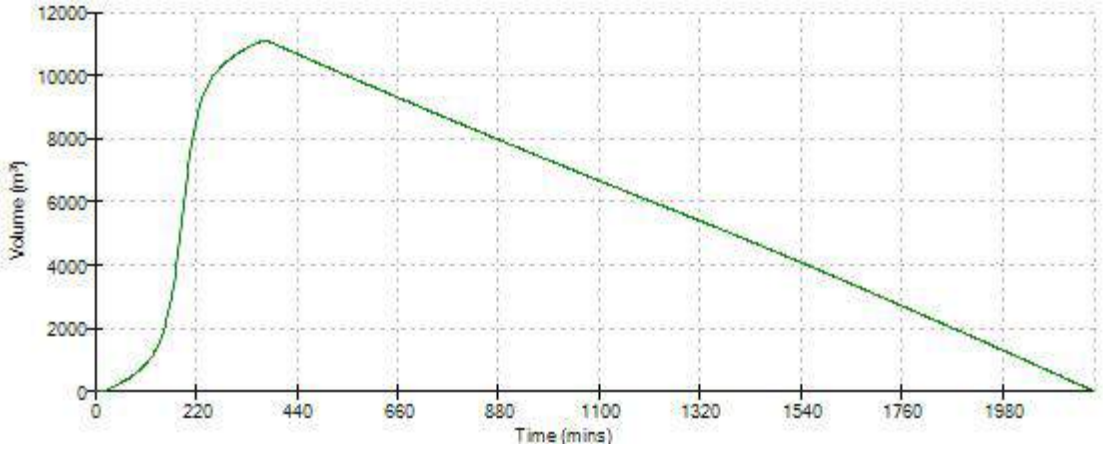

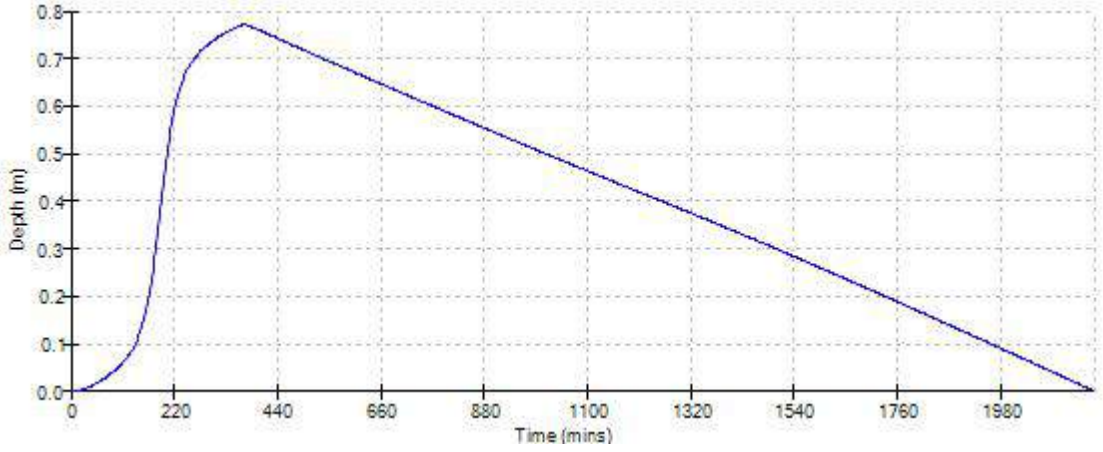

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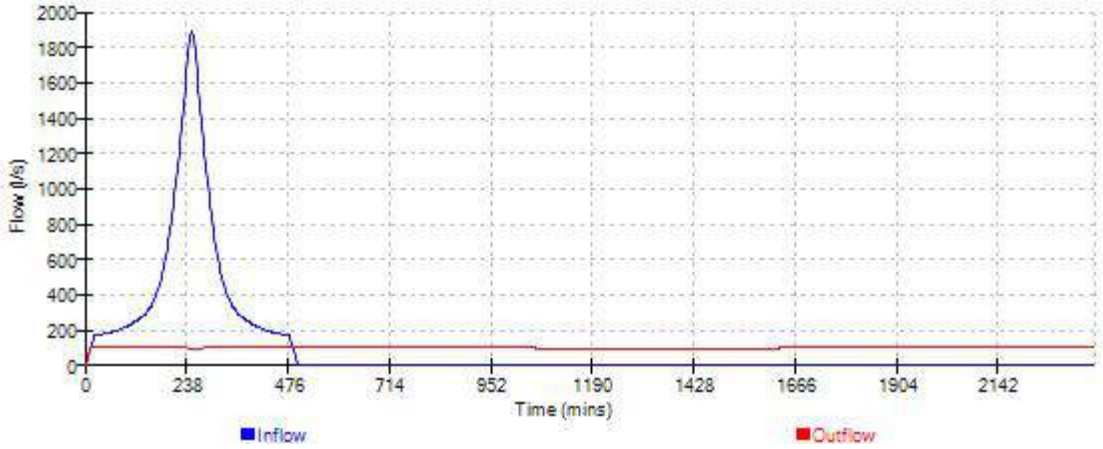
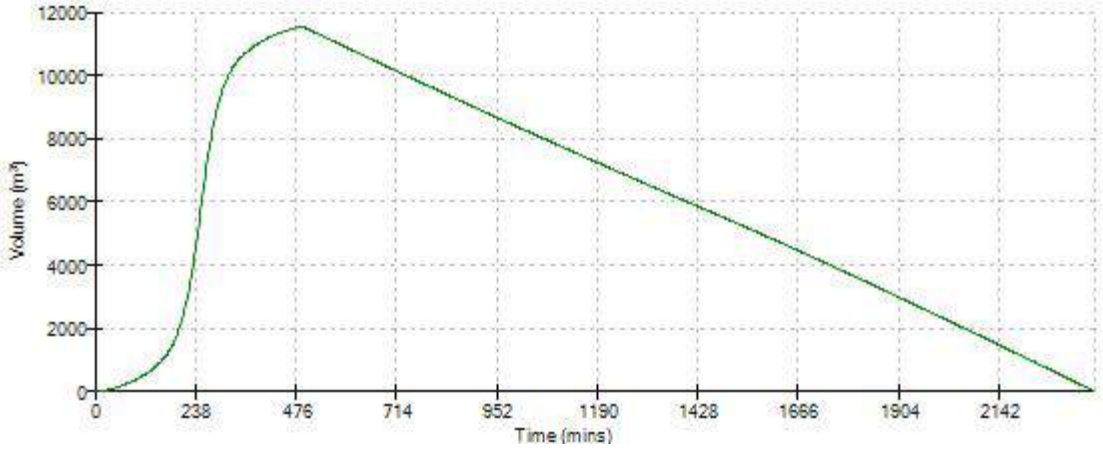
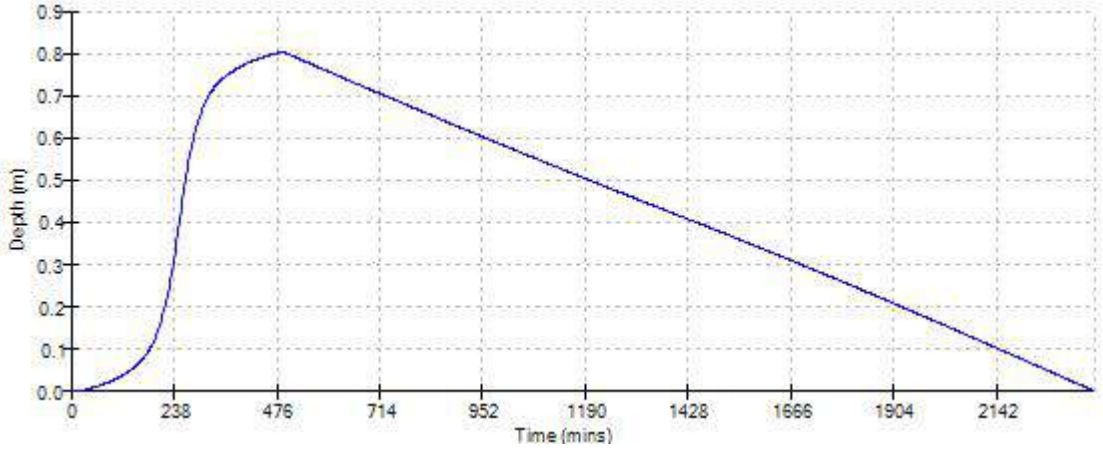
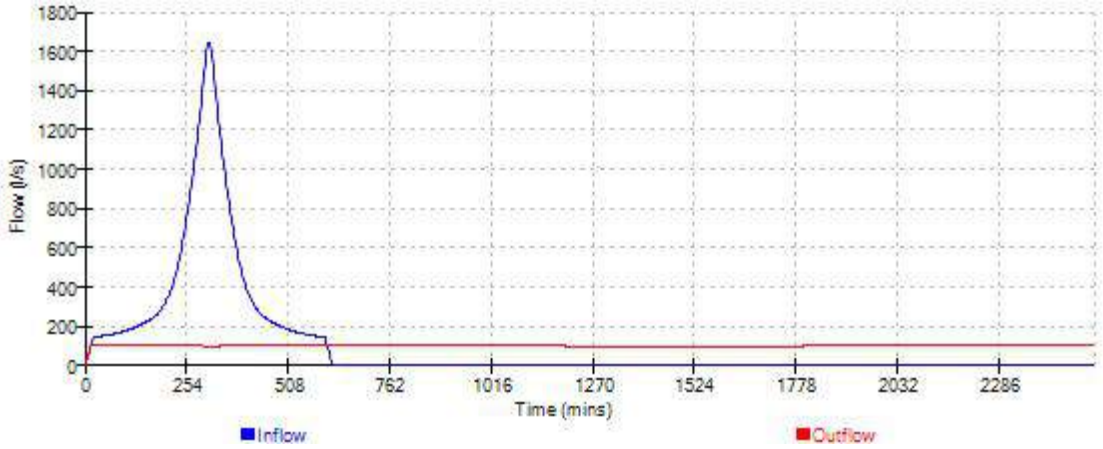
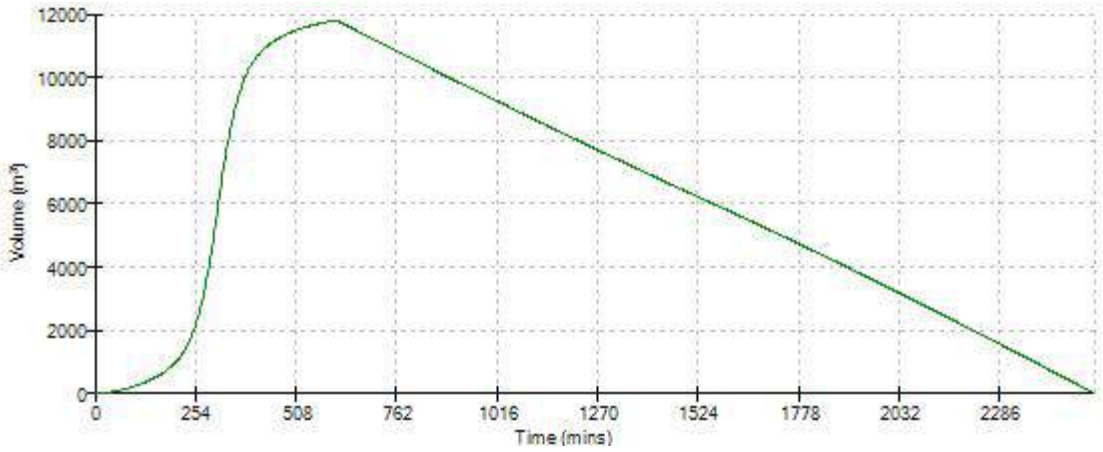


