

SITE BASED STORMWATER MANAGEMENT PLAN

CHANGE APPLICATION TO ROL201800079 STAGE 1 22 INDUSTRIAL LOTS

ADDRESS

60 Stapylton Jacobs Well Road, Stapylton

REAL PROPERTY DESCRIPTION

Lot 501 on SP295994

PREPARED FOR

Frasers Property (Australia) Pty Ltd

March 2020 (Rev. 3)



gassman
development
perspectives

project coordination
urban + regional planning
landscape + urban design
engineering services
environmental management
visualisation + spatial services
surveying services
advisory services

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No.	Author	Reviewer	Date
INTERNAL DRAFT	Ian Grieves	Mitchell Gassman	16 December 2019
1.	Ian Grieves	Mitchell Gassman	20 December 2019
2.	Ian Grieves	Mitchell Gassman	20 February 2020
3.	Ian Grieves	Mitchell Gassman	12 March 2020

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Final Distribution

Frasers Property (Australia) Pty. Ltd. (Client)	1 electronic copy
City of Gold Coast Council (Assessment Manager)	1 electronic copy
GDP File	1 electronic copy

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1.0 INTRODUCTION

Gassman Development Perspectives (GDP) has been engaged by Frasers Property (Australia) Pty Ltd (Client) to prepare a Site Based Stormwater Management Plan over land situated at 60 Stapylton Jacobs Well Road, Stapylton (Lot 501 on SP295994) being the 'subject site'.

This report has been prepared for submission to City of Gold Coast Council (Council) as part of a Change Application to the existing Development Permit for Reconfiguration of Lot (Council Ref: ROL201800079) with the intent of investigating and addressing the stormwater quantity and stormwater quality requirements for the proposed development in accordance with the applicable State and Local Government standards.

Stormwater quantity is addressed through pre and post development scenarios modelled in XPSTORM software utilising temporal pattern inputs from the Australian Rainfall & Runoff (AR&R) Data Hub and the AR&R Storm Generator.

A strategy for managing post development peak flows discharging from the site and the required attenuation measures are provided to demonstrate that any increase in peak flows can be managed within the subject site as not to measurably impact neighbouring properties.

Stormwater quality analysis is also undertaken through the use of MUSIC software to confirm the adequacy of proposed Stormwater Quality Improvement Devices (SQIDs) required to meet the State Planning Policy's (SPP 2017) Water Quality Objectives (WQOs) and the pollutant removal targets set by City of Gold Coast Council.

It is noted that the extent of the proposed stormwater quantity and quality basin servicing the changed Stage 1 layout is consistent with the approved management plan being "Site Based Stormwater Management Plan – Development Application for Reconfiguration of Lot Revision 3" prepared by Gassman Development Perspectives dated 30 August 2018 (Job No. 5738).

A copy of the XP-STORM and MUSIC modelling data files can be provided upon request.

2.0 SITE CHARACTERISTICS

2.1 LOCATION

The subject site is located within the City of Gold Coast Council local government boundaries.

The subject site is bounded by Stapylton Jacobs Well Road and existing industrial uses to the north, Christensen Road and existing industrial uses to the west and City of Gold Coast Council's land fill facility to the east.

The site has recently been cleared of all vegetation under existing Operation Works approval obtained from Council.

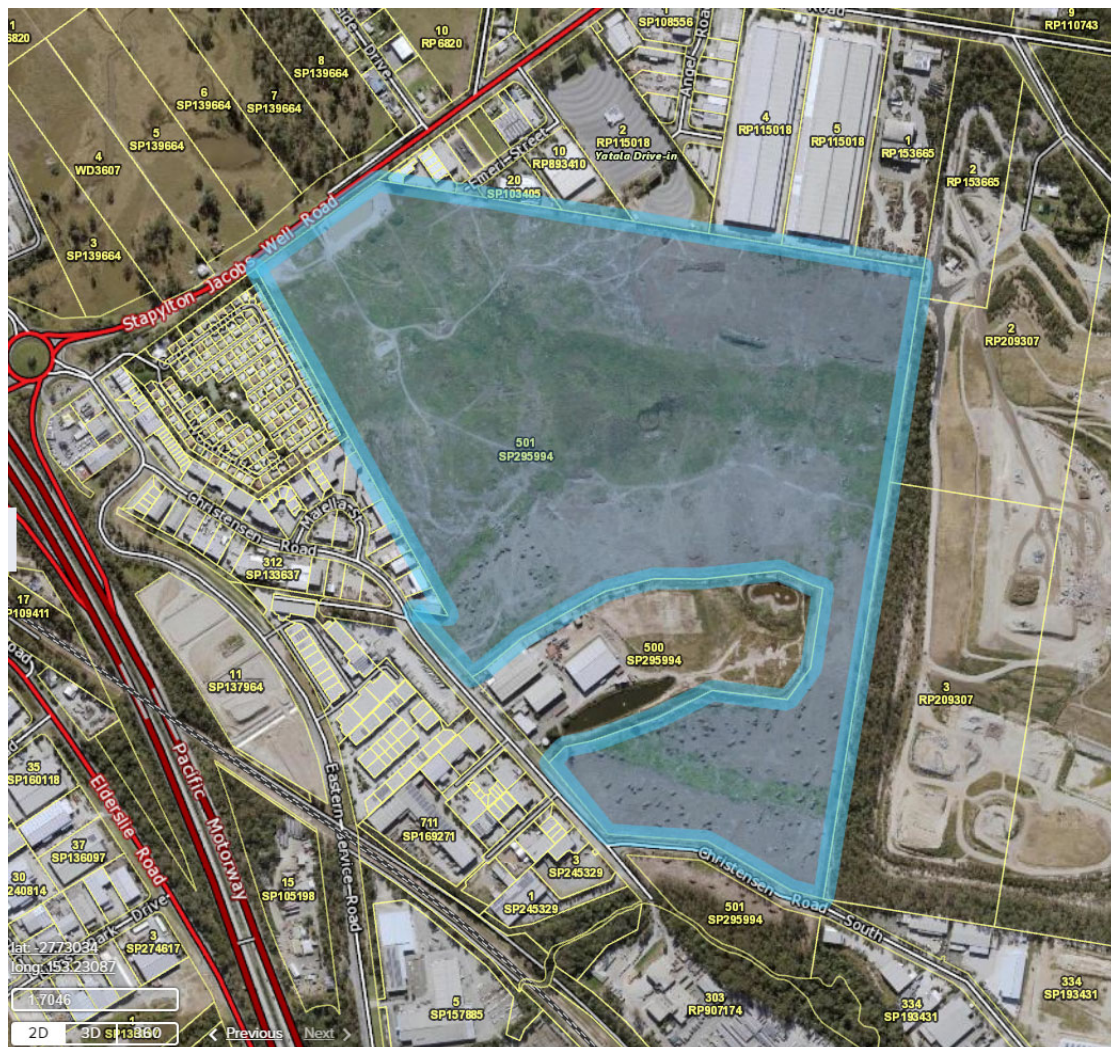


Figure 2.1: Site Locality Plan, Source: QLD Globe 2019

2.2 SITE AREA

The current area of the site is 64.239 Ha of which the proposed bulk earthworks change to ground level works for Stage 1 makes up approximately 27.681 Ha, (19.34 Ha development stage area including the drainage reserve). Refer to **Appendix J** for the proposed Reconfiguration of a Lot (ROL) plan.

2.3 EXISTING TOPOGRAPHY AND SITE DRAINAGE

Along the south-eastern boundary of the subject site is the existing high point of 29.23m AHD with a ridge line extending through to the properties' northern boundary. This existing topography defines the existing catchments of the site and current stormwater discharge locations along the northern and eastern boundaries. These low points are visible within **Appendix A – Site Survey Plan** of the report with the pre development catchments defined within **Appendix B – Pre and Post Development Catchment Plans**.

2.4 EXISTING LAND USAGE

The subject land is vacant following the clearing of all vegetation in 2019.

2.5 PLANNING PROVISIONS AND PROPOSED DEVELOPMENT

The subject site is zoned “Low Impact Industry, Future Precinct” and “Medium Impact Industry, Future Precinct” under Council’s current City Plan. The current proposal involves creating further industrial lots created within the subject site which will require large scale bulk earthworks necessary to facilitate clear and flat earthwork pads suitable for this land use.

2.6 FLOODING

The subject site is located within the extent of the Flood Overlay as defined in Council’s City Plan Interactive Mapping – Version 5, 6 and 7.

Compensatory earthworks within private property located off Yellowwood Road to the north was undertaken in 2019 to balance flood storage where fill within the subject site is proposed below the Designated Flood Level of RL8.60m AHD (Q₁₀₀) utilising CoGC City Plan v5 which was current at the time of the existing approval.

On-site regional flood storage volumes have been calculated for the site based on Council’s provided flood level of 8.60m AHD (CoGC City Plan v5) and the existing surface levels within the property boundary. The volume of on-site regional flood storage is equal to 19,927m³. In summary, the compensatory balance flood storage works was provided as follows:

Site Address	Available Q ₁₀₀ Flood Storage Volume	
	Pre Developed	Post Developed
60 Stapylton Jacobs Well Road, Stapylton	19,927 m ³	14,544 m ³
Shortfall of Flood Storage at Subject Site	5,383 m ³	
Earthworks below Q ₁₀₀ at Yellowwood Rd	5,769 m ³ *	

* A gain of 386 m³ of flood storage has been achieved in the post development scenario.

Appendix D provides detailed drawings of the bulk earthworks undertaken and that a flood storage balance between the pre and post development scenario has been achieved.



3.0 CONVEYANCE MANAGEMENT AND PRE AND POST DEVELOPMENT CATCMENTS

3.1 LAWFUL POINT OF DISCHARGE

The *Queensland Urban Drainage Manual* (QUDM) 1992 edition *formerly* set criteria that defined a lawful point of discharge for a proposed development. The term described a two-point test. This criterion is obsolete.

The meaning defined in QUDM 2017 is different from the more general term 'lawful discharge of stormwater' because it *"requires the stormwater to be released at a location that is under the lawful control of the local government or other statutory authority from whom permission to discharge has been received."*

The revised criteria for determining a lawful point of discharge are: (taken from QUDM 2017)

- i) Will the proposed development alter the sites stormwater discharge characteristics in a manner that may substantially damage a third party property?

- ii) Is the location of the discharge from the development site under the lawful control of the local government or other statutory authority from whom permission to discharge has been received?
- iii) An authority to discharge over affected properties will be necessary. In descending order of certainty, an authority may be in the form of: a) dedication of a drainage reserve or park, b) a registered easement for stormwater discharge / works or written discharge approval.

The subject development proposal will utilise one (1) lawful point of discharge being to the northern boundary of the site; utilising the existing 2.70m x 3.00m RCBC “cattle crossing” located under Stapylton Jacobs Well Road. The existing structure – historically used for paddock-to-paddock farm access is an asset of DTMR. An extension to this structure is required to accommodate for the widened carriageway of the ultimate DTMR signalised intersection upgrade which provides vehicular access to the development. Please refer to **Appendix M** for the detailed functional layout plans of the intersection.

Modifications works to the upstream side of the cattle crossing culvert are required to provide a suitable utility services corridor within the upgraded verge. Modifications will involve reducing the height of the box culvert cell by replacing with multiple pipe culverts in conjunction with the basin outlet configuration works.

3.2 PRE DEVELOPMENT CATCHMENTS

The existing natural slope currently dictates the overland flow and drainage pattern of the subject site as illustrated in the pre development stormwater catchment plan within **Appendix B**. The flow patterns generally follow the ridgeline falling towards the existing low points of the site.

3.3 POST DEVELOPMENT CATCHMENTS

The intent of the proposed bulk earthworks outlined within this Stormwater Management Plan is to generally follow the pre development conditions to ensure no worsening of stormwater impacts downstream both during and post the construction period.

Whilst the proposed bulk earthworks over the site generally flatten the existing steep grades of the land as part of creating the earthworked pads, the increase in impervious areas associated with the proposed land use mean that a hydrologic review is required to determine the changes in discharge characteristics (i.e. peak flow, water quality) from the site and to identify suitable attenuation measures that need to be implemented to mitigate any potential downstream impacts.

The post development catchments are illustrated within the post development catchment plan included within **Appendix B**.

4.0 HYDROLOGICAL ASSESSMENT

4.1 TEMPORAL PATTERNS AND RAINFALL DATA

Rainfall data for use in XPSTORM software has been sourced from the Australian Rainfall & Runoff 2016 Storm Generator and the AR&R Data Hub. This application generates rainfall data for the various design storm hydrographs which have been utilised in the below modelling of stormwater runoff from the subject site.

Appendix H contains a copy of the Intensity-Frequency-Duration (IFD) data sourced from the Bureau of Meteorology (BoM) utilised for the hydraulic analysis and sediment basin sizing.

Appendix I contains a copy of the AR&R Data Hub rainfall data utilised for the XPSTORM hydrological analysis. It is noted that the predicted climate change factors, and pre-burst losses are incorporated into the data for analysis.

4.2 CATCHMENTS

As discussed within Section 3 of this report the pre and post development stormwater catchments (refer **Appendix B**) have been determined using a combination of the site based Contour and Detail survey undertaken by Gassman Development Perspectives (refer **Appendix A**) along with LiDAR survey of the surrounding area to identify any potential external catchments.

A summary of the parameters assigned to these sub-catchments used to assess the pre and post development flows is contained within *Tables 4.2A, 4.2B and 4.2C* below which aligns with the two scenarios assessed within this reporting.

Parameter		Sub-Catchments (Pre Development - Total Site)		
Name		CAT-X1	CAT-X2	CAT-1
Area (Ha)		1.637	2.182	12.715
Vectored Slope (%)		1.00	1.00	5.41
Impervious Area (%)		90.00	90.00	5.00
Pervious Area (%)		10.00	10.00	95.00
Roughness (n)		0.020	0.020	0.080
Parameter		Catchments (Pre Development - Total Site)		
Name		CAT-2	CAT-3	CAT-4
Area (Ha)		7.114	3.015	8.666
Vectored Slope (%)		5.95	5.54	5.80
Impervious Area (%)		1.00	0.00	0.00
Pervious Area (%)		99.00	100.00	100.00
Roughness (n)		0.050	0.080	0.100
Parameter		Catchments (Pre Development - Total Site)		
Name		CAT-5	CAT-6	CAT-6A
Area (Ha)		4.144	6.474	4.767
Vectored Slope (%)		4.02	3.91	3.50
Impervious Area (%)		0.00	0.00	35.00
Pervious Area (%)		100.00	100.00	65.00
Roughness (n)		0.050	0.100	0.030
Parameter		Catchments (Pre Development - Total Site)		
Name		CAT-7	CAT-7A	CAT-8
Area (Ha)		9.981	3.410	2.481
Vectored Slope (%)		3.51	2.50	3.00
Impervious Area (%)		0.00	85.00	0.00
Pervious Area (%)		100.00	15.00	100.00
Roughness (n)		0.060	0.020	0.060
Parameter		Catchments (Pre Development - Total Site)		
Name		CAT-9	CAT-10	
Area (Ha)		2.210	8.523	
Vectored Slope (%)		2.21	6.75	
Impervious Area (%)		0.00	9.50	
Pervious Area (%)		100.00	90.50	
Roughness (n)		0.060	0.030	

Table 4.2A: Pre Development Catchment Parameters

Parameter		Catchments (Total Site)	
Reporting Location	LPoD-1	LPoD-2	LPoD-3
Contributing Sub Catchments	CAT-1, CAT-2, CAT-3, CAT-X2, CAT-4, CAT-5, CAT-6, CAT-6A, and CAT-X1	CAT-7 and CAT-7A	CAT-8
Area (Ha)	50.714	13.391	2.481
Vectored Slope (%)	4.01	3.01	3.00
Impervious Area (%)	3.10	2.50	0.00
Pervious Area (%)	96.90	97.50	100.00
Roughness (n)	0.059	0.059	0.060
Initial Loss (mm)	17.20	17.20	17.20
Continuing Loss (mm/hr)	1.10	1.10	1.10
Parameter		Catchments (Total Site)	
Reporting Location	LPoD-4	LPoD-5	
Contributing Sub Catchments	CAT-9	CAT-10	
Area (Ha)	2.21	8.523	
Vectored Slope (%)	2.21	6.75	
Impervious Area (%)	0.00	9.50	
Pervious Area (%)	100.00	90.50	
Roughness (n)	0.060	0.030	
Initial Loss (mm)	17.20	5.00	
Continuing Loss (mm/hr)	1.10	2.50	

Table 4.2B: Contributing Catchment Parameters to Reporting Locations

Parameter		Catchments (Post Development - Stage 1)	
Name		DEV-5 <i>Impervious Catchment</i>	DEV-5 <i>Pervious Catchment</i>
Total Area (Ha)		15.071 (81% Impervious, 19% Pervious)	
Area Split (Ha)		12.208	2.863
Vectored Slope (%)		1.70	1.70
Impervious Area (%)		100.00	0.00
Roughness (n) for Impervious Area		0.020	-
Pervious Area (%)		0.00	100.00
Roughness (n) for Pervious Area		-	0.035
Initial Loss (mm)		0.00	17.20
Continuing Loss (mm/hr)		2.50	1.10

Table 4.2C: Post Development Catchment Parameters

4.3 LAND USE

Land uses were mapped within the pre and post development catchments with the varying hydraulic roughness and hydrological losses input into the XPSTORM model summarised in *Table 4.3 below*.

Land Use Type DEV-5 ONLY	Initial Loss (mm)	Continuing Loss (mm/hr)
Pre Developed		
Pervious	5.00	2.50
Impervious	0.00	2.50

Land Use Type DEV-5 ONLY	Initial Loss (mm)	Continuing Loss (mm/hr)
Post Developed		
Pervious	17.20	1.10
Impervious	0.00	2.50

Land Use Type	Initial Loss (mm)	Continuing Loss (mm/hr)
Pre Developed		
Pervious	17.20	1.10
Impervious	0.00	1.10

Land Use Type	Initial Loss (mm)	Continuing Loss (mm/hr)
Post Developed		
Pervious	17.20	1.10
Impervious	0.00	1.10

Table 4.3: Summary of Adopted Initial & Continuing Losses (AR&R Data-HUB 2016)

4.4 PRE AND POST DEVELOPMENT FLOW CALCULATIONS

XPSTORM modelling software was utilised to determine the pre and post development discharge flow rate for each catchment based on the parameters listed above.

The computations were undertaken for the standard Average Exceedance Probabilities (AEP) 63.2%, 50%, 20%, 10%, 5%, 2% and 1%.

Catchment runoff volumes to the respective existing Lawful Points of Discharge (reporting locations) are summarised in *Table 4.4*.

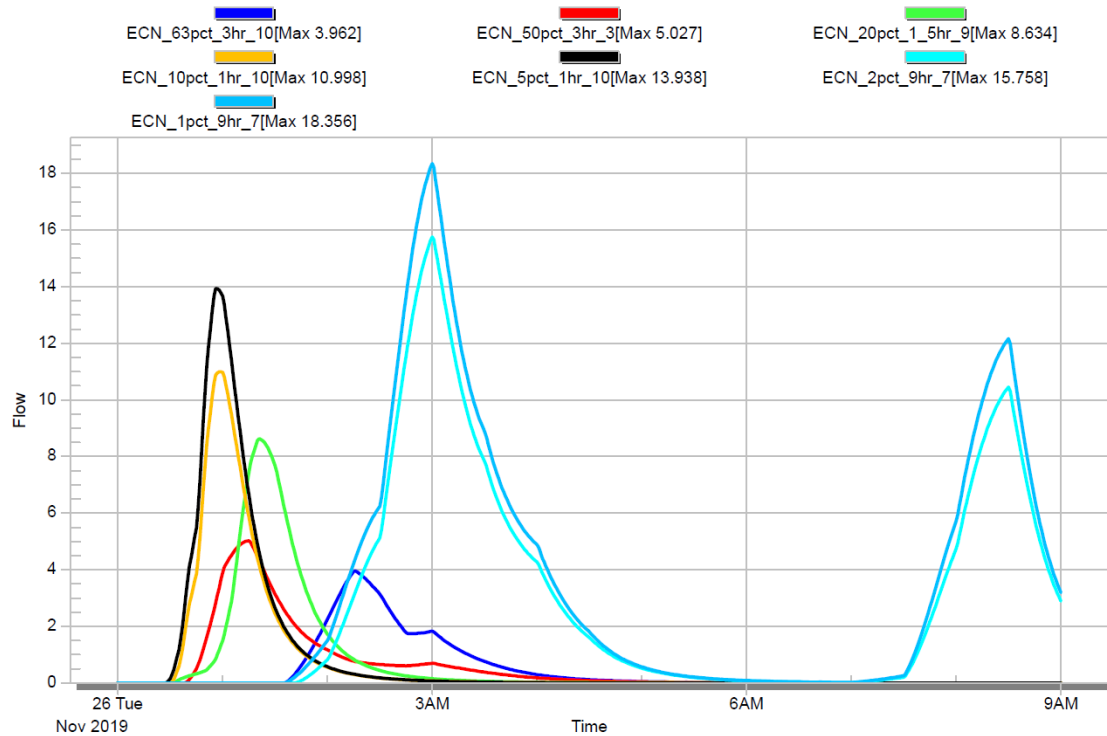
Catchment	Peak Flow Rates for Average Exceedance Probability (m ³ /s)						
Pre Developed Condition	63.2%	50%	20%	10%	5%	2%	1%
LPOD-1	3.962	5.027	8.634	10.998	13.938	15.758	18.356
LPOD-2	1.161	1.493	2.540	3.136	3.844	4.541	5.336
LPOD-3	0.278	0.351	0.555	0.665	0.789	0.991	1.150
LPOD-4	0.219	0.283	0.465	0.563	0.676	0.808	0.923
LPOD-5	1.769	2.049	2.919	3.571	4.148	4.818	5.487

Catchment	Peak Flow Rates for Average Exceedance Probability (m ³ /s)						
Post Developed Condition	63.2%	50%	20%	10%	5%	2%	1%
LPOD-5	3.913	4.427	6.106	7.253	8.358	9.717	10.723

Table 4.4: Flow Rates Calculated Using the Laurenson Method in XPSTORM

Figure 4.12 below contains the pre-developed peak flow rate hydrographs per reporting location / lawful point of discharge:

Node - LPOD-EX1



Node - LPOD-EX2

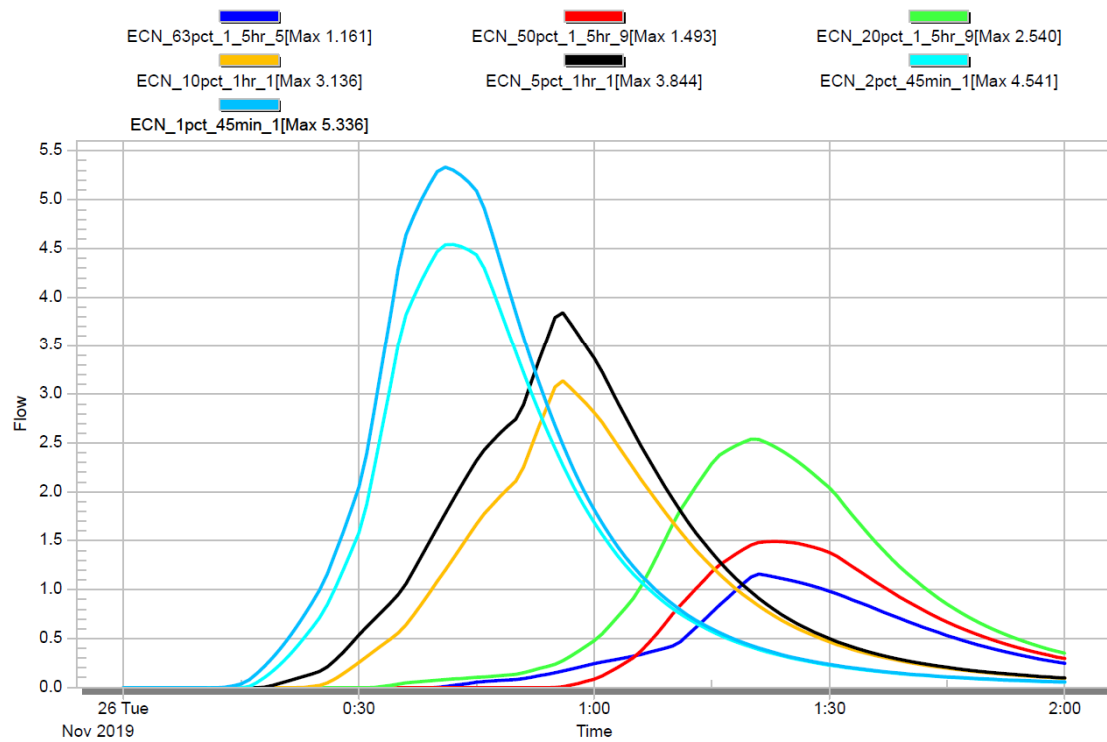
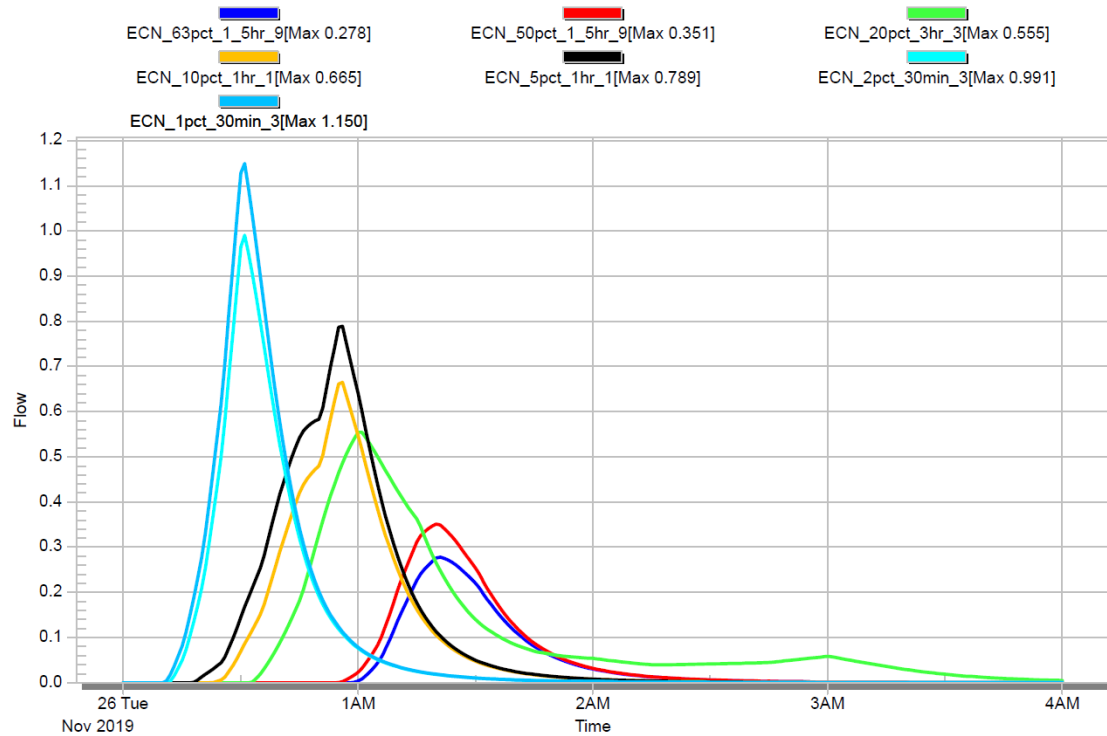


Figure 4.12: Pre Developed Peak Flow Rate Hydrographs

Node - LPOD-EX3



Node - LPOD-EX4

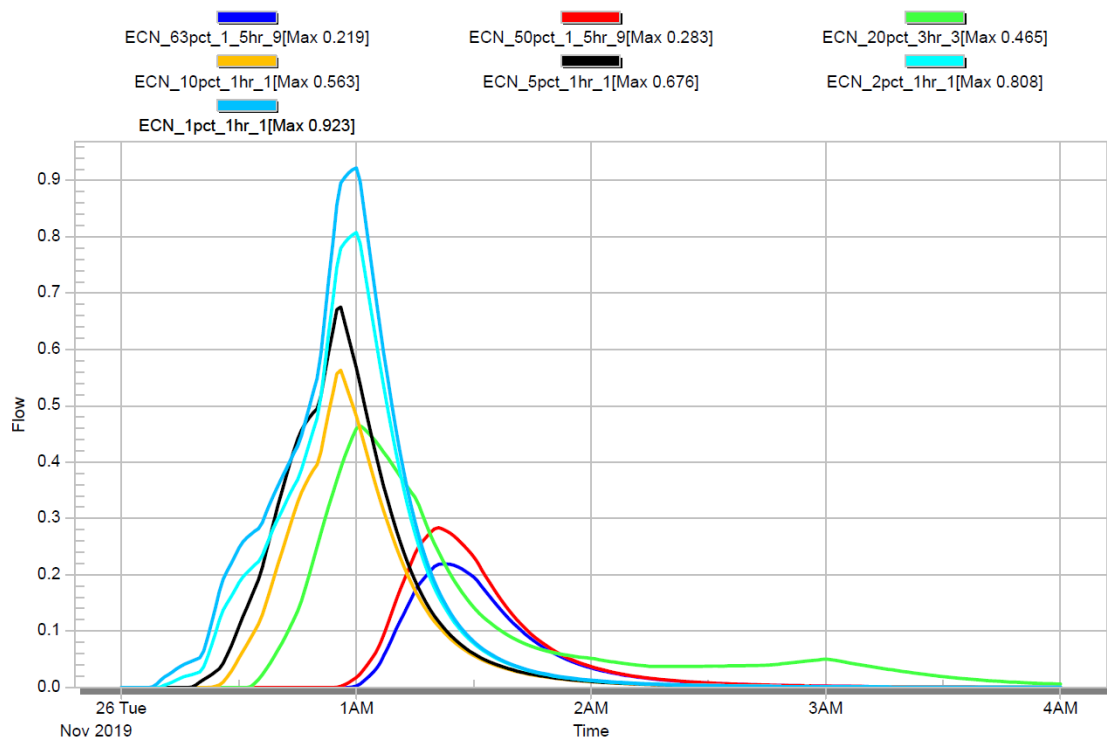


Figure 4.12: Pre Developed Peak Flow Rate Hydrographs (cont.)

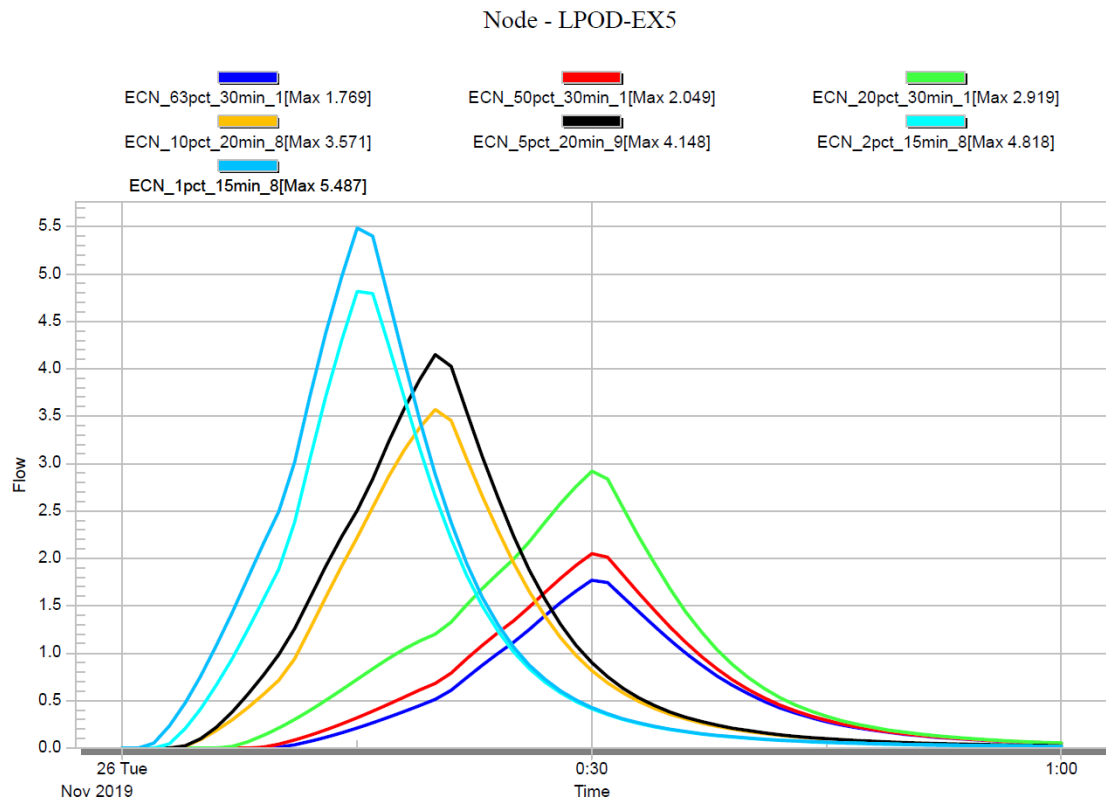


Figure 4.12: Pre Developed Peak Flow Rate Hydrographs (cont.)

Figure 4.13 below contains the *post* developed peak flow rate hydrograph at the reporting location / lawful point of discharge (CAT-10A / LPoD-5):

Node - LPOD-DEV5

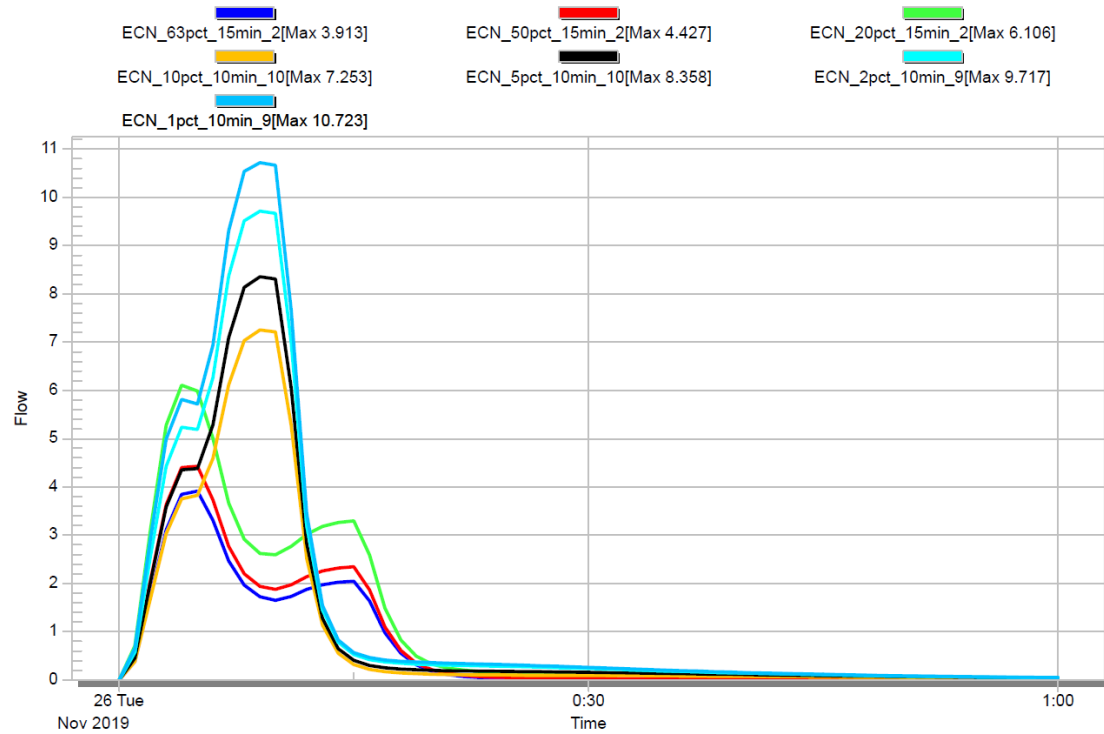


Figure 4.13: Post Developed Peak Flow Rate Hydrograph

5.0 STORMWATER QUANTITY, DETENTION & HYDRAULIC DESIGN

5.1 ATTENUATION OF DEVELOPED FLOWS

To ensure that the increased flow rates from the developed site have minimal impact on downstream property, the following hydrological objective has been set for stormwater exiting the subject site;

- *No increase in peak discharge flow rates from the developed site to downstream infrastructure.*

To achieve this objective, stormwater discharge from the development site must be detained to pre-development flow rates for all storms events up to and including the 1% AEP (equiv. to Q_{100}). The following sections provide a summary of the procedure used to design the onsite detention system at subject site.

5.2 METHODOLOGY

For the site catchment identified as having increase in peak flow rates when developed, a hydrologic model was created using XPSTORM. The model was then used to route post-development runoff through various proposed detention structures to determine the most efficient on-site detention system.

5.2.1 MODEL CONDITIONS

In XPSTORM three (3) hydraulic conditions were modelled in order to demonstrate the stormwater quantity, detention and hydraulic objective;

1. Existing Condition - Current condition of site with all the external catchments to assess the natural hydrology.
2. Developed Condition - Future condition of site when developed with all the external catchments. The main changes in hydrology as part of development include; increase in impervious area of the subject site due to the construction of the hardstand and other impervious areas and reduction in Manning's roughness coefficient for sections of the site to be developed.
3. Mitigated Condition - Future condition of site when developed with proposed detention structures in place with all the external catchments *where applicable*.

5.2.2 CRITICAL STORM EVENT AND DURATIONS

An analysis of storm events ranging from 63.2% AEP to 1% AEP was undertaken to determine the critical storm event and the critical storm duration per catchment. The determined critical storm events for the pre developed and post developed condition are indicated in *Table 5.2.2* below.

MODEL CONDITION	CRITICAL STORM EVENT	PEAK DURATION	PEAK FLOW
Pre Developed	AEP / Storm Ensemble #	(mins)	(m ³ /s)
LPOD-1	1% / 7	540 mins (9 Hrs)	18.356
LPOD-2	1% / 1	45 mins	5.336
LPOD-3	1% / 3	30 mins	1.150
LPOD-4	1% / 1	60 mins	0.923
LPOD-5	1% / 8	15 mins	5.487

MODEL CONDITION	CRITICAL STORM EVENT	PEAK DURATION	PEAK FLOW
Post Developed	AEP / Storm Ensemble #	(mins)	(m ³ /s)
LPOD-5	1% / 9	10 mins	10.723

Table 5.2.2: Critical Storm Event and Duration Summary Table

Critical storm duration hydrographs per model condition are indicated in *Figures 5.2.1 and 5.2.2*.

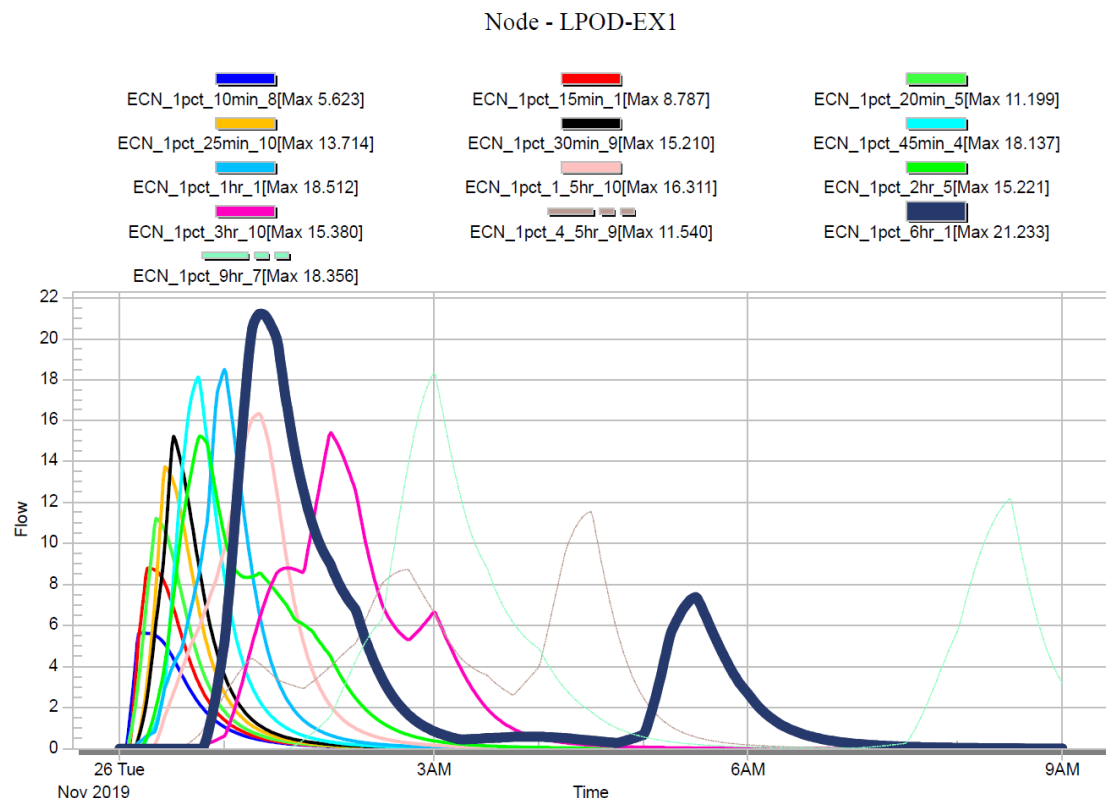
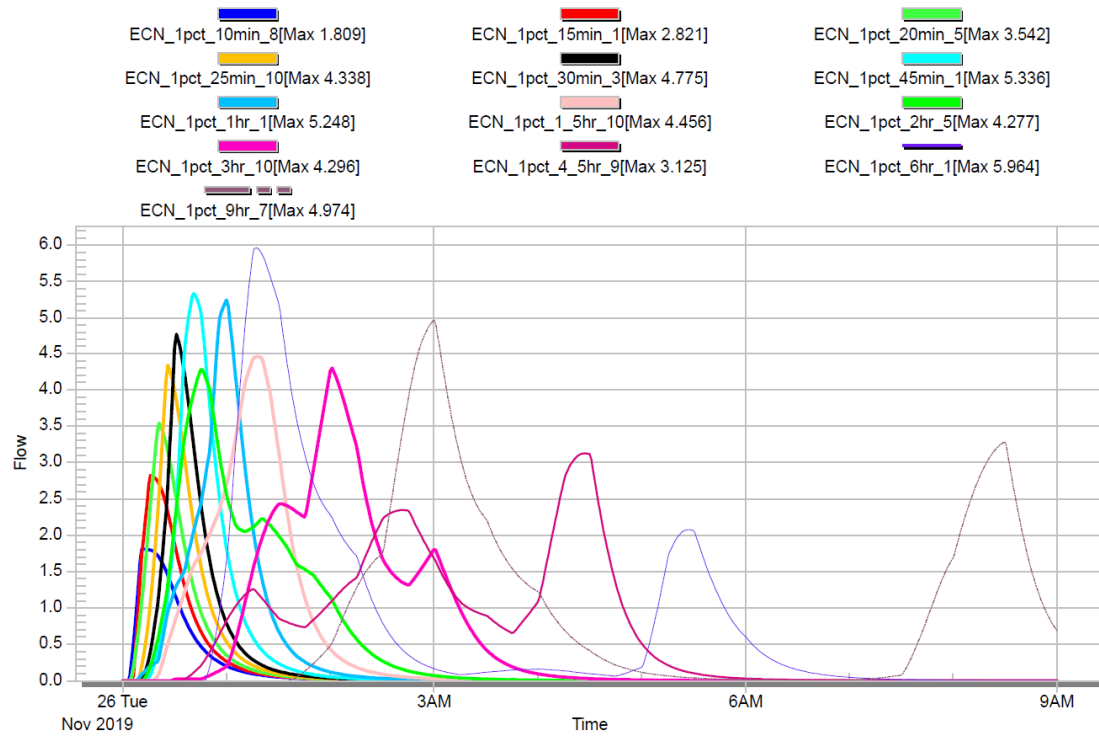