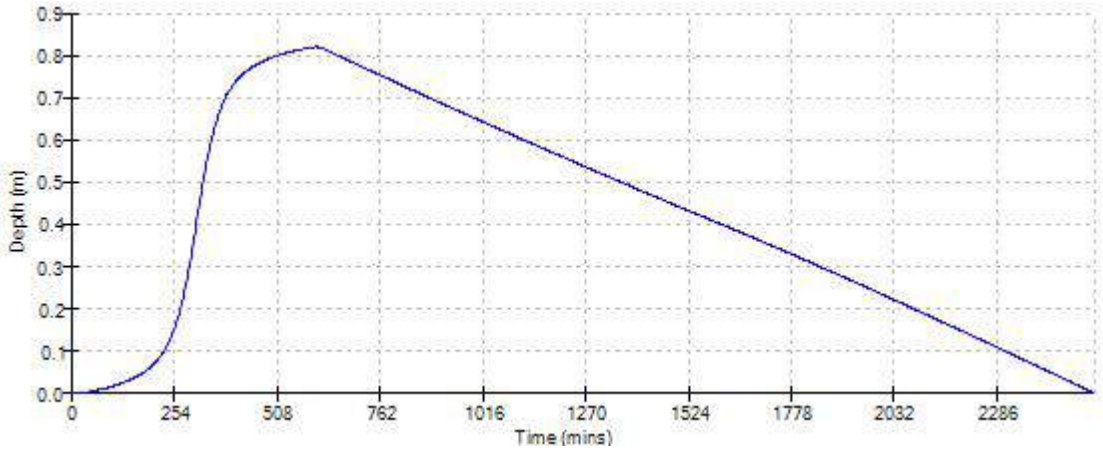




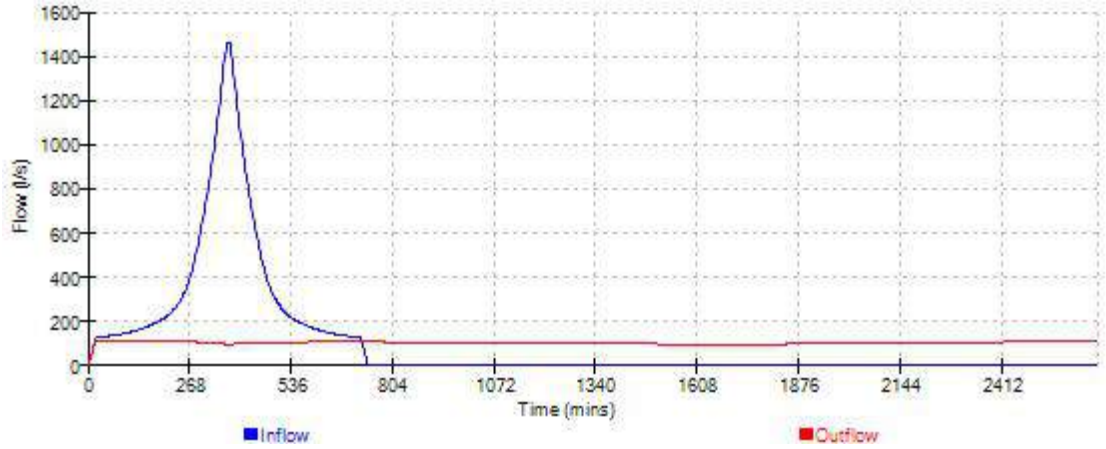
Event: 600 min Summer

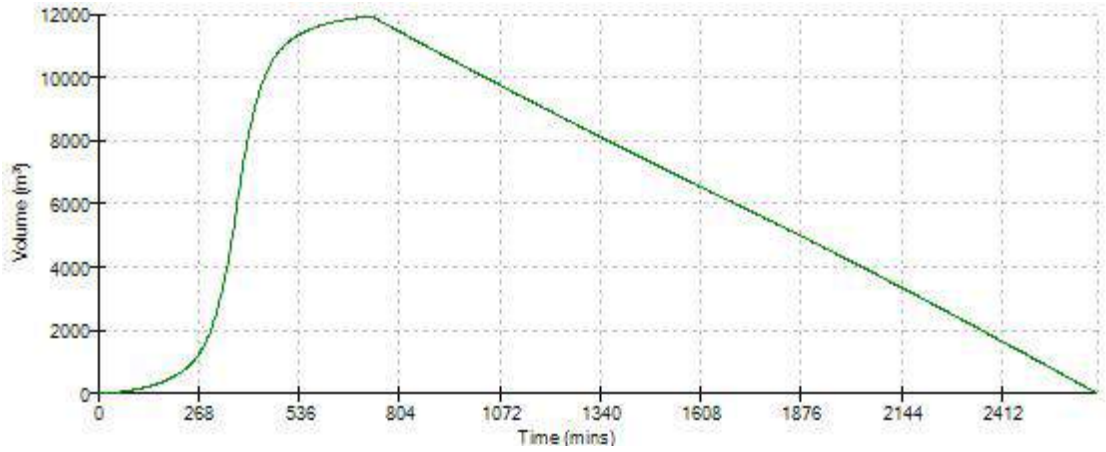


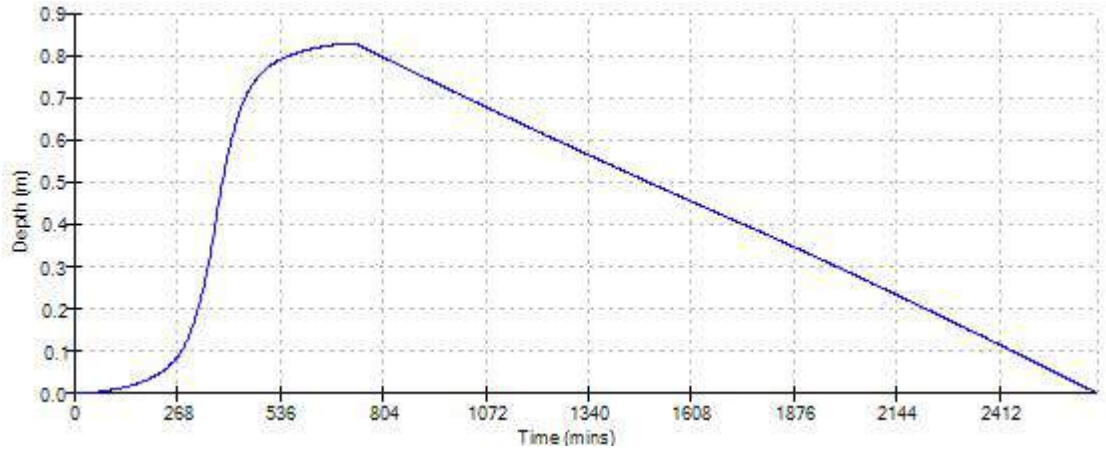




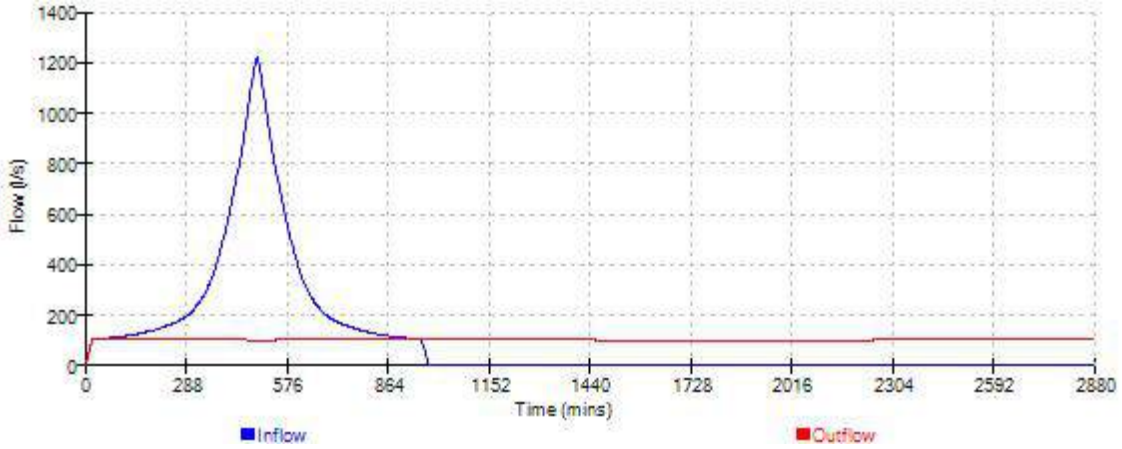
Event: 720 min Summer

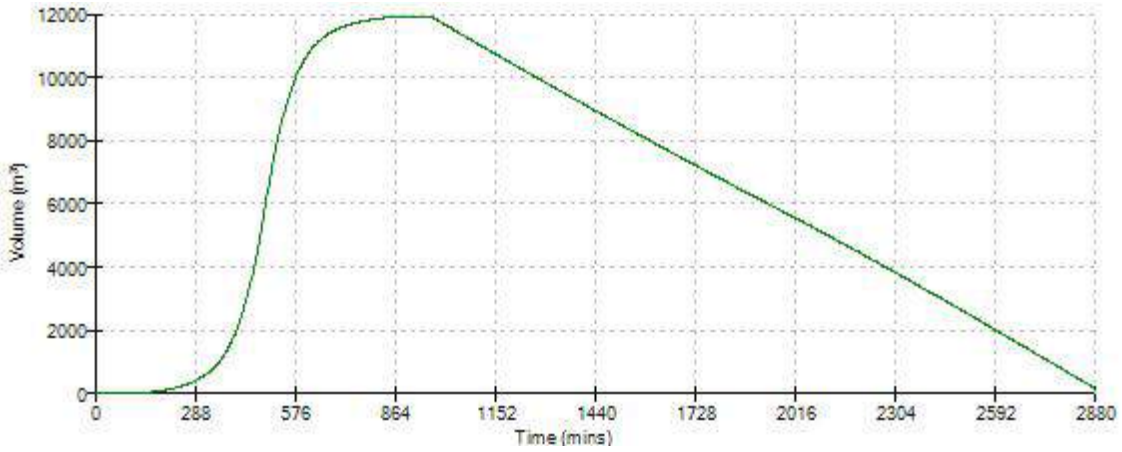


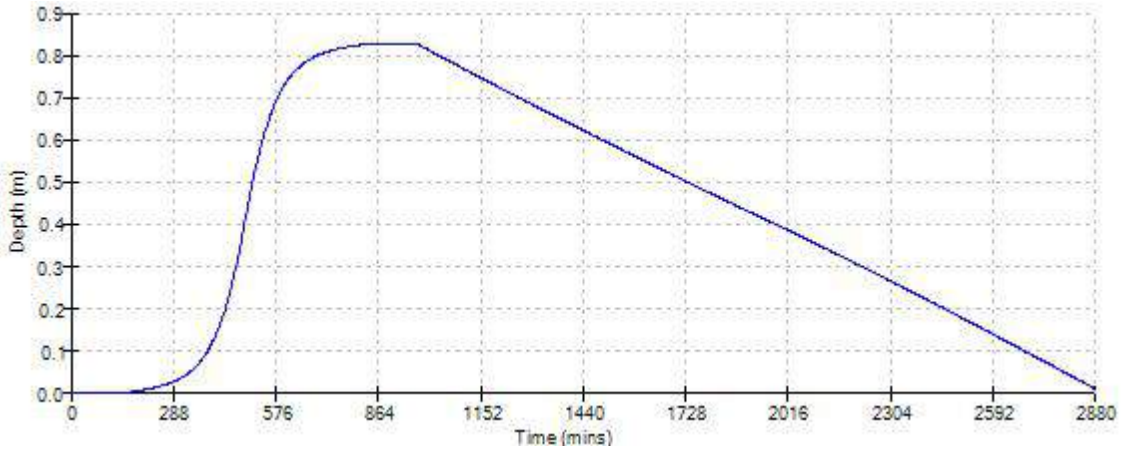




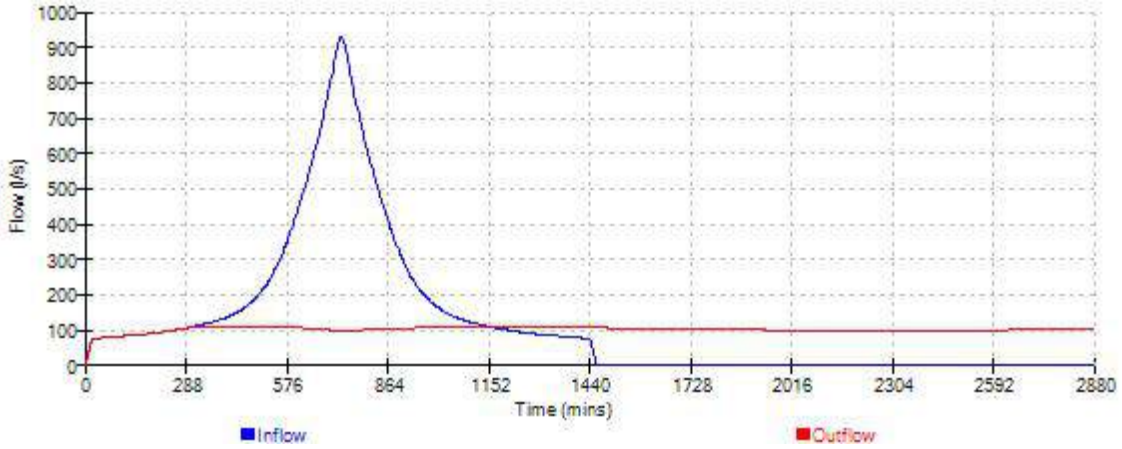
Event: 960 min Summer

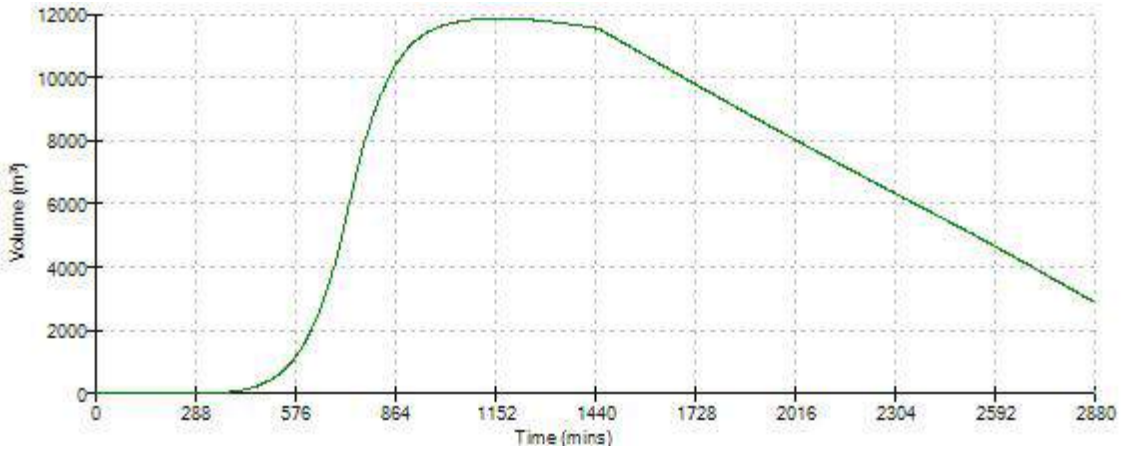


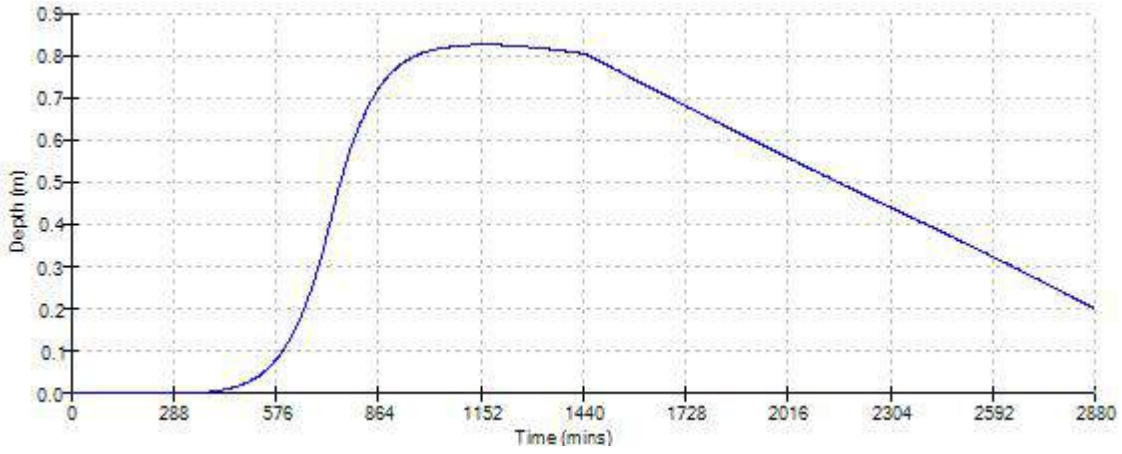




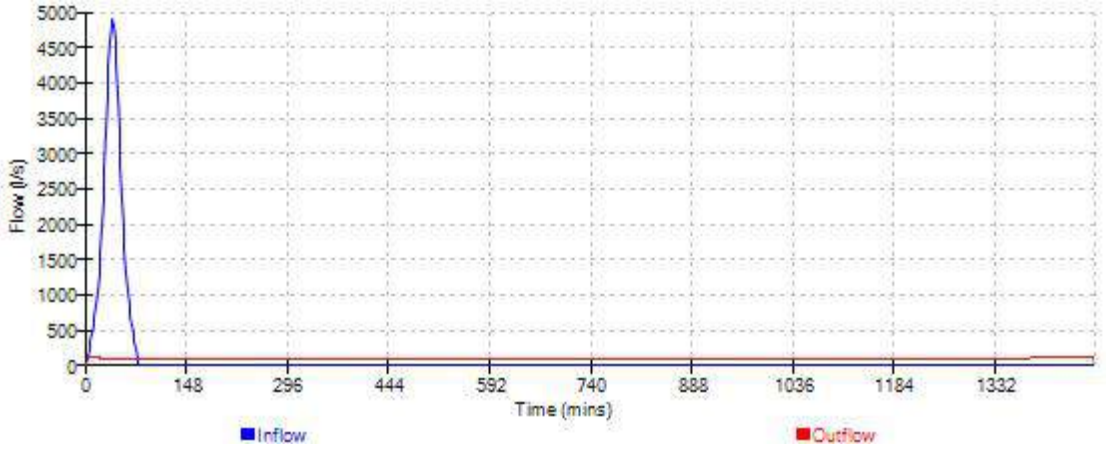
Event: 1440 min Summer

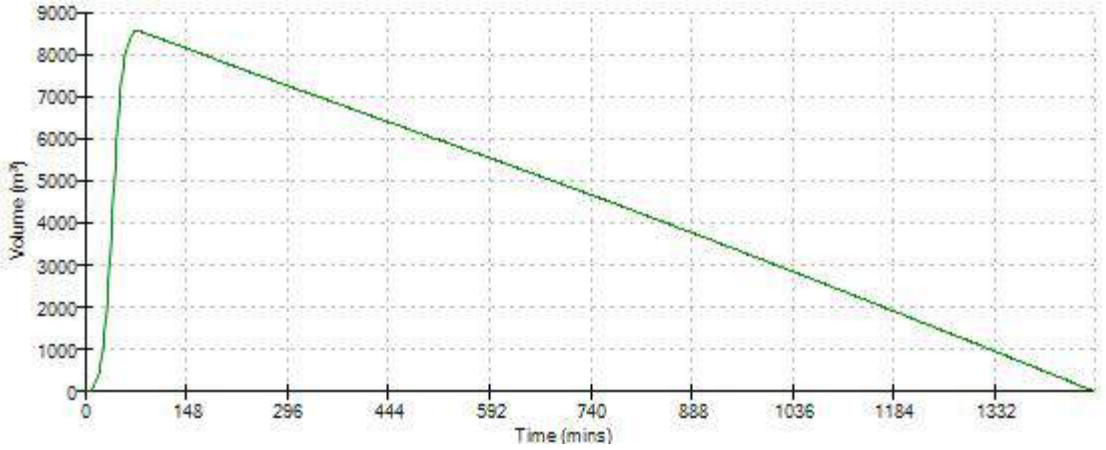


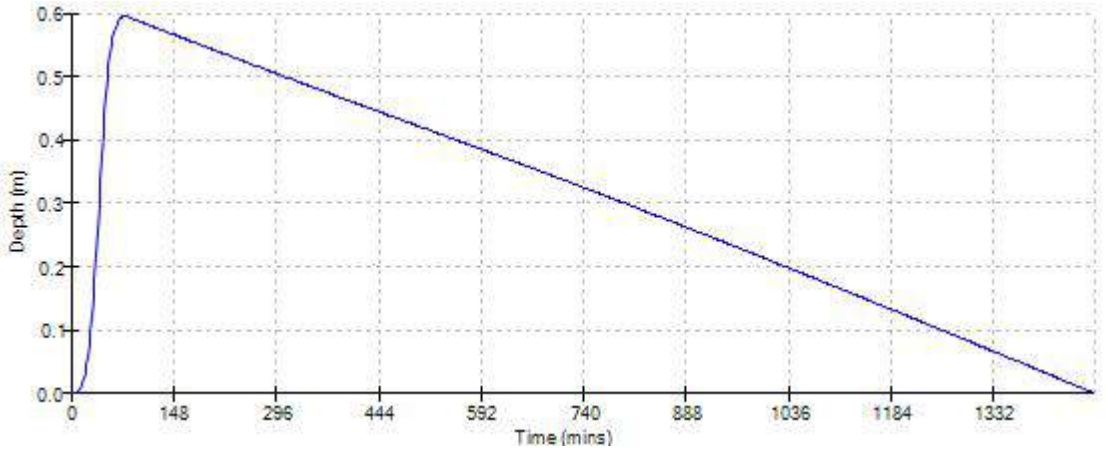




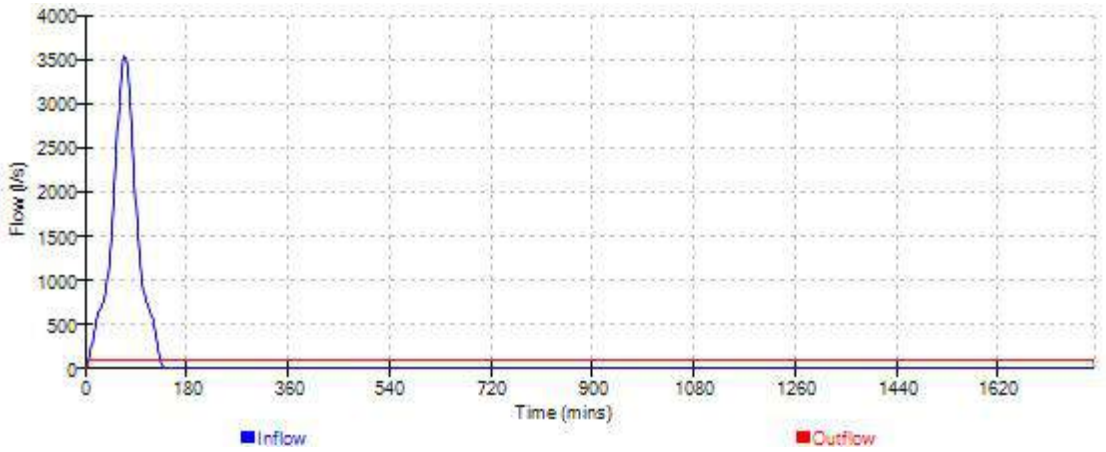
Event: 60 min Winter

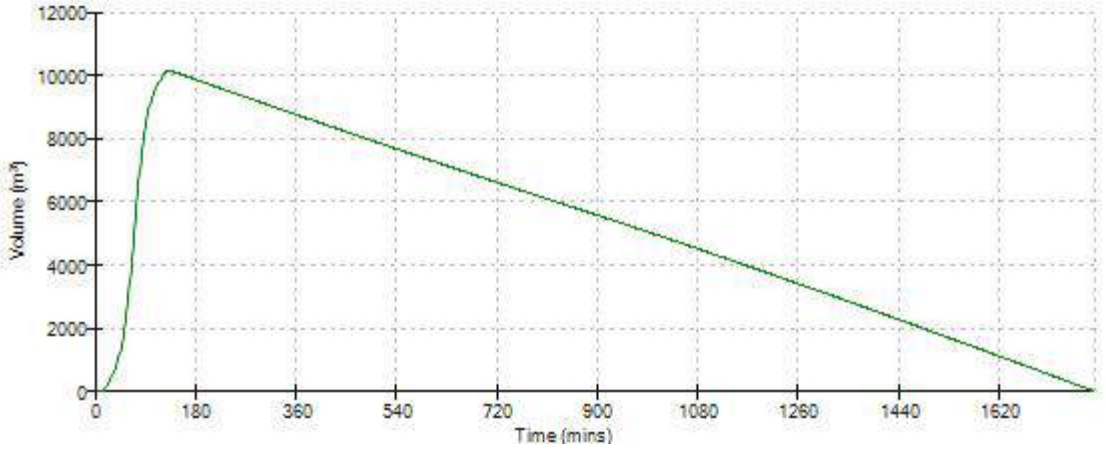


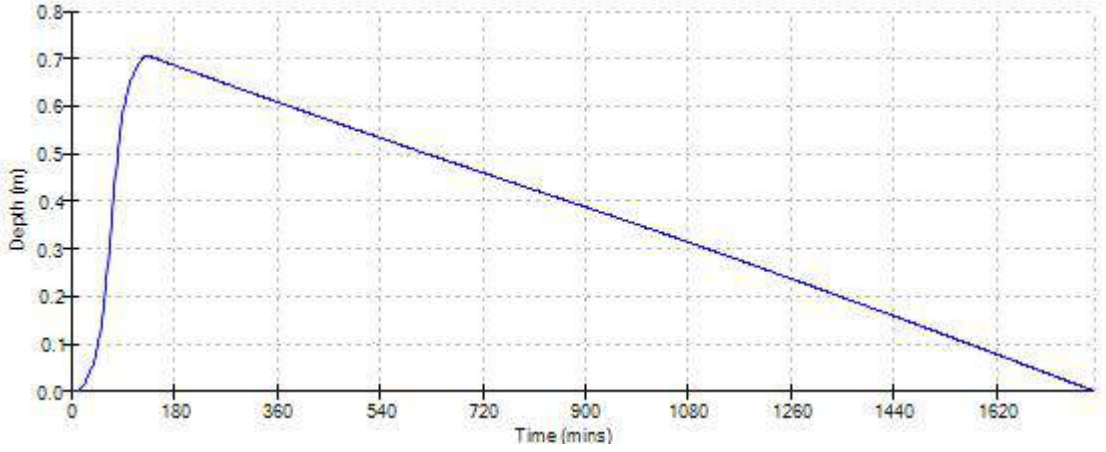




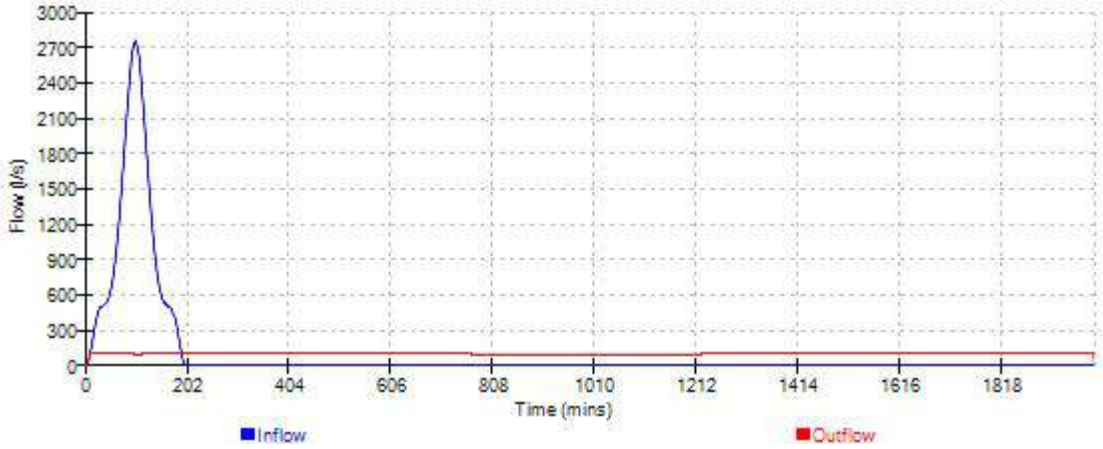
Event: 120 min Winter

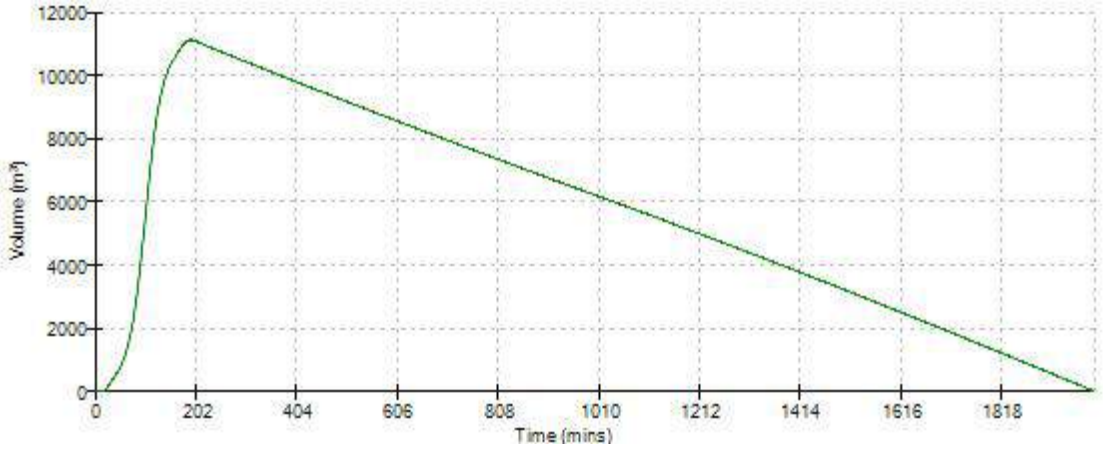


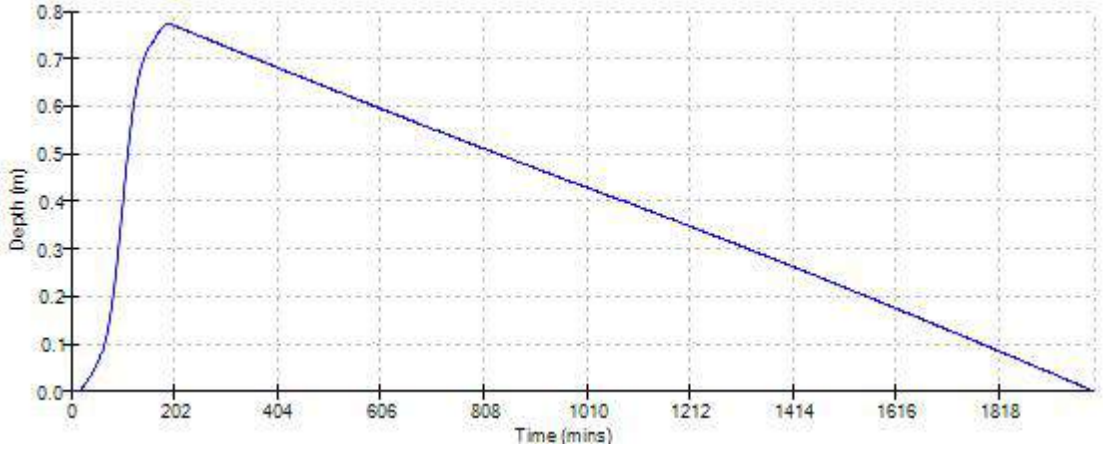




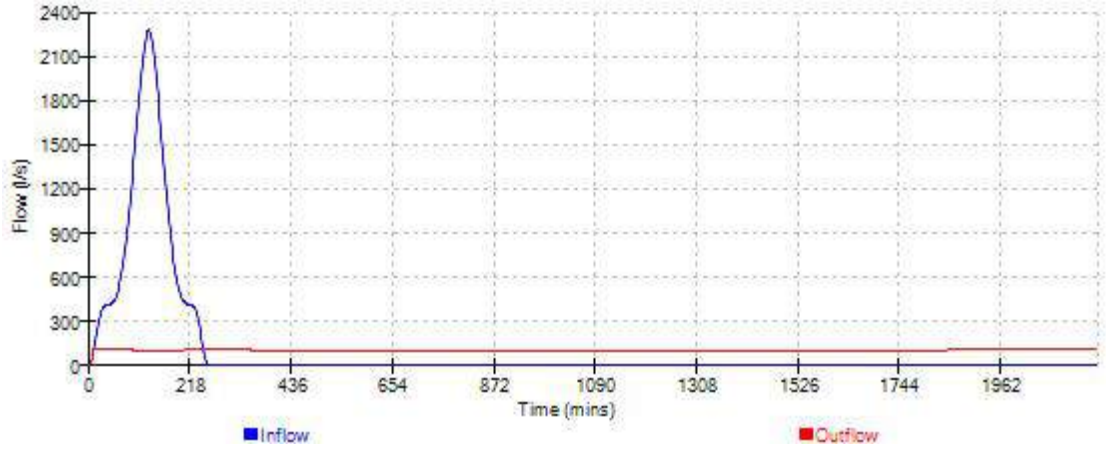
Event: 180 min Winter

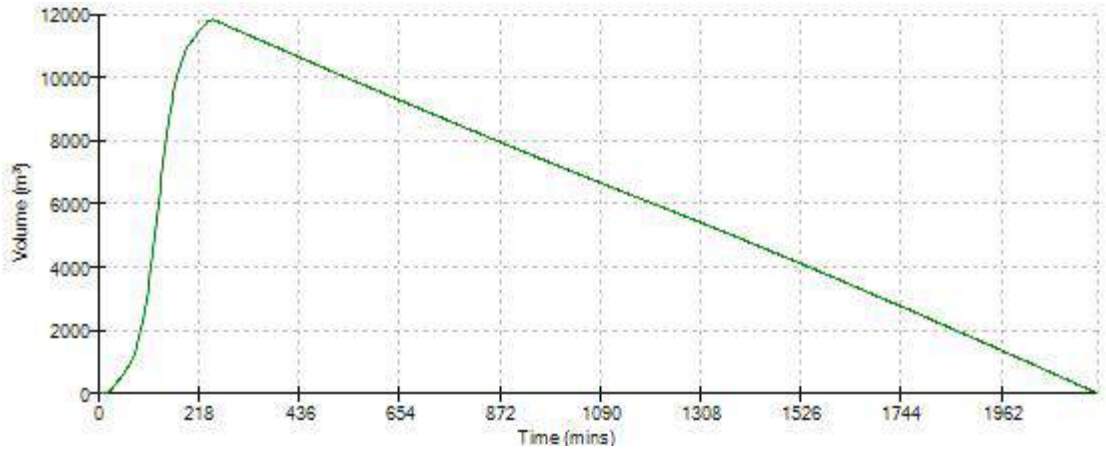


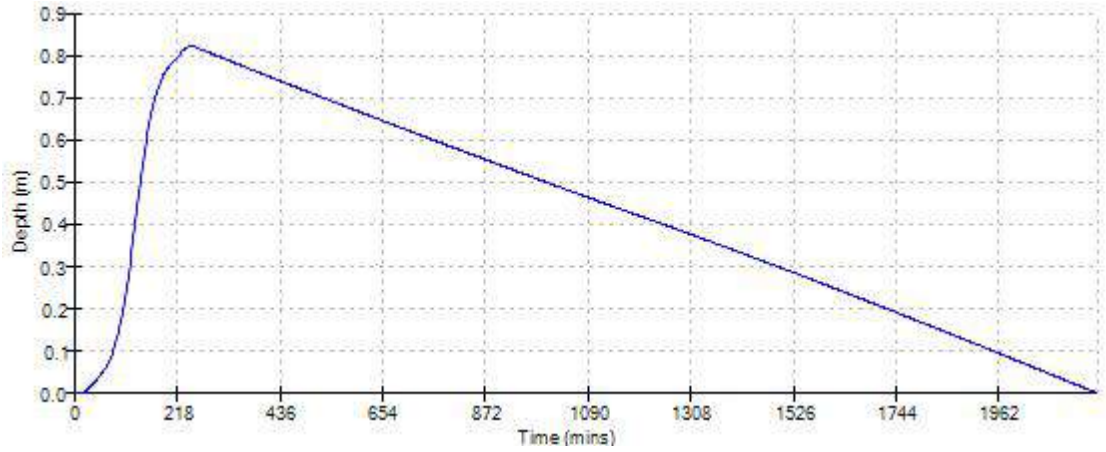




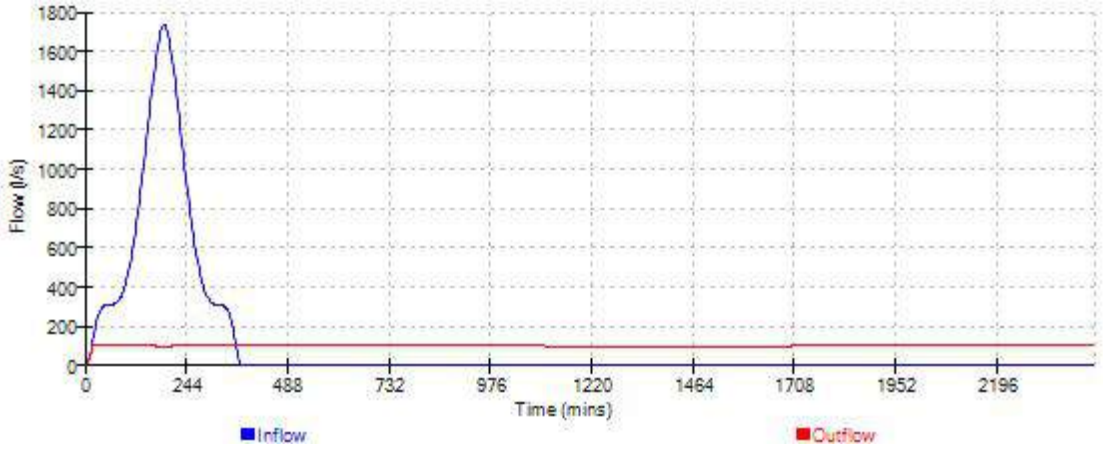
Event: 240 min Winter

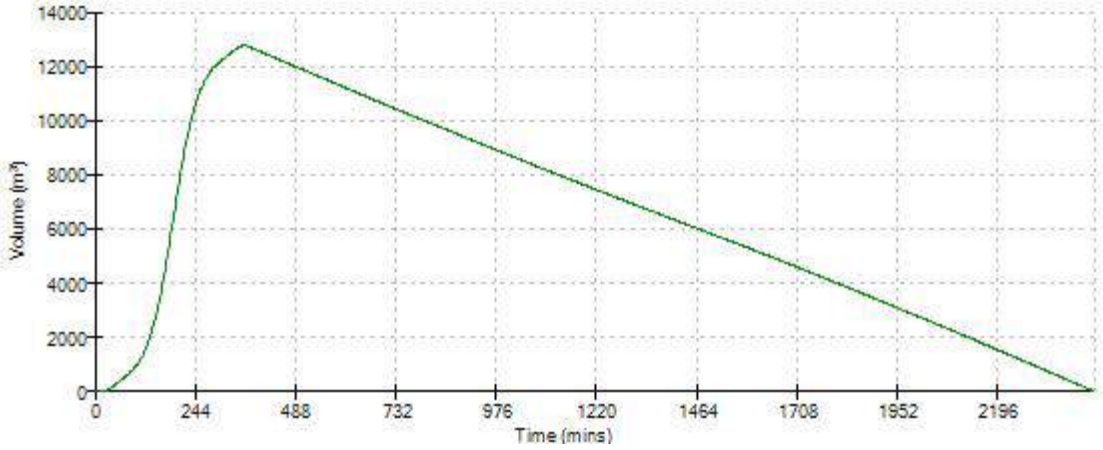


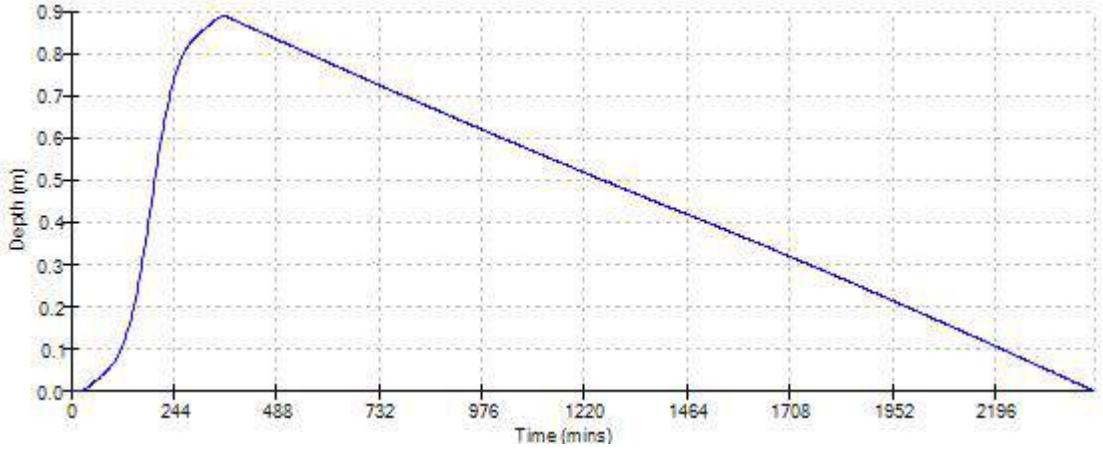




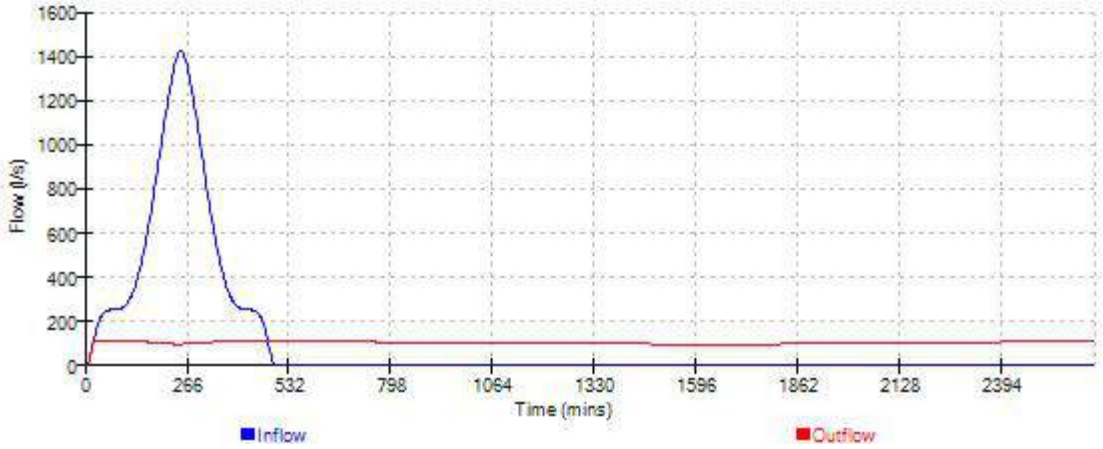
Event: 360 min Winter

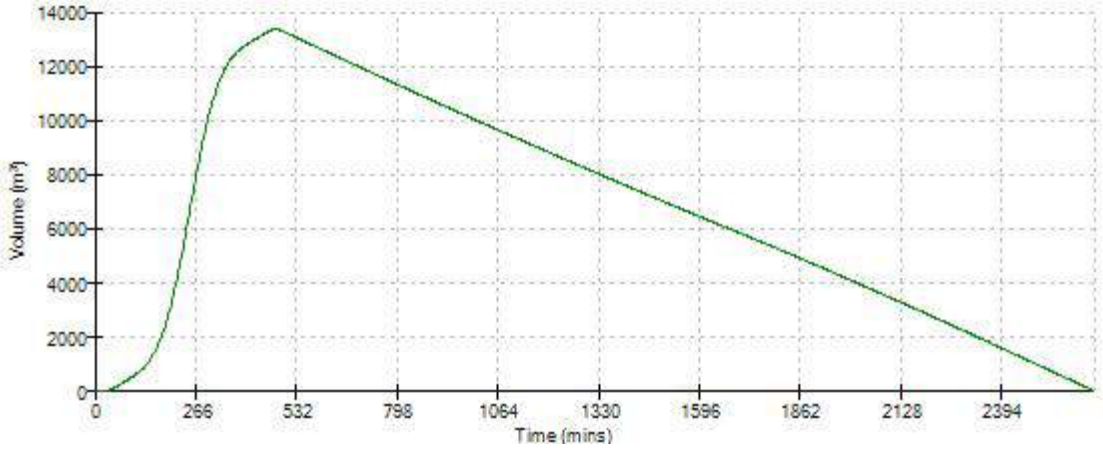


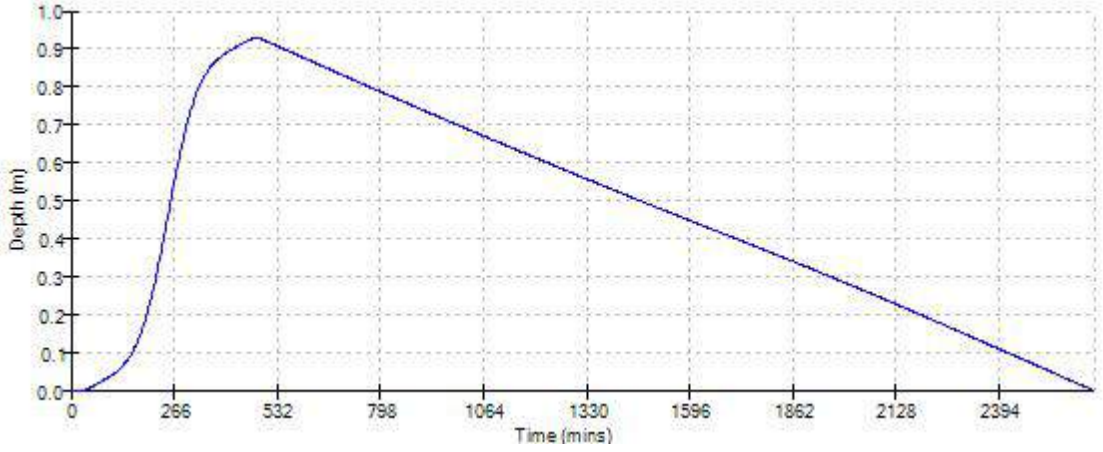




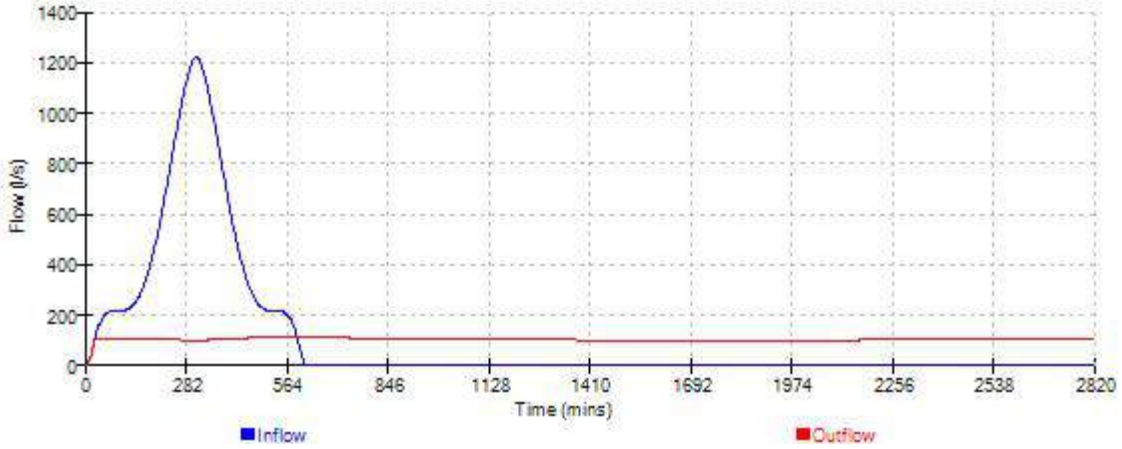
Event: 480 min Winter

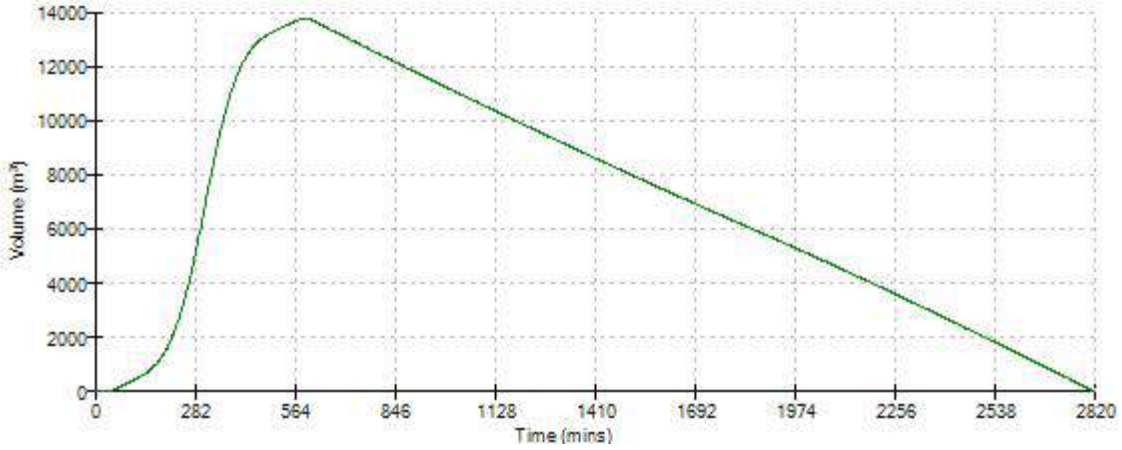


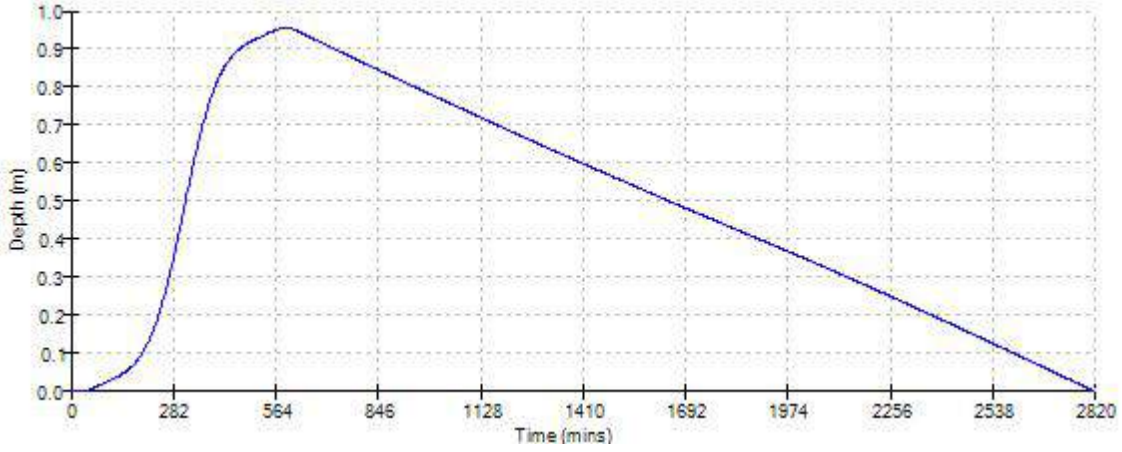




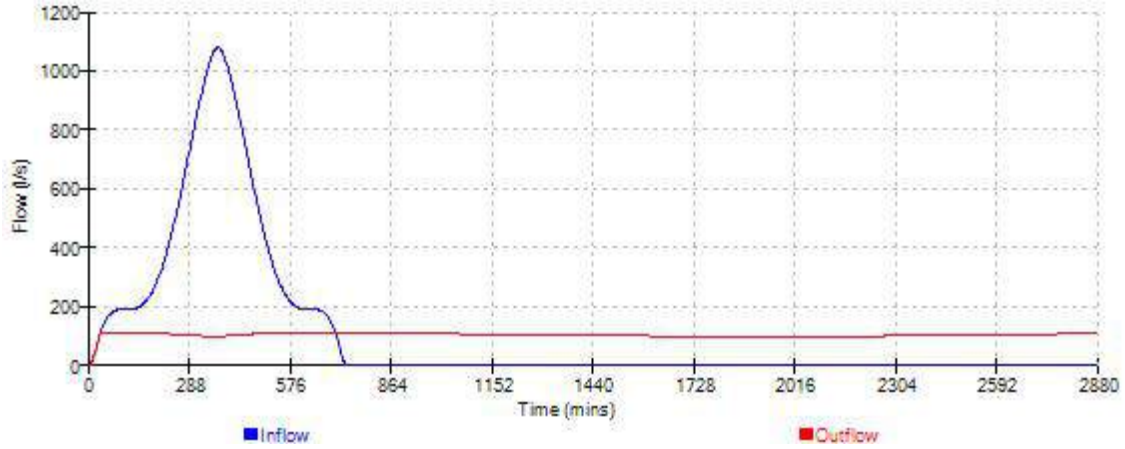
Event: 600 min Winter

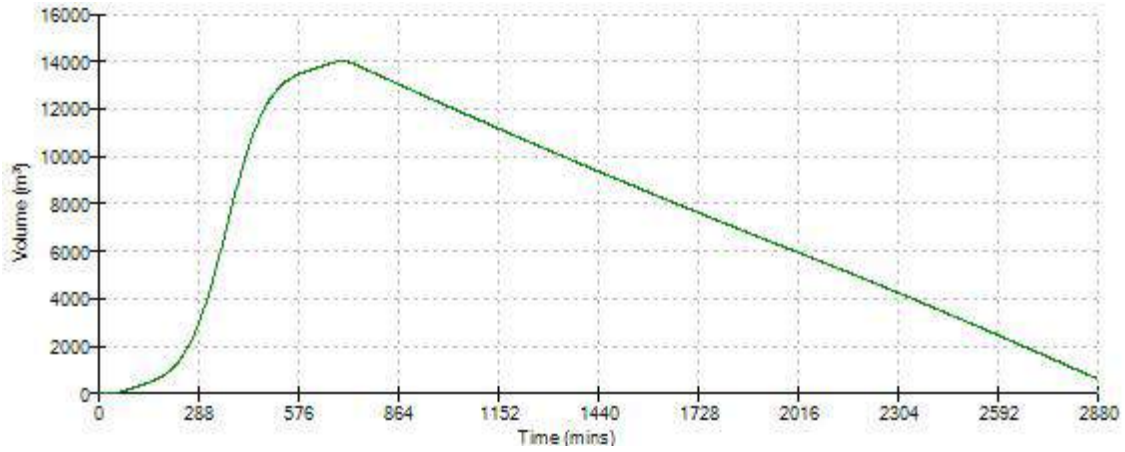


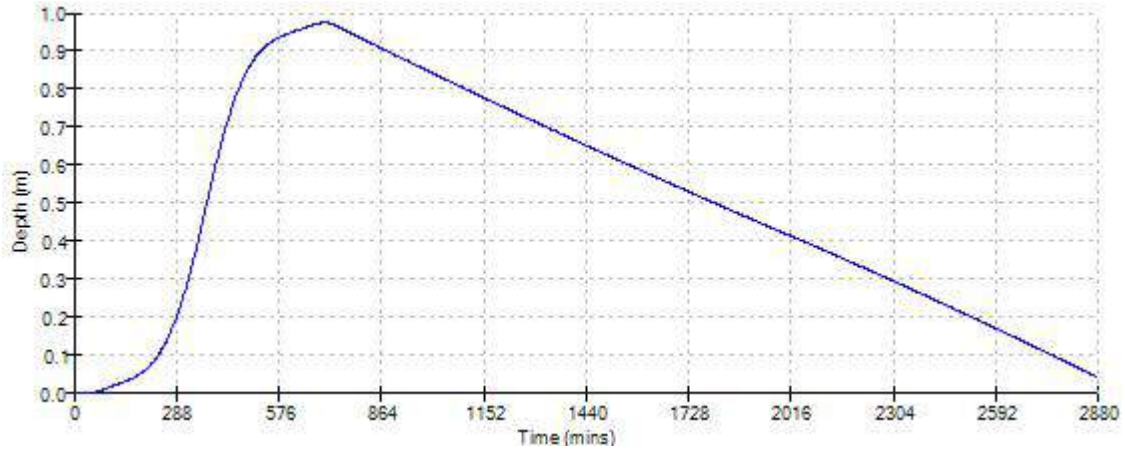




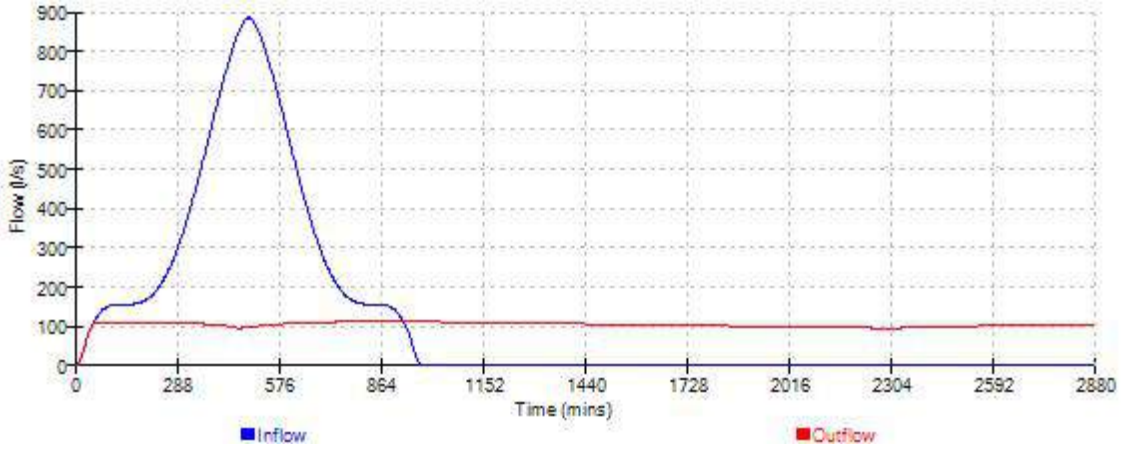
Event: 720 min Winter

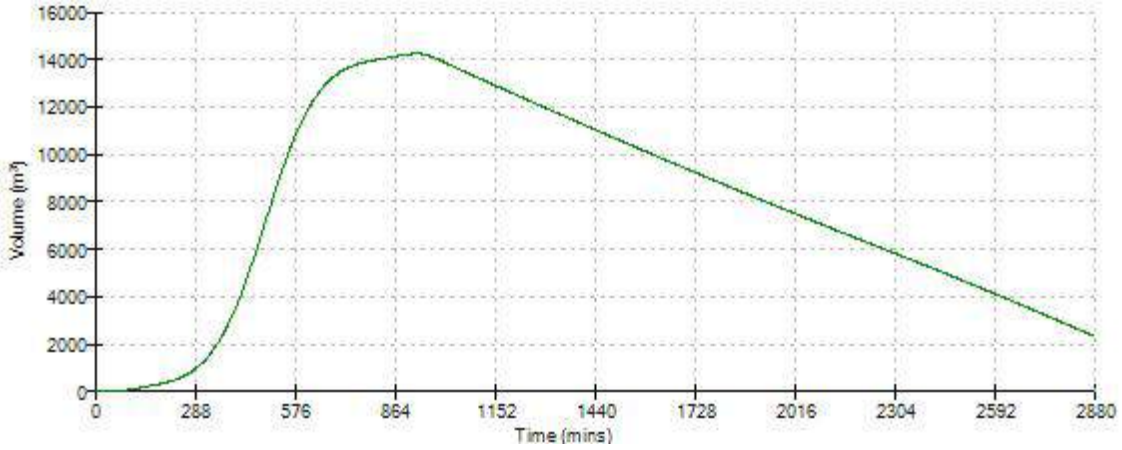


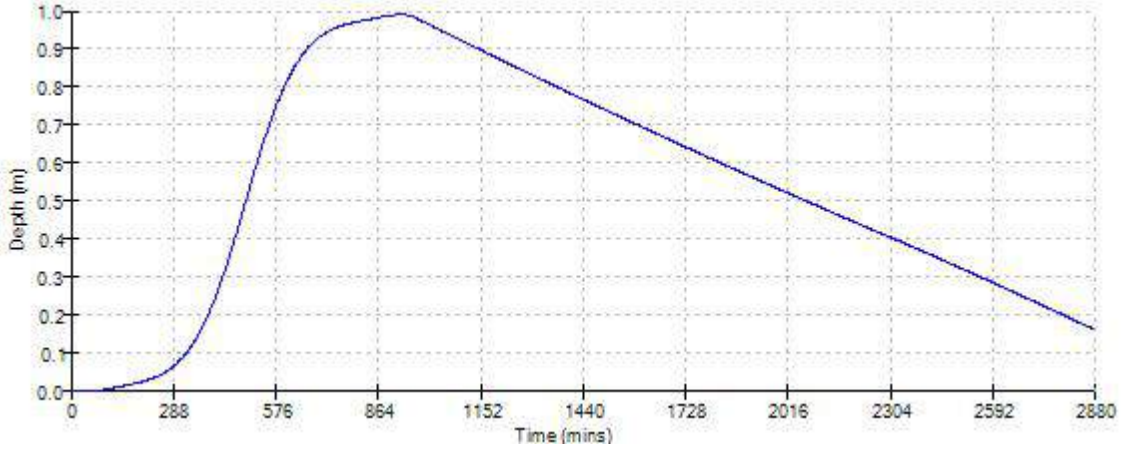




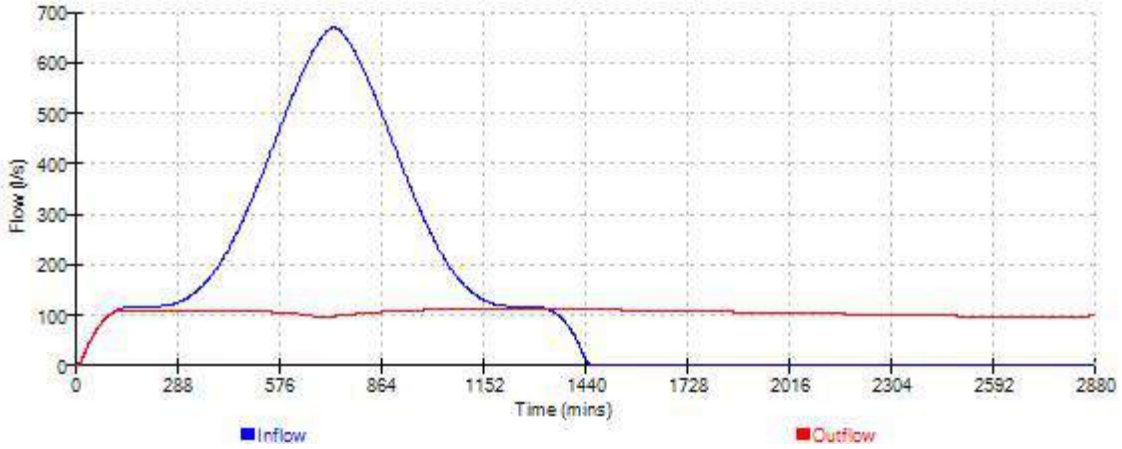
Event: 960 min Winter

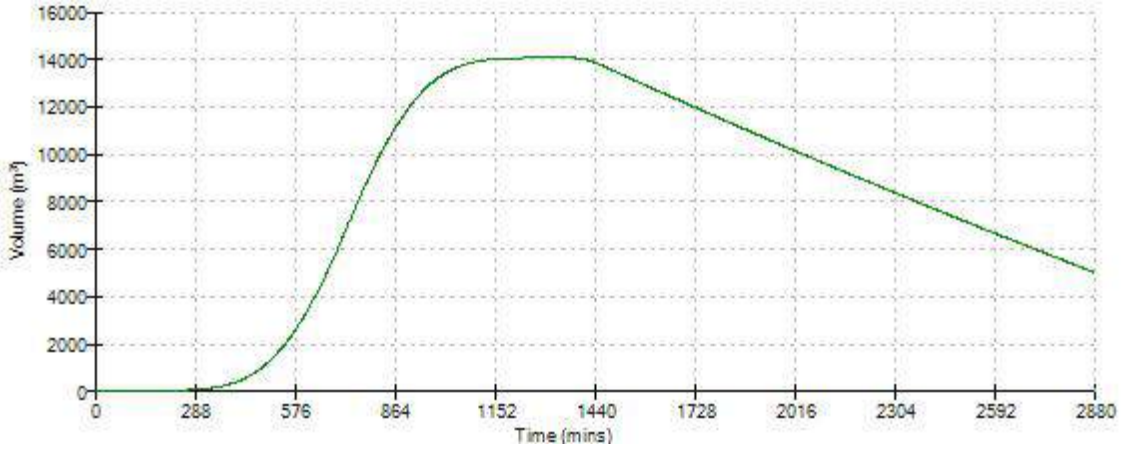


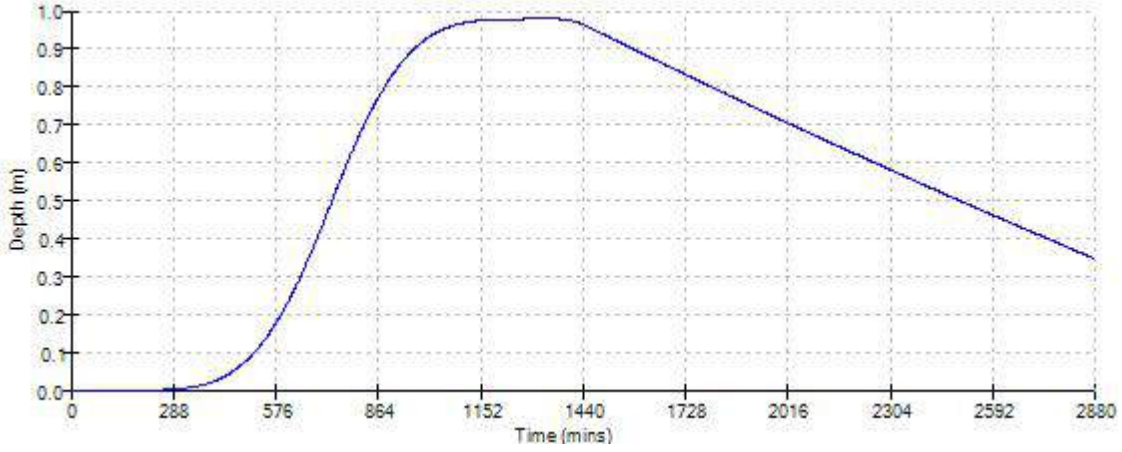




Event: 1440 min Winter







Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	100.249	0.249	109.1	8144.7	O K
30 min Summer	100.345	0.345	109.1	11263.5	O K
60 min Summer	100.454	0.454	109.1	14829.7	O K
120 min Summer	100.539	0.539	109.1	17593.2	O K
180 min Summer	100.593	0.593	109.1	19374.1	O K
240 min Summer	100.633	0.633	109.1	20689.3	O K
360 min Summer	100.690	0.690	109.1	22544.3	O K
480 min Summer	100.730	0.730	109.1	23836.2	O K
600 min Summer	100.759	0.759	109.1	24782.6	O K
720 min Summer	100.780	0.780	109.1	25491.9	O K
960 min Summer	100.809	0.809	109.1	26410.1	O K
1440 min Summer	100.836	0.836	109.1	27311.5	O K
2160 min Summer	100.830	0.830	109.1	27114.5	O K
2880 min Summer	100.818	0.818	109.1	26718.8	O K
4320 min Summer	100.801	0.801	109.1	26173.7	O K
5760 min Summer	100.785	0.785	109.1	25646.0	O K
7200 min Summer	100.767	0.767	109.1	25052.8	O K
8640 min Summer	100.747	0.747	109.1	24387.2	O K
10080 min Summer	100.725	0.725	109.1	23684.4	O K
15 min Winter	100.280	0.280	109.1	9151.4	O K
30 min Winter	100.388	0.388	109.1	12659.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	129.688	0.0	8344.0	34
30 min Summer	89.697	0.0	8992.0	49
60 min Summer	59.360	0.0	15291.0	78
120 min Summer	35.741	0.0	17588.2	138
180 min Summer	26.609	0.0	17431.5	196
240 min Summer	21.591	0.0	17354.2	256
360 min Summer	16.078	0.0	17314.9	374
480 min Summer	13.051	0.0	17355.8	494
600 min Summer	11.102	0.0	17442.9	612
720 min Summer	9.727	0.0	17559.7	730
960 min Summer	7.887	0.0	17807.0	968
1440 min Summer	5.899	0.0	18133.6	1444
2160 min Summer	4.403	0.0	35660.4	2068
2880 min Summer	3.578	0.0	35326.1	2420
4320 min Summer	2.679	0.0	34229.9	3200
5760 min Summer	2.186	0.0	54139.4	4032
7200 min Summer	1.871	0.0	57906.6	4840
8640 min Summer	1.648	0.0	61193.8	5704
10080 min Summer	1.482	0.0	59793.6	6552
15 min Winter	129.688	0.0	9163.6	34
30 min Winter	89.697	0.0	8847.6	49

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	100.511	0.511	109.1	16678.2	O K
120 min Winter	100.607	0.607	109.1	19823.7	O K
180 min Winter	100.670	0.670	109.1	21873.7	O K
240 min Winter	100.716	0.716	109.1	23398.4	O K
360 min Winter	100.783	0.783	109.1	25582.8	O K
480 min Winter	100.831	0.831	109.1	27136.2	O K
600 min Winter	100.866	0.866	109.1	28301.6	O K
720 min Winter	100.894	0.894	109.5	29201.6	O K
960 min Winter	100.932	0.932	110.5	30443.4	O K
1440 min Winter	100.977	0.977	111.8	31902.9	O K
2160 min Winter	100.992	0.992	112.2	32394.6	O K
2880 min Winter	100.978	0.978	111.8	31951.7	O K
4320 min Winter	100.945	0.945	110.9	30853.8	O K
5760 min Winter	100.918	0.918	110.2	29991.6	O K
7200 min Winter	100.886	0.886	109.3	28933.7	O K
8640 min Winter	100.849	0.849	109.1	27741.4	O K
10080 min Winter	100.811	0.811	109.1	26484.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	59.360	0.0	17137.3	78
120 min Winter	35.741	0.0	17409.9	136
180 min Winter	26.609	0.0	17311.8	194
240 min Winter	21.591	0.0	17295.2	252
360 min Winter	16.078	0.0	17381.5	368
480 min Winter	13.051	0.0	17554.9	484
600 min Winter	11.102	0.0	17757.9	602
720 min Winter	9.727	0.0	17921.7	718
960 min Winter	7.887	0.0	18150.3	950
1440 min Winter	5.899	0.0	18392.4	1408
2160 min Winter	4.403	0.0	35836.4	2076
2880 min Winter	3.578	0.0	36002.7	2708
4320 min Winter	2.679	0.0	35530.4	3384
5760 min Winter	2.186	0.0	60631.5	4328
7200 min Winter	1.871	0.0	64863.8	5264
8640 min Winter	1.648	0.0	65130.0	6160
10080 min Winter	1.482	0.0	62689.6	7072

Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 389142 409310	Shortest Storm (mins)	15
Data Type	Point	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 34.400

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	6.880	8	12	6.880	16	20	6.880
4	8	6.880	12	16	6.880			

Model Details

Storage is Online Cover Level (m) 102.000

Tank or Pond Structure

Invert Level (m) 100.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	32665.0	0.700	32665.0	1.400	0.0	2.100	0.0
0.100	32665.0	0.800	32665.0	1.500	0.0	2.200	0.0
0.200	32665.0	0.900	32665.0	1.600	0.0	2.300	0.0
0.300	32665.0	1.000	32665.0	1.700	0.0	2.400	0.0
0.400	32665.0	1.100	0.0	1.800	0.0	2.500	0.0
0.500	32665.0	1.200	0.0	1.900	0.0		
0.600	32665.0	1.300	0.0	2.000	0.0		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0401-1124-2050-1124
Design Head (m)	2.050
Design Flow (l/s)	112.4
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	401
Invert Level (m)	98.950
Minimum Outlet Pipe Diameter (mm)	450
Suggested Manhole Diameter (mm)	Site Specific Design (Contact Hydro International)

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.050	112.4
Flush-Flo™	0.691	112.3
Kick-Flo®	1.453	95.1
Mean Flow over Head Range	-	94.7

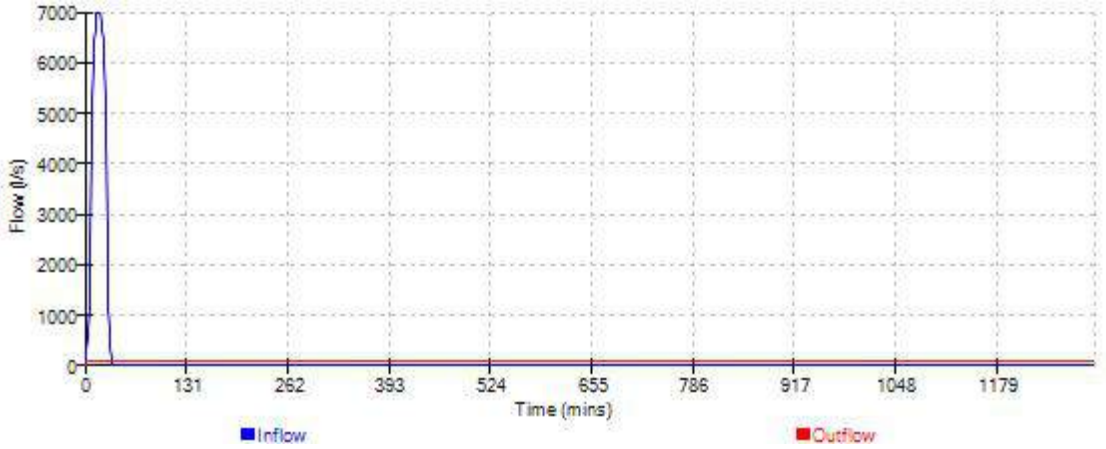
The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

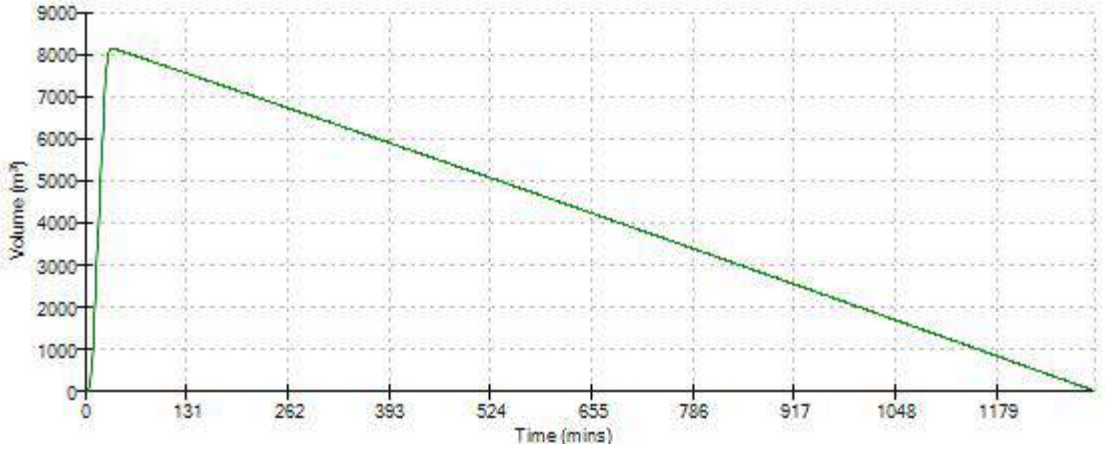
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	11.0	1.000	109.8	2.400	121.3	5.500	181.9
0.200	39.5	1.200	106.2	2.600	126.2	6.000	189.8
0.300	76.3	1.400	98.6	3.000	135.3	6.500	197.3
0.400	106.7	1.600	99.6	3.500	145.8	7.000	204.6
0.500	110.2	1.800	105.5	4.000	155.6	7.500	211.7
0.600	111.9	2.000	111.0	4.500	164.9	8.000	218.5
0.800	111.8	2.200	116.3	5.000	173.6	8.500	225.1