Figure 5.2.1: Critical Storm Event Durations for *Pre Developed* Catchments

Node - LPOD-EX2



Node - LPOD-EX3

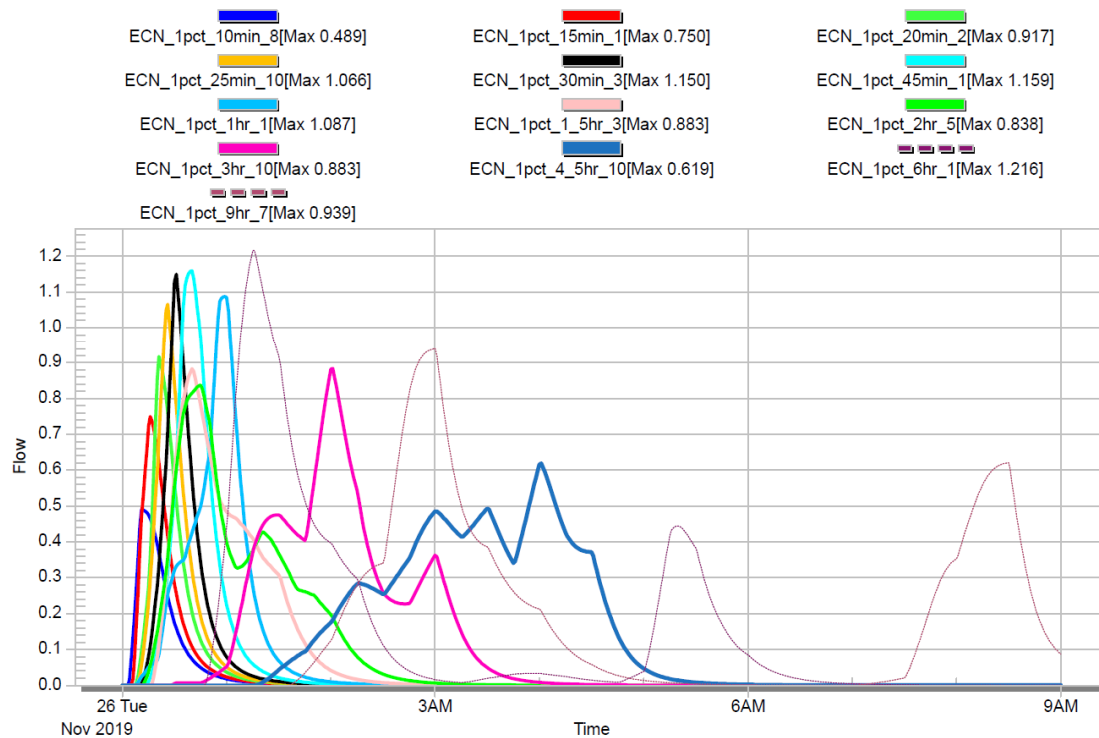
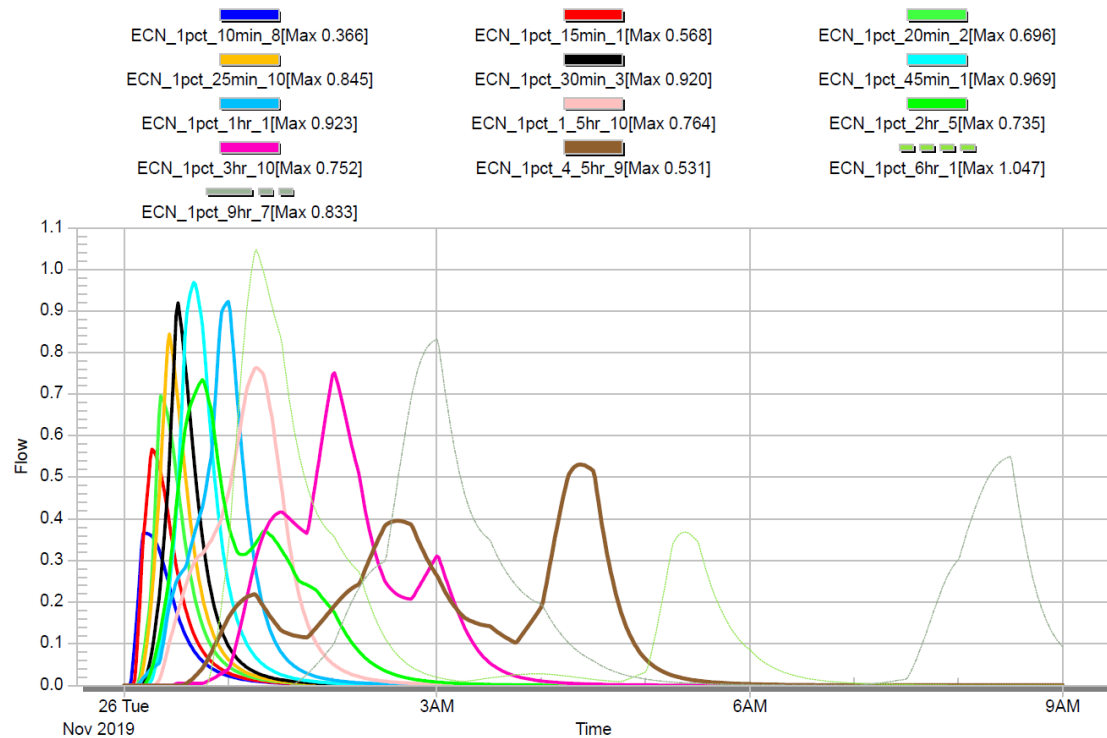


Figure 5.2.1: Critical Storm Event Durations for *Pre Developed* Catchments (cont.)

Node - LPOD-EX4



Node - LPOD-EX5

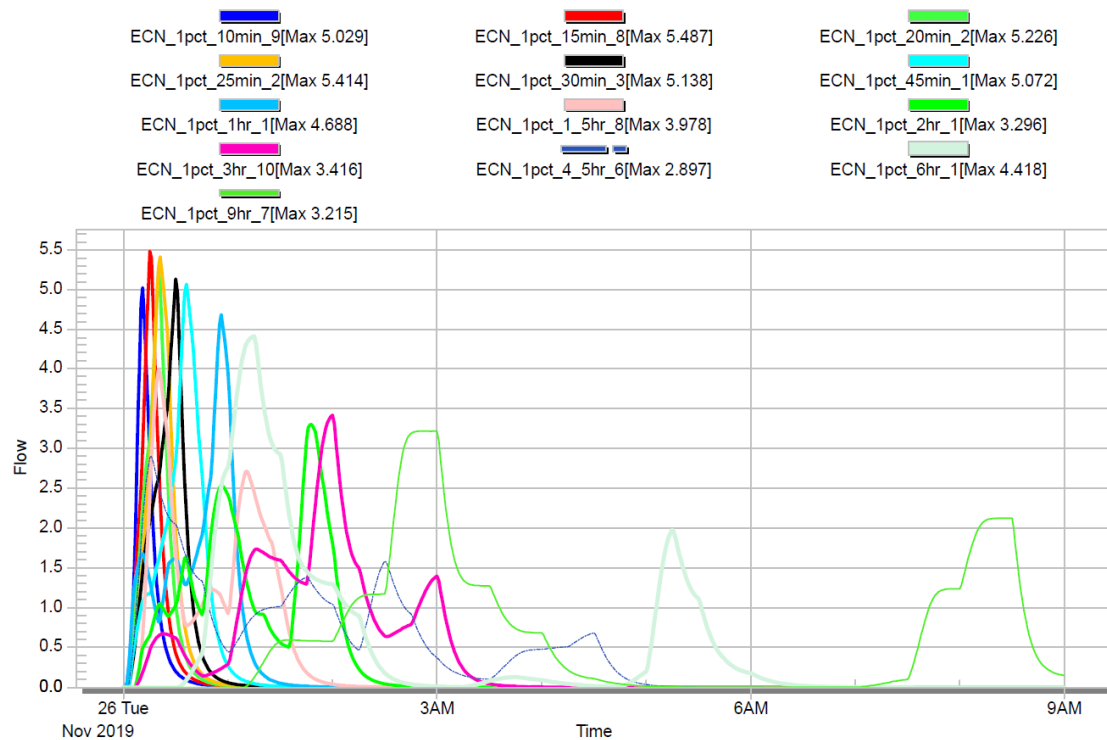


Figure 5.2.1: Critical Storm Event Durations for *Pre Developed* Catchments (cont.)

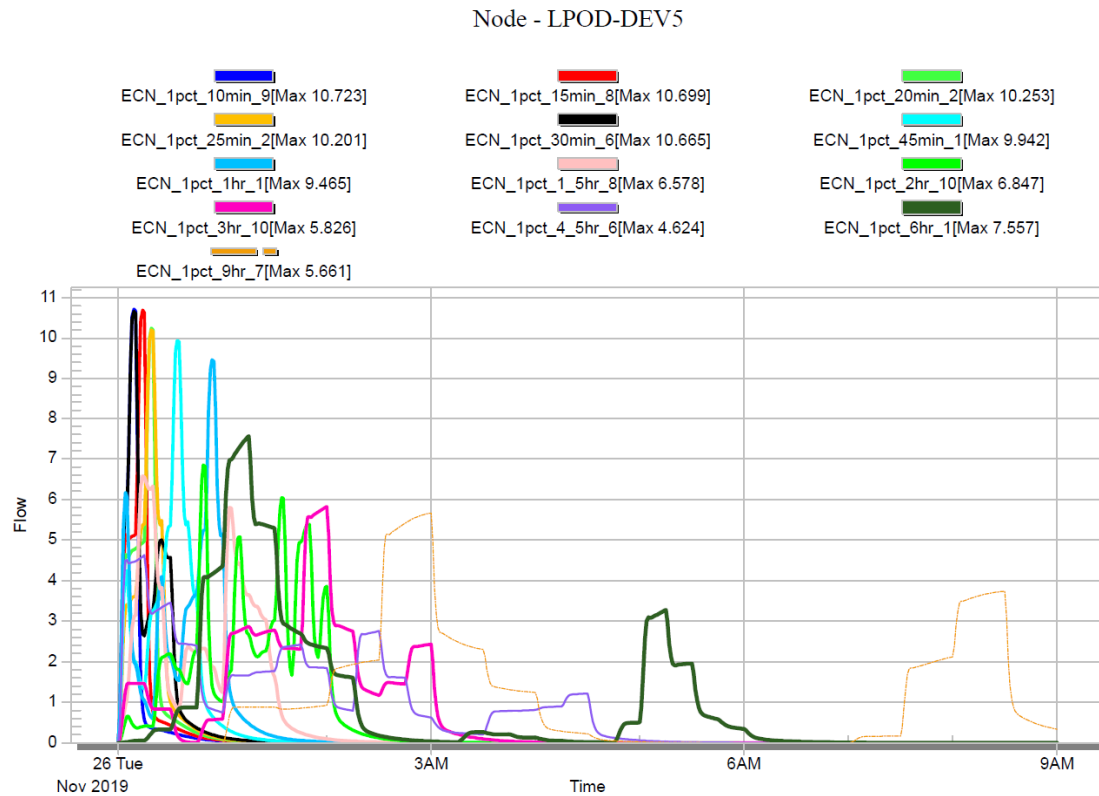


Figure 5.2.2: Critical Storm Event Durations for *Post Developed* Catchment (LPOD-5)

Refer **Appendix K** of this report which presents the detailed XPSTORM Box & Whisker plots for the above hydrological assessments.

5.2.3 DETENTION SYSTEM DESIGN

Detention devices capture and temporarily store stormwater runoff during major / critical storm events and release to the Lawful Point of Discharge (LPoD) at a controlled rate. Hence, detention devices act to mitigate potential downstream flooding impacts and also provide minor water quality treatment.

Therefore, to achieve the objective of zero post development flow rate increase to pre-developed 63.2% AEP (equiv. Q_1) to the 1% AEP (equiv. Q_{100}) flow rates at the downstream reporting location (outfall), on-site detention basins are introduced with low and high flow outlet configurations.

Table 5.2.3 includes the design details for the proposed on site detention system for Stage 1.

Parameter	Value
Catchment	DEV-5
Type	Detention basin (in ground)
Internal Batter Slope on Basin Sides	1 in 3
Basin Floor RL	5.800 m AHD
Basin Embankment / Crown R.L	8.100 m AHD
Basin Transverse Weir Crest RL	7.660 m AHD
Freeboard to Crown	0.440m
Detention Volume Depth	1.689m to 1% AEP WSL (<i>measured from floor / IL of basin</i>)
Detention Volume to Crown	8,458 m ³ to RL 8.100m (<i>deducting 0.30m extended detention</i>)
Detention Volume to 1% AEP WSL	5,498 m ³ to RL 7.489m (<i>deducting 0.30m extended detention</i>)
Detention Volume to Weir Crest	6,208 m ³ to RL 7.660m (<i>deducting 0.30m extended detention</i>)
Low Flow Outlets	3 / 600mm x 600mm grated field inlet pits <i>Top of grate levels set at 0.300m above basin floor at RL6.10m AHD</i> 225mm dia. circular orifice <i>IL at 0.600m above basin floor at IL6.40m AHD</i>
High Flow Outlets	1 / 1500 x 2000mm grated field inlet pit <i>1.175m above basin floor at RL6.975m AHD</i> 10 metre wide broad crested transverse weir <i>1.860m above basin floor at RL7.660m AHD</i> <i>1.70 discharge coefficient for transverse weir</i> 2 / 825mm RCP laid at max. grade of 1.084%

Table 5.2.3: Summary of Design Parameters of Proposed Detention System for Stage 1

5.2.4 MODEL RESULTS

Table 5.2.4.1 presents the results obtained from XPSTORM modelling as a result of implementing the above detention system for flow mitigation.

PRE-DEVELOPED PEAK FLOWS FOR CAT-10							
AEP	63.2%	50%	20%	10%	5%	2%	1%
LPOD-5 (CAT-10)	1.769	2.049	2.919	3.571	4.148	4.818	5.487

POST-DEVELOPED PEAK FLOWS (MITIGATED) FOR DEV-5							
AEP	63.2%	50%	20%	10%	5%	2%	1%
Mitigated Flow (m ³ /sec)	1.095	1.225	1.746	3.441	4.138	4.598	5.231
Max Water Elevation RL	6.635	6.720	7.057	7.179	7.256	7.357	7.489
Peak Duration (min)	30	180	180	60	60	360	360
Depth to WSL (m)	0.835	0.920	1.257	1.379	1.456	1.557	1.689

Table 5.2.4.1: Summary of XPSTORM Hydrologic / Hydraulic Results Catchment CAT-10 / DEV-5

Table 5.2.4.2 sums the mitigated discharges and compares directly against the pre developed hydrology condition across a range of standard storm events.

MITIGATED DISCHARGE SUMMARY FOR PROPOSED DETENTION BASIN (DEV-5)							
AEP	63.2%	50%	20%	10%	5%	2%	1%
1500 x 2000mm F.I. (m ³ /s)	0	0	0.136	1.708	2.309	2.671	3.164
600 x 600mm F.I. (1) (m ³ /s)	0.352	0.379	0.471	0.503	0.529	0.552	0.589
600 x 600mm F.I. (2) (m ³ /s)	0.352	0.379	0.471	0.503	0.529	0.552	0.589
600 x 600mm F.I. (3) (m ³ /s)	0.352	0.379	0.471	0.503	0.529	0.552	0.589
225mm dia. Orifice (m ³ /s)	0.041	0.090	0.199	0.223	0.243	0.272	0.302
10m Emergency Weir (m ³ /s)	0 *	0 *	0 *	0 *	0 *	0 *	0 *
TOTAL (m ³ /s)	1.095	1.225	1.746	3.441	4.138	4.598	5.231

Flow Mitigation from Existing Condition (m ³ /s)	0.674	0.824	1.173	0.130	0.011	0.220	0.256
Attenuation Achieved (Y/N)	Y	Y	Y	Y	Y	Y	Y
Flow Mitigation Achieved	38.1%	40.2%	40.2%	3.6%	0.3%	4.6%	4.7%

Table 5.2.4.2: Summary of Mitigated Discharges from XPSTORM Hydrologic / Hydraulic Results

* The emergency weir does not activate in a 1% AEP storm event – with predicted water surface levels only reaching RL7.489m. Freeboard of 0.171m is achieved in the major storm event to provide sufficient serviceability of the adjacent DTMR footpath to which emergency overflows are directed from the detention basin. Furthermore, the lowest allotment pad (Lot 101) adjacent the basin is proposed to be constructed +1.8 metres above the emergency weir crest level. Allotment pads 111, 112, 113 and 114 are proposed to be constructed +3.5 metres above the emergency weir crest level.

5.2.5 DISCUSSION ON MODELLING OUTCOMES

The above hydraulic modelling has confirmed that there is no increase in peak discharge flow rates from the development site to existing infrastructure or downstream / neighbouring properties by implementing the proposed designed detention measures. All AEP's ranging from 63.2% (equiv. Q_1) to 1% (equiv. Q_{100}) achieve mitigation.

Refer important note below.

Important Note:

Due to the predicted water surface elevations and depths – it is proposed that the bio-retention basin be fenced at its perimeter to restrict public access for safety. Fencing is proposed as the City of Gold Coast Council's standard chain wire type fencing (or approved equivalent) at a height of 1.80 metres above finished ground level.

Details of the fence type, embellishments and colour will be confirmed at the detailed design phase. Provision shall be made for a master-keyed gate location to enable access for Council staff to the maintenance track adjoining the internal entry road in Stage 1.

6.0 STORMWATER QUALITY

Stormwater quality analysis has been undertaken through the use of MUSIC software to confirm the adequacy of proposed Stormwater Quality Improvement Devices (SQIDs) required to meet the State Planning Policy's (SPP) Water Quality Objectives (WQOs) and the pollutant removal targets set by the City of Gold Coast Council. A suitable treatment strategy addressing the typical pollutant types generated during construction and operation of an industrial development are outlined within this section of reporting.

6.1 POLLUTANTS OF CONCERN

There are a number of pollutants typically generated during the operational phase (following construction) of an industrial development. These include:

- **Litter / gross pollutants**
- **Sediment**
- Toxic materials
- Heavy metals
- Hydrocarbons
- **Nutrients (i.e. nitrogen & phosphorous)**
- Pathogens / faecal coliforms
- Oxygen demanding substance
- Surfactants
- Acid or alkaline substances
- Organochlorines & organophosphates
- Thermal pollution

The key pollutants highlighted in **bold** above represent those that will be further addressed within this report. This will be done through the use of MUSIC modelling software which will assist in estimating the generation of the pollutants in the developed condition and the associated treatment measures requiring implementation in order to meet the stormwater quality objectives as defined within Section 6.2 of this report.

6.2 STORMWATER QUALITY OBJECTIVES (OPERATIONAL PHASE)

City of Gold Coast Council have set stormwater quality objectives with the intent of "protecting receiving water quality by limiting the quantity (loads) of stormwater pollutants discharged into receiving waters from development" such as that proposed over the subject site.

These are summarised in *Table 4.10 of SC6.11.4 Stormwater Drainage and Water Sensitive Urban Design standards* of Council's City Plan Version 7, and outlined below:

Pollutant Type	Load Reduction Objective (in mean annual load)
Gross Pollutants (>5mm)	90%
Total Suspended Solids (TSS)	80%
Total Phosphorous (TP)	60%
Total Nitrogen (TN)	45%

Table 6.2: CoGC's Stormwater Quality Objectives (Source: City Plan v7, Schedule SC6.11.4)

6.3 PROPOSED STORMWATER QUALITY MANAGEMENT STRATEGY

Development over the subject site has the potential to introduce increased pollutant loads and concentrated stormwater runoff into existing downstream waterways. To mitigate any potential increase in the export of pollutants from the subject site, suitable stormwater treatment devices will be utilised throughout the developed area as part of the integrated design of the road and stormwater drainage networks.

The implementation of a site-specific stormwater treatment train prior to the discharge of stormwater from the site will ensure the quality objectives outlined in Section 6.2 of this report are achieved.

6.3.1 BIO RETENTION BASINS

Due to the spatial allowances over the subject site and the proposed development type being an Industrial Estate, bio retention basins have been identified as a suitable Stormwater Quality Improvement Device (SQID) to reduce the off-site discharge of pollutants in line with the operational phase stormwater quality objectives identified within this report.

Bio retention basins are designed to treat conveyed stormwater by filtering contaminated runoff through various layers of vegetation, biologically active sands and loam filter media which capture the pollutants as the water percolates down through the system.

The treated water is then conveyed through a series of perforated pipes to downstream drainage systems. A typical configuration of a bio retention system is outlined in Figure 6.3.1 below.

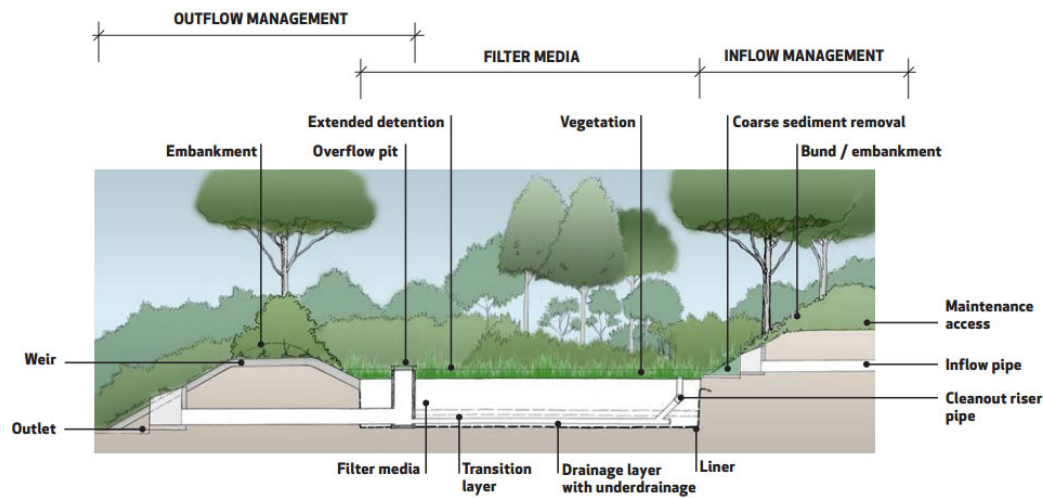


Figure 6.3.1: Components of a Typical Bio Retention System (Source: Water by Design, Bio Retention Technical Design Guidelines Version 1.1 Oct 2014)

The bio retention basin for the subject site has been designed in accordance with *Bio Retention Technical Design Guidelines (2014)* with the properties as outlined in *Table 6.3.1* below.

Outlet structures within the basin are designed to ensure an extended detention depth of 300mm is maintained over the filter media. The required surface area and filter media profile required to adequately treat the contributing developed catchment is discussed within Section 6.4 of this report.

Parameter	Value
Geofabric Lining to Base	Yes
Hydraulic Conductivity <i>Normal Analysis</i>	200 mm/hr
Hydraulic Conductivity <i>Sensitivity Analysis</i>	50 mm/hr
Orthophosphate Content	30 mg/kg
Filter Media's TN Content	400 mg/kg
Vegetation Properties	Basin to be vegetated with effective nutrient removal plants

Table 6.3.1: Summary of Adopted Bio Retention Parameters

6.4 MUSIC MODELLING METHODOLOGY FOR THE DEVELOPMENT SITE

MUSIC Version 6.3.0 was utilised for the water quality modelling of the proposed development in accordance with *Water by Design's MUSIC Modelling Guidelines 3.0 (2018)*.

Modelling of the developed scenario with the nominated SQIDs in place was undertaken replicate the transfer of pollutants through a stormwater drainage system and to assist in determining the effectiveness of the proposed stormwater treatment train in meeting the City of Gold Coast Stormwater Quality Objectives.

6.4.1 METEOROLOGICAL DATA

The meteorological data required for input into MUSIC software was obtained through CoGC's predetermined MUSIC-link v6.32 software application for Beenleigh Bowls Club (Stn No. 040406). The data utilised is in the form of 6-minute pluviographic data for a 10-year period from 01st January 1990 to 31st December 1999. The mean average rainfall for this period was 1,105mm.

Daily potential evapo-transpiration (PET) data (01/01/1990 to 31/12/1999) from the above-mentioned station has been used.