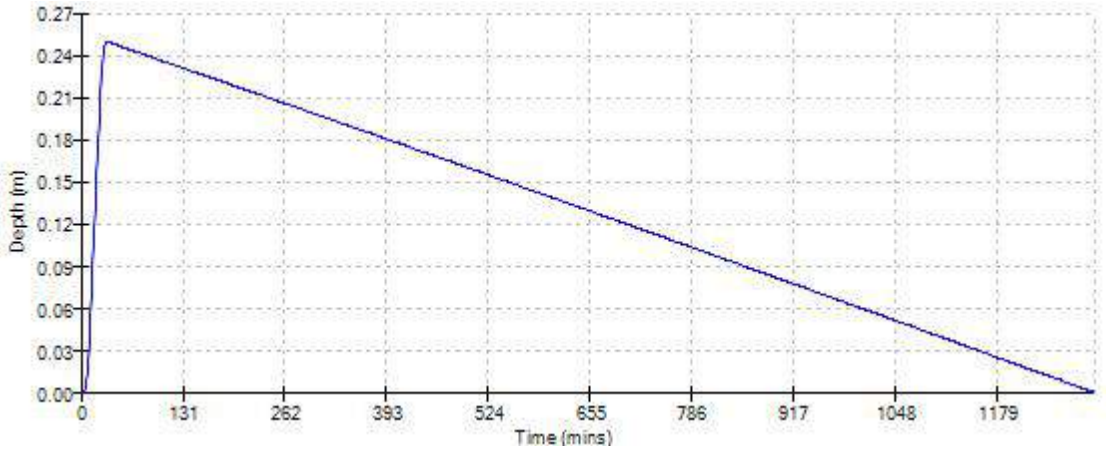
Hydro-Brake® Optimum Outflow Control

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
9.000	231.5	9.500	237.7				

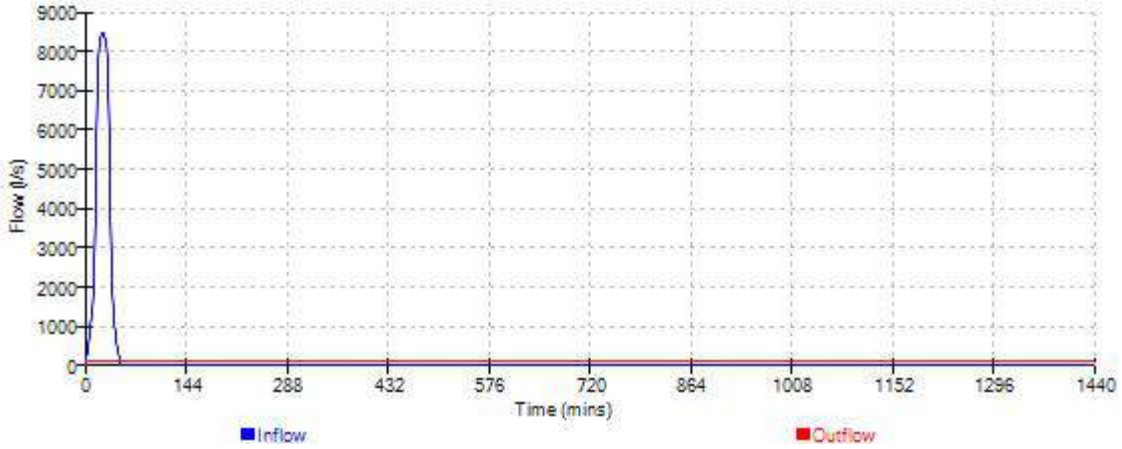
Event: 15 min Summer

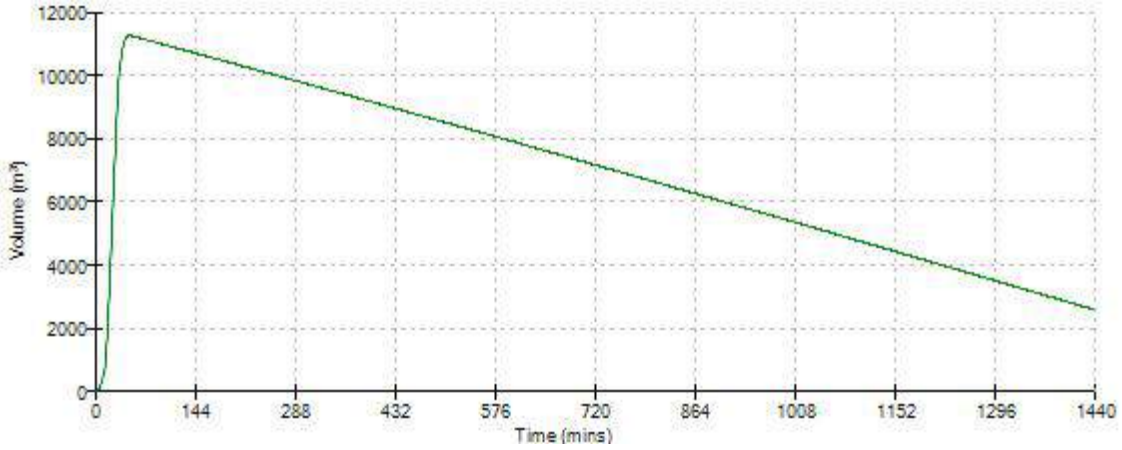


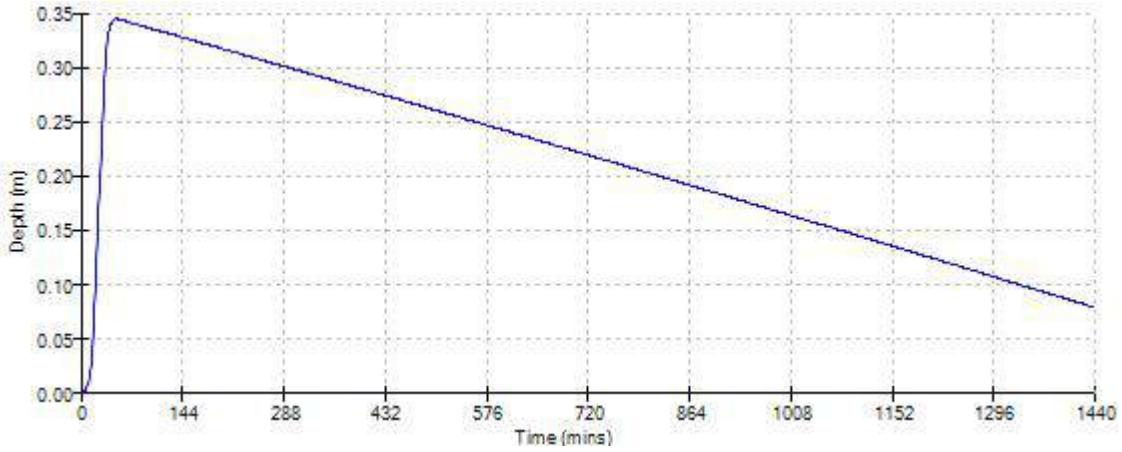




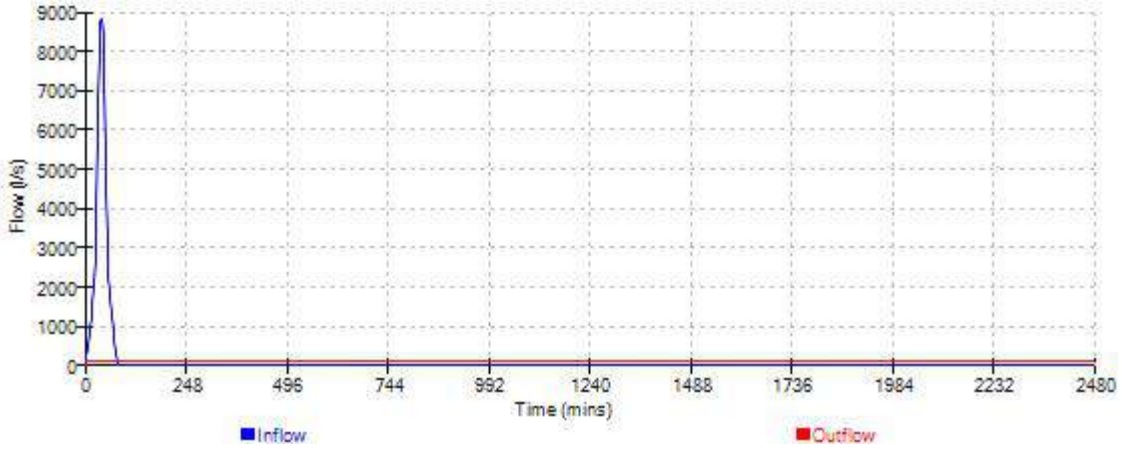
Event: 30 min Summer

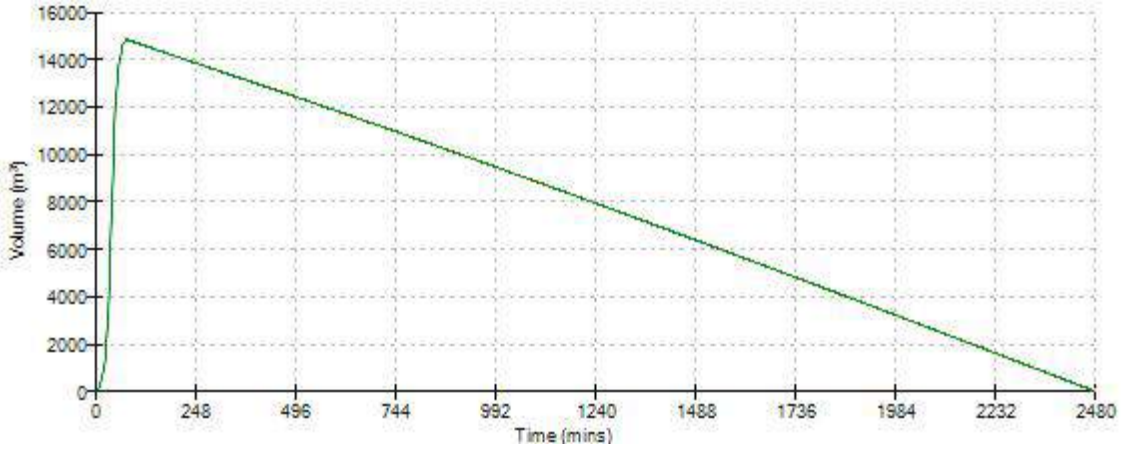


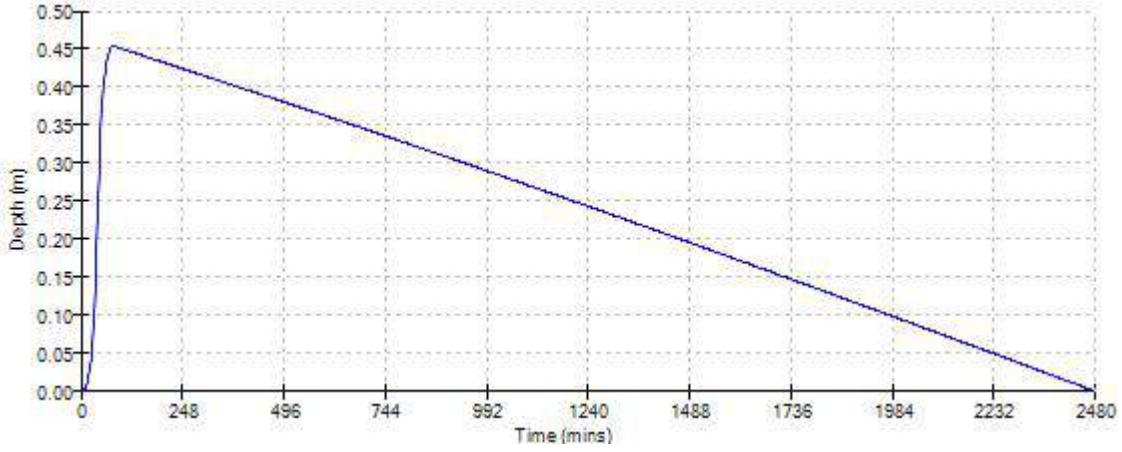




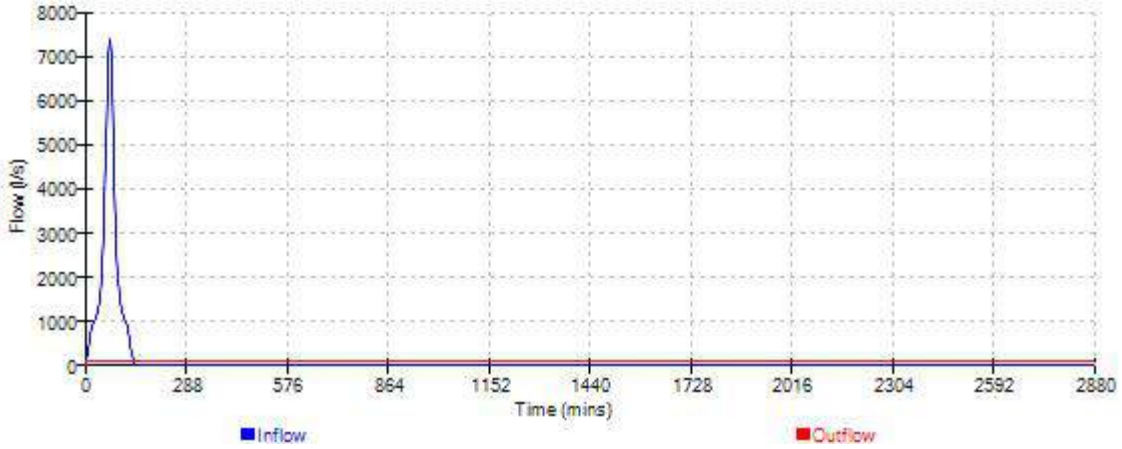
Event: 60 min Summer

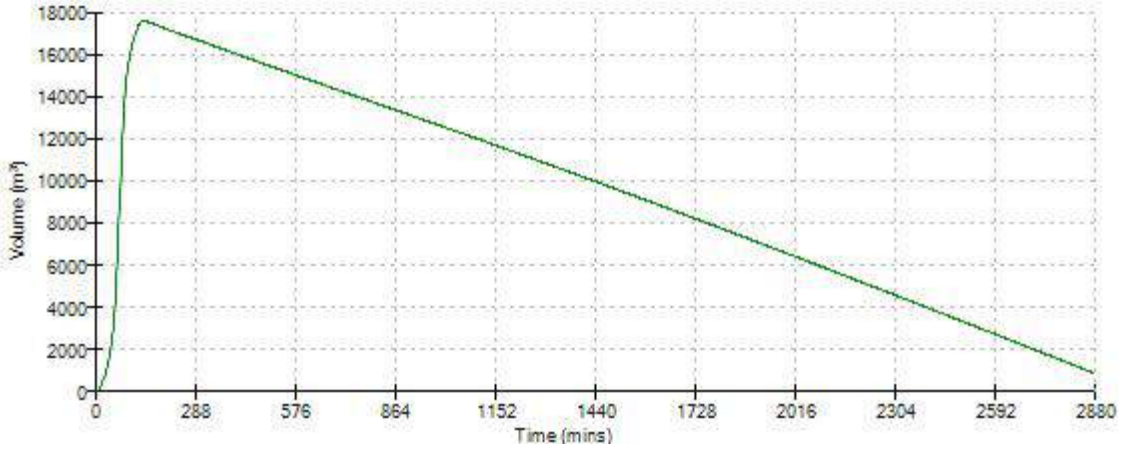


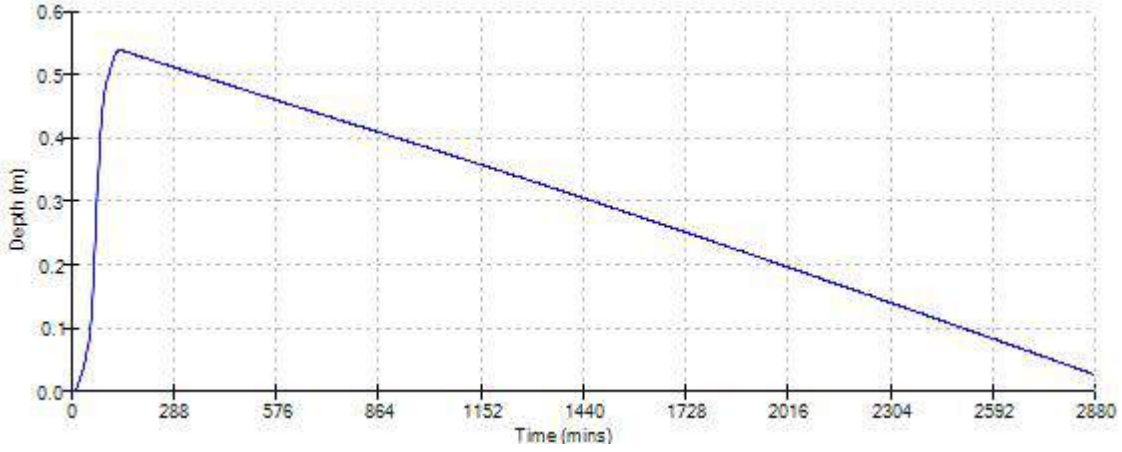




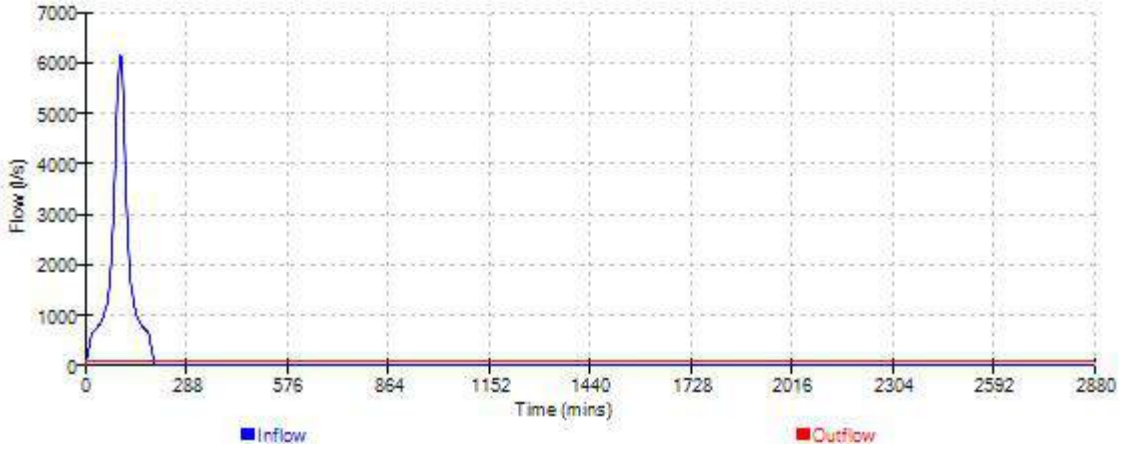
Event: 120 min Summer

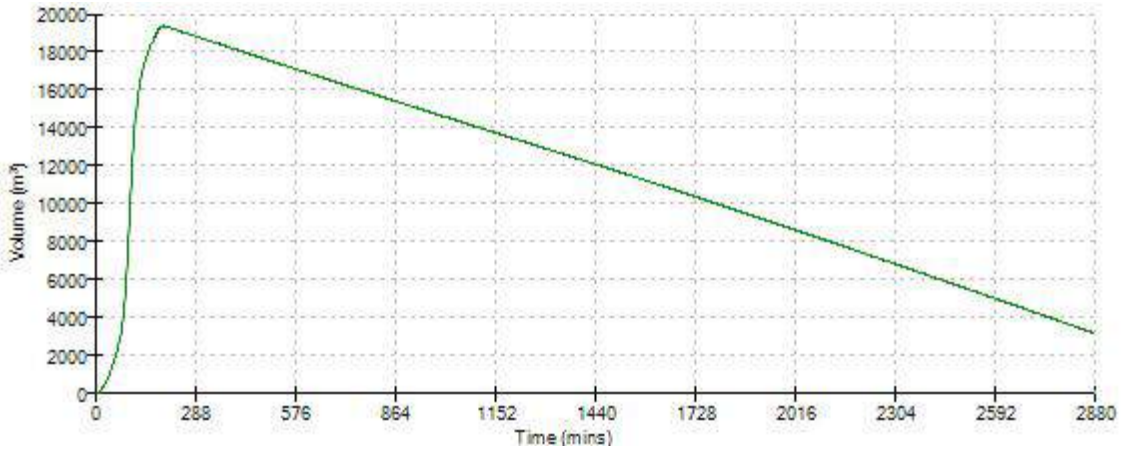


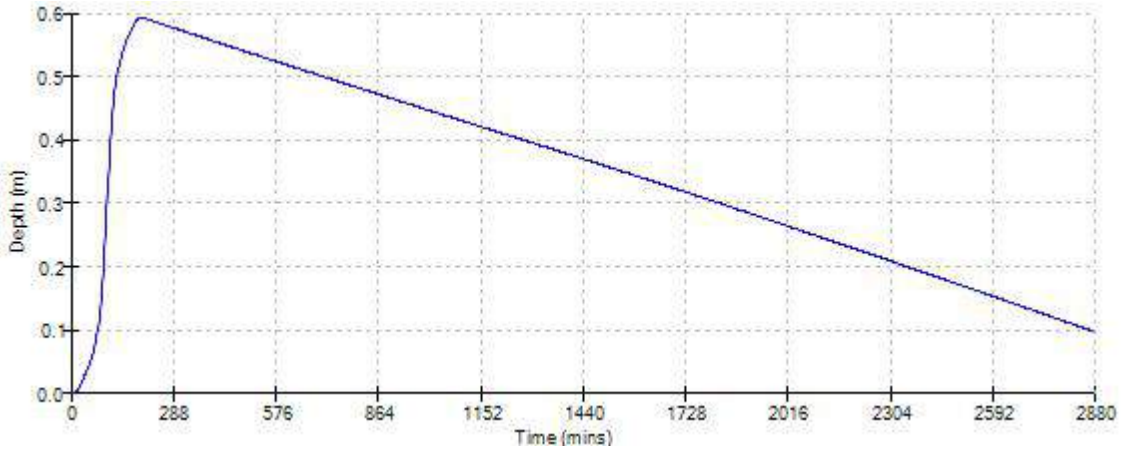




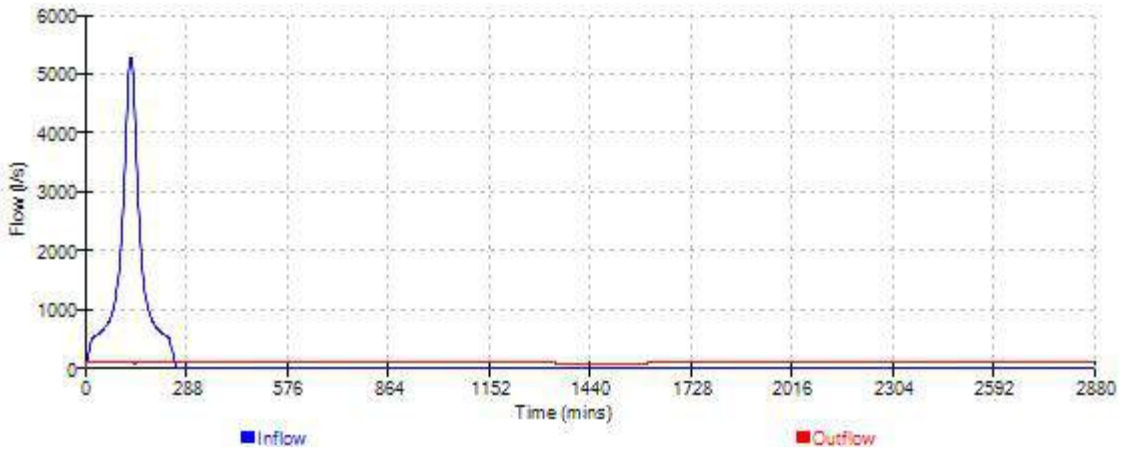
Event: 180 min Summer

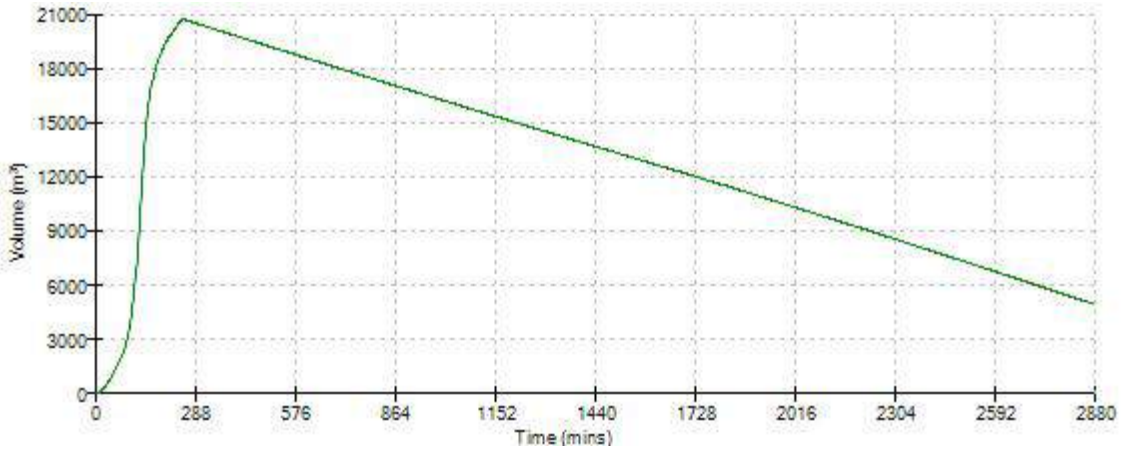


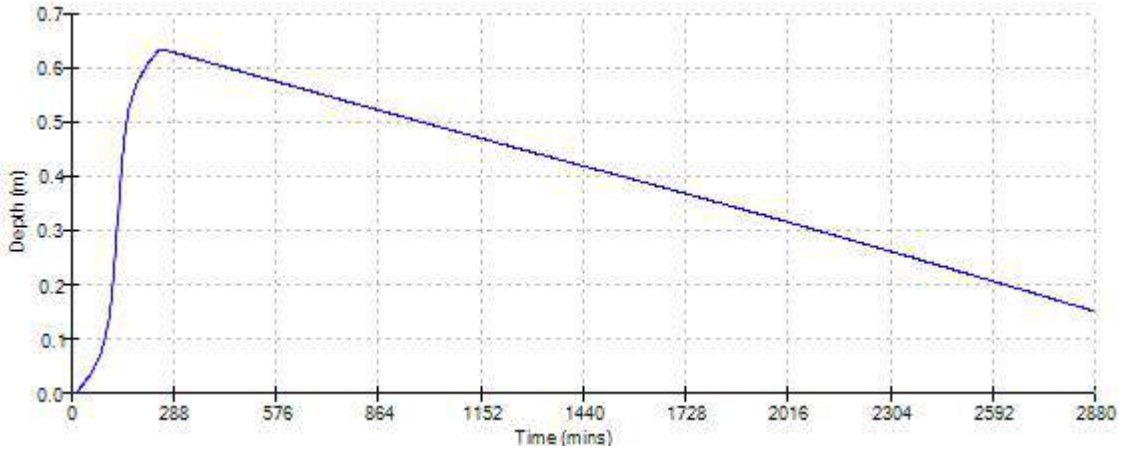




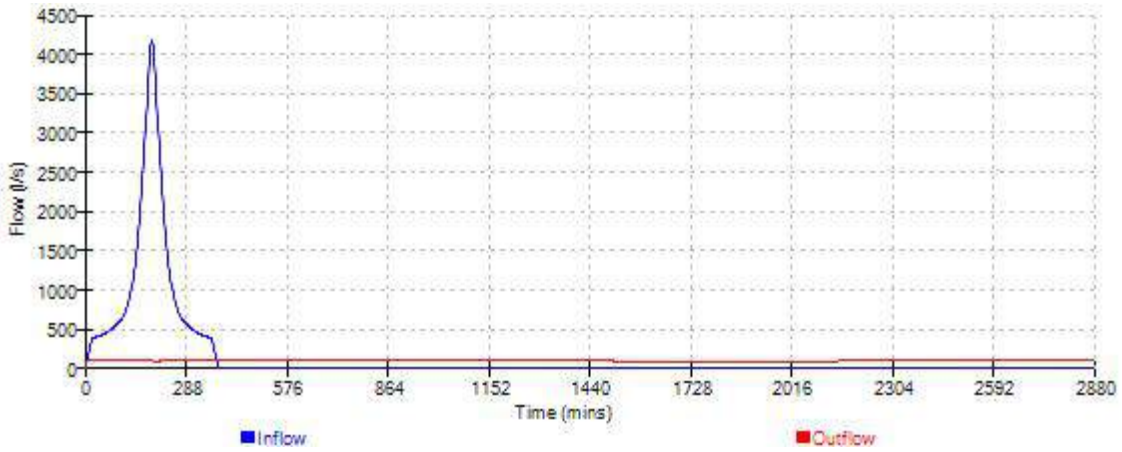
Event: 240 min Summer

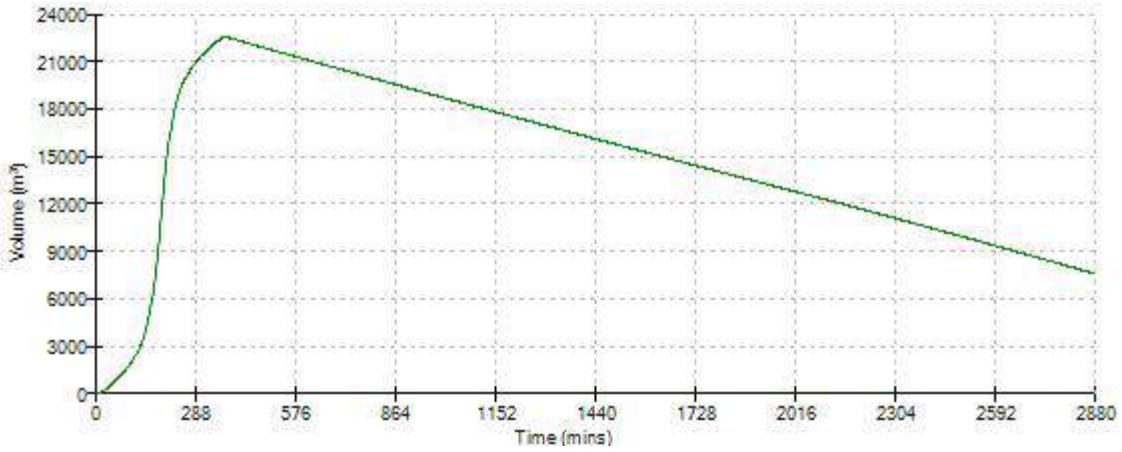


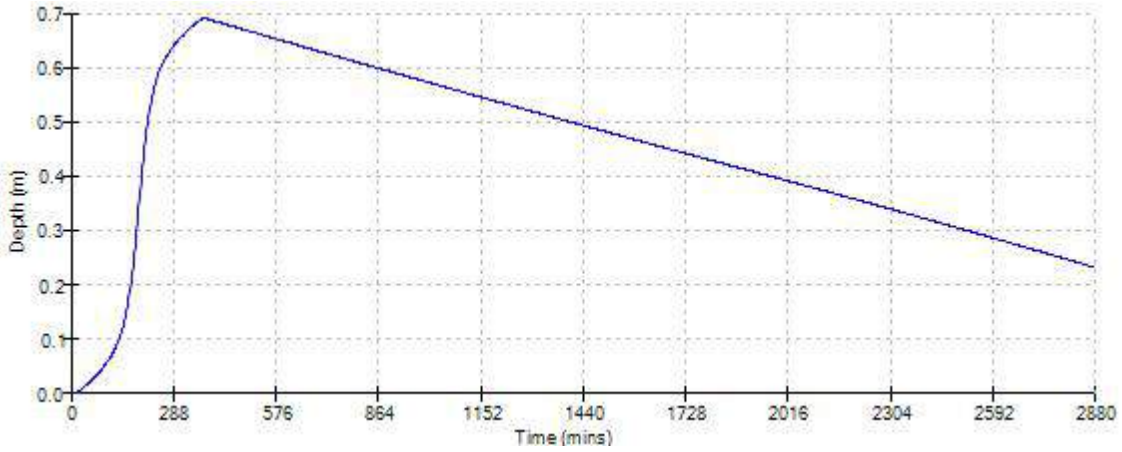




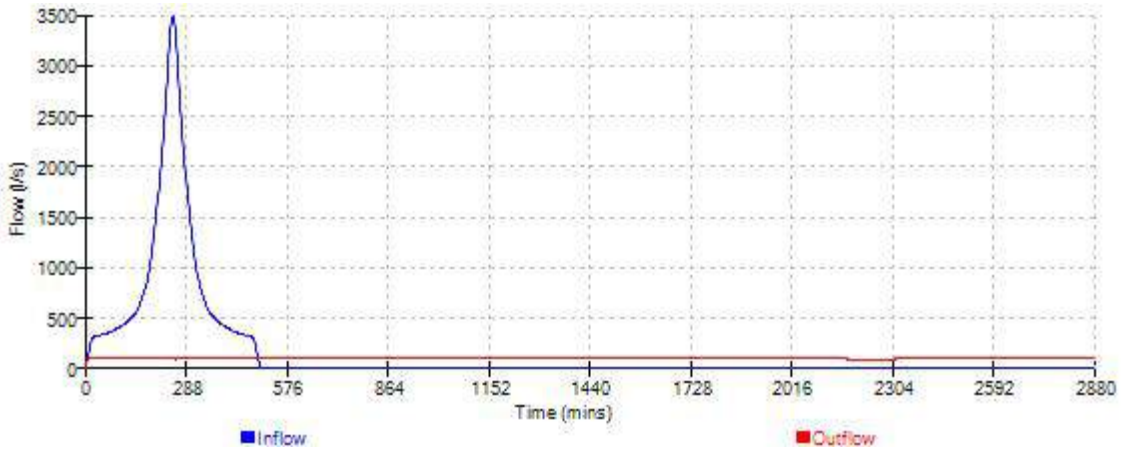
Event: 360 min Summer

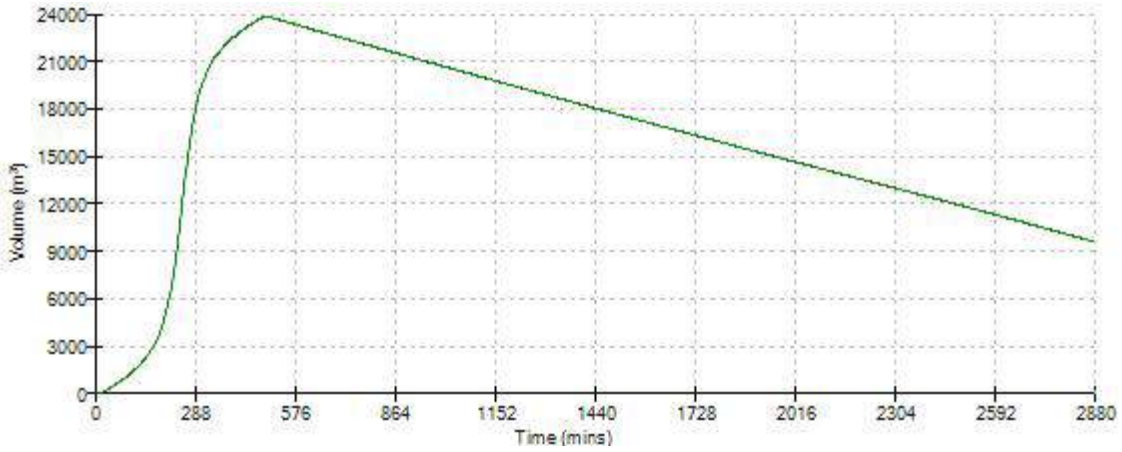


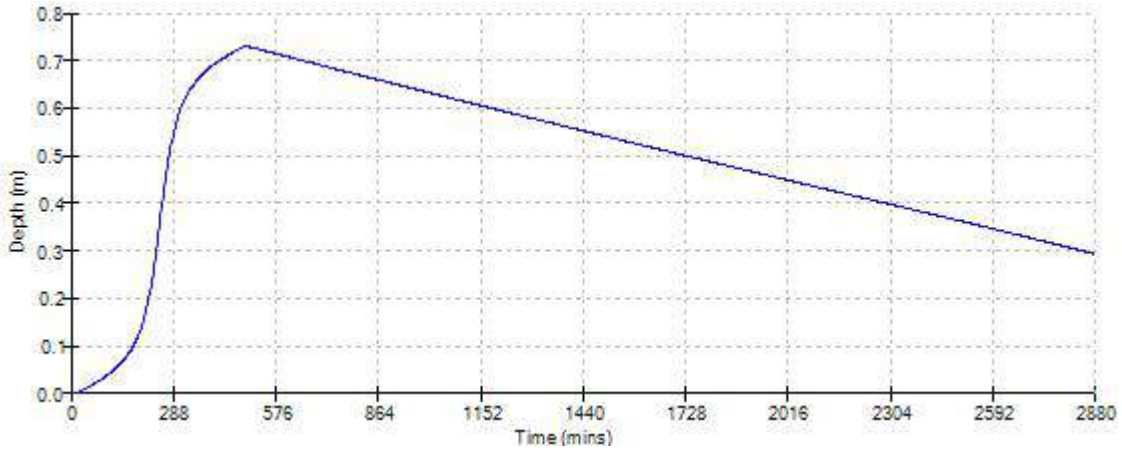




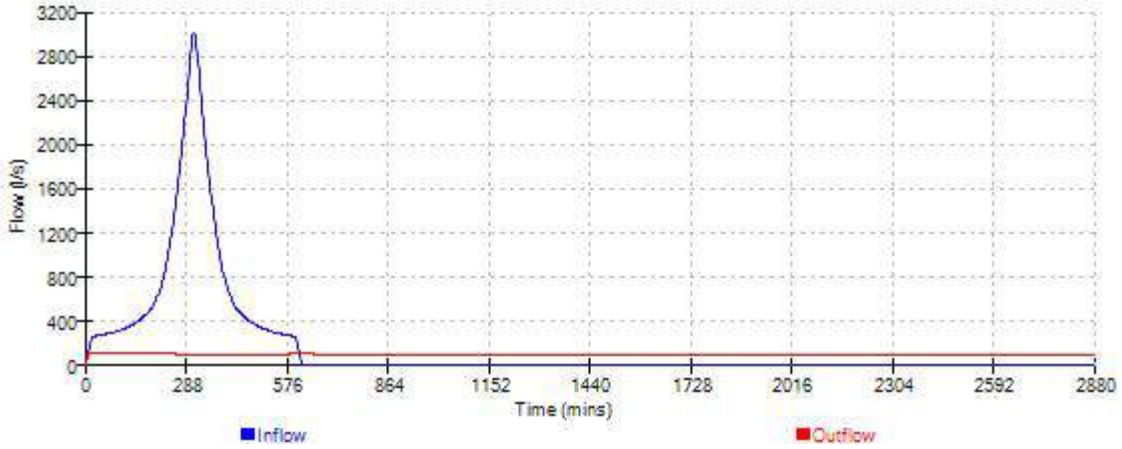
Event: 480 min Summer

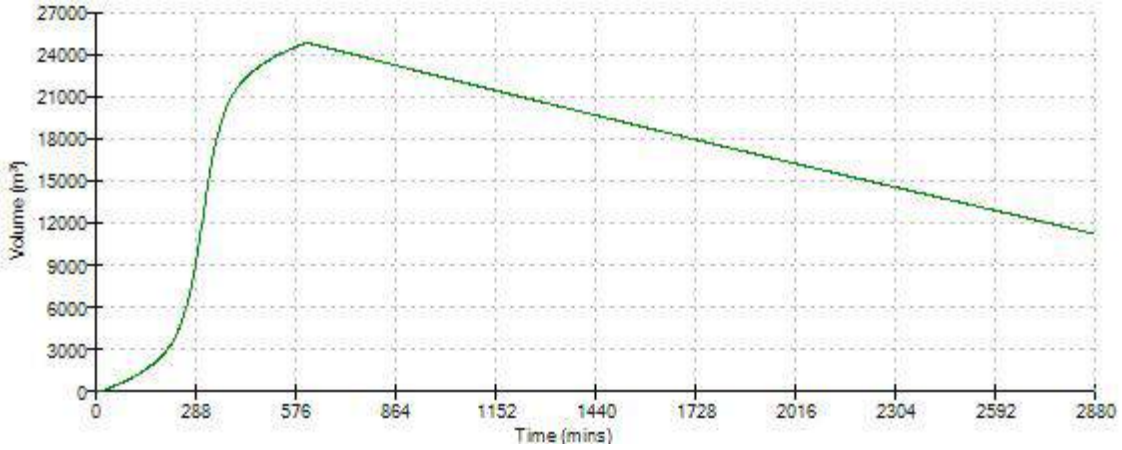


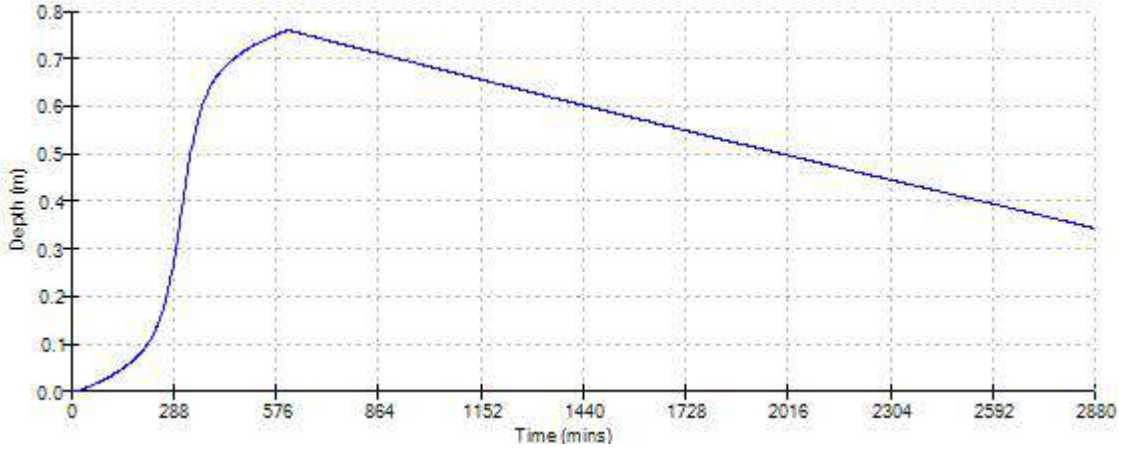




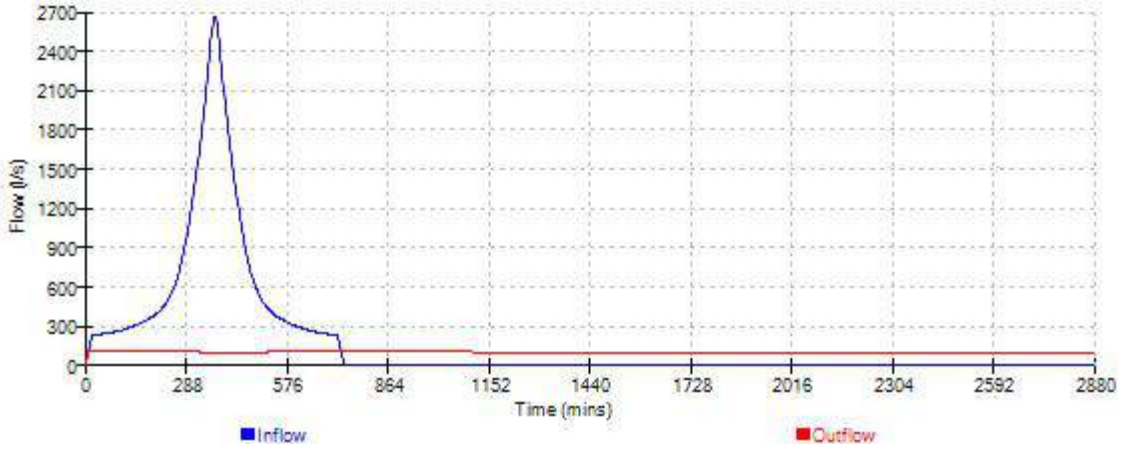
Event: 600 min Summer

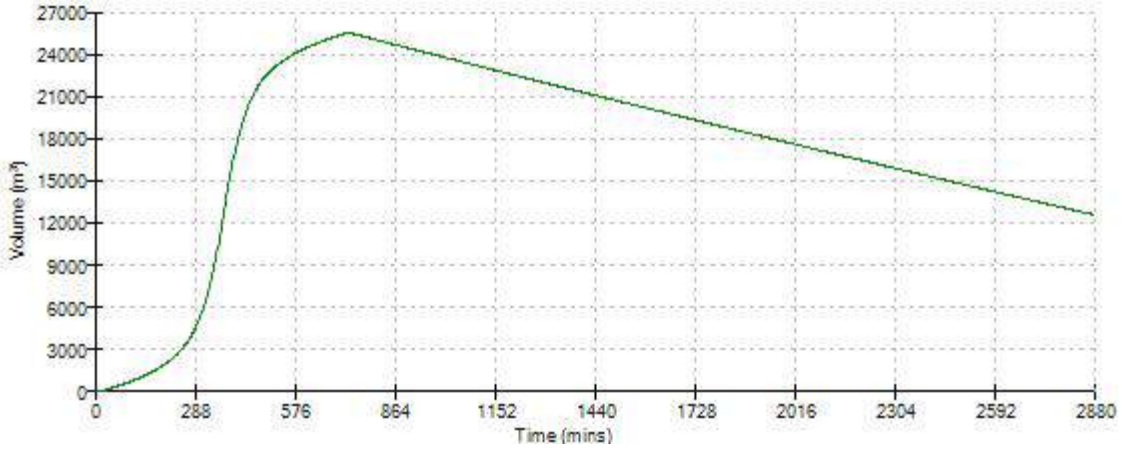


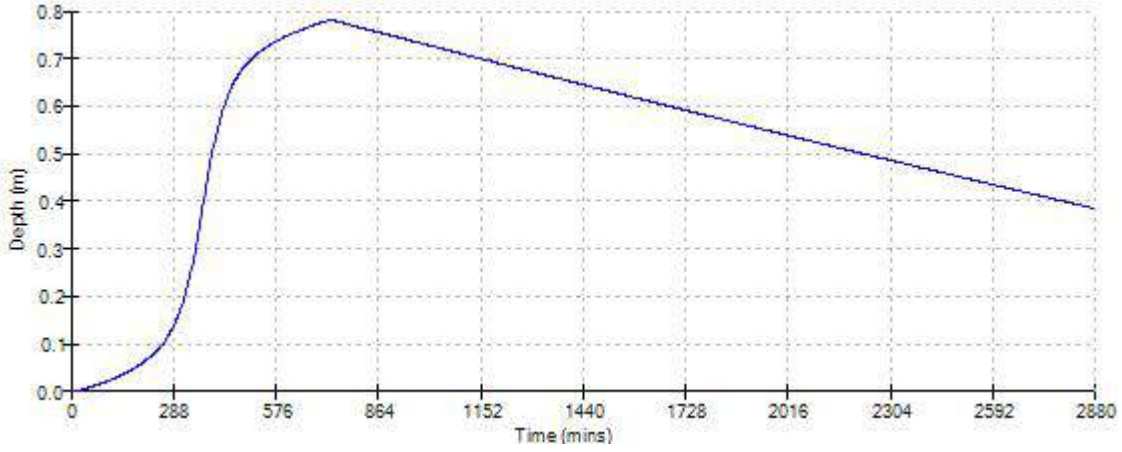




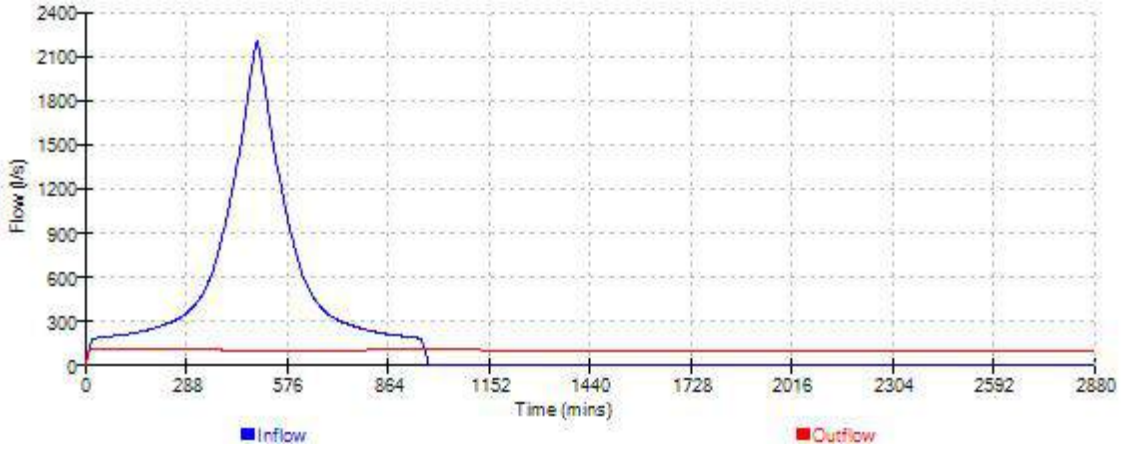
Event: 720 min Summer

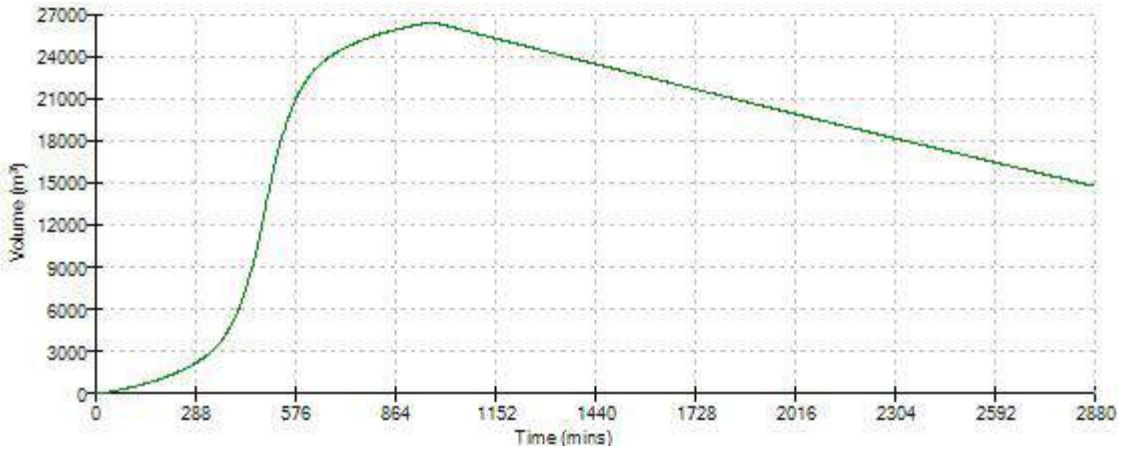


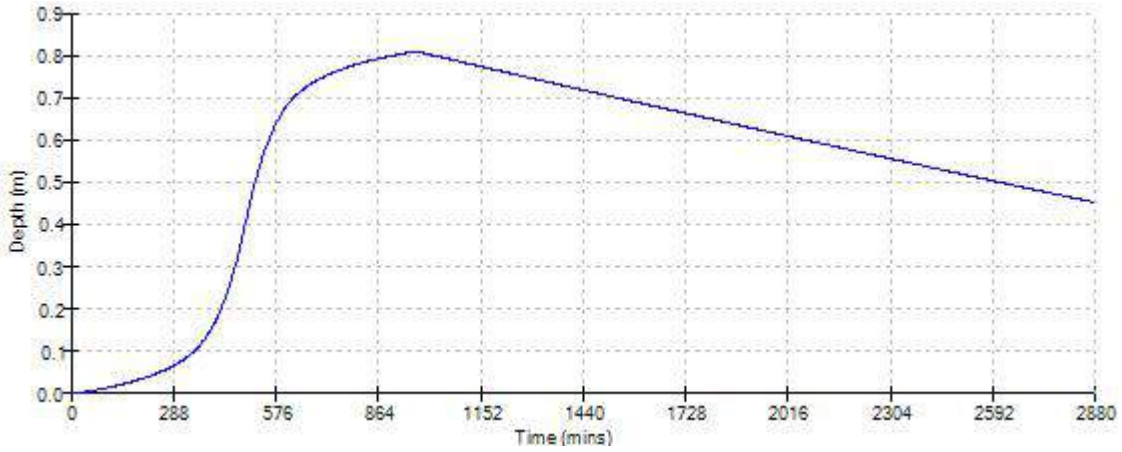




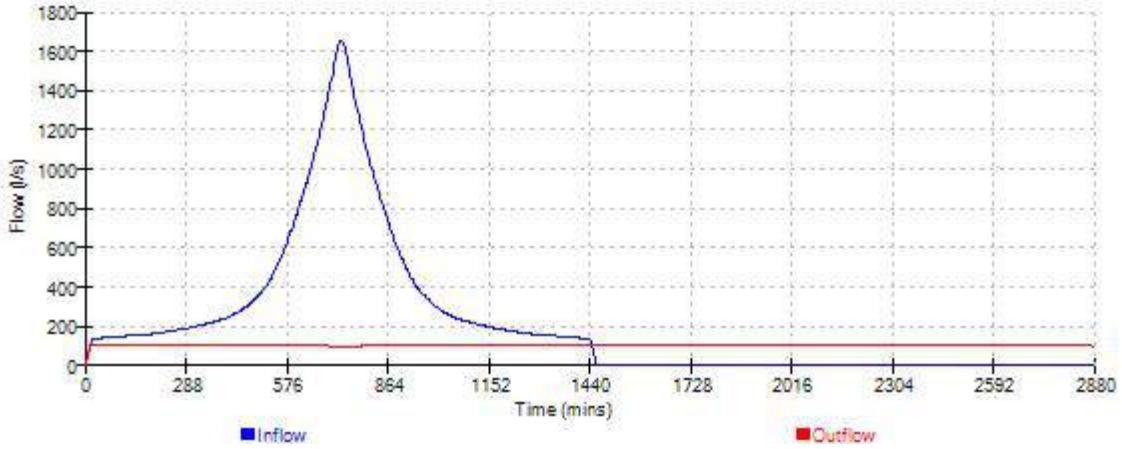
Event: 960 min Summer

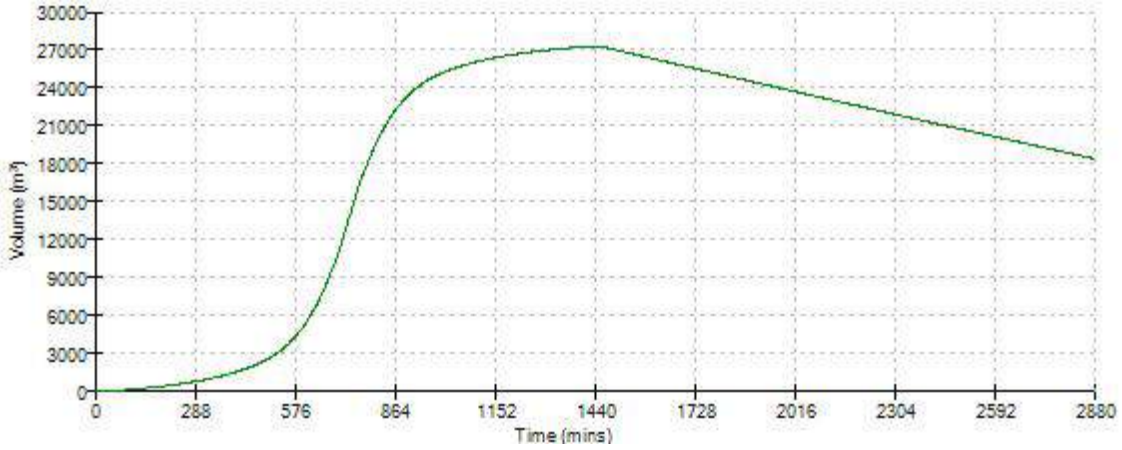


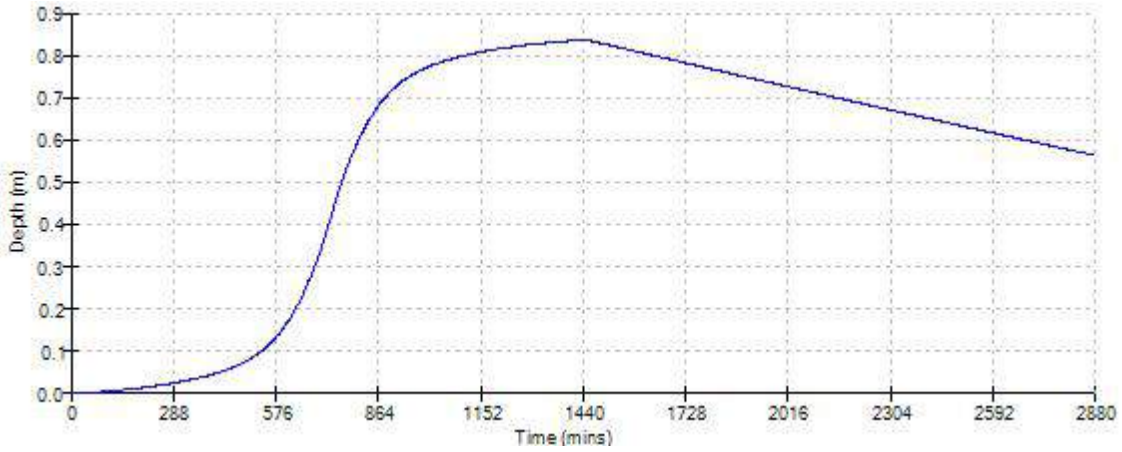




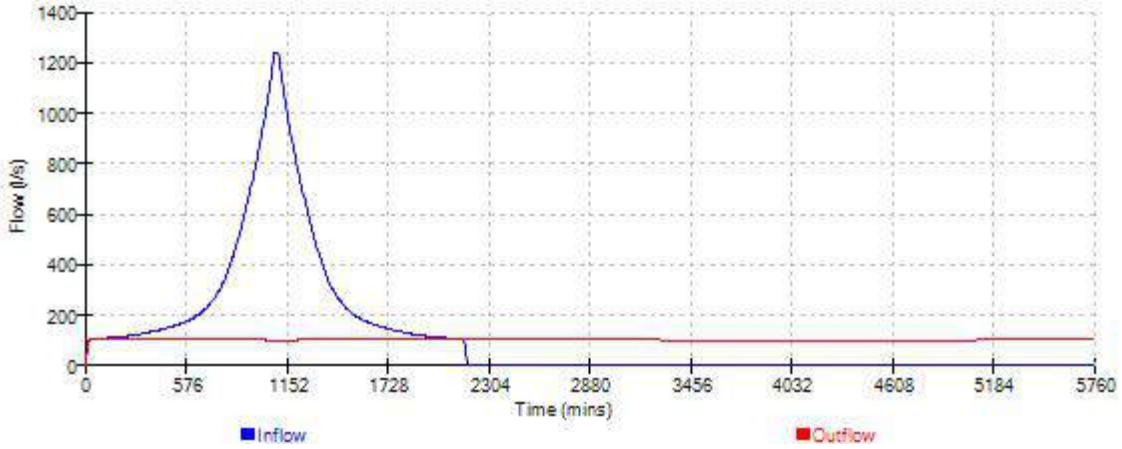
Event: 1440 min Summer

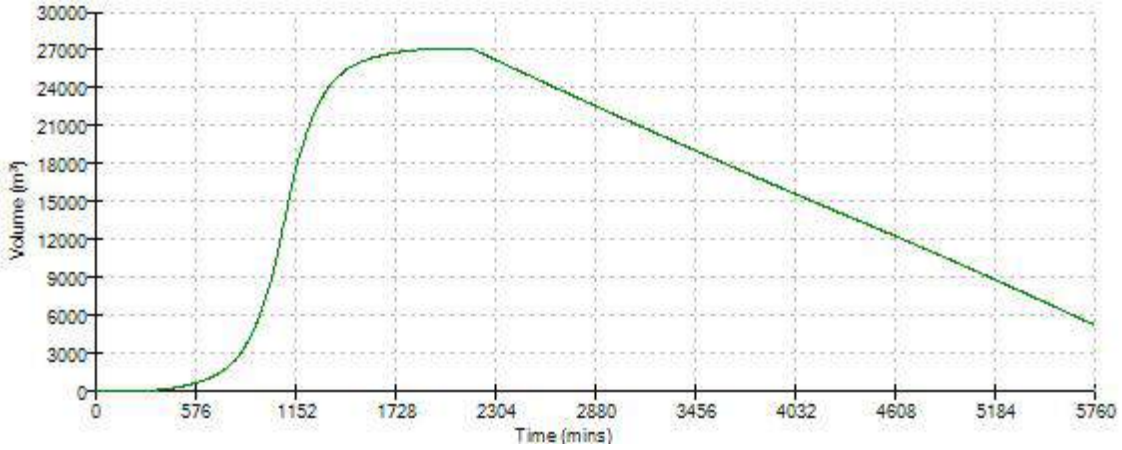


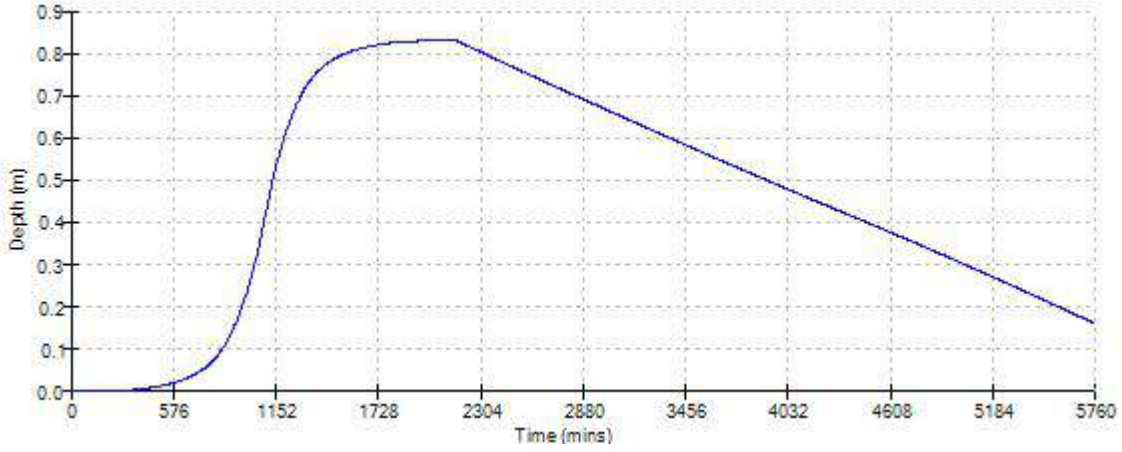




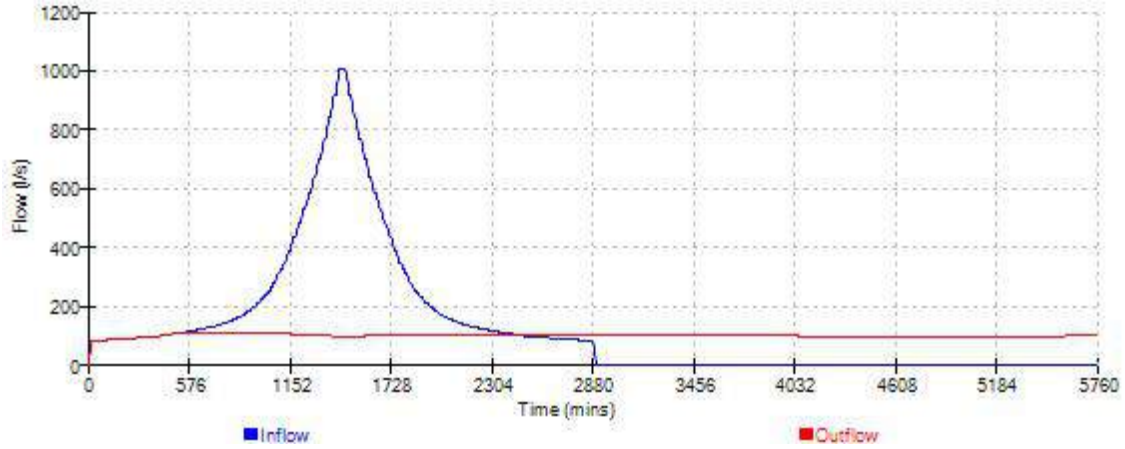
Event: 2160 min Summer

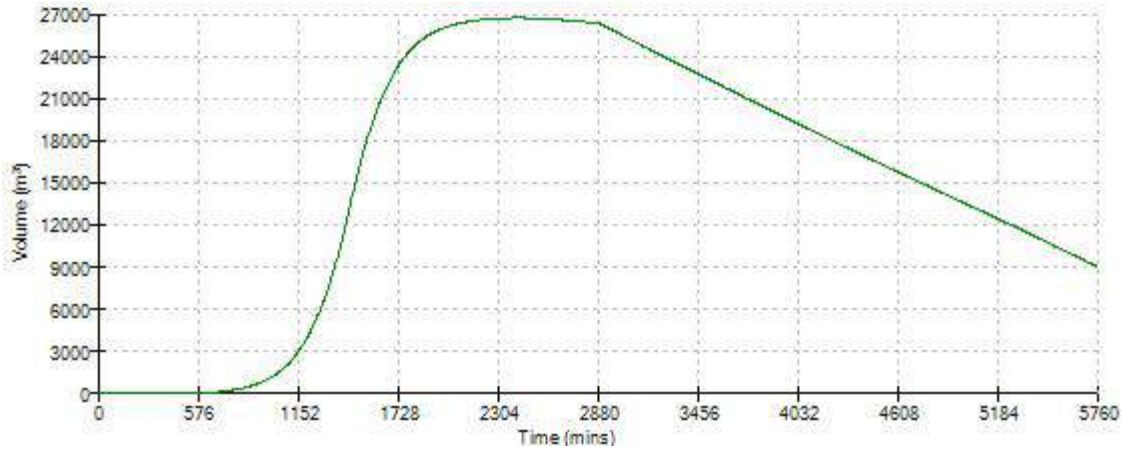


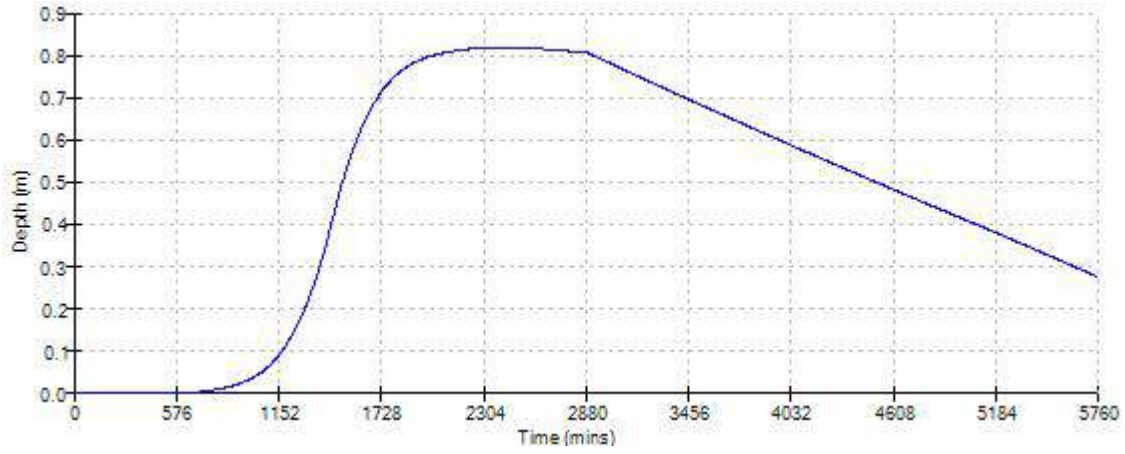




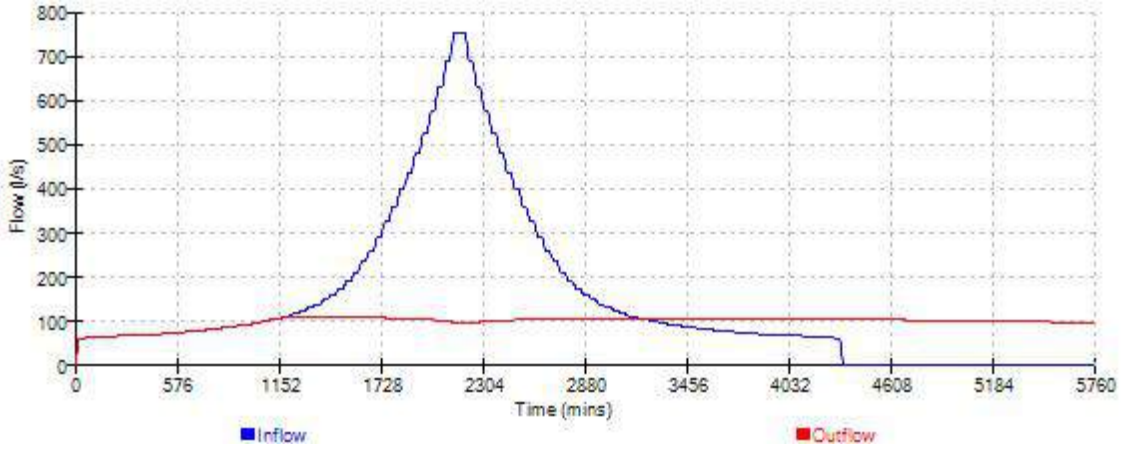
Event: 2880 min Summer

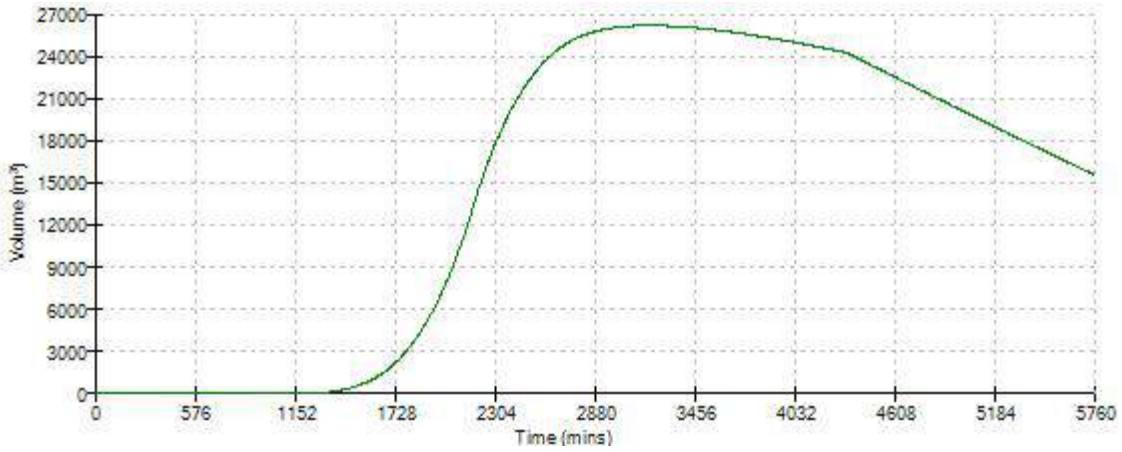


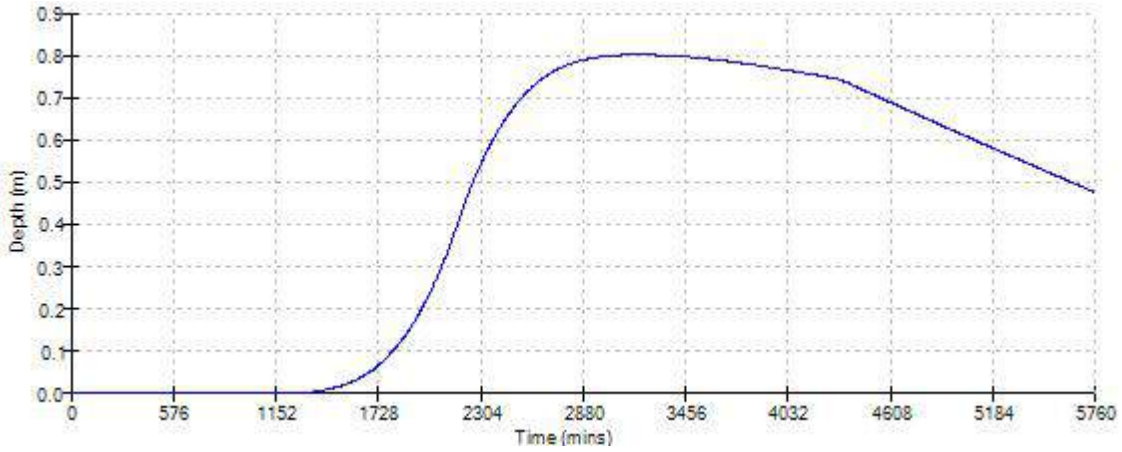




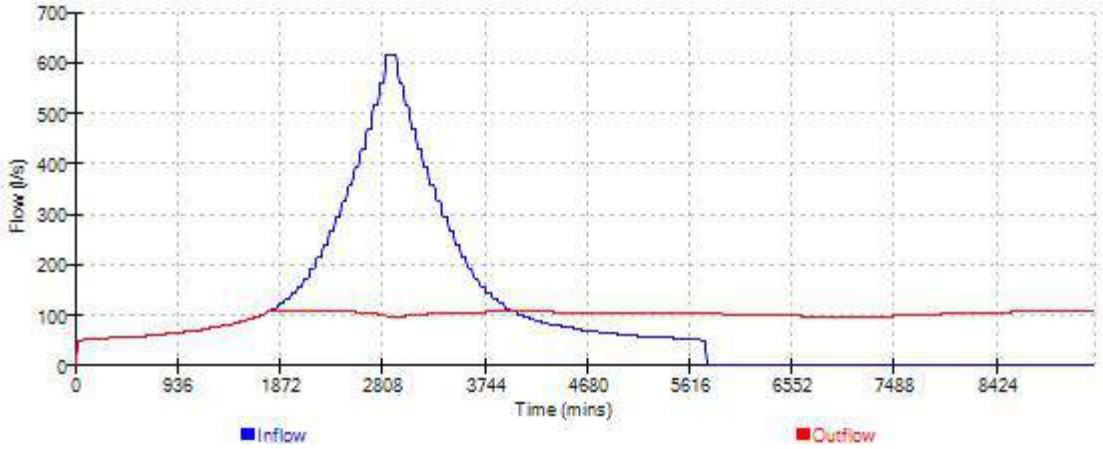
Event: 4320 min Summer

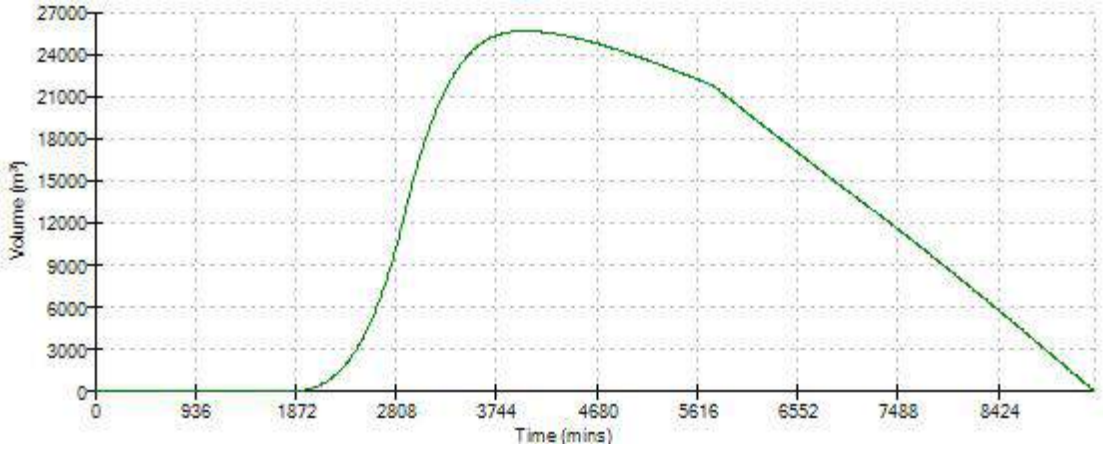


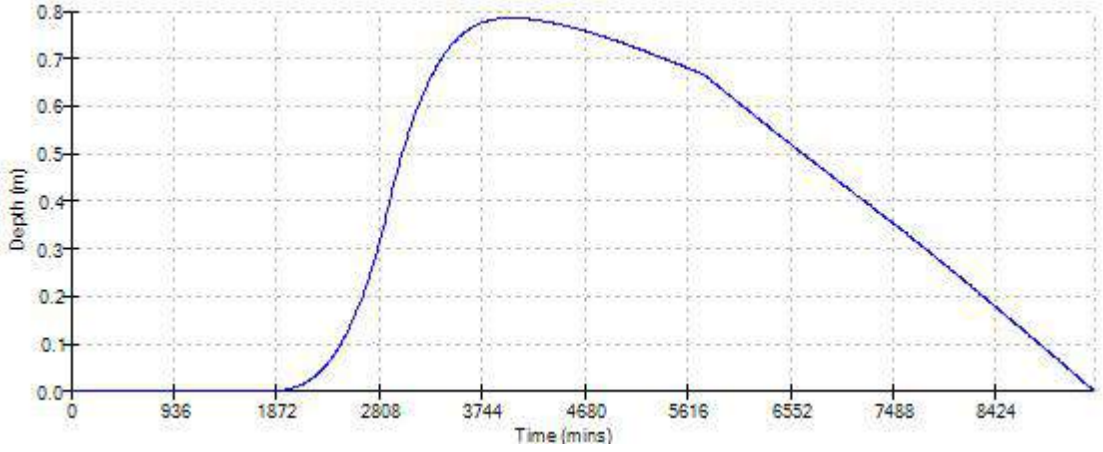




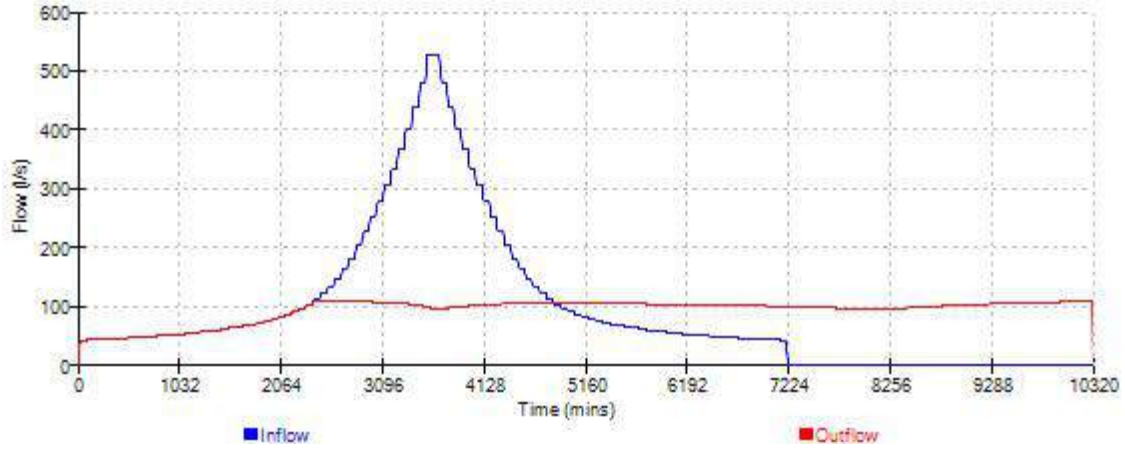
Event: 5760 min Summer

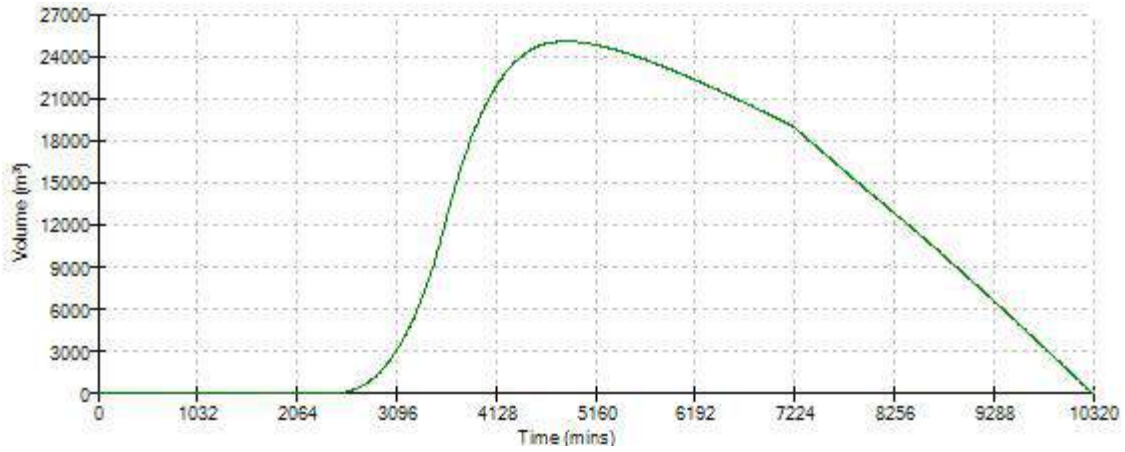


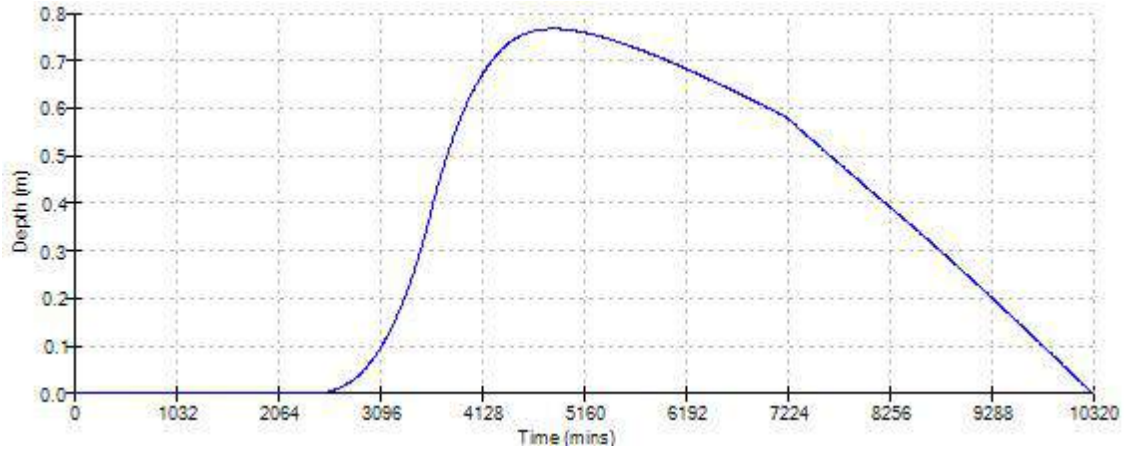




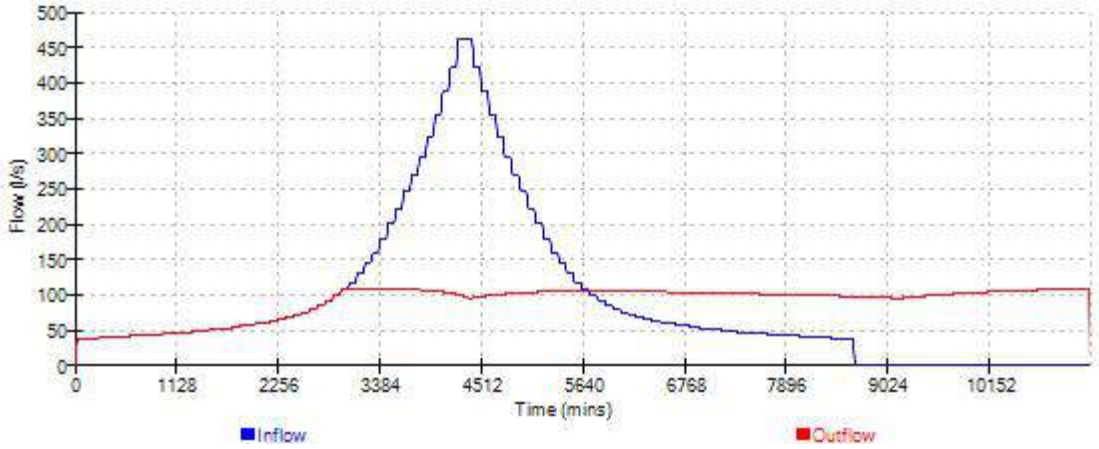
Event: 7200 min Summer

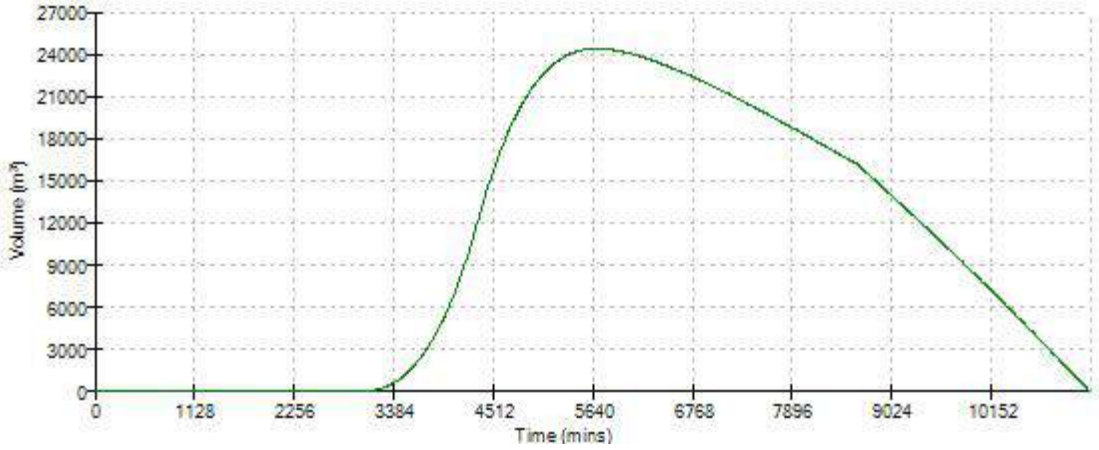


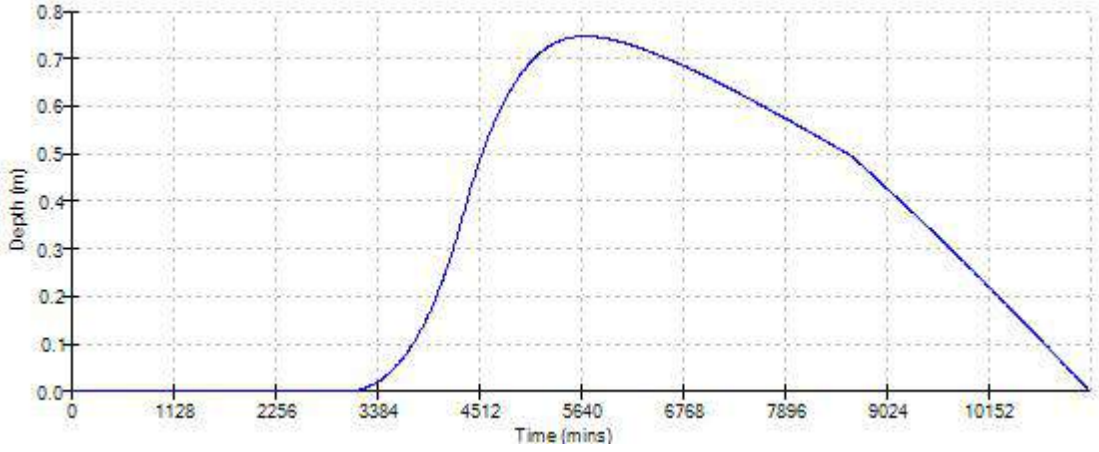




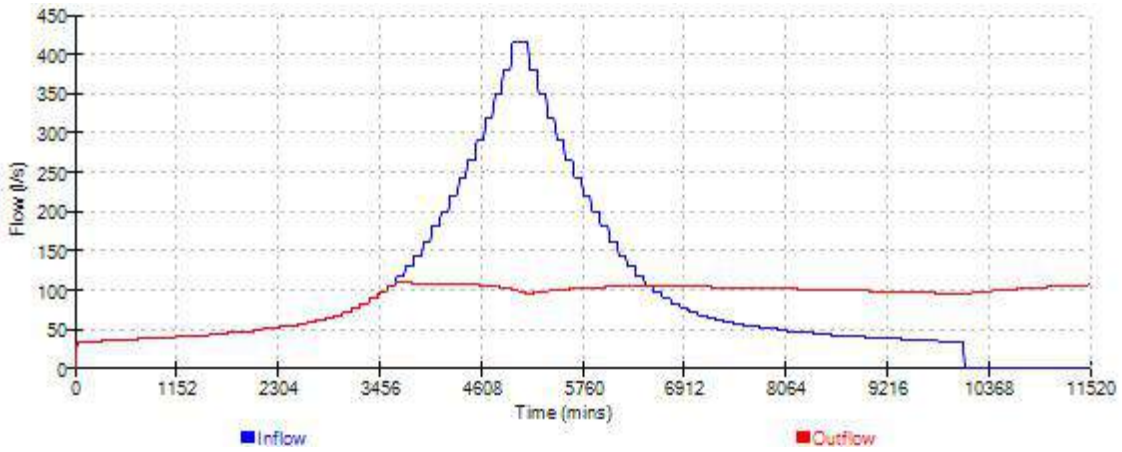
Event: 8640 min Summer

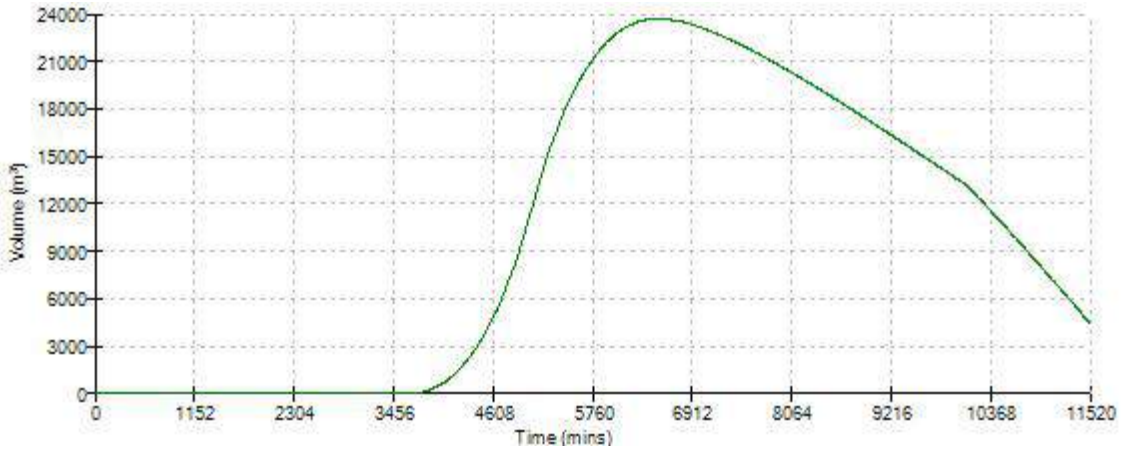


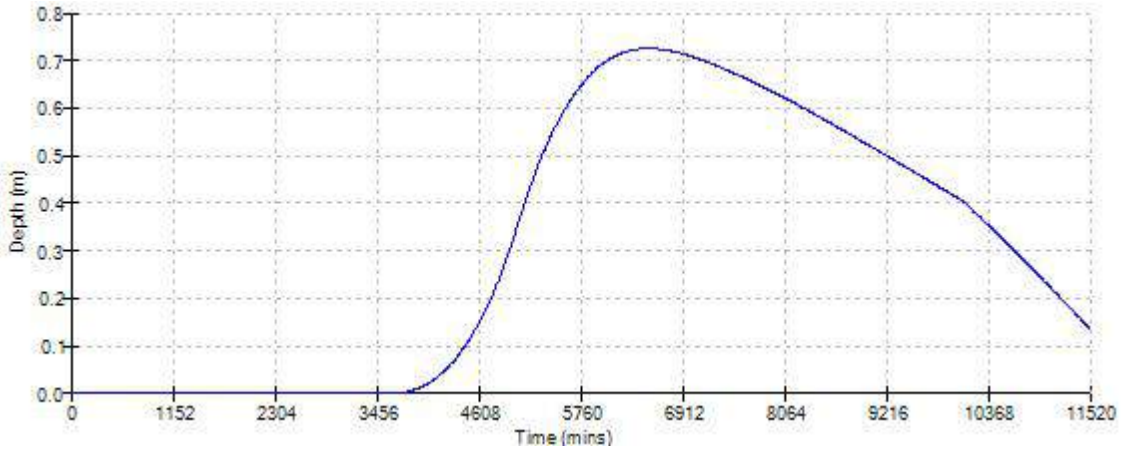




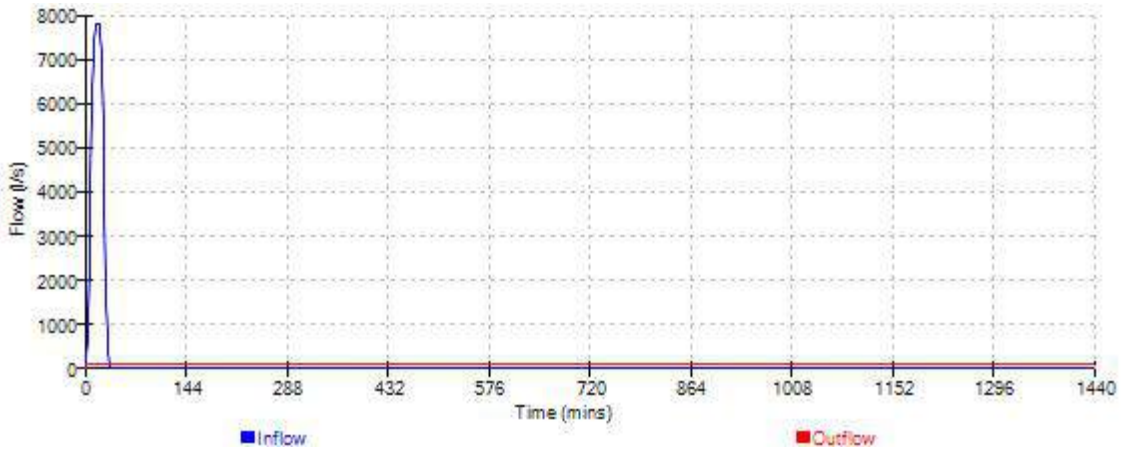
Event: 10080 min Summer

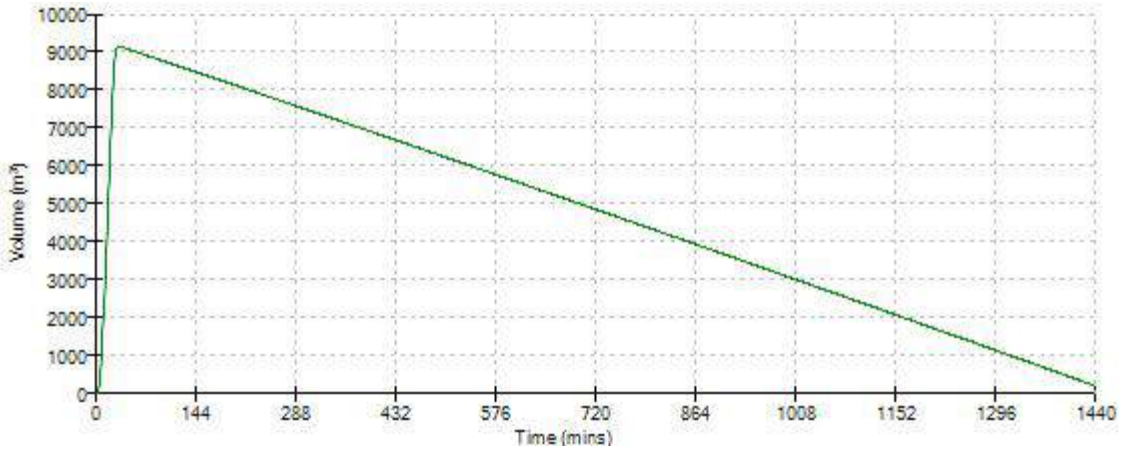


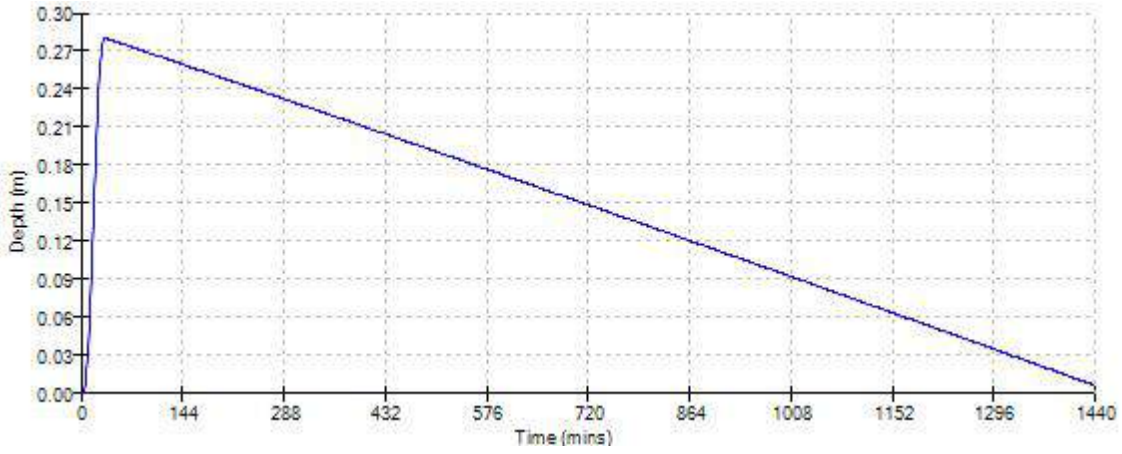




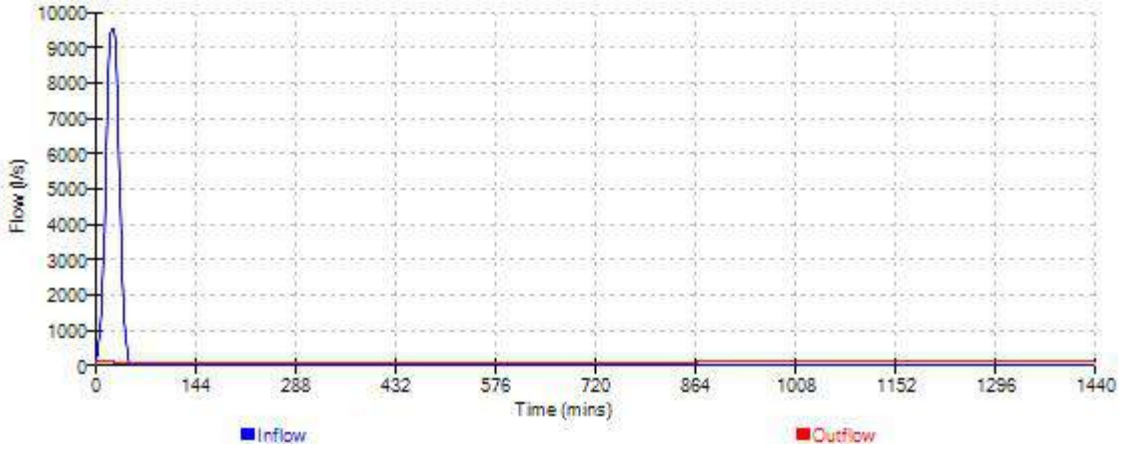
Event: 15 min Winter

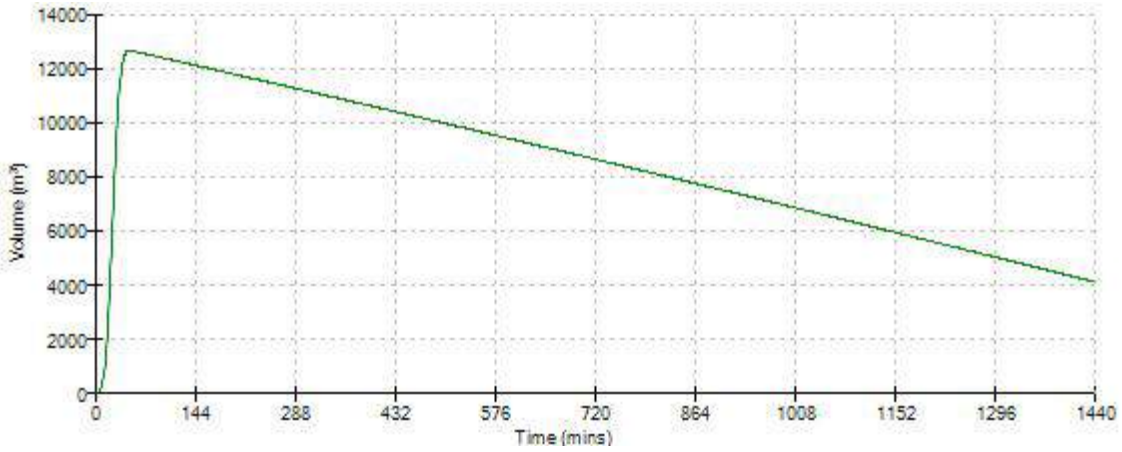


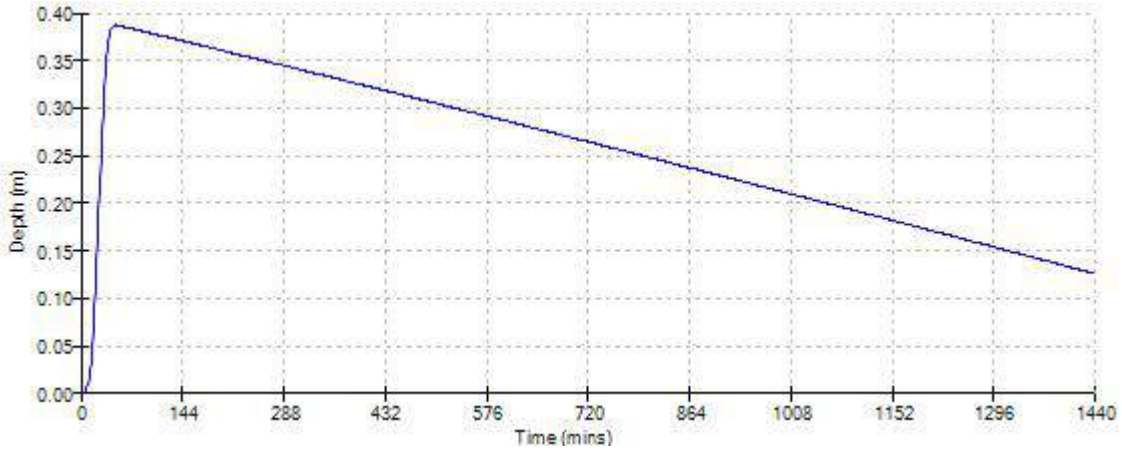




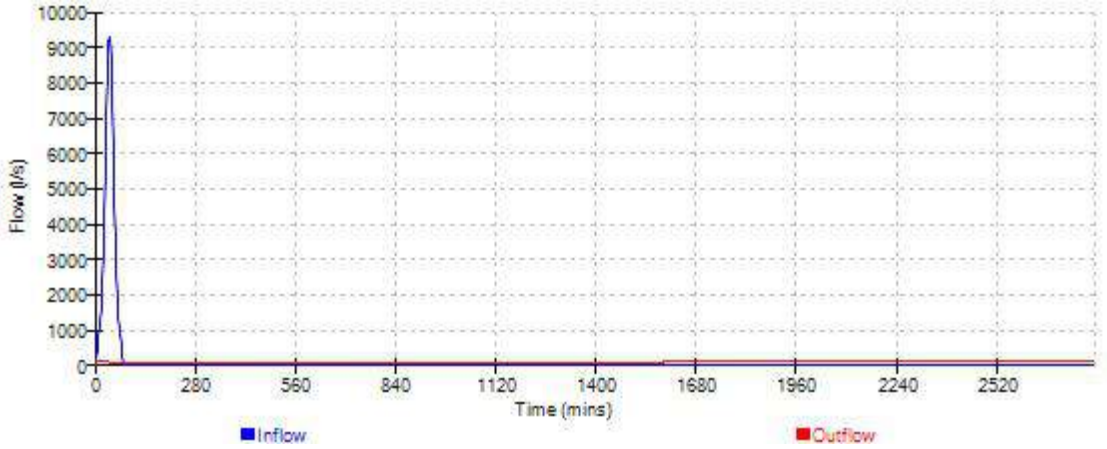
Event: 30 min Winter

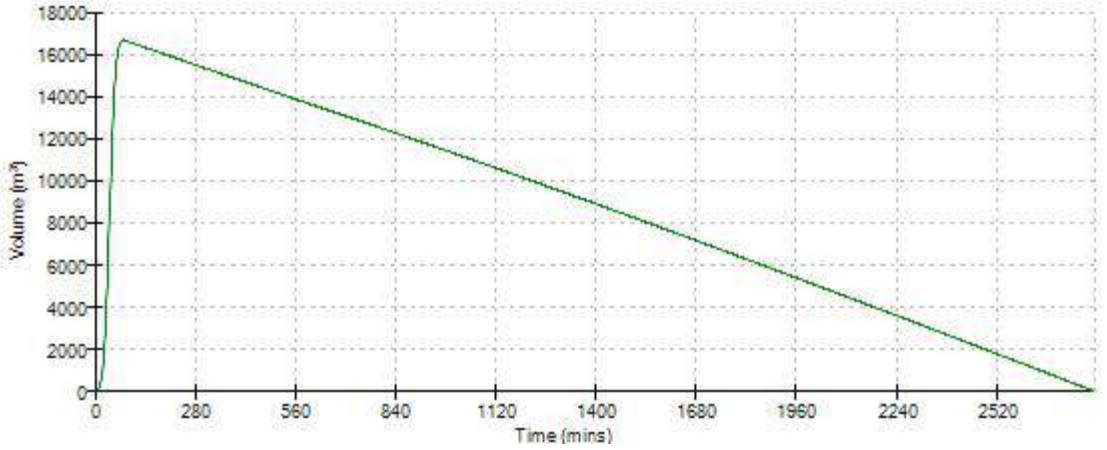


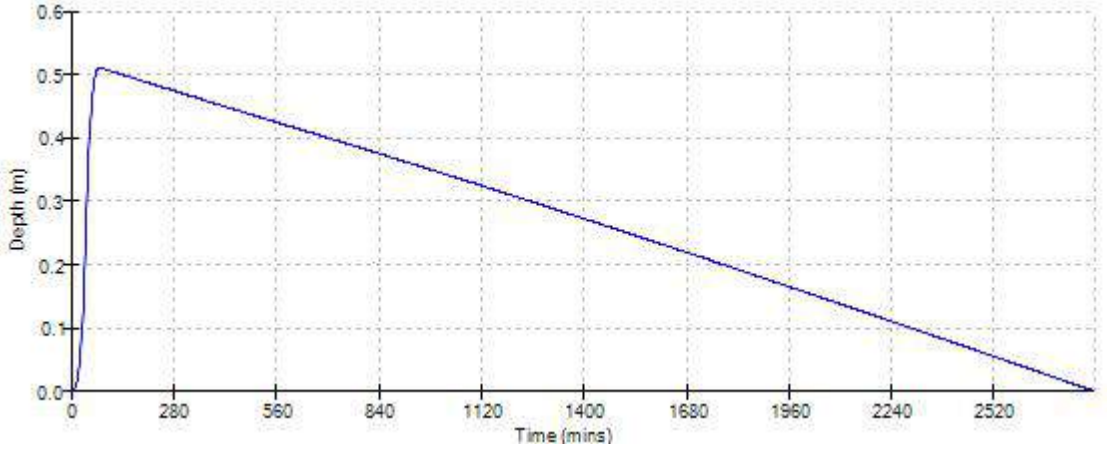




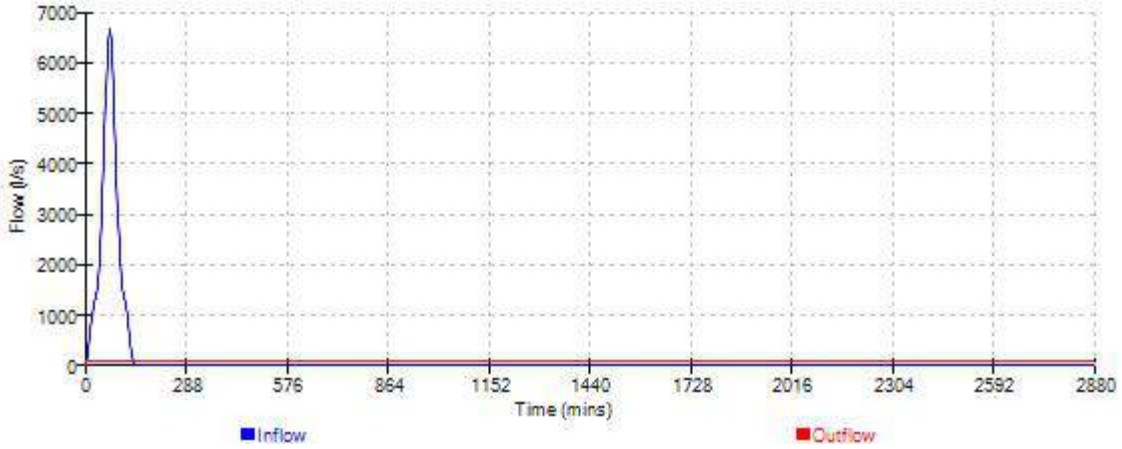
Event: 60 min Winter

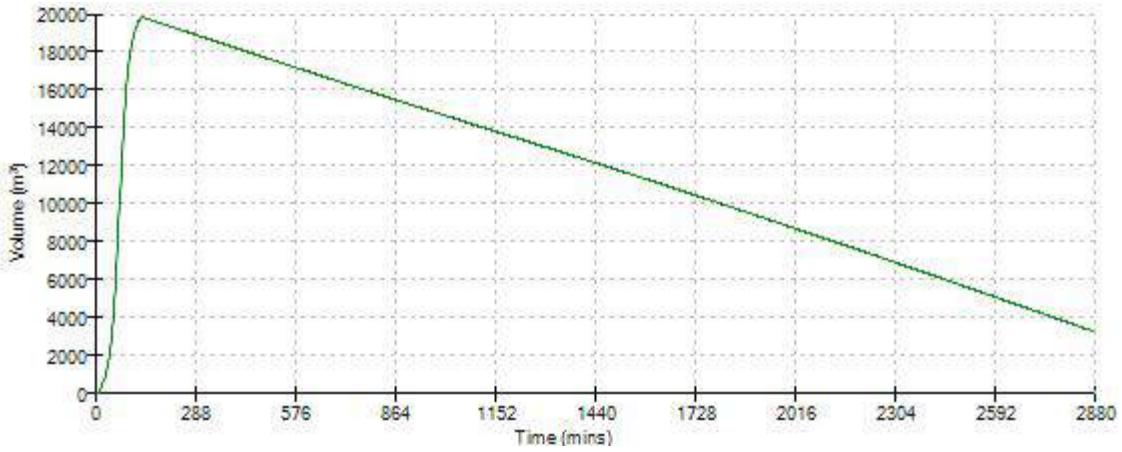


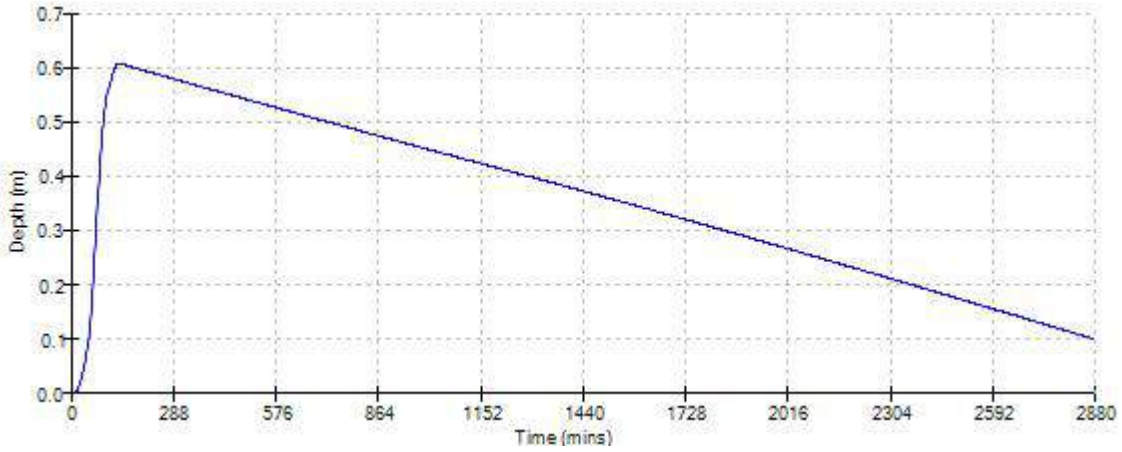




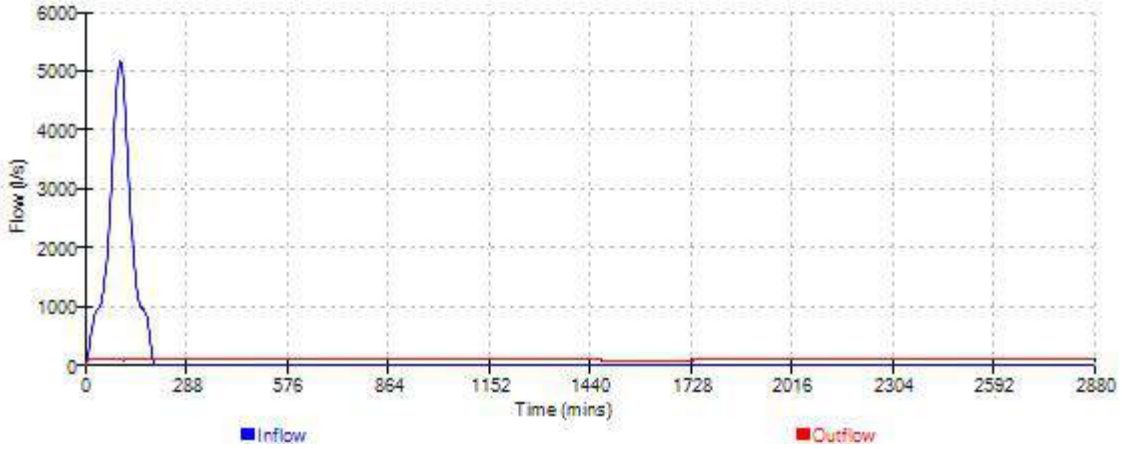
Event: 120 min Winter

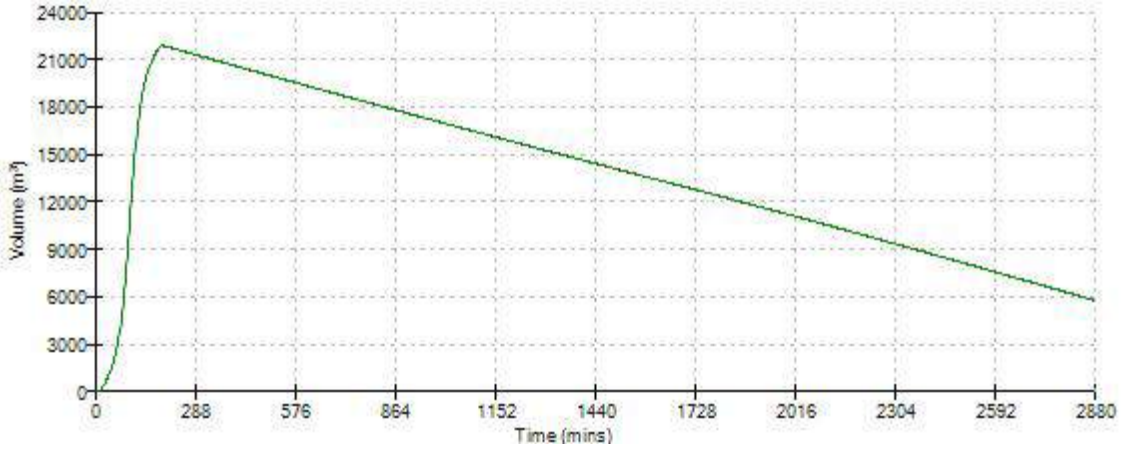


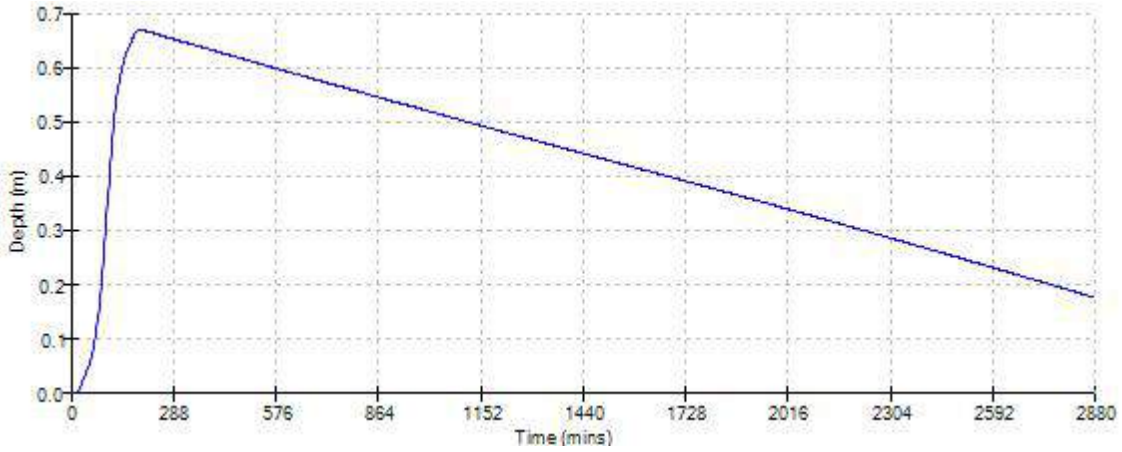




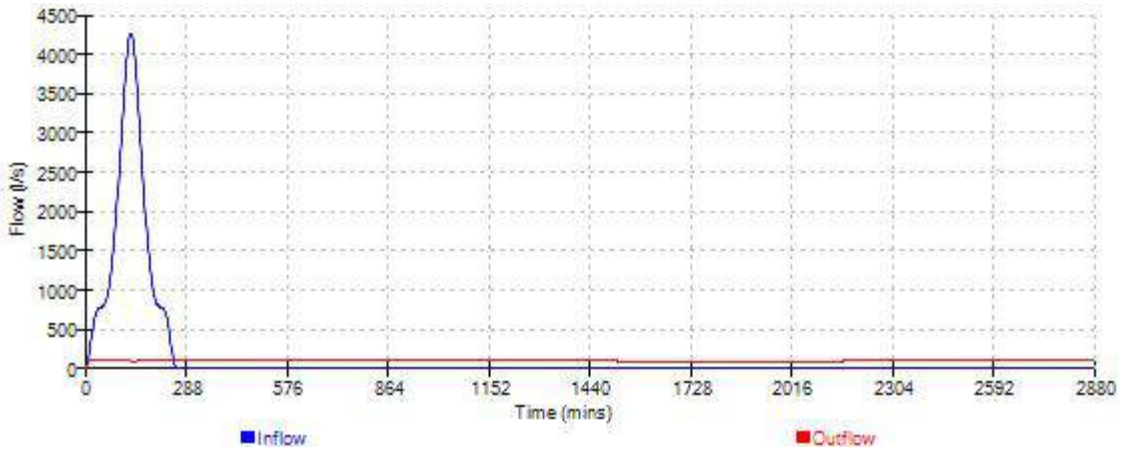
Event: 180 min Winter

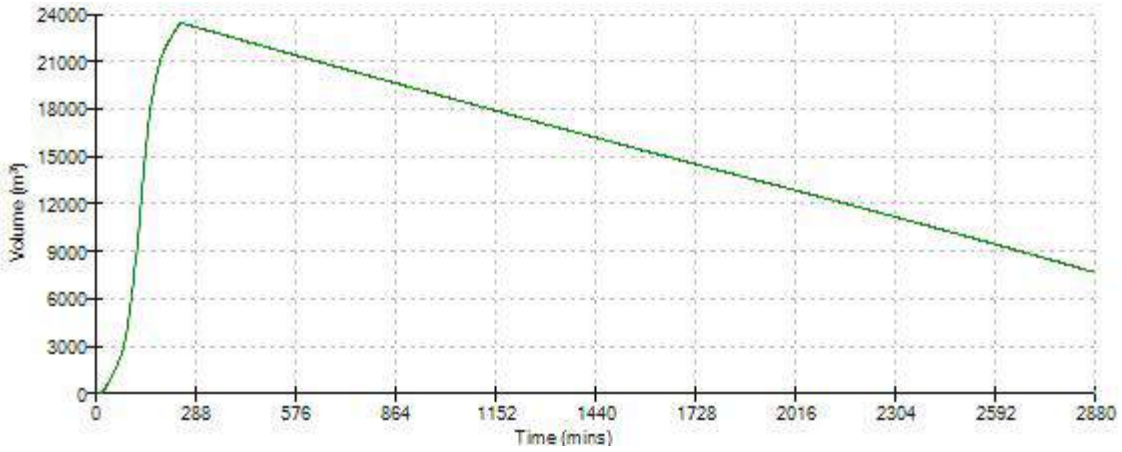


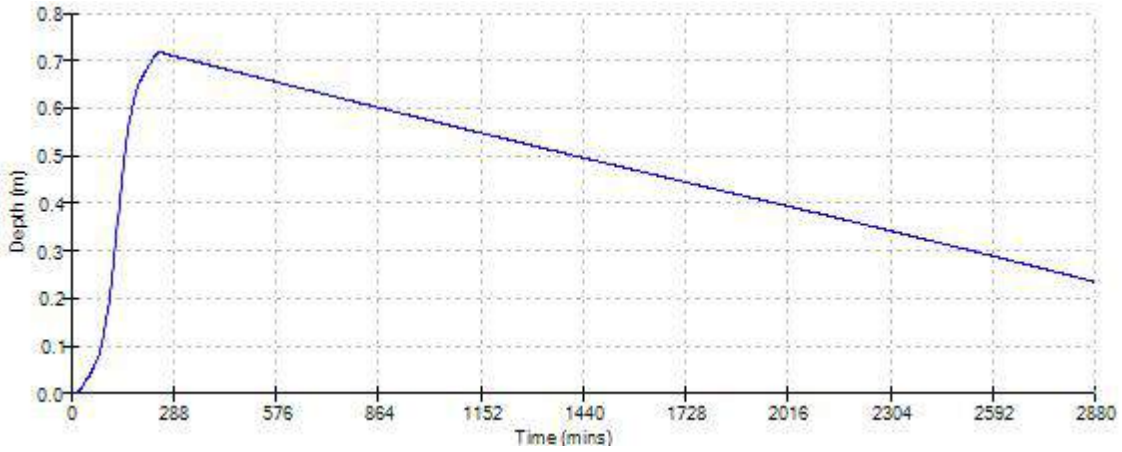




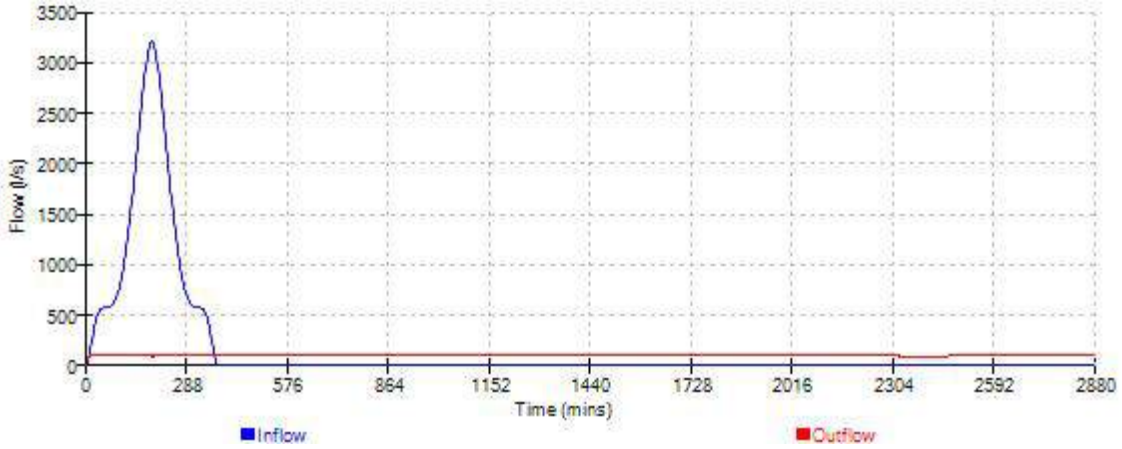
Event: 240 min Winter

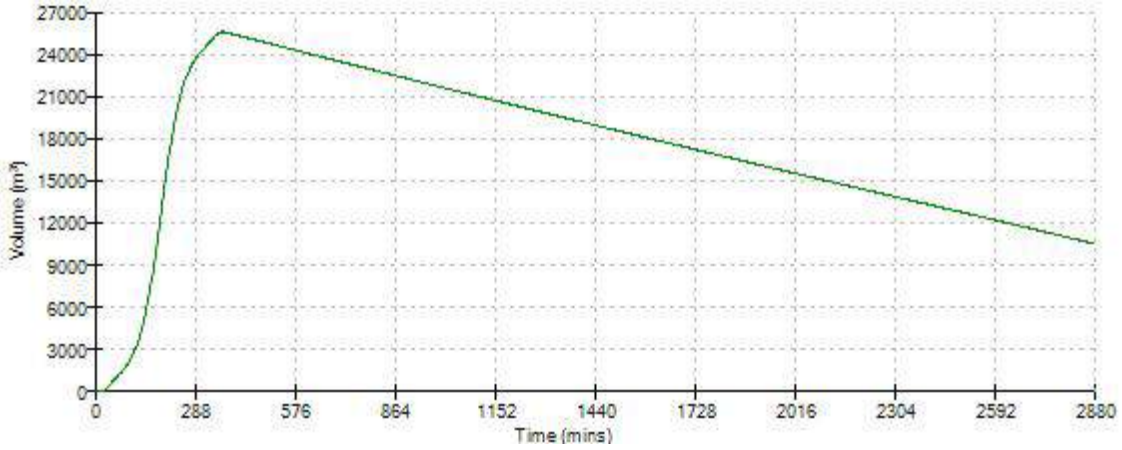


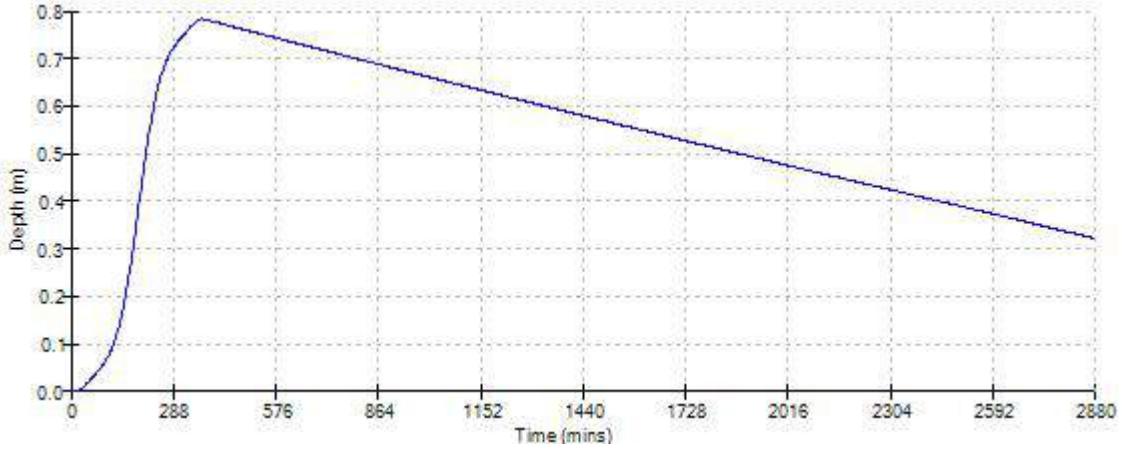




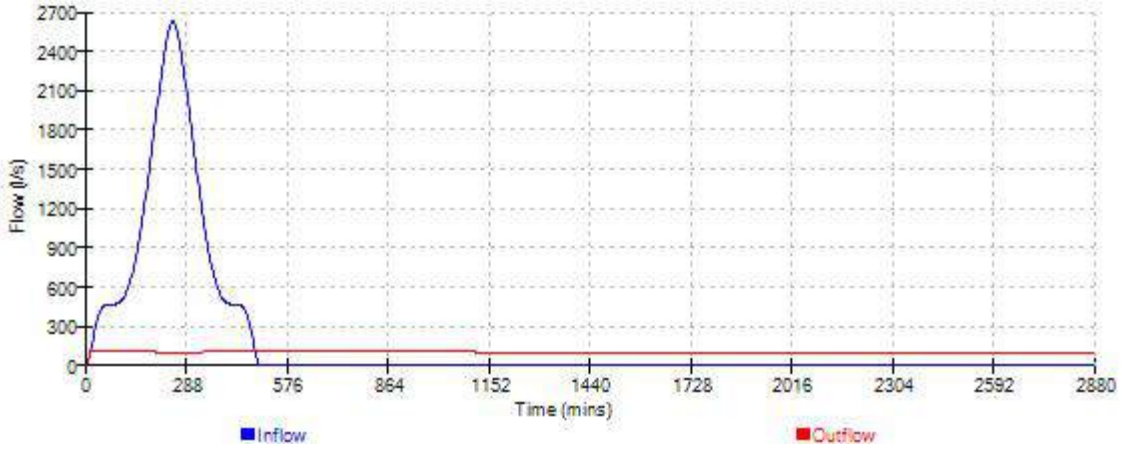
Event: 360 min Winter

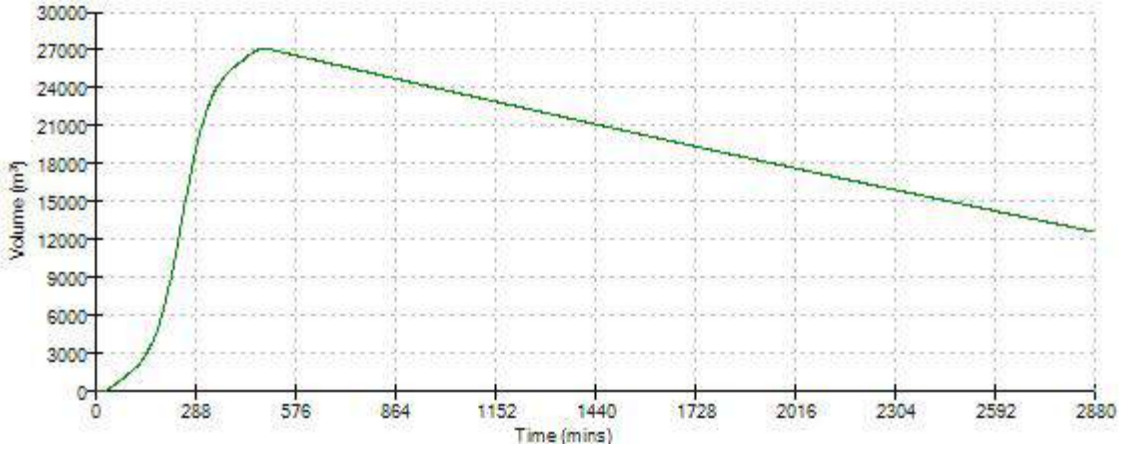


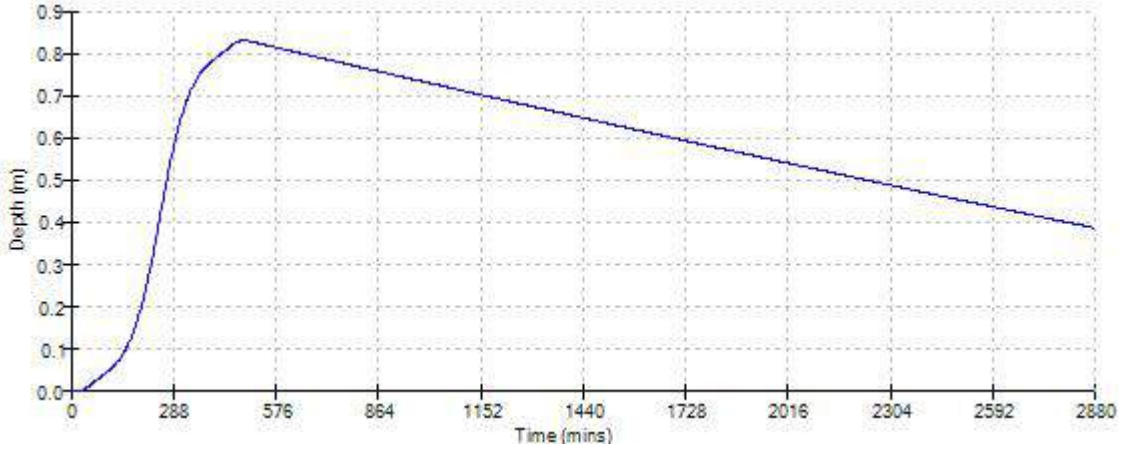




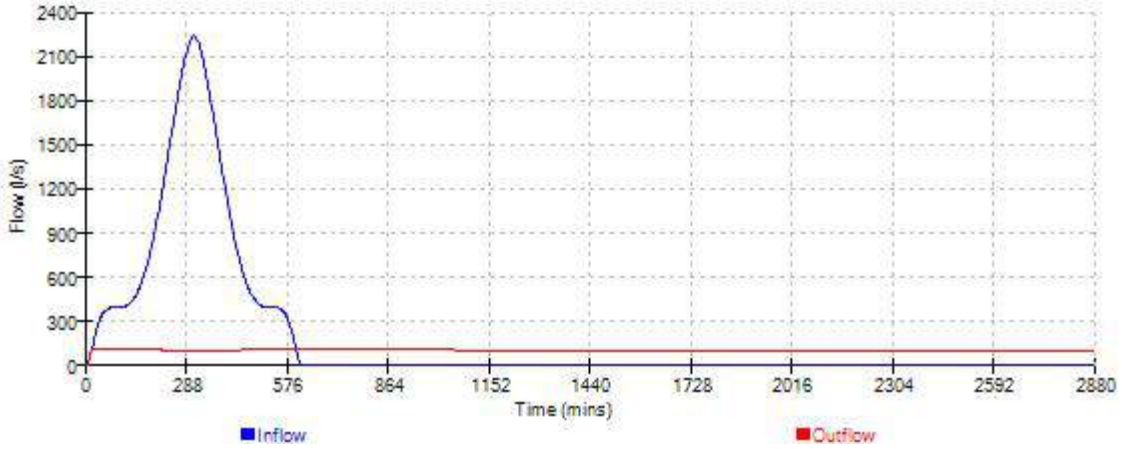
Event: 480 min Winter

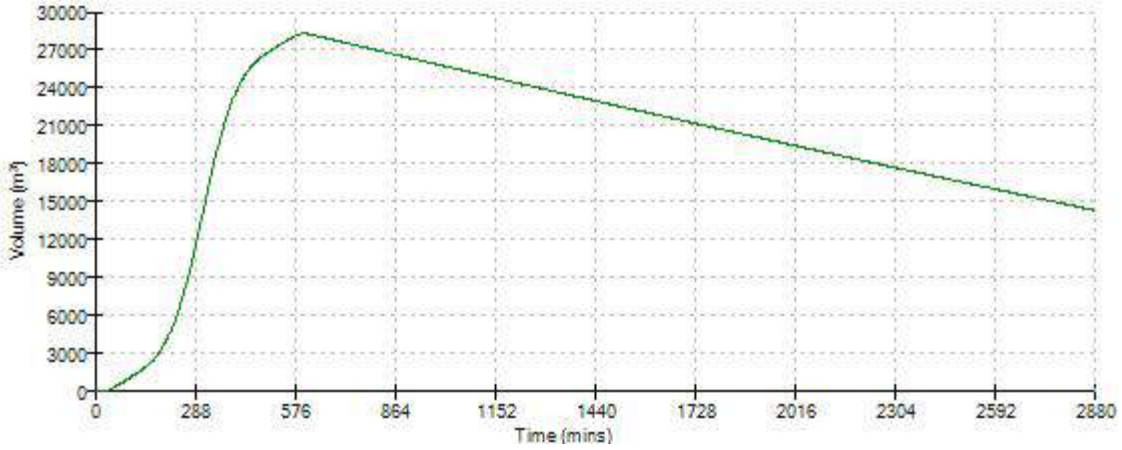


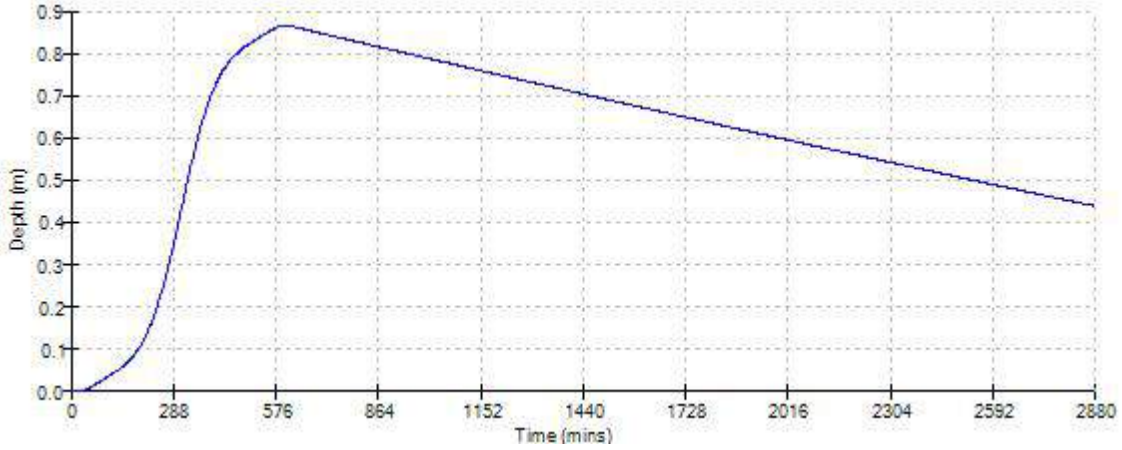




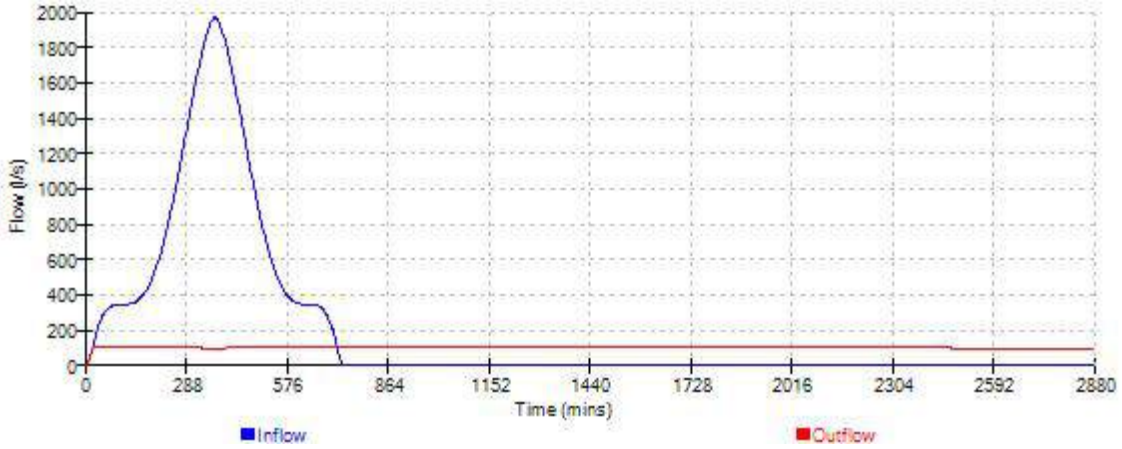
Event: 600 min Winter

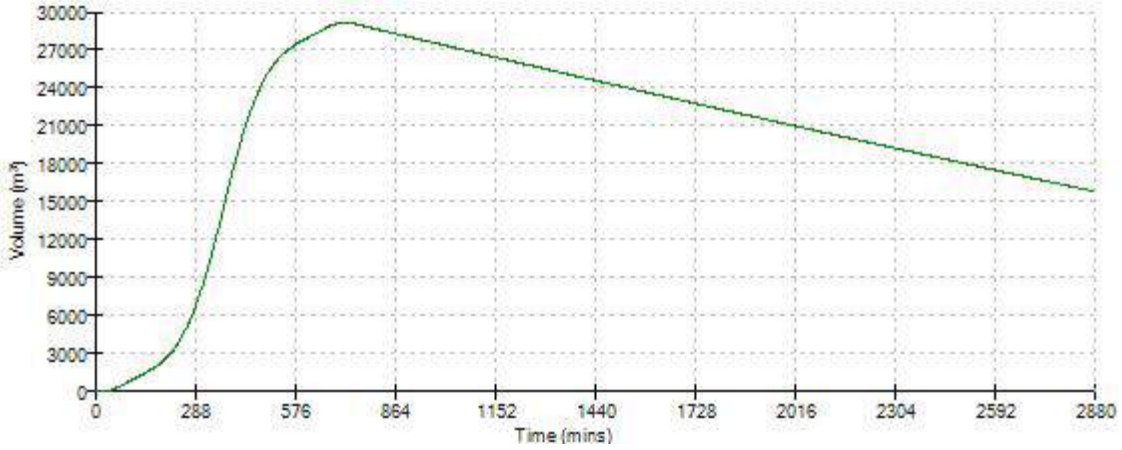


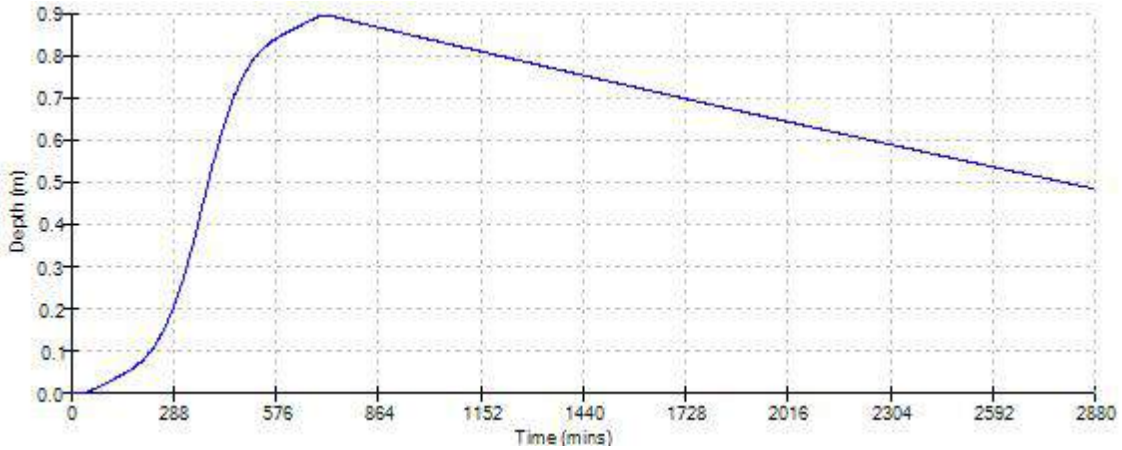




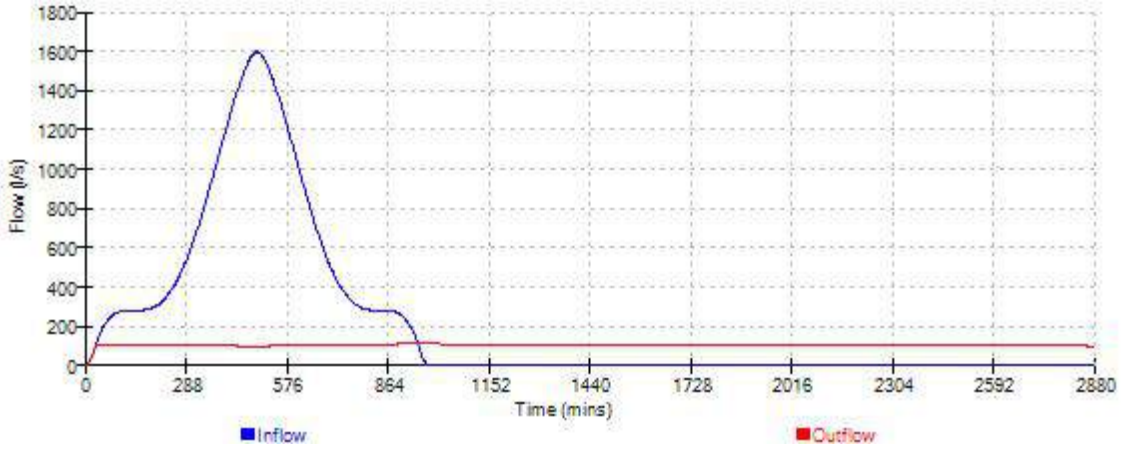
Event: 720 min Winter

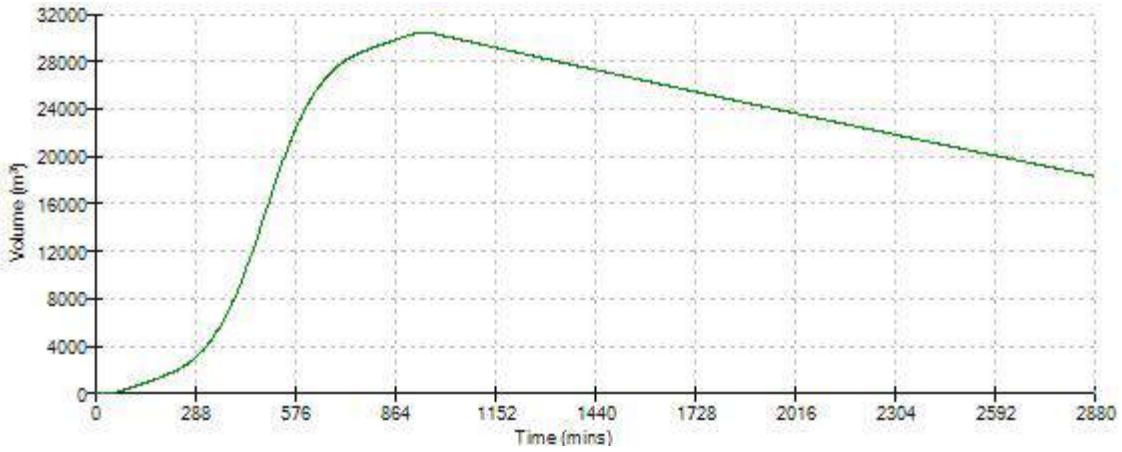


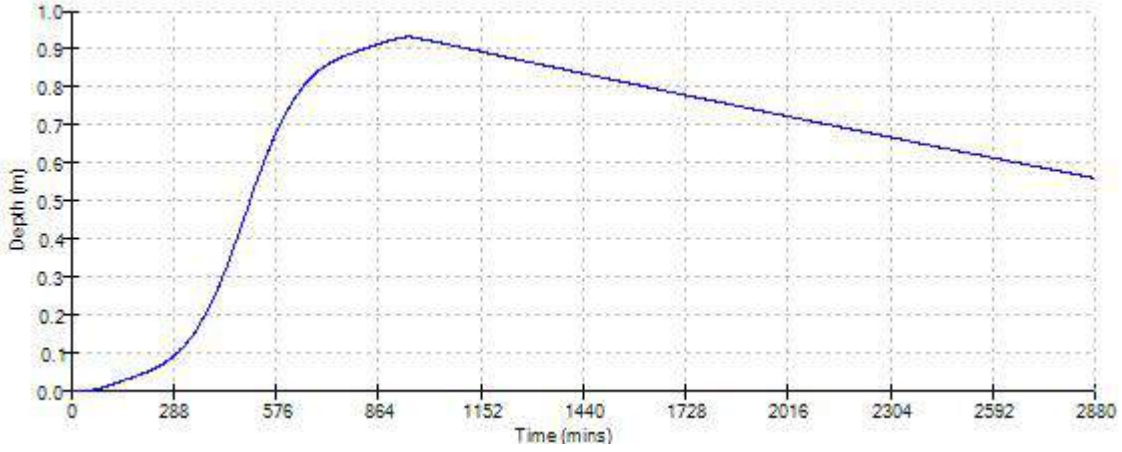




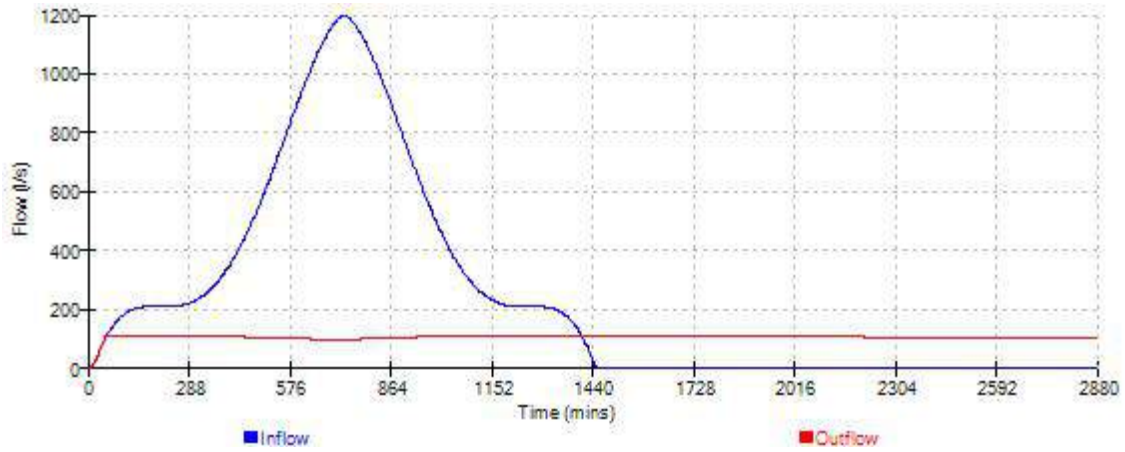
Event: 960 min Winter

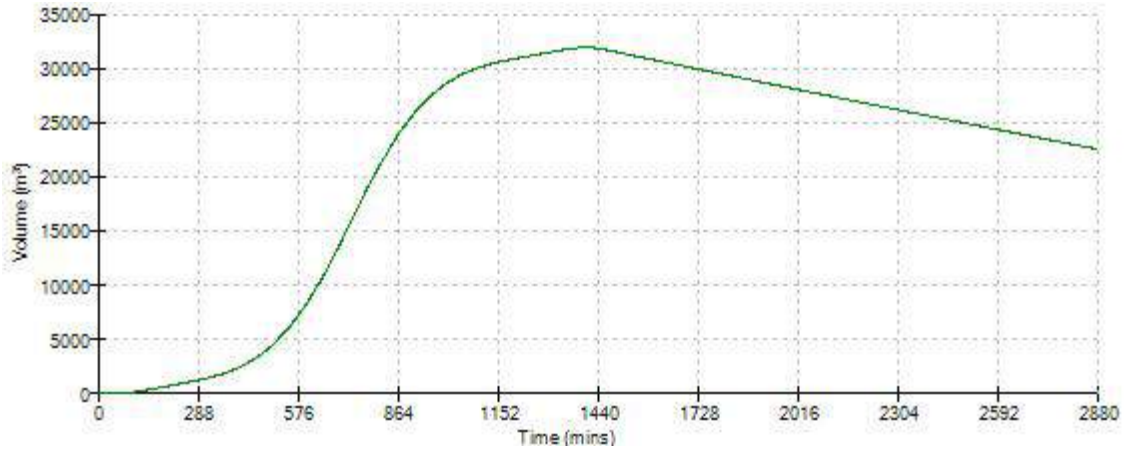


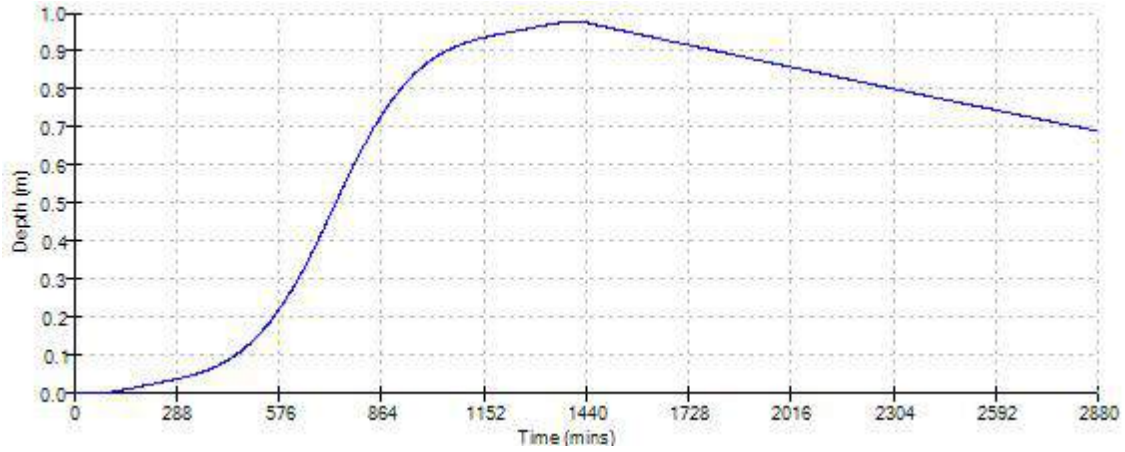




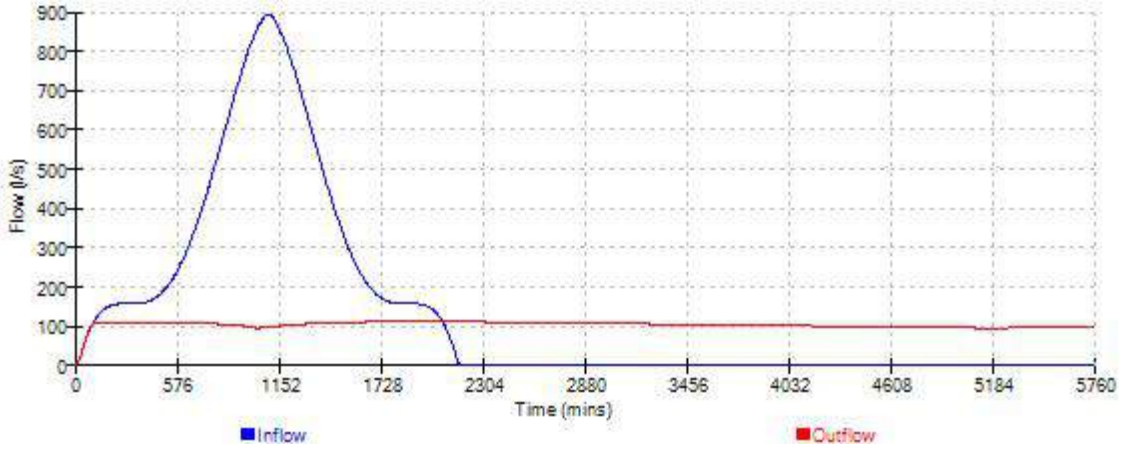
Event: 1440 min Winter

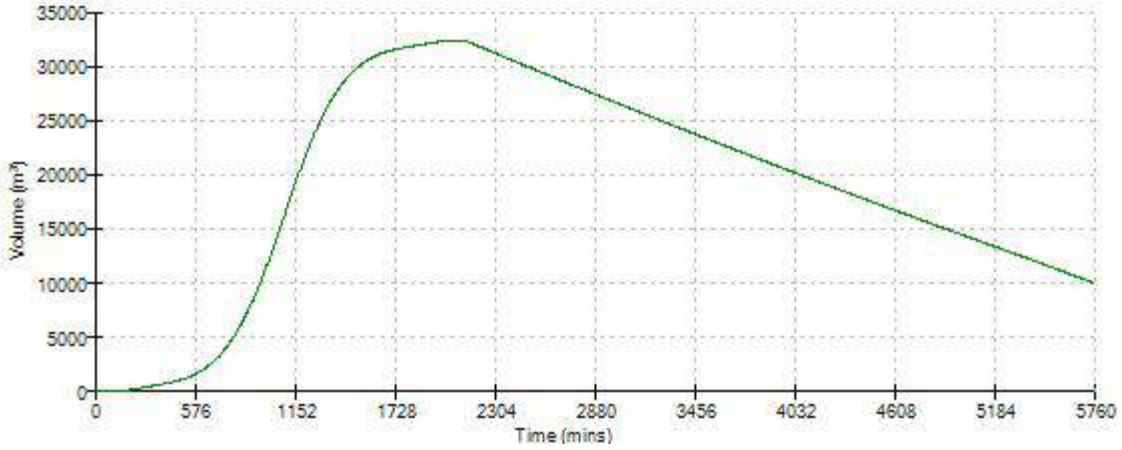


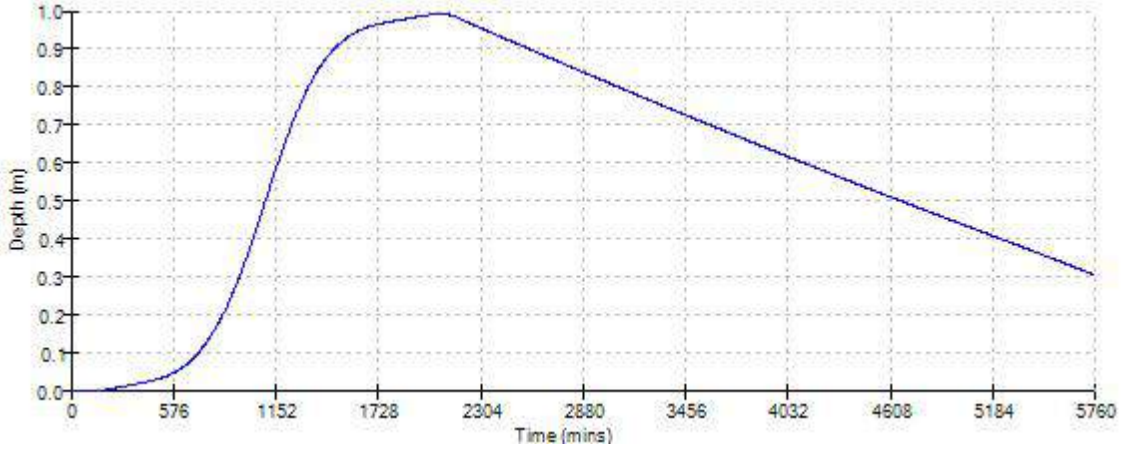




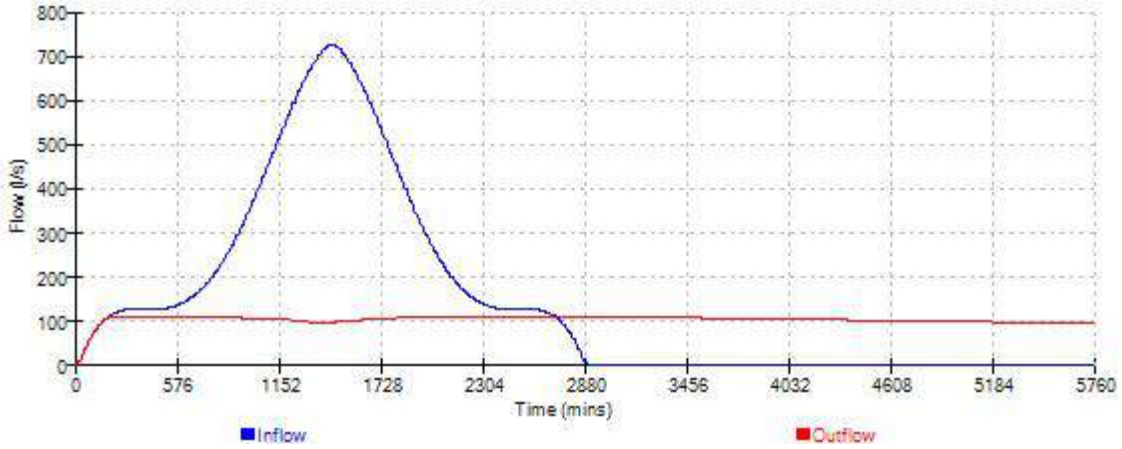
Event: 2160 min Winter

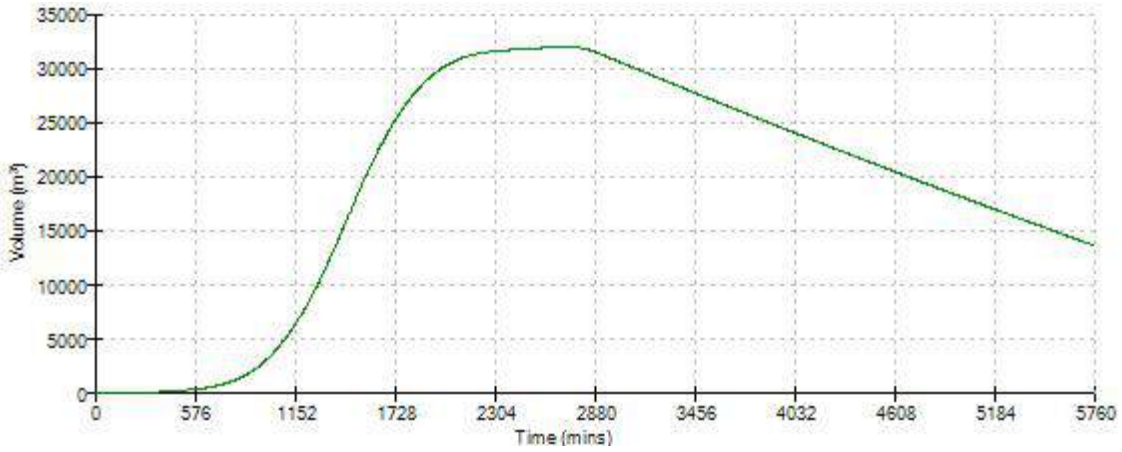


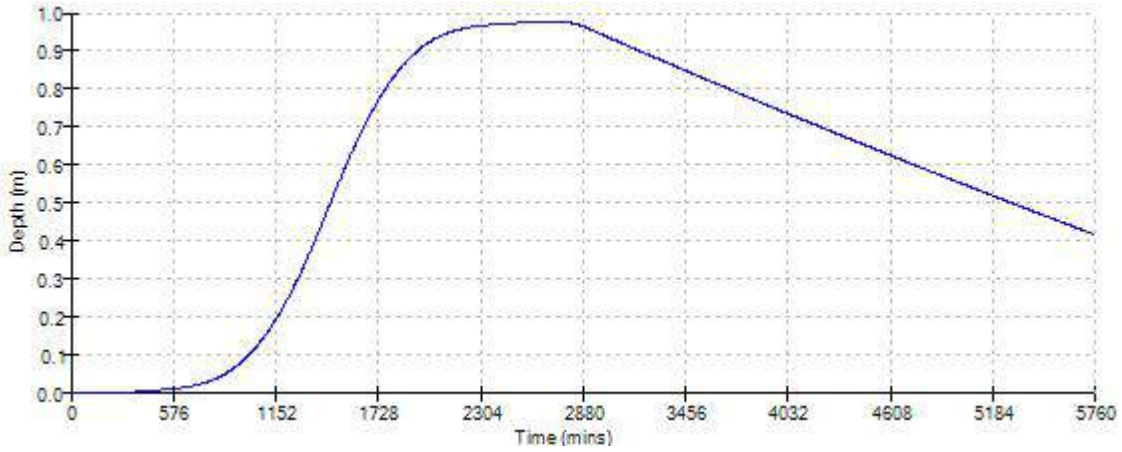




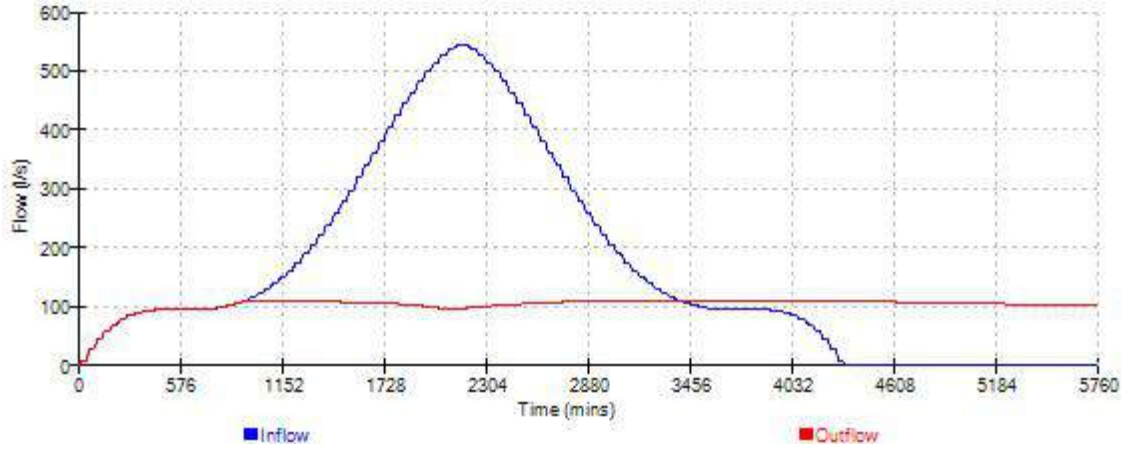
Event: 2880 min Winter

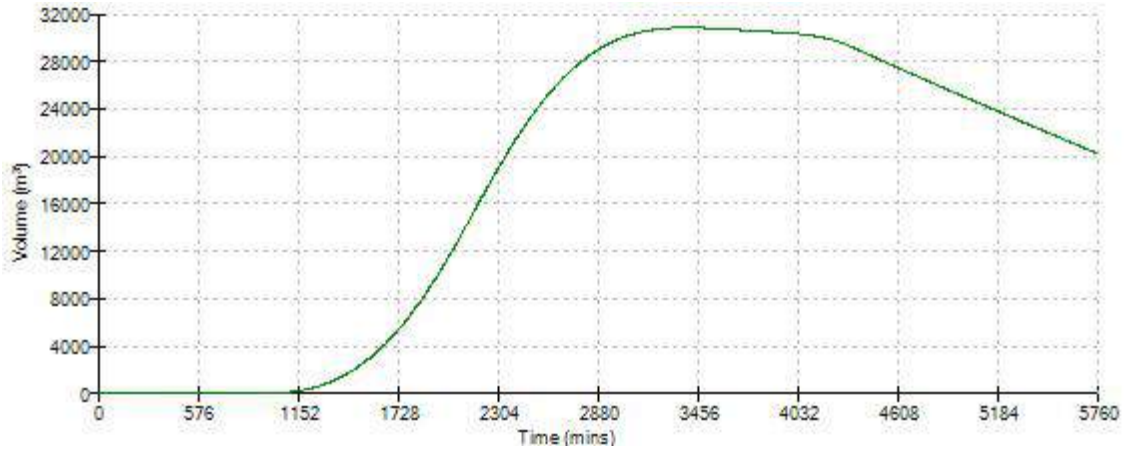


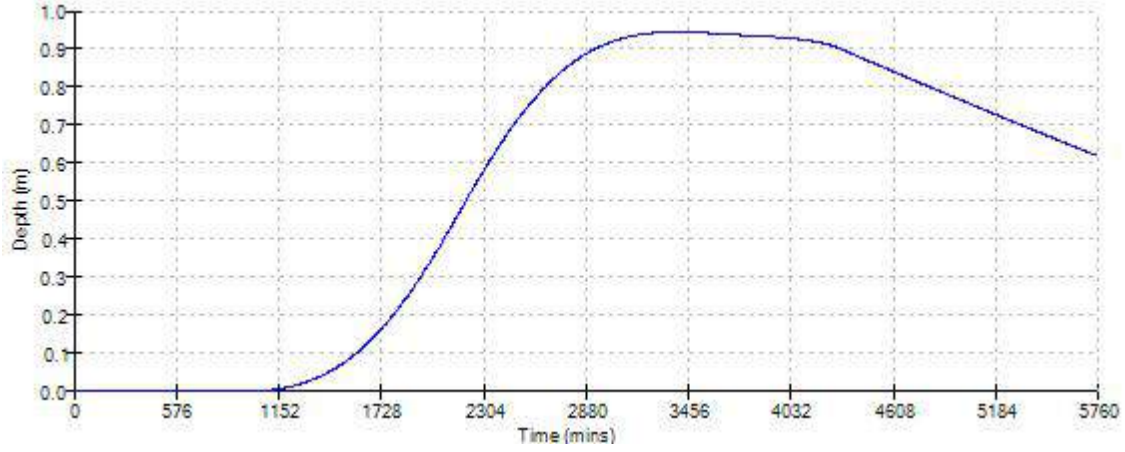




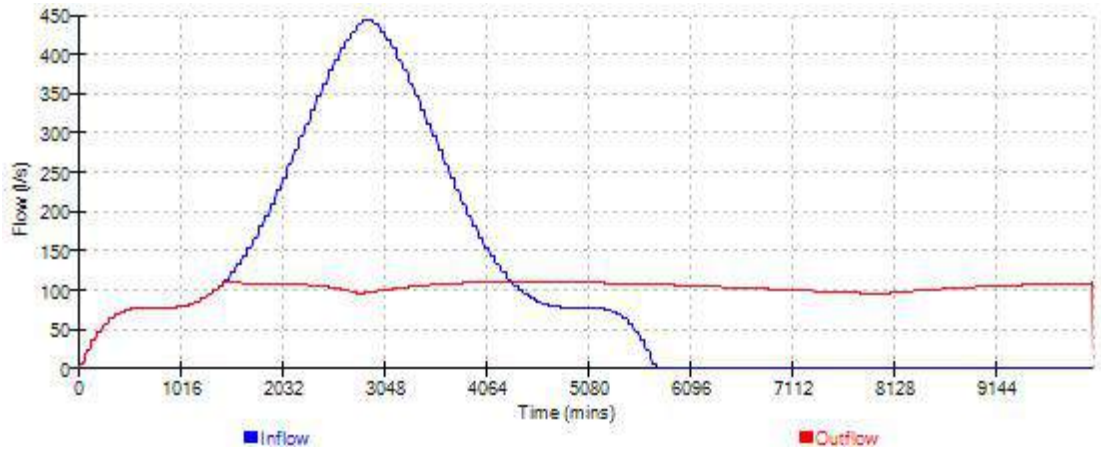
Event: 4320 min Winter

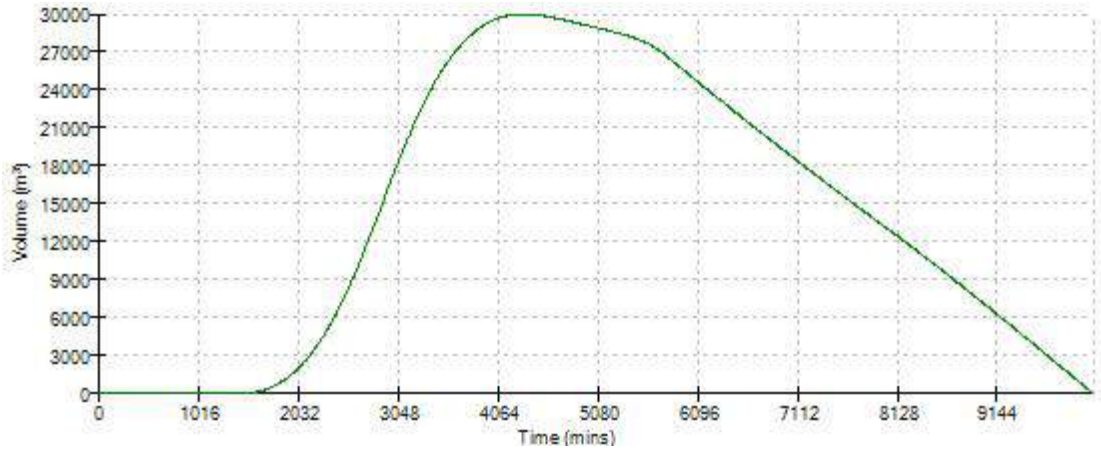


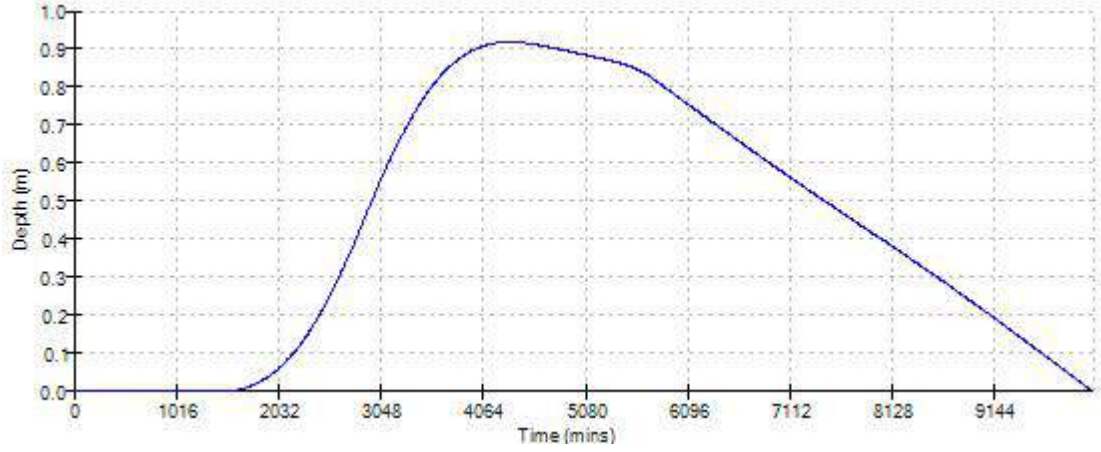




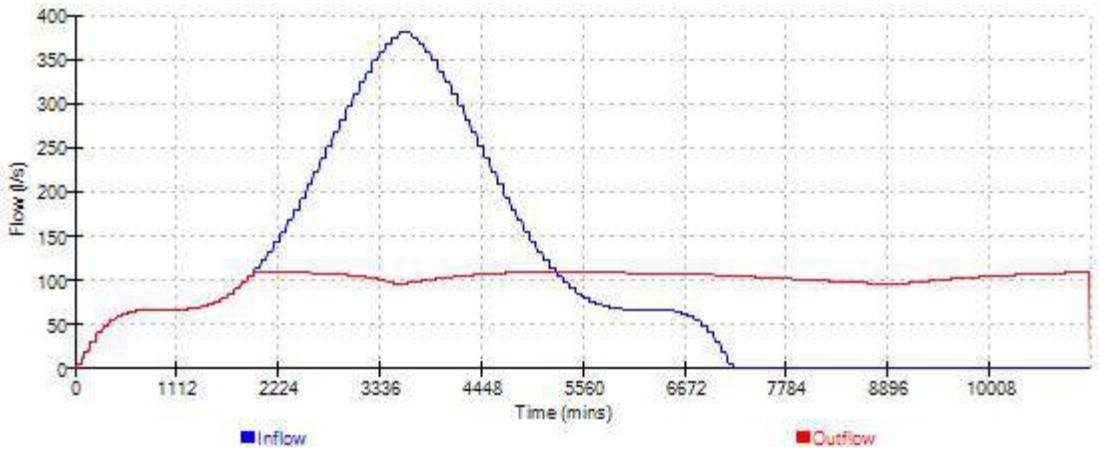
Event: 5760 min Winter

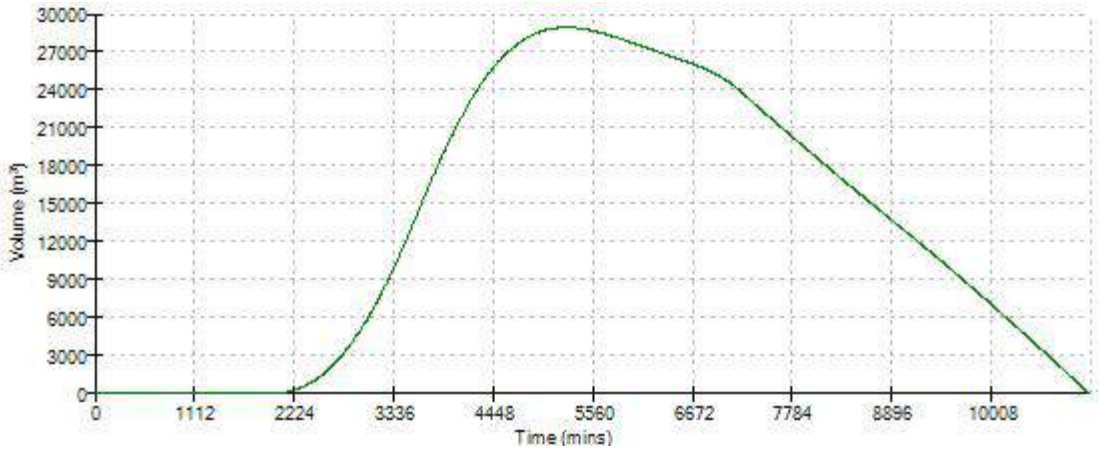


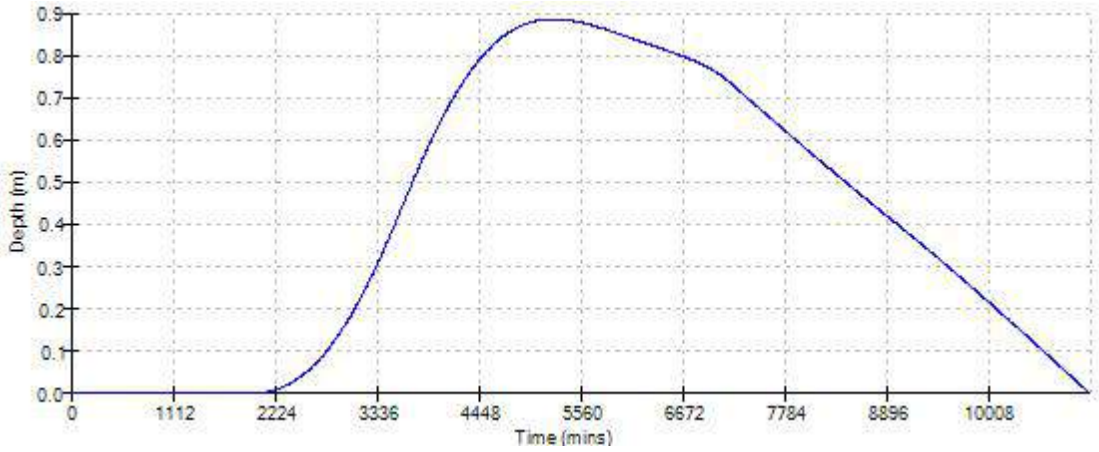




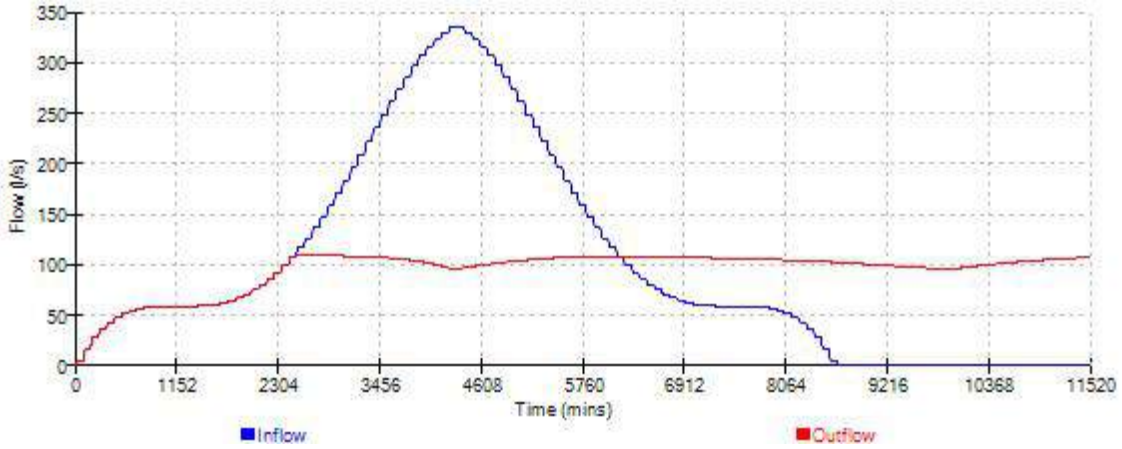
Event: 7200 min Winter

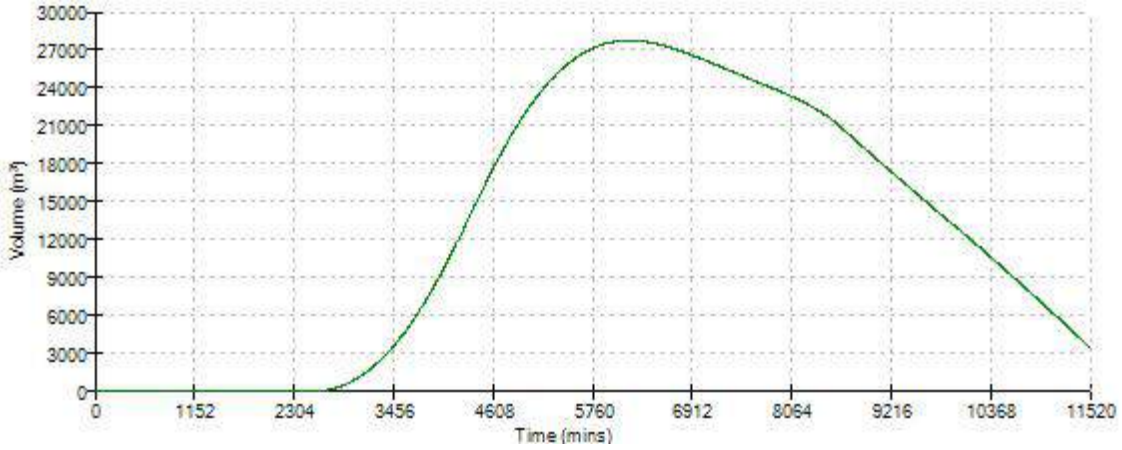


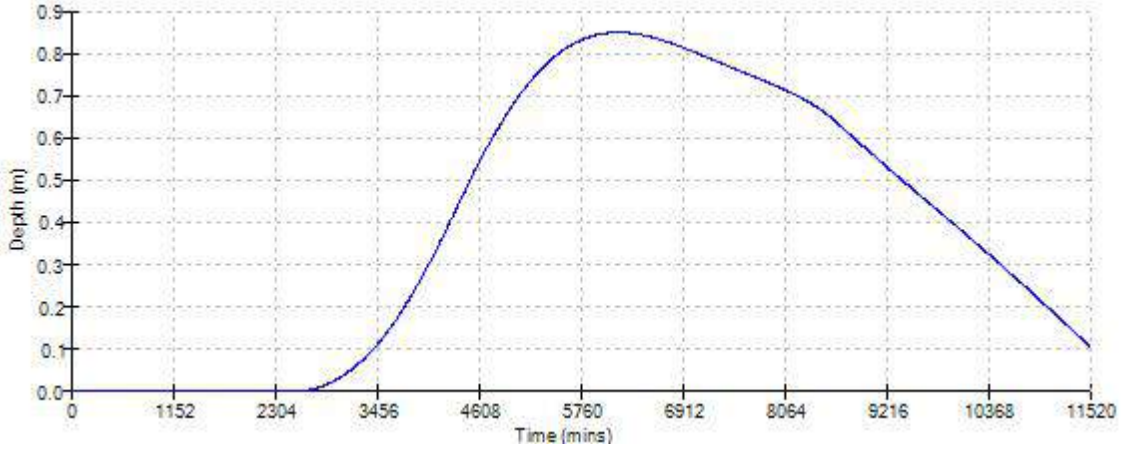




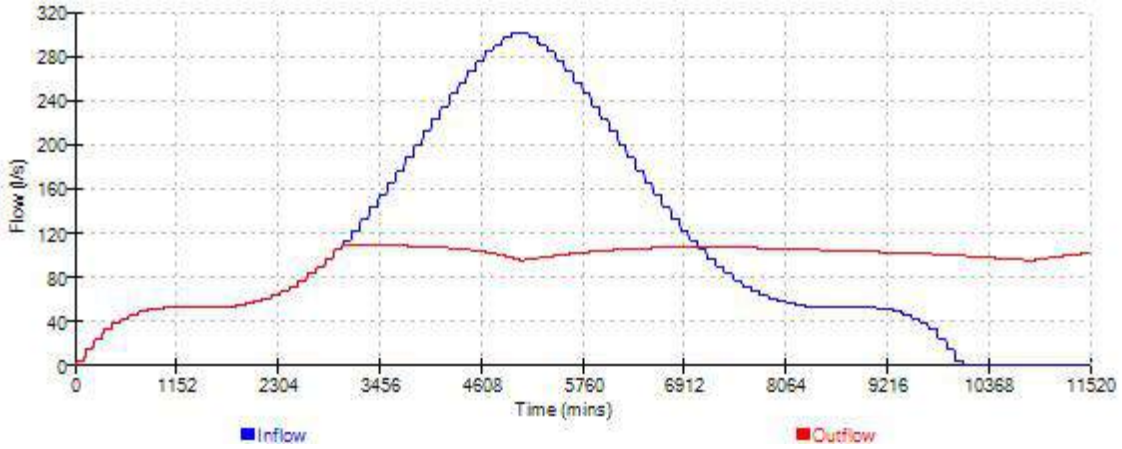
Event: 8640 min Winter

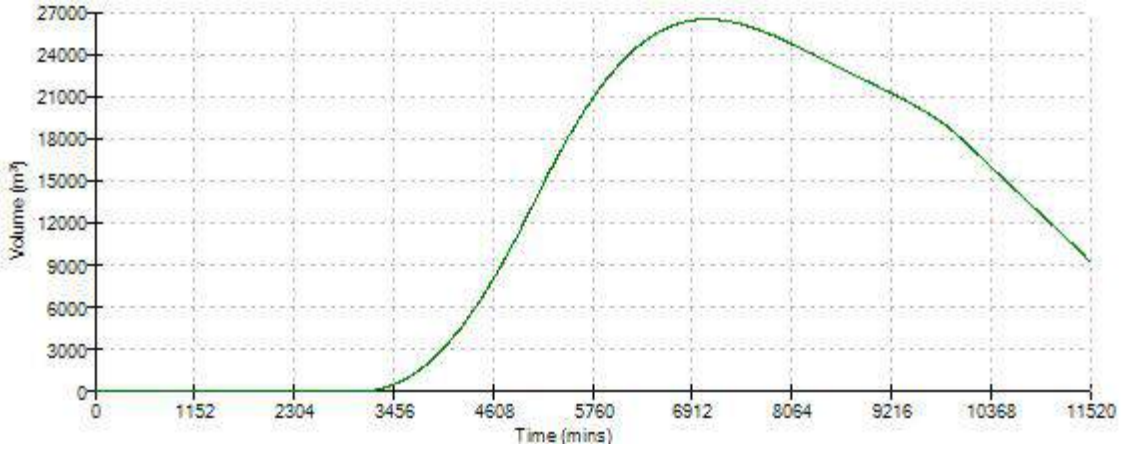


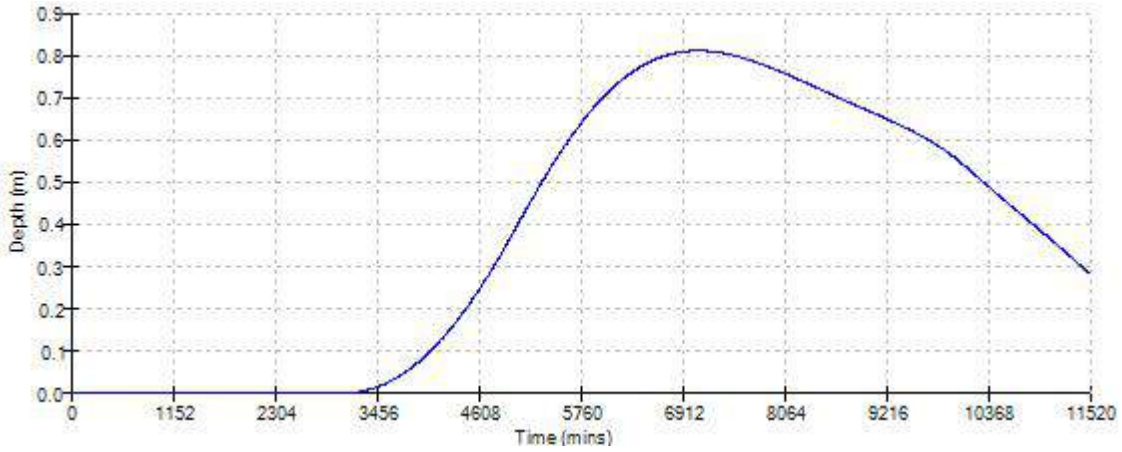




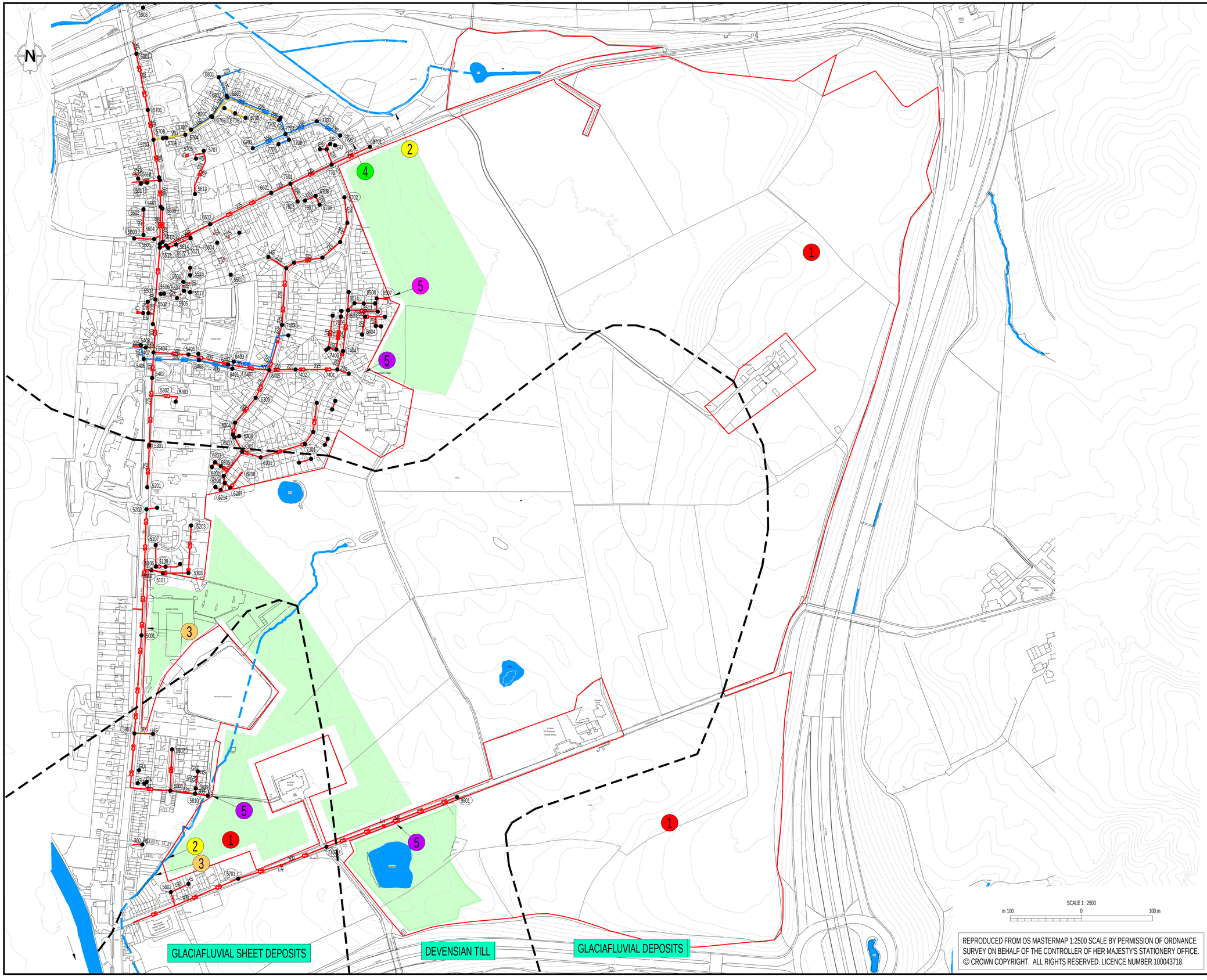
Event: 10080 min Winter







Appendix I Drainage Optioneering Sketch



NOTES

1. ALL DIMENSIONS IN MILLIMETRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS SHOWN OTHERWISE.
2. THIS DESIGN IS PROPOSED ON THE BASIS OF CLIENT BRIEF, SPECIFICATIONS, BEST PRACTICE AND RISK REDUCTION / ELIMINATION. THE DESIGNER MUST BE CONSULTED ON ANY PROPOSED CHANGES, BEFORE THEY ARE CONSIDERED FOR IMPLEMENTATION.
3. THE POSITION AND LEVEL INFORMATION OF UNITED UTILITIES APPARATUS IS AS PER SEWER RECORDS RECEIVED. NO WARRANTY IS GIVEN AS TO THE ACCURACY OR COMPLETENESS OF THIS INFORMATION. THE CONTRACTOR SHALL CHECK AND CONFIRM THE POSITION OF ALL SERVICES PRIOR TO EXCAVATION.

KEY

- SITE BOUNDARY
- PUBLIC COMBINED SEWERS
- PUBLIC SURFACE WATER SEWERS
- PUBLIC FOUL SEWERS
- APPROX. GLMACIOFLUVIAL EXTENT
- ASSUMED CULVERT ROUTE

SURFACE WATER DISCHARGE OPTIONS

- MANHOLE CHAMBER
- 1 SOAKAWAY
- 2 WATERCOURSE AND / OR LAND DRAIN
- 3 ROCHDALE CANAL
- 4 PUBLIC SURFACE WATER SEWER
- 5 PUBLIC COMBINED AND / OR FOUL SEWER
- OPTIMAL SURFACE WATER ATTENUATION LOCATION
- WATER FEATURES

SITE LOCATION

GRID REFERENCE: 389111, 409288
SITE ADDRESS: THORNHAM LANE, TRUB, ROCHDALE, M24 2SH

REV.	DATE	DESCRIPTION	DSGN'D	CHK'D	APP'D
P00	DD-MM-YY	FIRST ISSUE	TF	JW	JR

CLIENT: REDROW

PRINCIPAL DESIGNER: -

Waterco

Waterco Ltd., Eden Court,
Lon Parcwr Business Park, Ruthin LL15 1NJ
tel (+44) 1824 702220
www.waterco.co.uk

SCHEME: MANCHESTER ROAD, ROCHDALE

TITLE: DRAINAGE OPTIONEERING SKETCH

STATUS: PRELIMINARY

DESIGNED	CHECKED	APPROVED	SCALE / SHEET SIZE
TF	JW	JR	1 : 2500 / A1

DRAWING NO.: w10926-2001
REV: P00

Appendix J Maintenance Schedules