A summary of the information is indicated below:

Catchment Name: 5941 CoGC Industrial Development, Yatala MUSIC Model
Rainfall Station: 40406 BEENLEIGH
ET Station: User-defined monthly PET
Start Date: 1/01/1990 12:00 AM
End Date: 31/12/1999 11:54 PM
Modelling Time Step: 6 Minutes

	Rainfall/6 Minutes	Evapo-Transpiration
mean	0.013	4.086
median	0.000	3.600
maximum	22.100	6.290
minimum	0.000	2.000
10 percentile	0.000	2.033
90 percentile	0.001	6.194
	Rainfall	Evapo-Transpiration
mean annual	1105	1492

6.4.2 SOURCE NODES

MUSIC modelling has utilised the *City of Gold Coast (North) MUSIC-Link data (Version 6.32)* to define the parameters assigned to the pollutant source node inputs for the MUSIC model. Refer images on the following page. No calibration was undertaken to CoGC source nodes.

Refer **Appendix E** for the MUSIC Catchment Allocation Plans relevant to the modelling.

CITY OF GOLD COAST™
City of Gold Coast (Central)
City of Gold Coast Central.mlb
City of Gold Coast (North)
City of Gold Coast North.mlb
City of Gold Coast (South)
City of Gold Coast South.mlb

Current Project Version	
Music Version	6.3.0
MUSIC-link Data Version	6.32
Authority	City of Gold Coast
Area	City of Gold Coast (North)
Scenario	City of Gold Coast (North)

The intended industrial land use allows the developed catchment parameters to be conservatively assumed with the catchments broken down into a number of major surface types being ground level, roads (includes entire road reserve) and roofs.

These surface types were allocated an impervious area (%) and further refined through the MUSIC modelling process via the “split” catchment approach in accordance with the *Healthy Waterways MUSIC Modelling Guidelines Version 3.0 – 2018 Table 3.4 and 3.6*.

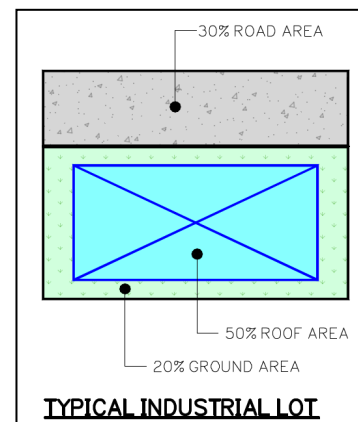
The below table and figures summarise the imperviousness of the allocated source nodes within the MUSIC model for Stage 1. Where a proposed architectural design was available for the site, the MUSIC modelling has assumed these areas to be exact. However, in the absence of an architectural layout; the modelling has been guided by *Table 3.4 Typical Surface-Type Splits* for Industrial Development type – where the surface splits are defined below:

Road – 30%

Roof – 50%

Ground – 20% (extract from *Healthy Waters V3.0*)

External catchments that are conveyed through the site are assumed to be treated on site by the relevant upstream lot owner prior to entering the subject site.



Surface Type: Industrial	MUSIC Source Node	Modelling Approach	Area (Ha)	Impervious %
(Percentage of Contributing Catchment)	Stage 1 (DEV-5) Total Catchment = 15.453 Ha			
Impervious (81%)	Road	Split	6.224	75
	Roof	Split	6.296	100
Pervious (19%)	Ground	Split	2.933	60
	Total		15.453	

Table 6.4: MUSIC Modelling Summary of Source Node Impervious Allocations

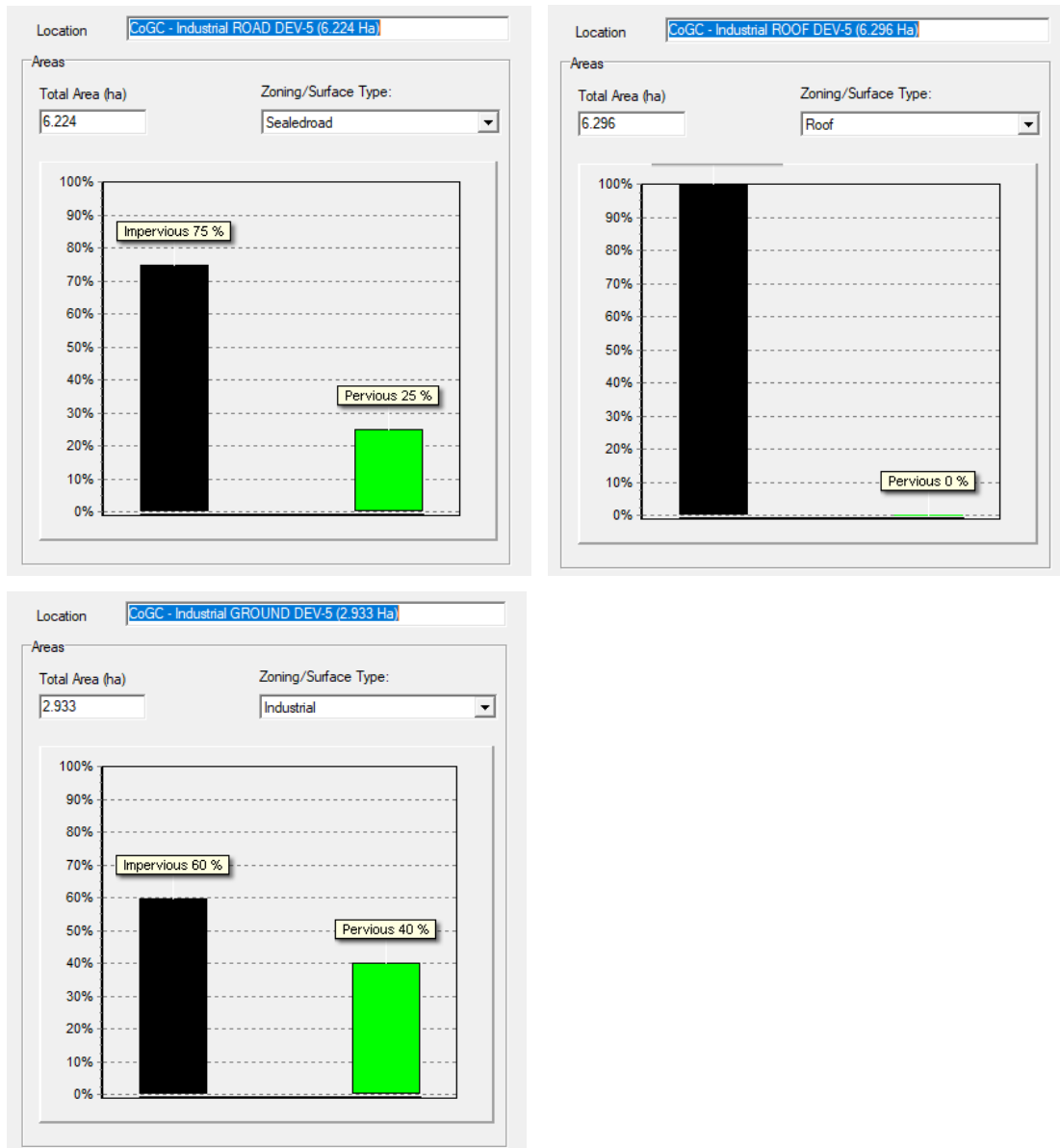


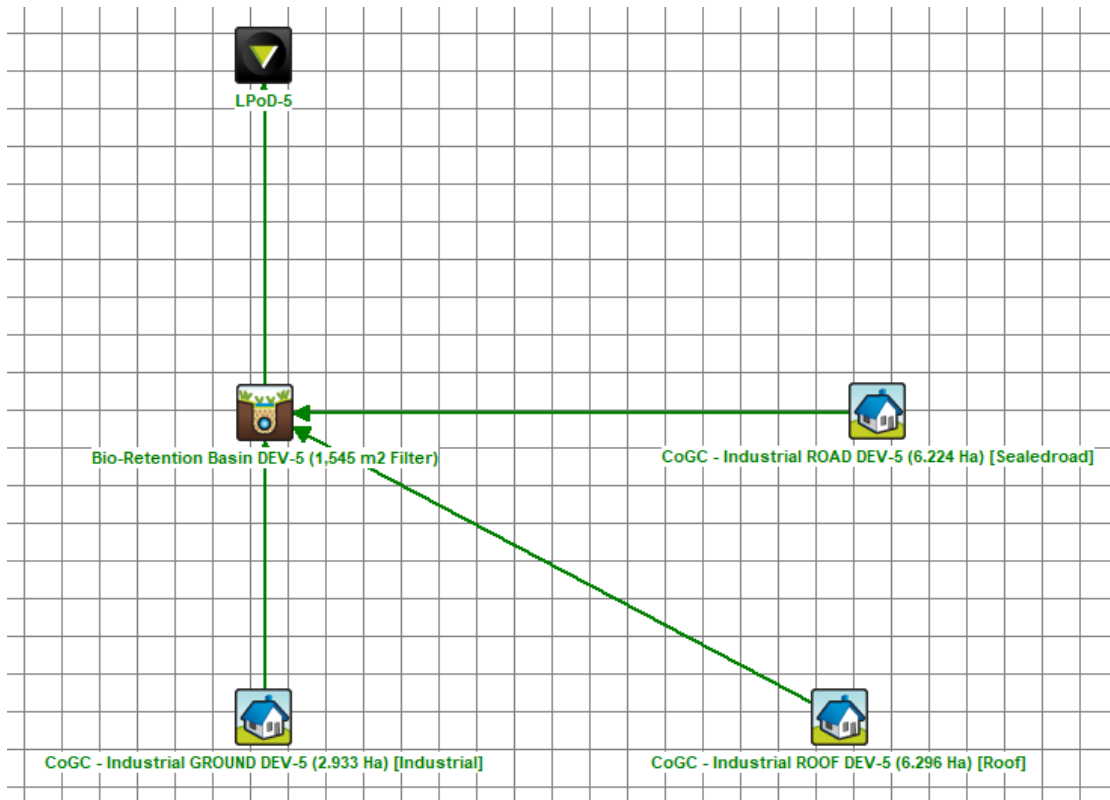
Figure 6.4.1: MUSIC Modelling Source Node Impervious Allocations

6.4.3 DRAINAGE LINKS

No routing has been adopted for the drainage links within the modelling that has been undertaken. This approach is believed to provide more conservative results.

6.4.4 MUSIC MODEL LAYOUT AND RESULTS

The diagrammatic representation of the source nodes, modelling configuration and results of pollutant reduction are outlined in Figure 6.4.4-1 below for the post developed catchment.



	Sources	Residual Load	% Reduction
Flow (ML/yr)	134	129	3.4
Total Suspended Solids (kg/yr)	25200	6520	74.2
Total Phosphorus (kg/yr)	51.2	20	61
Total Nitrogen (kg/yr)	291	190	34.7
Gross Pollutants (kg/yr)	3350	0	100

SENSITIVITY ANALYSIS @ 50mm/hr SATURATED HYDRAULIC CONDUCTIVITY.

	Sources	Residual Load	% Reduction
Flow (ML/yr)	134	129	3.3
Total Suspended Solids (kg/yr)	25200	4530	82
Total Phosphorus (kg/yr)	51.2	13.8	73.1
Total Nitrogen (kg/yr)	291	143	51
Gross Pollutants (kg/yr)	3350	0	100

NORMAL ANALYSIS @ 200mm/hr SATURATED HYDRAULIC CONDUCTIVITY.

The normal analysis returns a satisfactory result for meeting the SPP Water Quality Objectives. Refer above image for modelling outcomes.

Figure 6.4.4-1: Catchment DEV-5 MUSIC Layout and Results

The reduction in target pollutants to meet City of Gold Coast Council's requirements are achieved based on the below bio retention measures being implemented for the catchment.

Parameter	Value
	DEV-5
Filter Area (m2)	1,545
Filter Media Depth (m)	0.70
Extended Detention Depth (m)	0.30
Weir Crest Width (m)	10.00

Refer also **Appendix F** for the CoGC MUSIC-Link summary report card to support the modelling outcomes described in this section.

Inlet Properties	
Low Flow By-pass (cubic metres per sec)	0.000
High Flow By-pass (cubic metres per sec)	100.000
Storage Properties	
Extended Detention Depth (metres)	0.30
Surface Area (square metres)	1545.00
Filter and Media Properties	
Filter Area (square metres)	1545.00
Unlined Filter Media Perimeter (metres)	0.01
Saturated Hydraulic Conductivity (mm/hour)	200.00
Filter Depth (metres)	0.70
TN Content of Filter Media (mg/kg)	400
Orthophosphate Content of Filter Media (mg/kg)	30.0
Infiltration Properties	
Exfiltration Rate (mm/hr)	0.00

NORMAL ANALYSIS

Table 6.4.4: Summary of Proposed Bio Retention Measures

Lining Properties	
Is Base Lined?	☒ Yes ☐ No
Vegetation Properties	
☒ Vegetated with Effective Nutrient Removal Plants	
☐ Vegetated with Ineffective Nutrient Removal Plants	
☐ Unvegetated	
Outlet Properties	
Overflow Weir Width (metres)	10.00
Underdrain Present?	☒ Yes ☐ No
Submerged Zone With Carbon Present?	☐ Yes ☒ No
Depth (metres)	0.45

NORMAL ANALYSIS

Table 6.4.4: Summary of Proposed Bio Retention Measures (cont.)

CATCHMENT DRAINING TO THE SOUTH OF STAGE 1 (DEV-1 part)

Part of the developed catchment for Stage 1 has been designed to discharge to the south of Stage 1 into the future Stage 2 basin. MUSIC modelling was undertaken to determine the required bio-filtration media area to sufficiently treat the contributing runoff in line with the WQO's outlined in Section 6.2.

In the ultimate developed scenario – the stormwater quality and quantity basin is proposed to be located along the eastern boundary of the site (adjacent the CoGC Stapylton landfill buffer) catering for the entire future (Stage 2) industrial development proposal. As Council's policy requires that 80% of the total catchment must be developed prior to installation of the filter media, it is proposed that filter media associated with the part of Stage 1 will be bonded as uncompleted works with Council for the purpose of plan sealing of Stage 1 allotments and the temporary sediment basin as documented in the Change to Ground Level detailed Engineering Drawings. Servicing this part of the catchment will stay in place until such time as Stage 2 is developed to facilitate installation of the required stormwater quality treatment measures.

The modelling undertaken below is for the contributing Stage 1 *balance* catchment only, not the ultimate catchment.

Surface Type: Industrial	MUSIC Source Node	Modelling Approach	Area (Ha)	Impervious %
(Percentage of Contributing Catchment)	Stage 1 Balance (DEV-1 part) Total Catchment = 4.380 Ha			
Impervious (79%)	Road	Split	2.140	75
	Roof	Split	1.311	100
Pervious (21%)	Ground	Split	0.929	60
	Total		4.380	

Table 6.5: MUSIC Modelling Summary of Source Node Impervious Allocations (DEV-1 part.)

The reduction in target pollutants to meet City of Gold Coast Council's requirements are achieved based on the below bio retention measures being implemented for the catchment.

Parameter	Value
	DEV-1 part
Filter Area (m2)	660
Filter Media Depth (m)	0.70
Extended Detention Depth (m)	0.30
Weir Crest Width (m)	5.00

Refer also **Appendix F** for the CoGC MUSIC-Link summary report card to support the modelling outcomes described in this section.

	Sources	Residual Load	% Reduction
Flow (ML/yr)	36.9	35	5.2
Total Suspended Solids (kg/yr)	8280	1550	81.3
Total Phosphorus (kg/yr)	15.3	4.26	72.1
Total Nitrogen (kg/yr)	78.2	43.5	44.4
Gross Pollutants (kg/yr)	933	0	100

SENSITIVITY ANALYSIS @ 50mm/hr SATURATED HYDRAULIC CONDUCTIVITY.

	Sources	Residual Load	% Reduction
Flow (ML/yr)	36.9	35	5.1
Total Suspended Solids (kg/yr)	8280	1000	87.9
Total Phosphorus (kg/yr)	15.3	2.68	82.4
Total Nitrogen (kg/yr)	78.2	32.1	59
Gross Pollutants (kg/yr)	933	0	100

NORMAL ANALYSIS @ 200mm/hr SATURATED HYDRAULIC CONDUCTIVITY.

The normal analysis returns a satisfactory result for meeting the SPP Water Quality Objectives. Refer above image for modelling outcomes.

7.0 CONSTRUCTION, OPERATIONAL MANAGEMENT & MAINTENANCE

7.1 CONSTRUCTION PHASE SEDIMENT AND EROSION CONTROL

The operational phase detention basin (within Stage 1) is proposed to be utilised as a sediment basin during the construction phase of the development. The sizing of this basin has been determined using the ICEA Best Practice Erosion & Sediment Control Guidelines.

A High Efficiency Sediment (HES) basin is proposed off the balance fill pad to the immediate south of the development stage boundary. The sizing of the sediment basins have been undertaken in accordance with the requirements of the SPP.

Refer to **Appendix C** which contains copies of the sediment basin designs and calculations.

Where ultimate detention basin sizing does not align with the volumetric requirements of International Erosion Control Association's (IECA) Best Practice Guidelines, temporary construction phase sediment basins will be implemented.

Monitoring and maintenance of both the construction phase sediment basins and associated sediment and erosion control measures implemented over the site will be in accordance with IECA's Best Practice Guidelines and City of Gold Coast Council's standards.

7.2 ASSET OWNERSHIP AND HANDOVER

The SQIDs have been designed in accordance with QUDM standards and City of Gold Coast Council's Land Development Guidelines and in doing so aim to provide suitable and safe vehicular access for future maintenance.

The current development proposal retains the SQIDs as assets of the developer though a formal handover from the Contractor to the Asset Owner will be required to ensure the SQIDs have been built in accordance with the requirements

7.3 MAINTENANCE OF BIO RETENTION BASINS DURING OPERATIONAL PHASE

Inspections and maintenance are to be carried out on a yearly basis to determine if the SQIDs are functioning as intended.

The WSUD Technical Design Guideline for South East Queensland incorporates Maintenance Checklists (*Refer **Appendix G***) covering the items to be inspected and should be utilised and kept on record to ensure that a mechanism is in place to log the continued effectiveness of the SQIDs.

Inspections and any required maintenance will be the responsibility of the asset owner.

8.0 CONCLUSION

Gassman Development Perspectives have prepared this Site Based Stormwater Management Plan to support an application for *Reconfiguration of Lot* over Lot 501 on SP295994 (60 Stapylton Jacobs Well Road, Stapylton).

The purpose of which is to address and manage stormwater quantity and quality requirements of the proposed development over the subject site in accordance with the relevant State and Local Authority's legislation and regulatory guidelines.

The key outcomes achieved through the analysis and modelling undertaken within this report are demonstrated in the stormwater bio-retention and sediment basin designs within **Appendix C**, and are as described below:

Stormwater Quantity

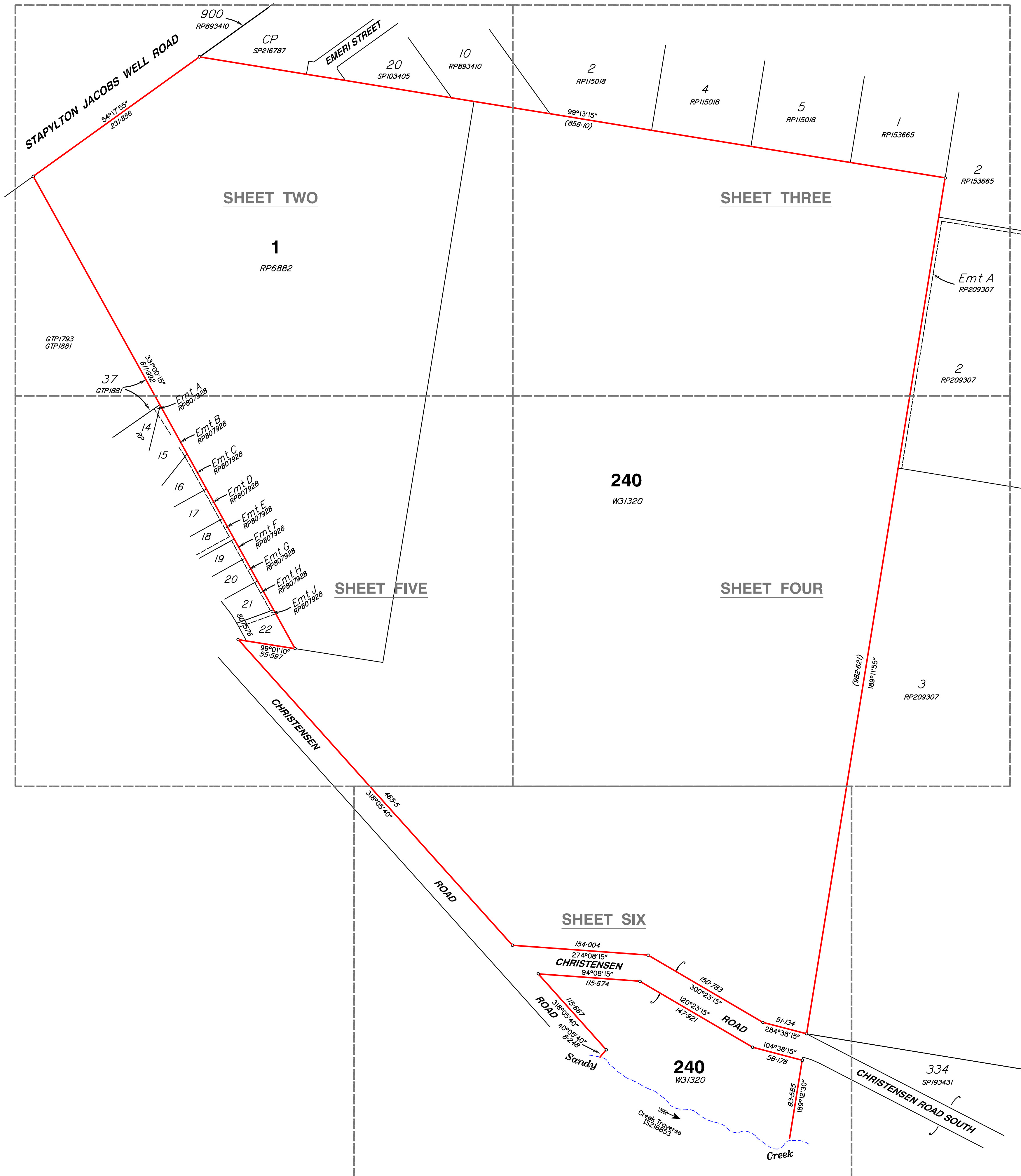
Suitable attenuation measures are able to be incorporated into the proposed development to ensure there is no adverse impacts to downstream properties, waterways or infrastructure as a result of an increase in peak stormwater flow rates discharging from the subject site upon development.

This is achieved through the design of an appropriately sized detention basin that complies with City of Gold Coast Council's Land Development Guidelines and the Queensland Urban Drainage Manual (QUDM).