Operation and Maintenance Requirements for Detention Basins

Maintenance Schedule	Required Action	Typical Frequency
Regular maintenance	Remove litter and debris	Monthly
	Cut grass-for spillways and access routes	Monthly (during growing season), or as required
	Cut grass - meadow grass in and around basin	Half yearly (spring - before nesting season, and autumn)
	Manage other vegetation and remove nuisance plants	Monthly (at start, then as required)
	Inspect inlets, outlets and overflows for blockages, and clear if required.	Monthly
	Inspect banksides. structures. pipework etc. for evidence of physical damage	Monthly
	Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies.	Monthly (for first year), then annually or as required
	Check any penstocks and other mechanical devices	Annually
	Tidy all dead growth before start of growing season	Annually
	Remove sediment from inlets, outlet and forebays	Annually (or as required)
	Manage wetland plants in outlet pool – where provided	Annually (as set out in Chapter 23)
Occasional maintenance	Reseed- areas of poor vegetation growth	As required
	Prune and trim any trees and remove cuttings	Every 2 years. or as required
	Remove sediment from inlets, outlets. forebays and main basin when required	Every 5 years. or as required (likely to be minimal requirements where effective upstream source control is provided)
Remedial actions	Repair erosion or other damage by reseeding or re-turfing	As required
	Realignment of rip-rap	As required
	Repair/rehabilitation of inlets, outlets and overflows	As required
	Relevel uneven surfaces and reinstate design levels	As required

Ref. Table 22.1 CIRIA C753 'The SuDS Manual'

The maintenance requirements detailed above are to be undertaken by the site owner.

Name :

Position :

Date :

Signed on behalf of the site owner :

Operation and Maintenance Requirements for Permeable Paving

Maintenance Schedule	Required Action	Typical Frequency
Regular maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment
Occasional maintenance	Stabilise and move contributing and adjacent areas	As required
	Removal of weeds or management using glyphospate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements
Remedial actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50mm of the level or the paving	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)
Monitoring	Inspect for evidence of poor operation and / or weed growth – if required, take remedial action	Three-monthly, 48hr after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

Ref. Table 20.15, CIRIA C753 'The SuDS Manual'

The maintenance requirements detailed above are to be undertaken by the site owner.

Name :

Position :

Date :

Signed on behalf of the site owner :

Operation and Maintenance Requirements for Ponds and Wetlands

Maintenance Schedule	Required Action	Typical Frequency
Regular maintenance	Remove litter and debris	Monthly (or as required)
	Cut the grass – public areas	Monthly (during growing season), or as required
	Inspect marginal and bankside vegetation and remove nuisance plants (for first 3 years)	Monthly (at start, then as required)
	Inspect inlets, outlets, banksides, structures, pipework etc for evidence of blockage, and / or physical damage.	Monthly
	Inspect water body for signs of poor water quality	Monthly (May – October)
	Inspect silt accumulation rates in any forebay and in main body of the pond and establish appropriate removal frequencies; undertake contamination testing once some build-up has occurred, to inform management and disposal options.	Half yearly
	Check any mechanical devices e.g. penstocks	Half yearly
	Hand cut submerged and emergent aquatic plants (at minimum of 0.1m above pond base; include max 25% of pond surface)	Annually