Stormwater Quality

Stormwater quality objectives for the subject site are achieved through the design of a suitable stormwater treatment train that implements all necessary steps to ensure that the quality of stormwater discharging from the subject site meets the necessary standards to comply with City of Gold Coast Council's Water Sensitive Urban Design (WSUD) requirements, Queensland Urban Drainage Manual (QUDM) and the performance objectives of the Queensland State Planning Policy (SPP).

Appendix A – Site Survey Plan



Notes

This plan has been prepared for the exclusive use and purposes of the client as stated on this plan and should not be used by any other person or corporation and for any other purpose.

Property boundaries have not been defined by this survey and have been compiled from IS216853.

Only those underground features and services as shown on this plan have been located by this survey. Prior to any construction, demolition or excavation on the site, the relevant authority should be contacted for the location of any further underground services and detailed location of all services.

This plan may not be photocopied unless these notes are included.

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Client

HESTER

Project

CONTOUR AND DETAIL PLAN

Over Lot 1 on RP6882 and Lot 240 on WD31320

Parish of **ALBERT**

County of **Ward**

Local Govt **GOLD COAST CITY COUNCIL**

Level Datum	A.H.D.	Date Surveyed	Jan 2011
Meridian	IS216853	Surveyor	A. Macdonald
Contour Interval	0.2	Drawn	S. Holt
F.B.	No	Date Drafted	02-02-2011
Origin	PSM 133471	Checked	
	RL 22.169		

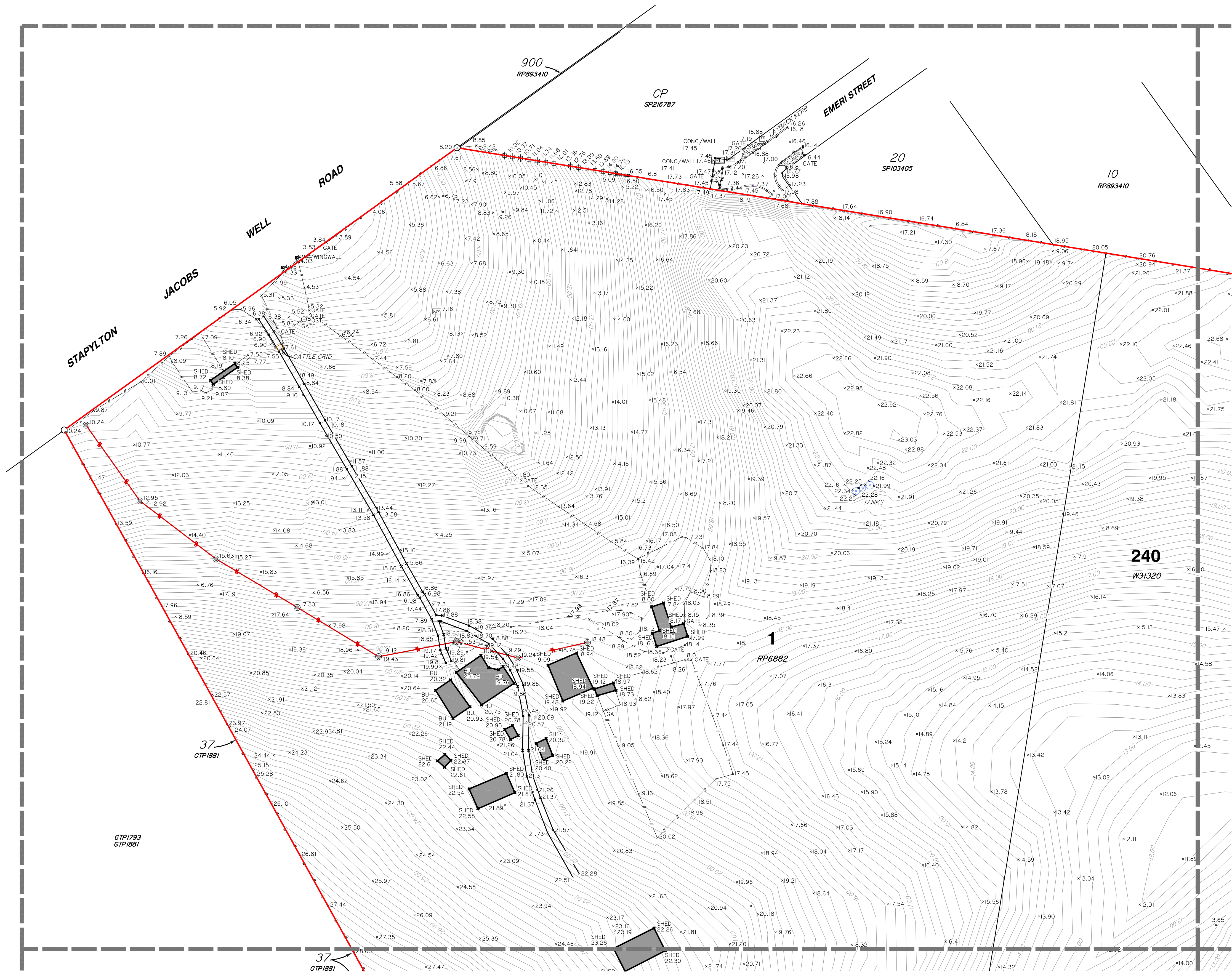
Scale (on A1 original)	Designed
1:2500	Drawn
	Date Designed



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perspectives

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design
environment
surveying

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e: mail@gassman.com.au
w: www.gassman.com.au



Scale 1:1000 - Lengths are in Metres.
0 10 20 30 40 50 60 70 80

- LEGEND**
- PERMANENT MARK
 - SEWER MANHOLE
 - SEWER INSPECTION OUTLET
 - ELECTRICITY PILLAR
 - ELECTRICITY POLE
 - ELECTRICITY POLE WITH LIGHT
 - TELSTRA PIT
 - MANHOLE
 - STORMWATER MANHOLE
 - GULLY TRAP
 - WATER METER
 - FIRE HYDRANT
 - VALVE
 - GATE
 - BOLLARD
 - CONCRETE
 - EDGE OF BITUMEN
 - FENCE
 - OVERHEAD ELECTRICITY
 - OPEN DRAIN
 - RETAINING WALL
 - EDGE OF GARDEN
 - CONTOUR LEVEL

Notes

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Client
HESTER

Project
CONTOUR AND DETAIL PLAN

Over Lot 1 on RP6882 and Lot 240 on WD31320

Parish of **ALBERT**
County of **Ward**
Local Govt **GOLD COAST CITY COUNCIL**

Level Datum	A.H.D.	Date Surveyed	Jan 2011
Meridian	IS133471	Surveyor	A. Macdonald
Contour Interval	0.2	Drawn	S. Holt
F.B.	No	Date Drafted	02-02-2011
Origin	PSM 133471	Checked	
	RL 22.169		
Scale (on A1 original)		Designed	
		Drawn	
		Date Designed	

 **gasman development perspectives** planning design environment surveying

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Gold Coast and Logan Office
Access Business Park
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t: (07) 38073333
f: (07) 32975461
e: mail@gasman.com.au
w: www.gasman.com.au

REFERENCE No. **5093-10**
PLAN No. **5093 S CD 01**



LEGEND

- PERMANENT MARK
- SEWER MANHOLE
- SEWER INSPECTION OUTLET
- ELECTRICITY PILLAR
- ELECTRICITY POLE
- ELECTRICITY POLE WITH LIGHT
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County of **Ward**

Local Govt **GOLD COAST CITY COUNCIL**

Level Datum	A.H.D.	Date Surveyed	Jan 2011
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Contour Interval	0.2	Drawn	S. Holt
F.B.	No	Date Drafted	02-02-2011
Origin	PSM 133471	Checked	RL 22.169
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	Drawn		
	Date Designed		



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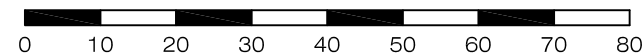


SEE SHEET THREE



SEE SHEET SIX

Scale 1:1000 - Lengths are in Metres.



LEGEND

- PERMANENT MARK
- SEWER MANHOLE
- SEWER INSPECTION OUTLET
- ELECTRICITY PILLAR
- ELECTRICITY POLE
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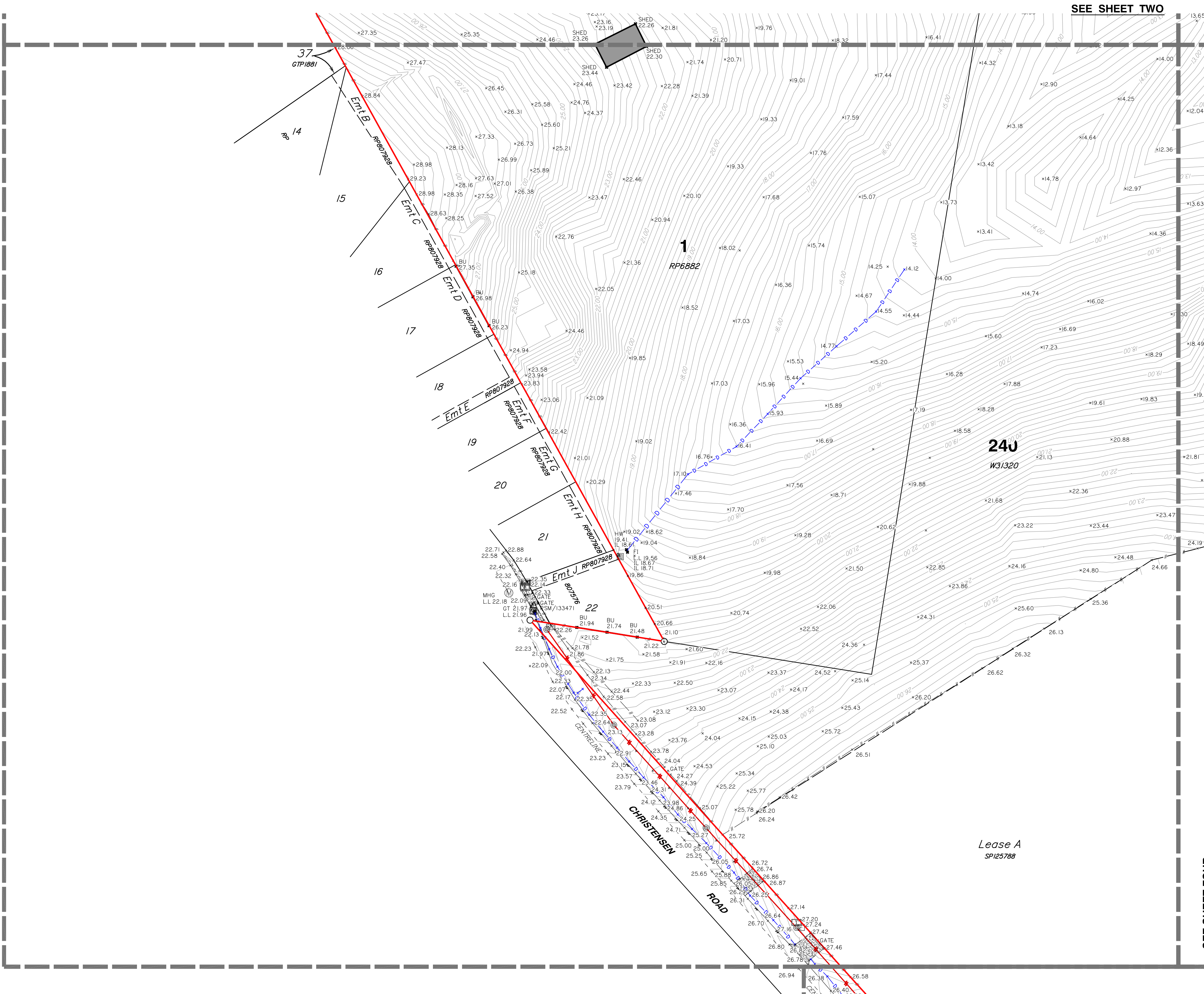
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1:1000	Drawn
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REFERENCE No. **5093-10**

PLAN No. **5093 S CD 01**



Scale 1:1000 - Lengths are in Metres.
0 10 20 30 40 50 60 70 80

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1:1000	Date Designed



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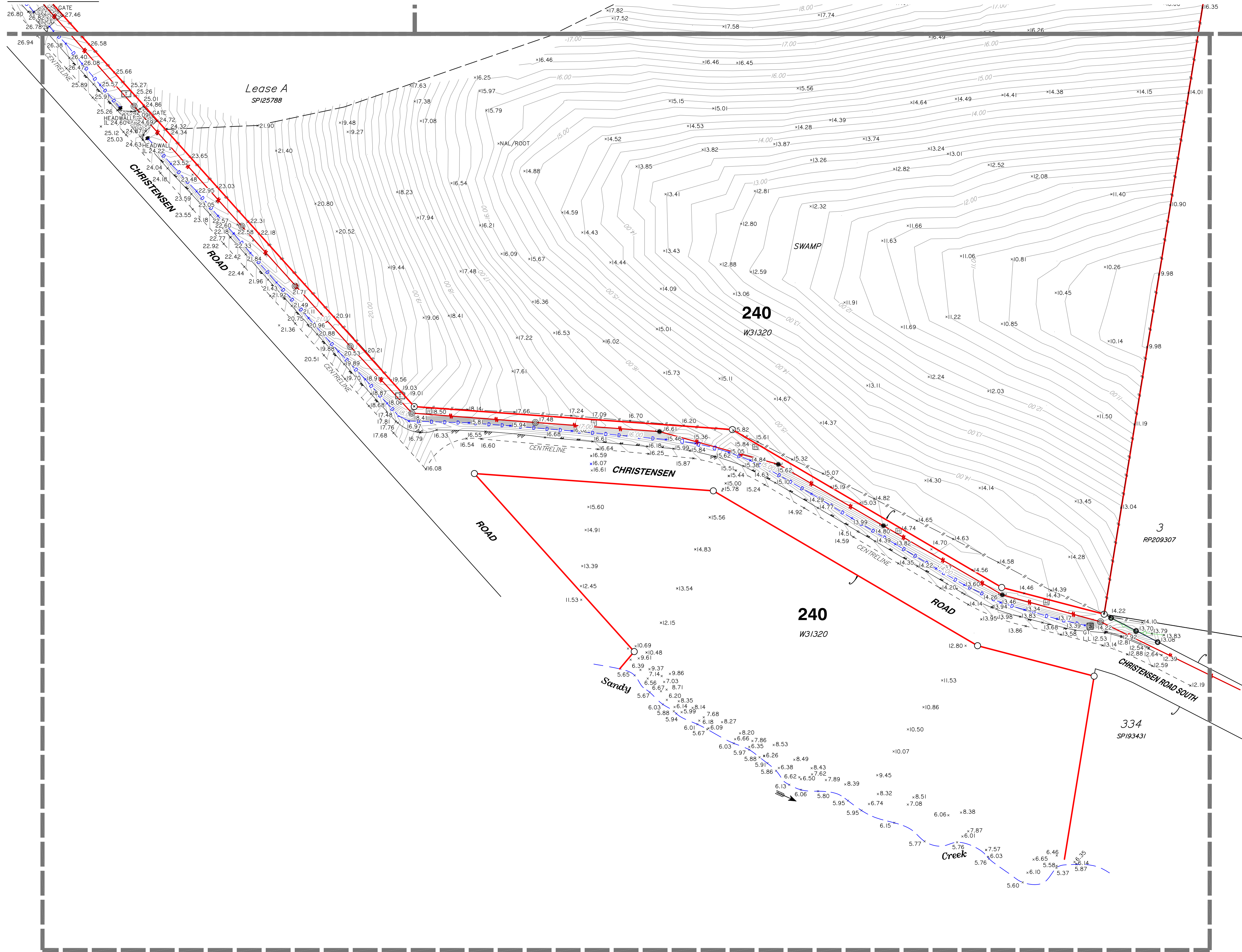
REFERENCE No. **5093-10**

PLAN No. **5093 S CD 01**



SEE SHEET FIVE

SEE SHEET FOUR



LEGEND

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	RL 22.169		

Scale (on A1 original)	Designed
1:1000	Date Designed



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REFERENCE No. **5093-10**

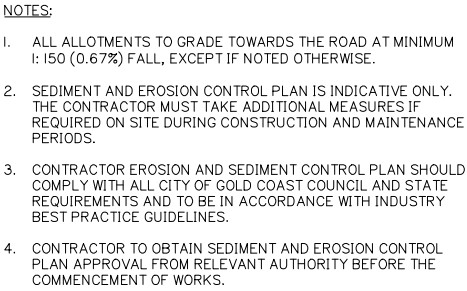
PLAN No. **5093 S CD 01**

Scale 1:1000 - Lengths are in Metres.



Appendix B – Pre and Post Development Catchment Plans

Appendix C – Design of Stormwater Quantity and Quality Basin



planning | environment | landscape | engineering | survey
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Gold Coast & Logan | 76 Business Street, Yatala QLD | PO Box 392, Beenleigh 4207

FRASERS PROPERTY
(AUSTRALIA) PTY. LTD

Site Address:
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ROAD & 31 YELLOWWOOD
ROAD, STAPYLTON QLD 4207

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Lot:	501, 4
Plan:	SP295994, RP6843
Local Authority:	CITY OF GOLD COAST COUNCIL
Level Datum:	AHD
Meridian:	-
Contour Interval:	-
PSM:	-
RL:	-

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DRAWING TITLE
CONSTRUCTION PHASE
SEDIMENT BASIN 1
LAYOUT

C	12-03-2020	INFORMATION REQUEST RESPONSE	SK	MC
B	20-02-2020	INFORMATION REQUEST RESPONSE	JG	MC
A	20-12-2019	ORIGINAL ISSUE	JRG	MC
Issue	Date	Description	DRN	CH

1:500 (FULL SIZE A1)
1:1000 (HALF SIZE A3)

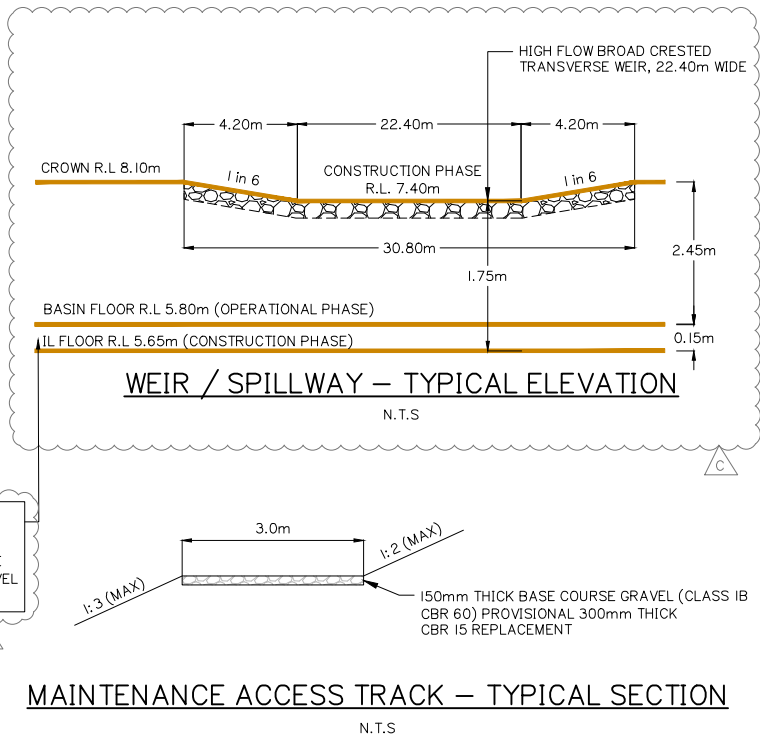
Scale at A1: 1:500

Designed:	IG
Drafted:	JRG
Approved:	MG
RPEQ:	16939
Signed:	
Date:	12-03-2020

Drawing No:	Rev. No:
5941 ENG BE1 026	C

SCALE 1: 500 (AI)

SEDIMENT BASIN DESIGN												
BASIN ID	SELECT DURATION OF CATCHMENT DISTURBANCE	IS DEWATERING OF TRENCHES REQUIRED?	EQUIPMENT LEASE OR PURCHASE?	SELECT CATCHMENT SCALE	DO ALL FLOWS ENTER BASIN AT SINGLE POINT?	BASIN TYPE	DOSING EQUIPMENT					
No. 1	> 12 MONTHS	NO	LEASE	> 5Ha	NO	TYPE A	IFOD–RAIN					
BASIN ID	CATCHMENT AREA	DESIGN EVENT	I_x yr, 24 hr	WATER TEMPERATURE	K_s	SETTLING ZONE DEPTH (D_s)	W:L	OPTIMUM LOW–FLOW DECAN T RATE	SELECTED LOW–FLOW DECAN T RATE (Q_d)	MIN SETTLING ZONE VOLUME (Min V_s)	MIN SETTLING ZONE SURFACE AREA (Min A_s)	LIMITING CRITERIA
	(Ha)	(1: X YEARS)	(mm/hr)	(°C)	(s/m)	(m)	(1:X)	(L/s/Ha)	(L/s/Ha)	(m³)	(m²)	
	No. 1	15.071	I	4.53	20	11150	1.3	4.8	9	9	3704	
BASIN ID	SETTLING ZONE			FREE WATER ZONE		SEDIMENT STORAGE ZONE		OVERALL DIMENSIONS RELATIVE TO SPILLWAY CREST (EXCL. FOREBAY)				
	ACTUAL SETTLING ZONE VOLUME (V_s)	ACTUAL SETTLING ZONE AREA (A_s)	SCOUR VELOCITY	DEPTH OF FREE WATER ZONE	VOLUME OF FREE WATER ZONE	SEDIMENT STORAGE VOLUME	SEDIMENT STORAGE DEPTH (APPROX.)	BATTER	WIDTH	LENGTH	DEPTH	
	(m³)	(m²)	(m/s)	(m)	(m³)	(m³)	(m)	(1: X)	(m)	(m)	(m)	
No. 1	3704	2827	0.009	0.22	370	1111	0.47	3	28.2	135.4	2.00	
SPILLWAY												
BASIN ID	BASIN DESIGN LIFE	DESIGN ARI	C_{10}	C	t_c	I	Q	HEAD OVER SPILLWAY	SPILLWAY CREST LENGTH	SPILLWAY CREST RL	MIN EMBANKMENT RL	
		yr				(mm/hr)	(m³/s)	(m)	(m)	(m)	(m)	
No. 1	> 12 MONTHS	1: 50	0.85	0.98	20.00	160.00	6.55	0.25	30.80	7.40	8.10	
BASIN ID	SETTLING ZONE (incl. sediment storage)				FOREBAY				HYDRAULIC CONTROLS			
	VOLUME (m³)	LENGTH (m)	WIDTH (m)	DEPTH (m)	VOLUME (m³)	LENGTH (m)	WIDTH (m)	DEPTH (m)	SPILLWAY CREST LENGTH (m)	SPILLWAY CREST (RL)	EMBANKMENT (RL)	LEVEL SPREADER CREST (RL)
	No.1	5185.2	135.4	28.2	2.00	763.40	13.5	28.2	2.00	30.8	7.40	8.10



MAINTENANCE ACCESS TRACK – TYPICAL SECTION

N.T.S

CONSTRUCTION PHASE SEDIMENT BASIN LAYOUT



Client:



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Project: M38 INDUSTRIAL
PARK YATALA

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ROAD & 31 YELLOWWOOD
ROAD, STAPYLTON QLD 4207

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RPD:

Lot: 501, 4
Plan: SP295994, RP6843
Local Authority: CITY OF GOLD COAST
COUNCIL
Level Datum: AHD
Meridian: -
Contour Interval: -
PSM: -
RL: -

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DRAWING TITLE
CONSTRUCTION PHASE
SEDIMENT BASIN 1
SECTIONS

C	12-03-2020	INFORMATION REQUEST RESPONSE	SK	MG	
B	20-02-2020	INFORMATION REQUEST RESPONSE	IG	MG	
A	20-12-2019	ORIGINAL ISSUE	JRG	MG	
Issue	Date	Description	DRN	CHK	

NOT TO SCALE

Scale at A1: NTS

Designed: IG

Drafted: JRG

Approved: MG

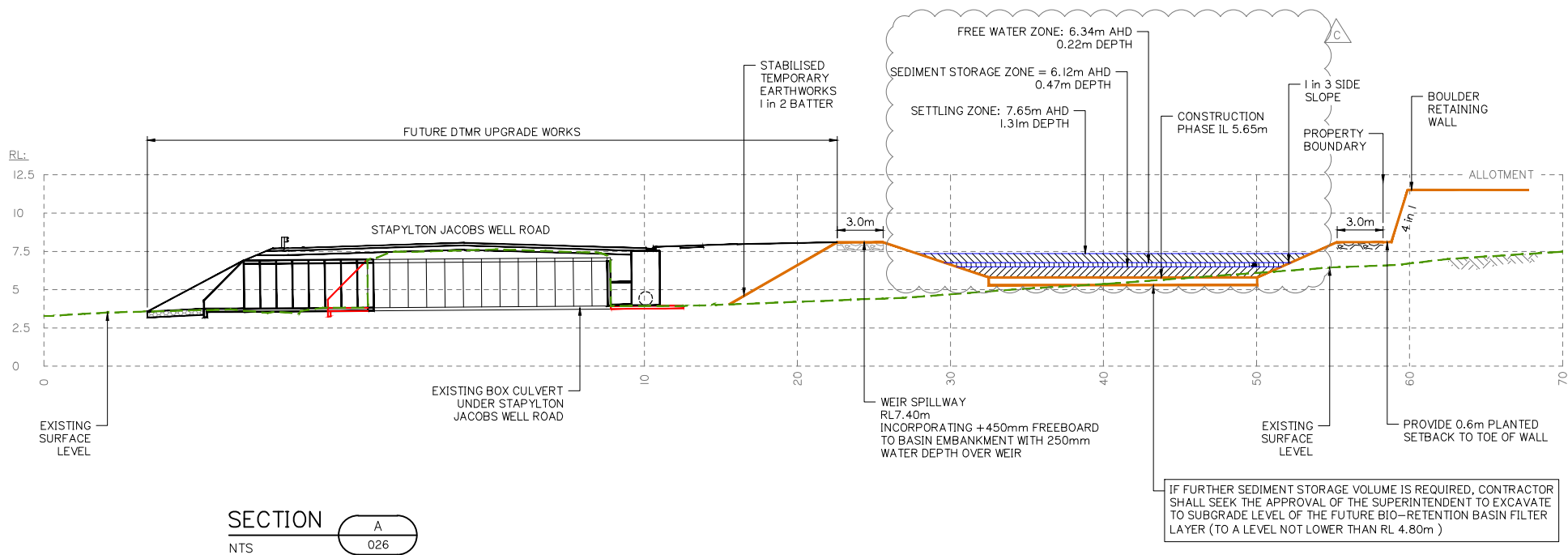
RPEQ: 16939

Signed:

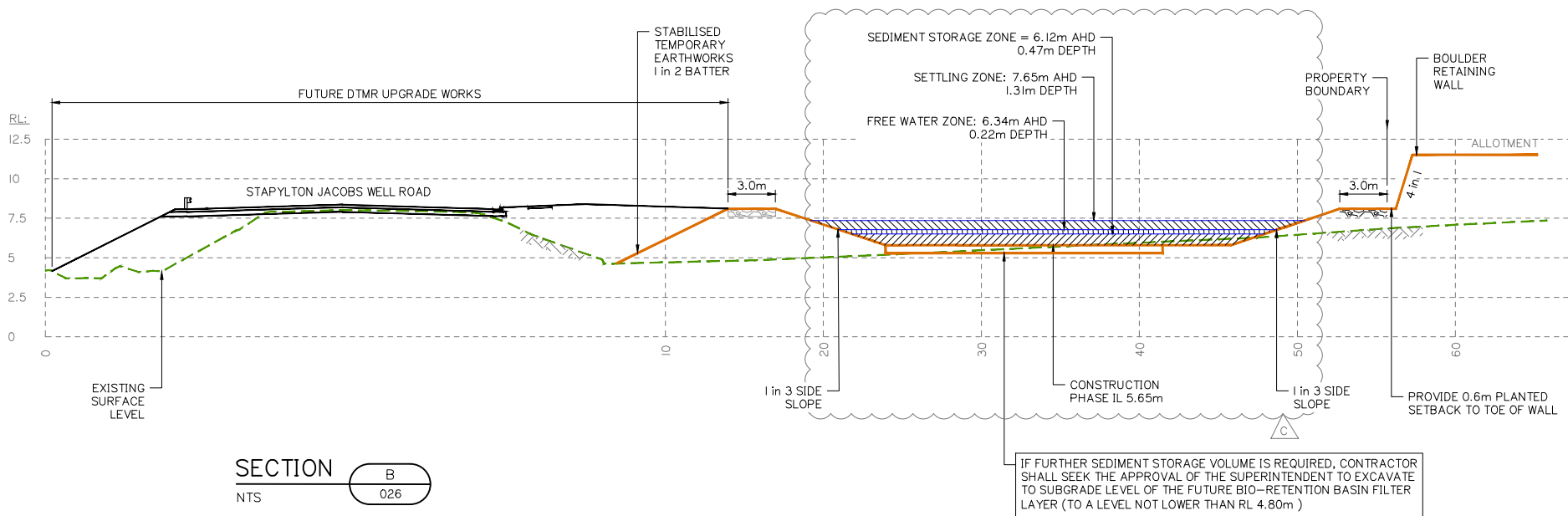
Date: 12-03-2020

Drawing No:
5941 ENG BE1 027

Rev. No:
C



SECTION A
NTS 026



SECTION B
NTS 026



		SPILLWAY									
BASIN ID	BASIN DESIGN LIFE	DESIGN ARI	C _D	C	tc	I	Q	HEAD OVER SPILLWAY	SPILLWAY CREST LENGTH	SPILLWAY CREST RL	MIN EMBANKMENT RL
		yr				(mm/hr)	(m ³ /s)	(m)	(m)	(m)	(m)
No. 2	> 12 MONTHS	1:50	0.88	1.01	25.00	143.00	4.81	0.28	19.10	9.81	10.54

Client:



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PARK YATALA

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CONSTRUCTION PHASE
SEDIMENT BASIN 2
LAYOUT

A	20-02-2020	INFORMATION REQUEST RESPONSE	IG	MG
B	20-12-2019	ORIGINAL ISSUE	JRG	MO
Institute	Date	Description	DRN	CH-K

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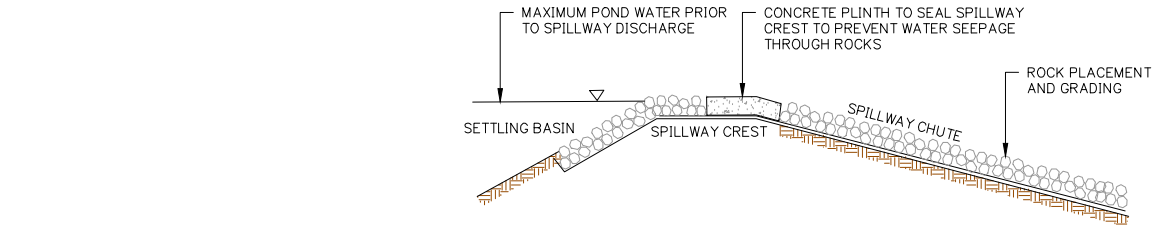


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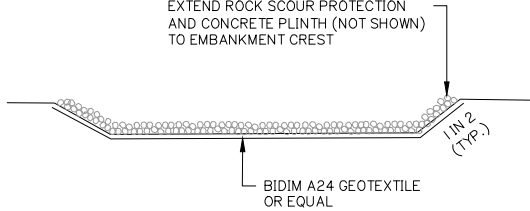
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Designed:	IG
Drafted:	JRG
Approved:	MG
RPEQ:	16939
Signed:	
Date:	20-02-2020

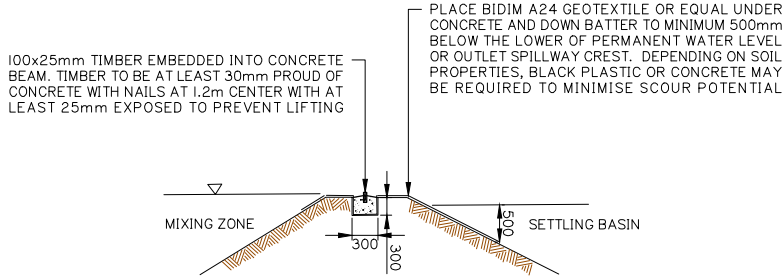
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5941 ENG BE1 028	B



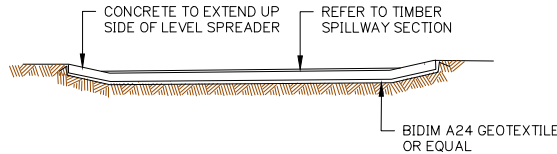
OUTLET SPILLWAY DETAILS
TYPICAL CROSS SECTION
NOT TO SCALE



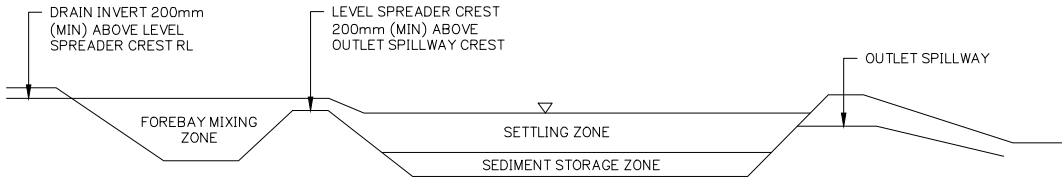
OUTLET SPILLWAY DETAILS
TYPICAL LONGITUDINAL SECTION
NOT TO SCALE



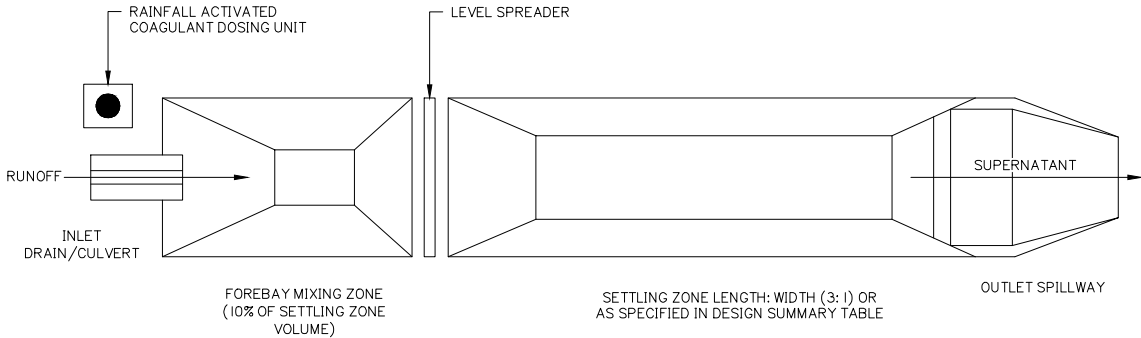
LEVEL SPREADER DETAILS
TYPICAL CROSS SECTION
NOT TO SCALE



LEVEL SPREADER DETAILS
TYPICAL LONG SECTION
NOT TO SCALE



TYPE A SEDIMENT BASIN LONGITUNDAL SECTION (TYP.)
NOT TO SCALE



TYPE A SEDIMENT BASIN PLAN VIEW (TYP.)
NOT TO SCALE

CONSTRUCTION PHASE SEDIMENT BASIN 2 SECTIONS

Client:



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ROAD, STAPYLTON QLD 4207

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SCALE IN METRES



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1:1000 (HALF SIZE A3)

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Date:	20-02-2020

Drawing No:
5941 ENG BE1 029

Rev. No:
B



**FRASERS
PROPERTY**

FRASERS PROPERTY
(AUSTRALIA) PTY. LTD.

Site Address:
60 STAPYLTON JACOBS WELL
ROAD & 31 YELLOWWOOD
ROAD, STAPYLTON QLD 4207

Lot:	501, 4
Plan:	SP295994, RP6843
Local Authority:	CITY OF GOLD COAST COUNCIL
Level Datum:	AHD
Meridian:	-
Contour Interval:	-
PSM:	-
RL:	-

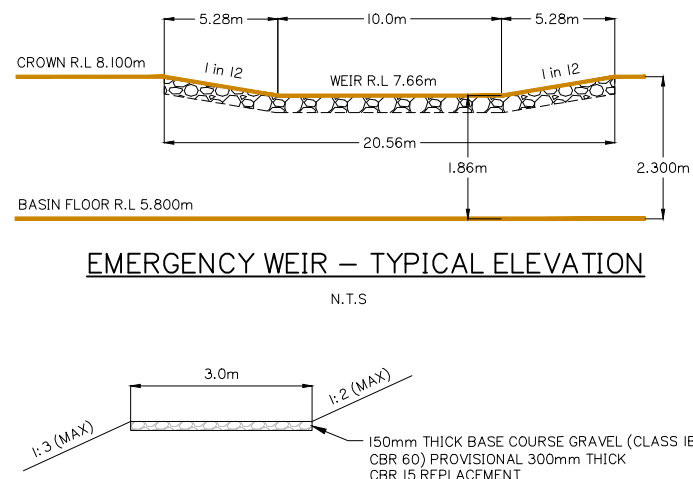
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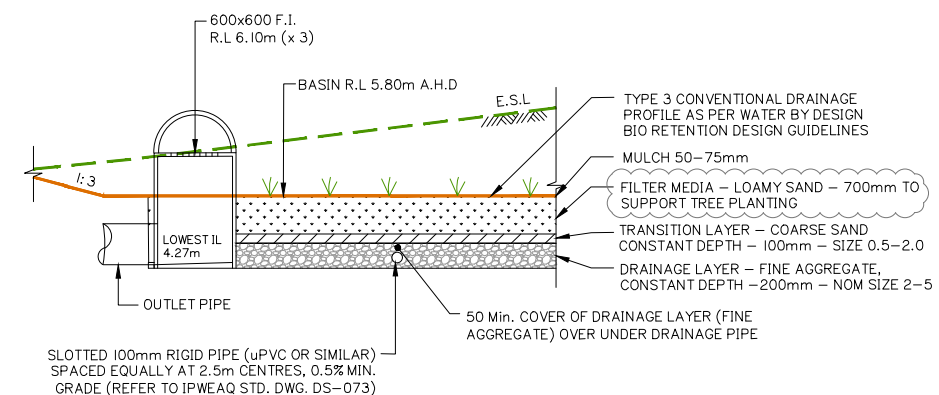
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B	20-09-2020	INFORMATION REQUEST RESPONSE	IQ	MG	
A	20-12-2019	ORIGINAL ISSUE	JRG	MG	
Issue	Date	Description	DRN	CHK	

Designed:	IG
Drafted:	JRG
Approved:	MG
RPEQ:	16939
Signed:	
Date:	12-03-2020

Drawing No:	Rev. No:
5941 ENG BE1 570	C

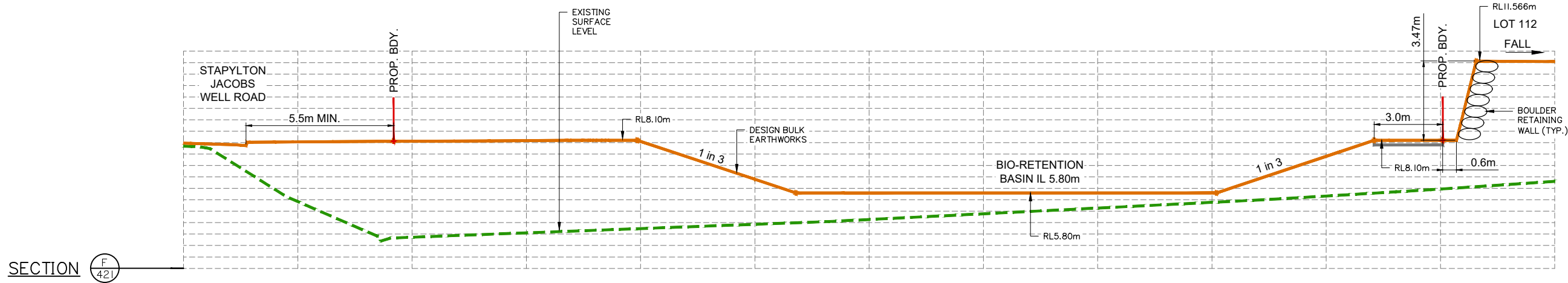
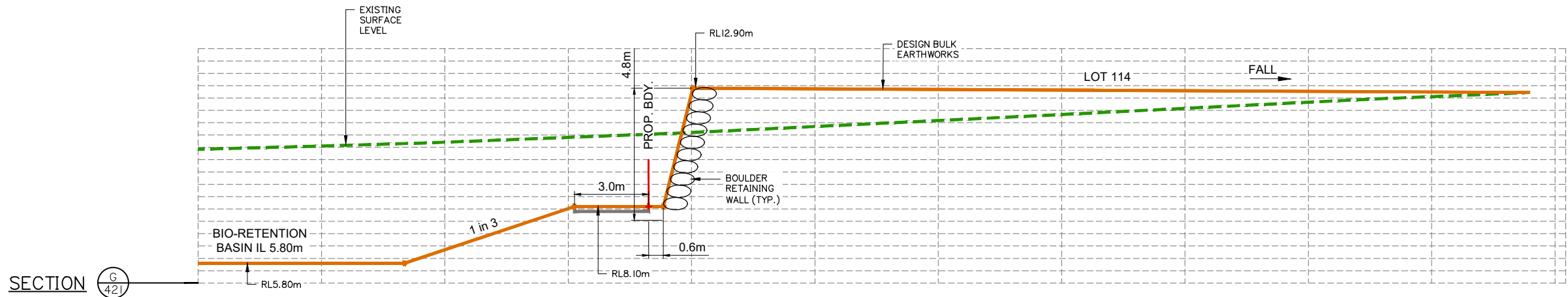
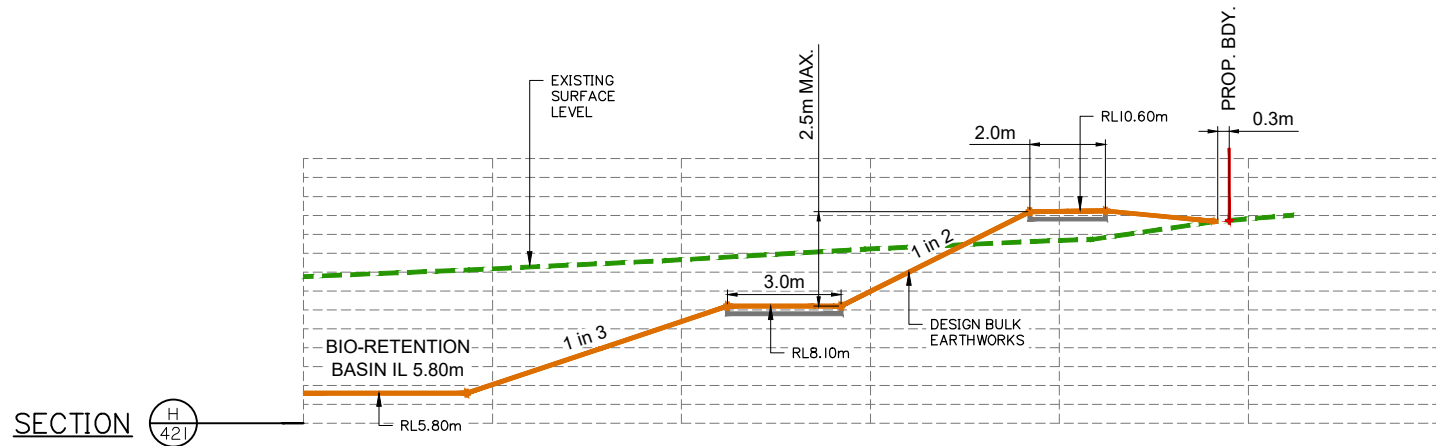
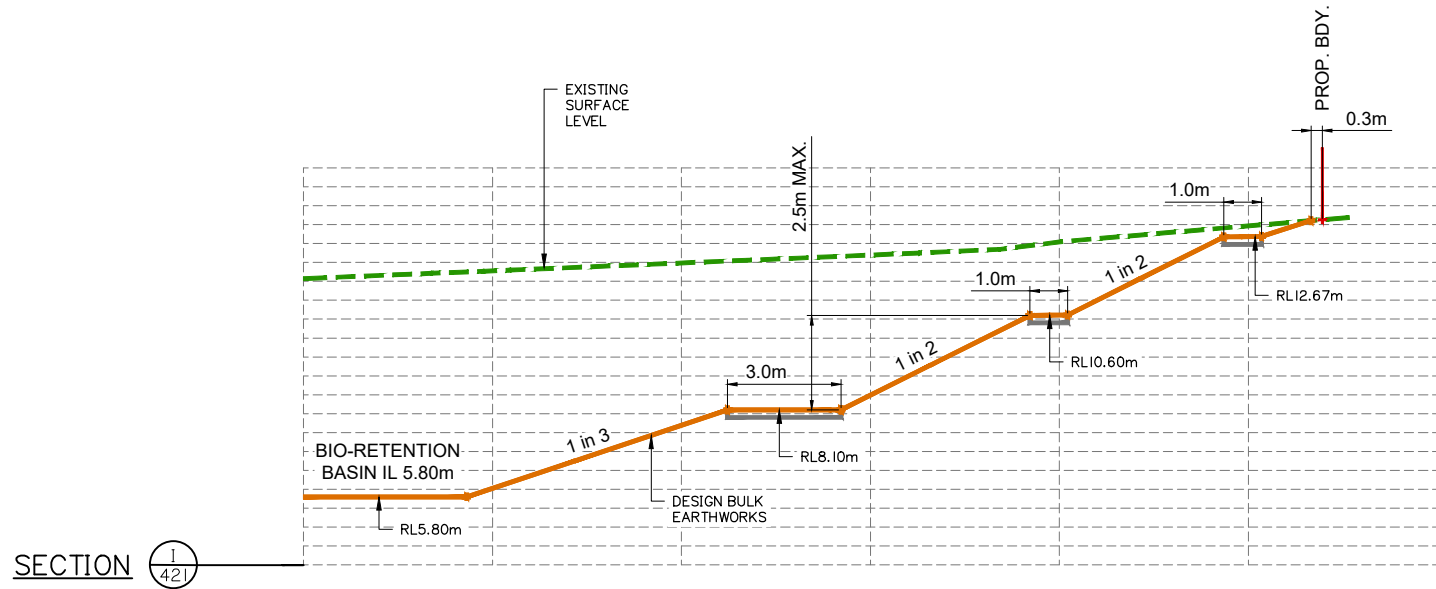