	Remove 25% of bank vegetation from water's edge to a minimum of 1m above water level	Annually
	Remove sediment from any forebay	Every 1 – 5 years, or as required
	Remove sediment and planting from one quadrant of the main body of ponds without sediment forebays	Every 5 years, or as required
Occasional maintenance	Remove sediment from the main body of big ponds when pool volume is reduced by 20%	With effective pre-treatment, this will only be required rarely, e.g. 25-50 years
Remedial actions	Repair erosion or other damage	As required
	Replant where necessary	As required
	Aerate pond when signs of eutrophication are detected	As required
	Realign rip-rap or repair other damage	As required
	Repair/rehabilitate of Inlets, outlets and overflows	As required

Ref. Table 23.1 CIRIA C753 'The SuDS Manual'

The maintenance requirements detailed above are to be undertaken by the site owner.

Name :

Position :

Date :

Signed on behalf of the site owner :

Operation and Maintenance Requirements for Soakaways

Maintenance Schedule	Required Action	Typical Frequency
Regular maintenance	Inspect for sediment and debris in pre-treatment components and floor of inspection tube or chamber and inside concrete manhole rings	Annually
	Cleaning of gutters and any filters on downpipes	Annually (or as required based on inspections)
	Trimming any roots that may be causing blockages	Annually (or as required)
Occasional maintenance	Remove sediment and debris from pre-treatment components and floor inspection tube or chamber and inside of concrete manhole rings.	As required, based on inspections
Remedial actions	Reconstruct soakaway and/or replace or clean void fill, if performance deteriorates or failure occurs.	As required
	Replacement of clogged geotextile (will require reconstruction of soakaway)	As required
Monitoring	Inspect silt traps and note rate of sediment accumulation.	Monthly in the first year and then annually
	Check soakaway to ensure emptying is occurring	Annually

Ref. Table 13.1, CIRIA C753 'The SuDS Manual'

The maintenance requirements detailed above are to be undertaken by the site owner.

Name :

Position :

Date :

Signed on behalf of the site owner :

Operation and Maintenance Requirements for Swale

Maintenance Schedule	Required Action	Typical Frequency
Regular maintenance	Remove litter and debris	Monthly (or as required)
	Cut the grass – to retain grass height within specified design range	Monthly (during growing season), or as required
	Manage other vegetation and remove nuisance plants	Monthly at start, then as Required
	Inspect inlets, outlets and overflows for blockages, and clear if required	Monthly
	Inspect infiltration surfaces for ponding, compaction, silt accumulation, record areas where water is ponding for > 48 hours	Monthly, or when required
	Inspect vegetation coverage	Monthly for 6 months, quarterly for 2 years, then half yearly
	Inspect inlets and facility surface for silt accumulation, establish appropriate silt removal frequencies	Half yearly
Occasional maintenance	Reseed areas of poor vegetation growth, alter plant types to better suit conditions, if required	As required or if bare soil is exposed over 10% or more of the swales treatment area
Remedial actions	Repair erosion or other damage by re-turfing or reseeding	As required
	Relevel uneven surfaces and reinstate design levels	As required
	Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction of the soil surface	As required
	Remove build-up of sediment on upstream gravel trench, flow spreader or at top of filter strip	As required
	Remove and dispose of oil or petrol residues using safe standard practices	As required

Ref. Table 17.1 CIRIA C753 'The SuDS Manual'

The maintenance requirements detailed above are to be undertaken by the site owner.

Name :

Position :

Date :

Signed on behalf of the site owner :

Operation and Maintenance Requirements for Attenuation Storage Tanks

Maintenance Schedule	Required Action	Typical Frequency
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action	Monthly for 3 months, then annually
	Remove debris from the catchment surface (where it may cause risks to performance)	Monthly
	For systems where rainfall infiltrates into the tank from above, check surface of filter for blockage by sediment, algae or other matter; remove and replace surface infiltration medium as necessary	Annually
	Remove sediment from pre-treatment structures and/ or internal forebays	Annually, or as required
Remedial actions	Repair/rehabilitate inlets, outlet, overflows and vents	As required
Monitoring	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed	Annually
	Survey inside of tank for sediment build-up and remove If necessary	Every 5 years or as required

Ref. Table 21.3, CIRIA C753 'The SuDS Manual'

The maintenance requirements detailed above are to be undertaken by the site owner.

Name :

Position :

Date :

Signed on behalf of the site owner :

Appendix K Concept Designers Risk Assessment

CONCEPT DESIGNER'S RISK ASSESSMENT

Project:	Manchester Road, Rochdale	**Project No:**	w10926
Client:	Redrow Homes Limited		
Report Reference:	w10926-190515-FRA and Drainage Strategy		

Prepared by:	Jennifer Gibson	**Date:**	26/04/2019
Checked by:	Joanne Williams	**Date:**	09/05/2019
Reviewed by:	Josh Rigby	**Date:**	14/05/2019

Requirement:

The Construction (Design and Managment) Regulations 2015 (CDM 2015) place an obligation on the Designer to take all reasonable steps to provide, with the design, sufficient information about the design, construction or maintenance of the structure, to adequately assist the client, other designers and contractors to comply with their duties under CDM. The Designer has undertaken this assessment to identify any extra-ordinary risks, or those that would not be expected on this particular project by an experienced and competent Contractor. The aim is to avoid needless paperwork and bureaucracy and ensure the assessment is project specific, relevant and proportionate to the risk.

DRA Summary

Each of the following risk areas has been considered using the question below. Is a risk present which is considered to be **extra-ordinary or unexpected** in this instance?

If **YES** - A detailed risk assessment is required at design stage
If **UNKNOWN** - Insufficient information has been provided at concept design stage and the risks are unknown. Further consideration must be given at design stage(s)
If **NO** - No further action is required.

Hazard Ref.	Risk Areas	YES, UNKNOWN or NO	Comments
1	Ground Conditions	Yes	BGS mapping and desk study shows artificial ground in the northern extent of the site
2	Hazardous Environment	Unknown	
3	Existing Working Environment	Unknown	
4	Existing Services	Unknown	
5	Proximity to Other Structure(s)	Unknown	Possible culverts on site
6	Near Waterbody / flood risk	Yes	Ponds have been identifed on site. EA flood maps indentify surface water flooding
7	Proximity to Other Activities	Yes	Near highways and local roads
8	Sequence of Construction	Unknown	
9	Access	Unknown	
10	Interfaces	Unknown	
11	Confined Space Working	Unknown	
12	Maintenance Considerations	Yes	Drainage system will require maintenance
13	Working at Height	Unknown	
14	Steep Slopes	Unknown	
15	Demolition / Refurbishment / Repair	Unknown	
16	Welfare	Unknown	
17	Occupational Health	Unknown	
18	Environmental Issues	Unknown	Weils disease
19	Other Significant Hazards not Identified Above	Unknown	
20	Residual Risk to Future Users	Unknown	