BIORETENTION BASIN I LAYOUT PLAN



TYPICAL BIO-RETENTION BASIN DETAIL

g:\Projects\5941\engineering\Acad\BE1 CGL\Current\5941 ENG BE1 570.dwg



BULK EARTHWORKS DETAILED SECTIONS SHEET 2 OF 2

Client:



Project: M38 INDUSTRIAL PARK YATALA

Site Address:
60 STAPYLTON JACOBS WELL ROAD & 31 YELLOWWOOD ROAD, STAPYLTON QLD 4207

THIS DRAWING IS INTENDED TO BE PRINTED IN COLOUR

RPD:

Lot: 501, 4
Plan: SP295994, RP6843
Local Authority: CITY OF GOLD COAST COUNCIL
Level Datum: AHD
Meridian: -
Contour Interval: -
PSM: -
RL: -

ISSUED FOR APPROVAL
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DRAWING TITLE
BULK EARTHWORKS
DETAILED SECTIONS
SHEET 2 OF 2

Issue	Date	Original Issue Description	IG DRN	MG CHK
A	20-02-2020			

SCALE IN METRES



1:100 (FULL SIZE A1)
1:200 (HALF SIZE A3)

Scale at A1: 1:100

Designed: IG

Drafted: IG

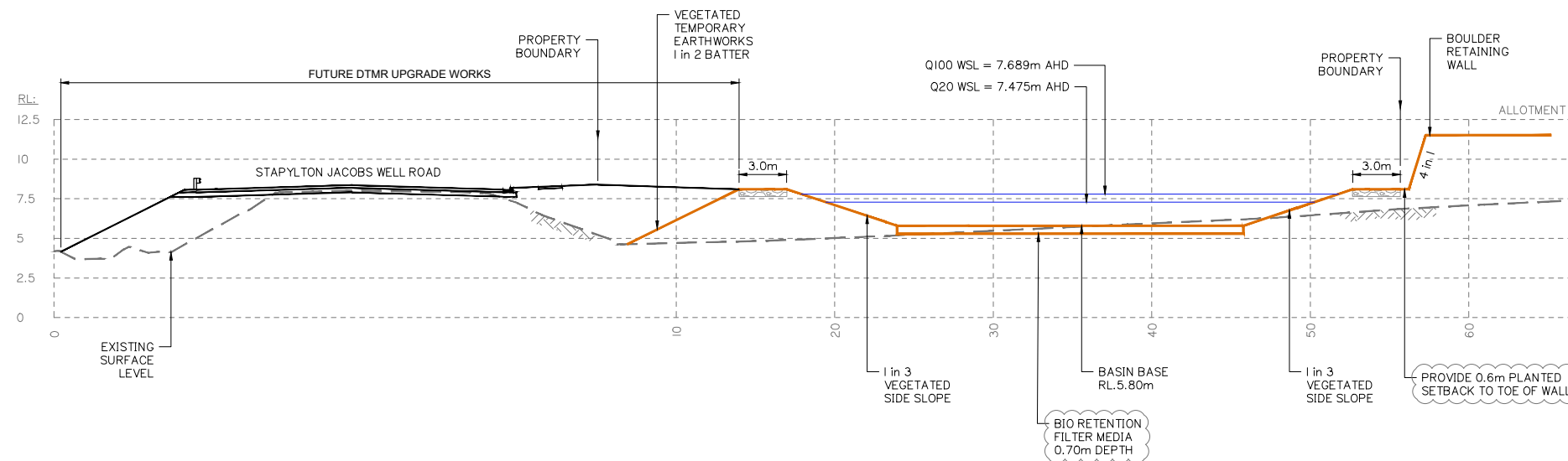
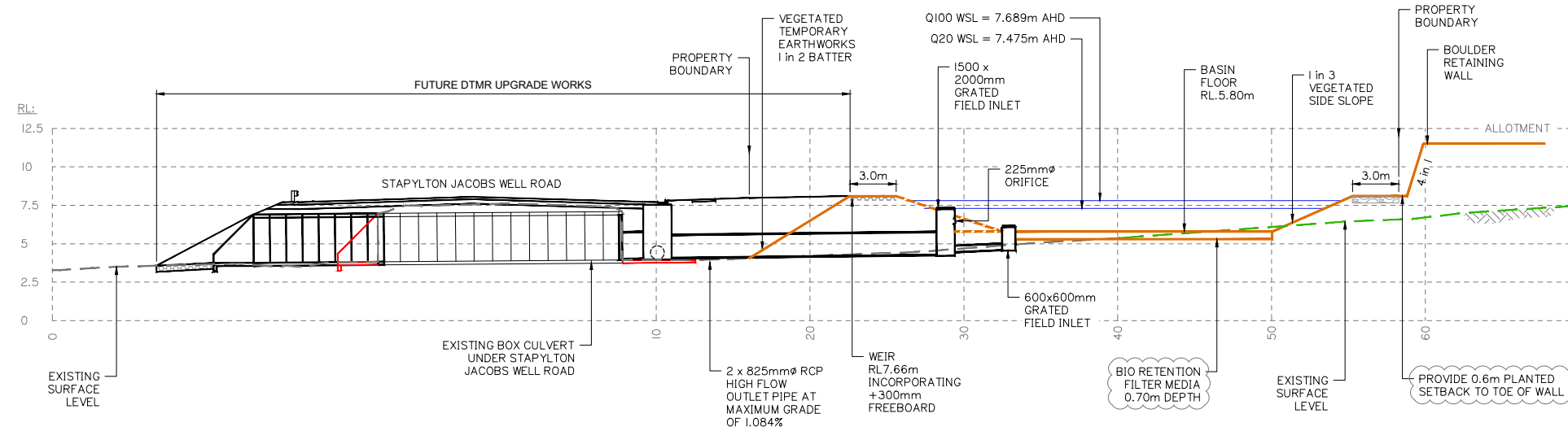
Approved: MG

RPEQ: 16939

Signed:

Date: 20-02-2020

Drawing No: 5941 ENG BE1 163
Rev. No: A



Appendix D – Balance Earthworks Below Defined Flood Event Level



Drawing No:	Rev. No:
5941 ENG BE1 056	B

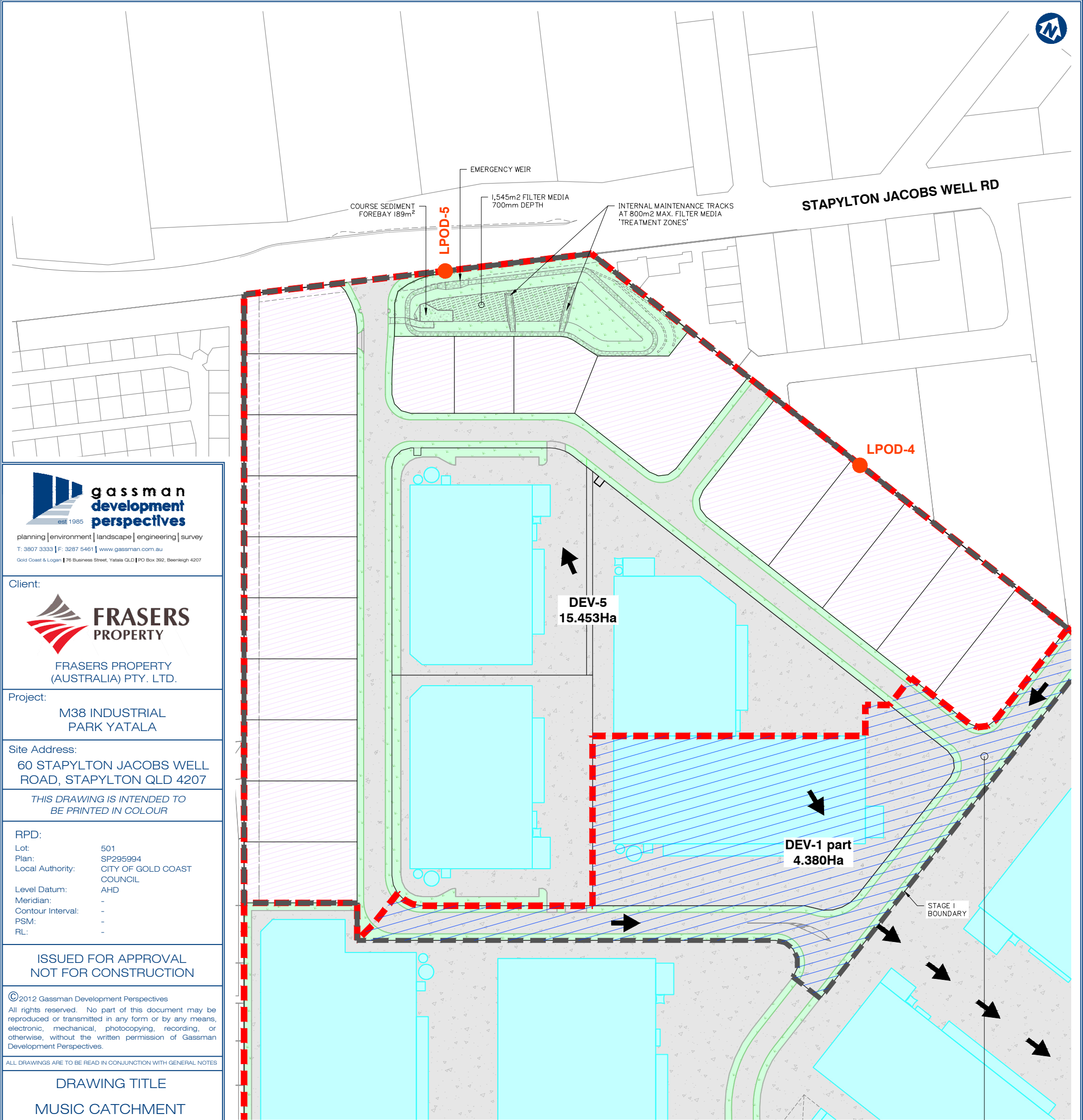


B	20-09-2020	INFORMATION REQUEST RESPONSE		IQ	MG
A	20-12-2019	ORIGINAL ISSUE		JRG	MG
Issue	Date	Description		DRN	CHK



Designed:	IG
Drafted:	JRG
Approved:	MG
RPEQ:	16939
Signed:	
Date:	20-02-2020

Appendix E – MUSIC Catchment Allocation Plan





est 1985
planning | environment | landscape | engineering | survey
T: 3807 3333 | F: 3287 5461 | www.gassman.com.au
Gold Coast & Logan | 75 Business Street, Yatala QLD | PO Box 392, Beenleigh 4207

Client:



FRASERS PROPERTY
(AUSTRALIA) PTY. LTD.

Project:

M38 INDUSTRIAL PARK YATALA

Site Address:

60 STAPYLTON JACOBS WELL ROAD, STAPYLTON QLD 4207

THIS DRAWING IS INTENDED TO BE PRINTED IN COLOUR

RPD:

Lot:	501
Plan:	SP295994
Local Authority:	CITY OF GOLD COAST COUNCIL
Level Datum:	AHD
Meridian:	-
Contour Interval:	-
PSM:	-
RL:	-

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DRAWING TITLE

MUSIC CATCHMENT ALLOCATION PLAN
STAGE 1

Issue	Date	Description	DRN	CHK
B	20-02-2020	INFORMATION REQUEST RESPONSE	JRG	MG
A	20-12-2019	ORIGINAL ISSUE	JRG	MG

0 25 50 75 100 125

1:1250 (FULL SIZE A1)
1:2500 (HALF SIZE A3)

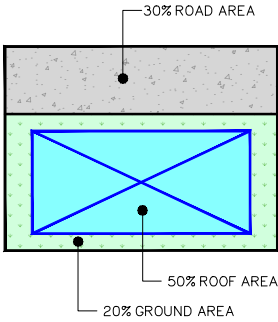
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Designed:	IG
Drafted:	JRG
Approved:	MG
RPEQ:	16939
Signed:	
Date:	20-02-2020

Drawing No: 5941 ENG SMP1 002 Rev. No: B

SURFACE TYPE: INDUSTRIAL	MUSIC SOURCE NODE	MODELLING APPROACH	AREA (Ha)	IMPERVIOUS %
Percentage of Contributing Catchment	Stage I (DEV-5) Total Catchment = 15.453 Ha			
IMPERVIOUS (81%)	ROAD	SPLIT	6.224	75
	ROOF	SPLIT	6.296	100
PERVIOUS (19%)	GROUND	SPLIT	2.933	60
	TOTAL		15.453	

- LEGEND**
- CATCHMENT BOUNDARY
 - ROAD
 - ROOF
 - GROUND
 - TYPICAL INDUSTRIAL LOT
REFER TO DETAIL OPPOSITE
 - 20m BUFFER +
ECOLOGICAL CORRIDOR



TYPICAL INDUSTRIAL LOT
TAKEN FROM MUSIC MODELLING
GUIDELINES v3.0 (2018)

- PROPOSED BIO RETENTION BASIN (DEV-5) DETAILS
- 1 IN 3 INTERNAL BATTER SLOPES.
 - 189m² COURSE SEDIMENT FOREBAY PROVIDED AT PIPE OUTLETS.
 - MAINTENANCE BUND / TRACK WHERE FILTER MEDIA TREATMENT ZONE EXCEEDS 800m².
 - 3.0m WIDE MAINTENANCE ACCESS TO PERIMETER.
 - 1,545m² FILTER AREA.
 - 0.70m FILTER DEPTH.
 - 300mm EXTENDED DETENTION.
 - 1,545m² EXTENDED DETENTION SURFACE AREA.
 - 200mm/hr SATURATED HYDRAULIC CONDUCTIVITY (NORMAL)
 - 50mm/hr SATURATED HYDRAULIC CONDUCTIVITY (SENSITIVE)
 - 400mg/kg TN CONTENT OF FILTER MEDIA.
 - 30mg/kg ORTHOPHOSPHATE CONTENT OF FILTER MEDIA.
 - BASE OF BASIN IS LINED.
 - BASIN IS VEGETATED WITH EFFECTIVE NUTRIENT REMOVAL PLANTS.
 - 10.0m BROAD CRESTED EMERGENCY SPILLWAY / WEIR (HIGH FLOW).
 - PERFORATED AND SOLID UNDER DRAINAGE IS PRESENT.
 - PROVIDE 1.80m HIGH CHAIN WIRE FENCING TO BASIN PERIMETER COLOURED: BLACK.

- BIO RETENTION BASIN
(DEV-1 part) DETAILS
- 660m² FILTER AREA.
 - 0.70m FILTER DEPTH.
 - 300mm EXTENDED DETENTION.
 - 660m² EXTENDED DETENTION SURFACE AREA.
 - 200mm/hr HYDRAULIC CONDUCTIVITY.
 - 400mg/kg TN CONTENT OF FILTER MEDIA.
 - 30mg/kg ORTHOPHOSPHATE CONTENT OF FILTER MEDIA.
 - BASE OF BASIN IS LINED.
 - BASIN IS VEGETATED WITH EFFECTIVE NUTRIENT REMOVAL PLANTS.
 - 5.0m BROAD CRESTED WEIR ASSUMED.
 - PERFORATED AND SOLID UNDER DRAINAGE IS PRESENT.

SURFACE TYPE: INDUSTRIAL	MUSIC SOURCE NODE	MODELLING APPROACH	AREA (Ha)	IMPERVIOUS %
Percentage of Contributing Catchment	Stage I (DEV-1 part) Total Catchment = 4.380 Ha			
IMPERVIOUS (79%)	ROAD	SPLIT	2.140	75
	ROOF	SPLIT	1.311	100
PERVIOUS (21%)	GROUND	SPLIT	0.929	60
	TOTAL		4.380	

(REFER BLUE CROSS-HATCHED AREA)

Appendix F – MUSIC Link Report

MUSIC-link Report

Project Details		Company Details	
Project:	5941 Frasers Property Yatala DEV-5	Company:	Gassman Development Perspectives Pty. Ltd.
Report Export Date:	5/02/2020	Contact:	Mitchell Gassman
Catchment Name:	5941 CoGC M88	Address:	c/o 76 Business Street Yatala 4207
Catchment Area:	15.453ha	Phone:	0738073333
Impervious Area*:	82.24%	Email:	mitchell@gassman.com.au
Rainfall Station:	40406 BEENLEIGH		
Modelling Time-step:	6 Minutes		
Modelling Period:	1/01/1990 - 31/12/1999 11:54:00 PM		
Mean Annual Rainfall:	1105mm		
Evapotranspiration:	1492mm		
MUSIC Version:	6.3.0		
MUSIC-link data Version:	6.32		
Study Area:	City of Gold Coast (North)		
Scenario:	City of Gold Coast (North)		

* takes into account area from all source nodes that link to the chosen reporting node, excluding Import Data Nodes

Treatment Train Effectiveness		Treatment Nodes		Source Nodes	
Node: LPoD-5	Reduction	Node Type	Number	Node Type	Number
Flow	3.31%	Bio Retention Node	1	Urban Source Node	3
TSS	81.1%				
TP	73.2%				
TN	51.6%				
GP	100%				

Comments

05/02/2020 MUSIC model amended to increase depth of filter media by +0.20m to a total of 0.70m excluding the transition layer and drainage layer. Filter media surface area has reduced to 1,545m² using 200mm/hr saturated hydraulic conductivity. In accordance with Healthy Land and Water's (HLW) MUSIC Modelling Guidelines Version 3.0 (November 2018) "for sensitivity testing, it is recommended that the designer simulate the bioretention system in MUSIC using a saturated hydraulic conductivity of 50mm/hr and present the results with the development application". – Section 4.5.2 Page 47. It is noted, however, that "compliance with water quality objectives is only required for the actual long term expected hydraulic conductivity i.e. 200mm/hr". – Section 4.5.2 Page 47

Passing Parameters

Node Type	Node Name	Parameter	Min	Max	Actual
Bio	Bio-Retention Basin DEV-5 (1_545 m2 Filter)	Exfiltration Rate (mm/hr)	None	None	0
Bio	Bio-Retention Basin DEV-5 (1_545 m2 Filter)	Extended detention depth (m)	None	1	0.3
Bio	Bio-Retention Basin DEV-5 (1_545 m2 Filter)	Filter depth (m)	0.4	1	0.7
Bio	Bio-Retention Basin DEV-5 (1_545 m2 Filter)	Hi-flow bypass rate (cum/sec)	None	None	100
Bio	Bio-Retention Basin DEV-5 (1_545 m2 Filter)	Orthophosphate Content in Filter (mg/kg)	None	None	30
Bio	Bio-Retention Basin DEV-5 (1_545 m2 Filter)	PET Scaling Factor	2.1	2.1	2.1
Bio	Bio-Retention Basin DEV-5 (1_545 m2 Filter)	Saturated Hydraulic Conductivity (mm/hr)	50	200	200
Bio	Bio-Retention Basin DEV-5 (1_545 m2 Filter)	Total Nitrogen Content in Filter (mg/kg)	None	None	400
Receiving	LPoD-5	% Load Reduction	None	None	3.31
Receiving	LPoD-5	GP % Load Reduction	90	None	100
Receiving	LPoD-5	TN % Load Reduction	45	None	51.6
Receiving	LPoD-5	TP % Load Reduction	60	None	73.2
Receiving	LPoD-5	TSS % Load Reduction	80	None	81.1
Urban	CoGC - Industrial GROUND DEV-5 (2.933 Ha)	Area Impervious (ha)	None	None	1.753
Urban	CoGC - Industrial GROUND DEV-5 (2.933 Ha)	Area Pervious (ha)	None	None	1.179
Urban	CoGC - Industrial GROUND DEV-5 (2.933 Ha)	Total Area (ha)	None	None	2.933
Urban	CoGC - Industrial ROAD DEV-5 (6.224 Ha)	Area Impervious (ha)	None	None	4.660
Urban	CoGC - Industrial ROAD DEV-5 (6.224 Ha)	Area Pervious (ha)	None	None	1.563
Urban	CoGC - Industrial ROAD DEV-5 (6.224 Ha)	Total Area (ha)	None	None	6.224
Urban	CoGC - Industrial ROOF DEV-5 (6.296 Ha)	Area Impervious (ha)	None	None	6.296
Urban	CoGC - Industrial ROOF DEV-5 (6.296 Ha)	Area Pervious (ha)	None	None	0
Urban	CoGC - Industrial ROOF DEV-5 (6.296 Ha)	Total Area (ha)	None	None	6.296

Only certain parameters are reported when they pass validation

MUSIC-link Report

Project Details		Company Details	
Project:	5941 Frasers Property Yatala DEV-1 part	Company:	Gassman Development Perspectives Pty. Ltd
Report Export Date:	20/02/2020	Contact:	Mitchell Gassman
Catchment Name:	5941 CoGC M88	Address:	c/o 76 Business Street Yatala 4207
Catchment Area:	4.38ha	Phone:	0738073333
Impervious Area*:	79.19%	Email:	mitchell@gassman.com.au
Rainfall Station:	40406 BEENLEIGH		
Modelling Time-step:	6 Minutes		
Modelling Period:	1/01/1990 - 31/12/1999 11:54:00 PM		
Mean Annual Rainfall:	1105mm		
Evapotranspiration:	1492mm		
MUSIC Version:	6.3.0		
MUSIC-link data Version:	6.32		
Study Area:	City of Gold Coast (North)		
Scenario:	City of Gold Coast (North)		

* takes into account area from all source nodes that link to the chosen reporting node, excluding Import Data Nodes

Treatment Train Effectiveness		Treatment Nodes		Source Nodes	
Node: LPoD-1 (part)	Reduction	Node Type	Number	Node Type	Number
Flow	5.09%	Bio Retention Node	1	Urban Source Node	3
TSS	87.9%				
TP	82.4%				
TN	59%				
GP	100%				

Comments

Sized for 'DEV-1 part' catchment only, discharge to ultimate basin within Stage 2

Passing Parameters

Node Type	Node Name	Parameter	Min	Max	Actual
Bio	Bio-Retention Basin DEV-1 part (660 m2 Filter)	Exfiltration Rate (mm/hr)	None	None	0
Bio	Bio-Retention Basin DEV-1 part (660 m2 Filter)	Extended detention depth (m)	None	1	0.3
Bio	Bio-Retention Basin DEV-1 part (660 m2 Filter)	Filter depth (m)	0.4	1	0.7
Bio	Bio-Retention Basin DEV-1 part (660 m2 Filter)	Hi-flow bypass rate (cum/sec)	None	None	100
Bio	Bio-Retention Basin DEV-1 part (660 m2 Filter)	Orthophosphate Content in Filter (mg/kg)	None	None	30
Bio	Bio-Retention Basin DEV-1 part (660 m2 Filter)	PET Scaling Factor	2.1	2.1	2.1
Bio	Bio-Retention Basin DEV-1 part (660 m2 Filter)	Saturated Hydraulic Conductivity (mm/hr)	50	200	200
Bio	Bio-Retention Basin DEV-1 part (660 m2 Filter)	Total Nitrogen Content in Filter (mg/kg)	None	None	400
Receiving	LPoD-1 (part)	% Load Reduction	None	None	5.09
Receiving	LPoD-1 (part)	GP % Load Reduction	90	None	100
Receiving	LPoD-1 (part)	TN % Load Reduction	45	None	59
Receiving	LPoD-1 (part)	TP % Load Reduction	60	None	82.4
Receiving	LPoD-1 (part)	TSS % Load Reduction	80	None	87.9
Urban	CoGC - Industrial GROUND DEV-1 part (0.929 Ha)	Area Impervious (ha)	None	None	0.555
Urban	CoGC - Industrial GROUND DEV-1 part (0.929 Ha)	Area Pervious (ha)	None	None	0.373
Urban	CoGC - Industrial GROUND DEV-1 part (0.929 Ha)	Total Area (ha)	None	None	0.929
Urban	CoGC - Industrial ROAD DEV-1 part (2.140 Ha)	Area Impervious (ha)	None	None	1.602
Urban	CoGC - Industrial ROAD DEV-1 part (2.140 Ha)	Area Pervious (ha)	None	None	0.537
Urban	CoGC - Industrial ROAD DEV-1 part (2.140 Ha)	Total Area (ha)	None	None	2.14
Urban	CoGC - Industrial ROOF DEV-1 part (1.311 Ha)	Area Impervious (ha)	None	None	1.311
Urban	CoGC - Industrial ROOF DEV-1 part (1.311 Ha)	Area Pervious (ha)	None	None	0
Urban	CoGC - Industrial ROOF DEV-1 part (1.311 Ha)	Total Area (ha)	None	None	1.311

Only certain parameters are reported when they pass validation

Appendix G – WSUD Bio Retention Basin Maintenance Checklists

BIORETENTION BASIN CONSTRUCTION INSPECTION CHECKLIST											
Asset I.D.					Inspected By:						
Site:					Date:						
					Time:						
Constructed By:					Weather:						
					Contact During Visit:						
Items inspected		Checked		Satisfactory		Items inspected		Checked		Satisfactory	
		Y	N	Y	N			Y	N	Y	N
DURING CONSTRUCTION & ESTABLISHMENT											
A. FUNCTIONAL INSTALLATION						Structural components					
Preliminary Works						15. Location and configuration of inflow systems as designed					
1. Erosion and sediment control plan adopted						16. Location and levels of overflow pits as designed					
2. Temporary traffic/safety control measures						17. Under-drainage connected to overflow pits as designed					
3. Location same as plans						18. Concrete and reinforcement as designed					
4. Site protection from existing flows						19. Set down to correct level for flush kerbs (streetscape applications only)					
Earthworks and Filter Media						20. Kerb opening width as designed					
5. Bed of basin correct shape and slope											
6. Batter slopes as plans						B. SEDIMENT & EROSION CONTROL (IF REQUIRED)					
7. Dimensions of bioretention area as plans						21. Stabilisation immediately following earthworks and planting of terrestrial landscape around basin					
8. Confirm surrounding soil type with design						22. Silt fences and traffic control in place					
9. Confirm filter media specification in accordance with Step 4						23. Temporary protection layers in place					
9. Provision of liner (if required)											
10. Under-drainage installed as designed						C. OPERATIONAL ESTABLISHMENT					
11. Drainage layer media as designed						24. Temporary protection layers and associated silt removed					
12. Transition layer media as designed (if required)						Vegetation					
14. Extended detention depth as designed						25. Planting as designed (species and densities)					
						26. Weed removal and watering as required					
FINAL INSPECTION											
1. Confirm levels of inlets and outlets						6. Check for uneven settling of banks					
2. Confirm structural element sizes						7. Under-drainage working					
3. Check batter slopes						8. Inflow systems working					
4. Vegetation as designed						9. Maintenance access provided					
5. Bioretention filter media surface flat and free of clogging											
COMMENTS ON INSPECTION											
ACTIONS REQUIRED											
Inspection officer signature:											

BIORETENTION BASIN MAINTENANCE CHECKLIST				
Inspection Frequency:	1 to 6 monthly	Date of Visit:		
Location:				
Description:				
Asset I.D.				
Site Visit by:				
INSPECTION ITEMS:	Y	N	Action Required (details)	
Sediment accumulation at inflow points?				
Litter within basin?				
Erosion at inlet or other key structures?				
Traffic damage present?				
Evidence of dumping (e.g. building waste)?				
Vegetation condition satisfactory (density, weeds etc)?				
Watering of vegetation required?				
Replanting required?				
Mowing/slashing required?				
Clogging of drainage points (sediment or debris)?				
Evidence of ponding?				
Damage/vandalism to structures present?				
Surface clogging visible?				
Drainage system inspected?				
Resetting of system required?				
COMMENTS				

BIORETENTION BASIN ASSET TRANSFER CHECKLIST			
Asset I.D.			
Asset Location:			
Construction by:			
'On-maintenance' Period:			
TREATMENT	Y	N	
System appears to be working as designed visually?			
No obvious signs of under-performance?			
MAINTENANCE	Y	N	
Maintenance plans and indicative maintenance costs provided for each asset?			
Vegetation establishment period completed (2 years)?			
Inspection and maintenance undertaken as per maintenance plan?			
Inspection and maintenance forms provided?			
ASSET INSPECTED FOR DEFECTS AND/OR MAINTENANCE ISSUES AT TIME OF ASSET TRANSFER	Y	N	
Sediment accumulation at inflow points?			
Litter within basin?			
Erosion at inlet or other key structures?			
Traffic damage present?			
Evidence of dumping (e.g. building waste)?			
Vegetation condition satisfactory (density, weeds etc)?			
Watering of vegetation required?			
Replanting required?			
Mowing/slashing required?			
Clogging of drainage points (sediment or debris)?			
Evidence of ponding?			
Damage/vandalism to structures present?			
Surface clogging visible?			
Drainage system inspected?			
COMMENTS/ACTIONS REQUIRED FOR ASSET TRANSFER			
ASSET INFORMATION	Y	N	
Design Assessment Checklist provided?			
As constructed plans provided?			
Copies of all required permits (both construction and operational) submitted?			
Proprietary information provided (if applicable)?			
Digital files (e.g. drawings, survey, models) provided?			
Asset listed on asset register or database?			

Appendix H – Bureau of Meteorology Rainfall Data



Location

Label: 60 Stapylton Road FRASERS

Latitude: -27.736 [Nearest grid cell: 27.7375 (S)]

Longitude: 153.238 [Nearest grid cell: 153.2375 (E)]

IFD Design Rainfall Intensity (mm/h)

Issued: 13 December 2019

Rainfall intensity for Durations, Exceedance per Year (EY), and Annual Exceedance Probabilities (AEP).

[FAQ for New ARR probability terminology](#)

Duration	Annual Exceedance Probability (AEP)						
	63.2%	50%#	20%*	10%	5%	2%	1%
1 min	155	175	239	281	323	378	419
2 min	127	144	200	240	281	339	386
3 min	119	135	187	224	261	313	354
4 min	114	130	178	212	246	292	328
5 min	110	124	170	202	233	275	307
10 min	90.5	102	139	163	187	217	240
11 min	87.4	98.9	134	158	180	209	230
15 min	76.8	86.8	118	138	158	183	202
20 min	66.7	75.5	103	121	138	160	177
25 min	59.2	67.0	91.1	107	123	143	159
30 min	53.3	60.3	82.3	97.1	112	131	145
45 min	41.5	47.0	64.6	76.6	88.6	105	117
1 hour	34.4	39.0	53.9	64.2	74.7	88.9	100
1.5 hour	26.2	29.7	41.4	49.8	58.3	70.1	79.5
2 hour	21.5	24.5	34.3	41.4	48.8	59.0	67.3
3 hour	16.4	18.7	26.4	32.1	38.0	46.3	53.1
4.5 hour	12.6	14.4	20.5	25.0	29.7	36.4	41.8
6 hour	10.5	12.0	17.2	21.0	25.0	30.7	35.3
9 hour	8.14	9.38	13.5	16.6	19.8	24.3	27.9
12 hour	6.85	7.92	11.5	14.1	16.8	20.6	23.7
18 hour	5.38	6.24	9.11	11.2	13.4	16.4	18.8
24 hour	4.53	5.27	7.72	9.51	11.4	13.9	16.0
30 hour	3.95	4.60	6.76	8.35	10.0	12.2	14.0
36 hour	3.53	4.11	6.05	7.48	8.98	11.0	12.6
48 hour	2.92	3.41	5.04	6.24	7.51	9.20	10.6
72 hour	2.19	2.56	3.79	4.72	5.71	7.01	8.07
96 hour	1.76	2.04	3.03	3.79	4.59	5.65	6.51

120 hour	1.46	1.69	2.51	3.14	3.82	4.70	5.41
144 hour	1.24	1.44	2.13	2.66	3.24	3.98	4.58
168 hour	1.08	1.24	1.83	2.29	2.79	3.42	3.93

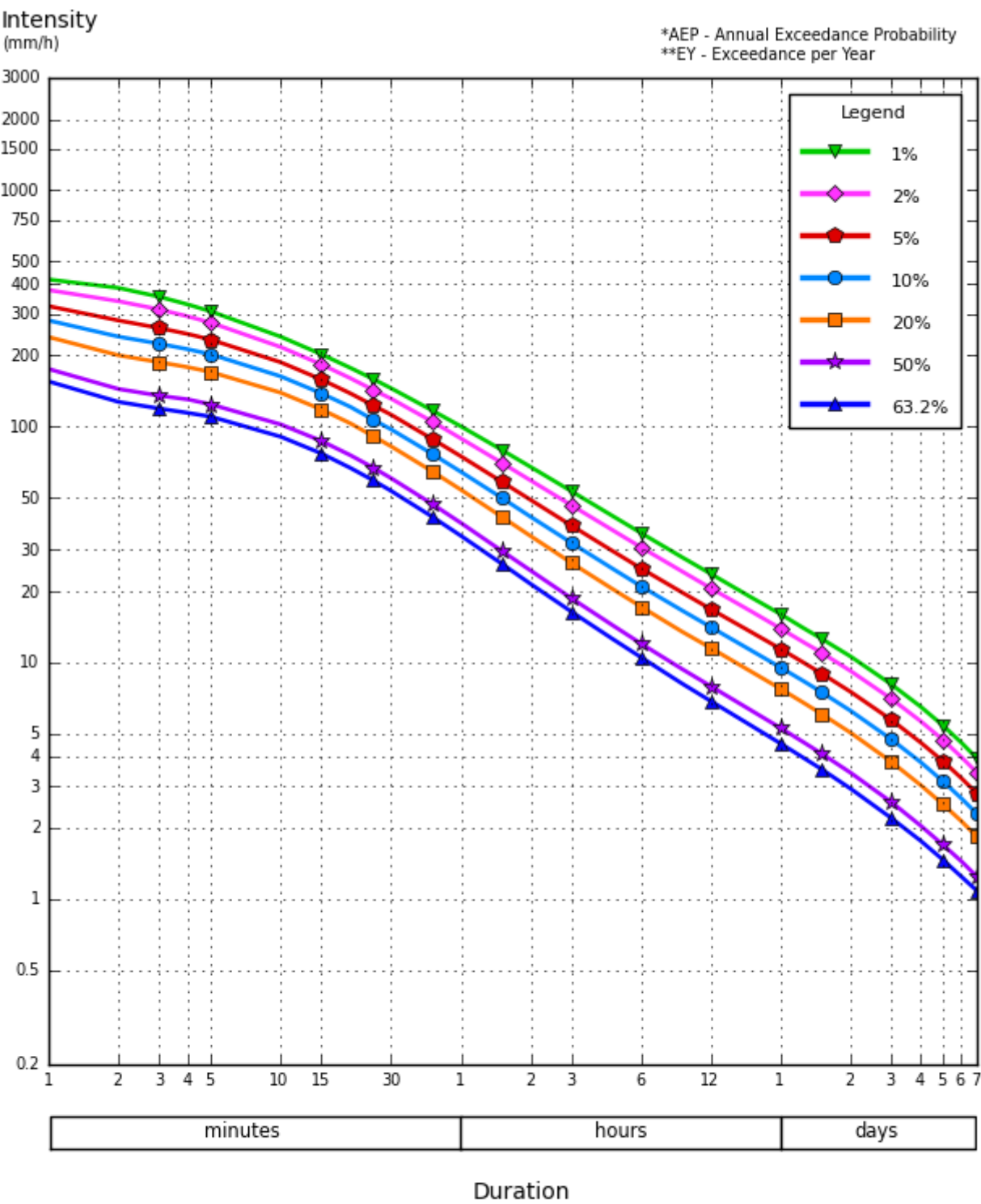
Note:

The 50% AEP IFD **does not** correspond to the 2 year Average Recurrence Interval (ARI) IFD.
Rather it corresponds to the 1.44 ARI.

* The 20% AEP IFD **does not** correspond to the 5 year Average Recurrence Interval (ARI) IFD.
Rather it corresponds to the 4.48 ARI.

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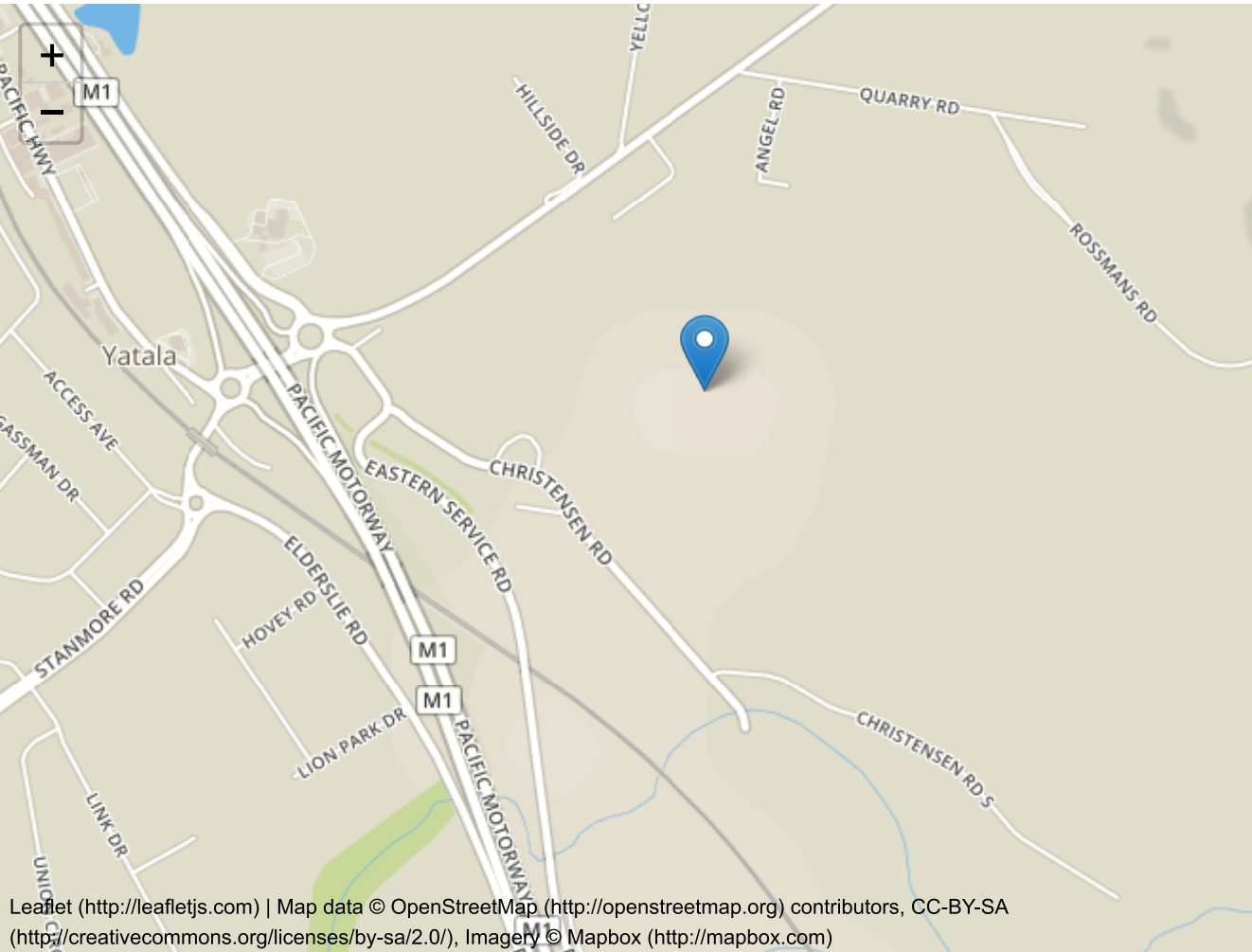
Appendix I – AR&R 2016 Storm Loss Data

ATTENTION: This site was updated recently, changing some of the functionality. Please see the changelog ([./changelog](#)) for further information

Australian Rainfall & Runoff Data Hub - Results

Input Data

Longitude	153.238
Latitude	-27.736
Selected Regions (clear)	
River Region	show
ARF Parameters	show
Storm Losses	show
Temporal Patterns	show
Areal Temporal Patterns	show
BOM IFDs	show
Median Preburst Depths and Ratios	show
10% Preburst Depths	show
25% Preburst Depths	show
75% Preburst Depths	show
90% Preburst Depths	show
Interim Climate Change Factors	show
Baseflow Factors	show



Data

River Region

Division	North East Coast
River Number	45
River Name	Logan-Albert Rivers

Layer Info

Time Accessed	26 November 2019 12:45PM
Version	2016_v1

ARF Parameters

$$ARF = Min \left\{ 1, \left[1 - a \left(Area^b - c \log_{10} Duration \right) Duration^{-d} \right. \right. \\ \left. \left. + e Area^f Duration^g \left(0.3 + \log_{10} AEP \right) \right. \right. \\ \left. \left. + h 10^{i Area \frac{Duration}{1440}} \left(0.3 + \log_{10} AEP \right) \right] \right\}$$

Zone	a	b	c	d	e	f	g	h	i
East Coast North	0.327	0.241	0.448	0.36	0.00096	0.48	-0.21	0.012	-0.0013

Short Duration ARF

$$ARF = Min \left[1, 1 - 0.287 \left(Area^{0.265} - 0.439 \log_{10} (Duration) \right) . Duration^{-0.36} \right. \\ \left. + 2.26 \times 10^{-3} \times Area^{0.226} . Duration^{0.125} \left(0.3 + \log_{10} (AEP) \right) \right. \\ \left. + 0.0141 \times Area^{0.213} \times 10^{-0.021 \frac{(Duration-180)^2}{1440}} \left(0.3 + \log_{10} (AEP) \right) \right]$$

Layer Info

Time Accessed	26 November 2019 12:45PM
Version	2016_v1

Storm Losses

Note: Burst Loss = Storm Loss - Preburst

Note: These losses are only for rural use and are **NOT FOR DIRECT USE** in urban areas

ID	27987.0
Storm Initial Losses (mm)	27.0
Storm Continuing Losses (mm/h)	1.6

Layer Info

Time Accessed	26 November 2019 12:45PM
Version	2016_v1

Temporal Patterns | Download (.zip) (static/temporal_patterns/TP/ECnorth.zip)

code	ECnorth
Label	East Coast North

Layer Info

Time Accessed	26 November 2019 12:45PM
Version	2016_v2

Areal Temporal Patterns | Download (.zip)
(./static/temporal_patterns/Areal/Areal_ECnorth.zip)

code	ECnorth
arealabel	East Coast North

Layer Info

Time Accessed	26 November 2019 12:45PM
---------------	--------------------------

Version	2016_v2
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BOM IFDs

Click here (http://www.bom.gov.au/water/designRainfalls/revise-ifd/?year=2016&coordinate_type=dd&latitude=-27.736&longitude=153.238&sadmin=true&sdhr=true&sdday=true&user_label=) to obtain the IFD depths for catchment centroid from the BoM website

Layer Info

Time Accessed	26 November 2019 12:45PM
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Median Preburst Depths and Ratios

Values are of the format depth (ratio) with depth in mm

min (h)\AEP(%)	50	20	10	5	2	1
60 (1.0)	2.5 (0.064)	4.6 (0.085)	6.0 (0.093)	7.3 (0.098)	8.7 (0.098)	9.8 (0.098)
90 (1.5)	2.8 (0.063)	10.7 (0.172)	15.9 (0.213)	20.9 (0.239)	16.8 (0.160)	13.8 (0.115)
120 (2.0)	2.6 (0.053)	9.9 (0.144)	14.8 (0.178)	19.4 (0.199)	20.9 (0.177)	21.9 (0.163)
180 (3.0)	3.8 (0.067)	13.4 (0.169)	19.8 (0.205)	25.9 (0.227)	32.8 (0.236)	38.0 (0.238)
360 (6.0)	5.8 (0.080)	19.3 (0.187)	28.2 (0.223)	36.8 (0.245)	64.4 (0.350)	85.1 (0.401)
720 (12.0)	6.0 (0.063)	19.6 (0.142)	28.6 (0.169)	37.2 (0.184)	61.7 (0.250)	80.1 (0.282)
1080 (18.0)	7.1 (0.063)	15.9 (0.097)	21.8 (0.108)	27.3 (0.113)	47.7 (0.162)	63.0 (0.186)
1440 (24.0)	7.0 (0.055)	12.7 (0.069)	16.5 (0.072)	20.2 (0.074)	32.0 (0.096)	40.9 (0.107)
2160 (36.0)	0.0 (0.000)	6.6 (0.030)	10.9 (0.041)	15.1 (0.047)	28.6 (0.072)	38.8 (0.086)
2880 (48.0)	0.0 (0.000)	5.5 (0.023)	9.1 (0.030)	12.6 (0.035)	23.2 (0.053)	31.1 (0.061)
4320 (72.0)	0.0 (0.000)	0.9 (0.003)	1.4 (0.004)	2.0 (0.005)	10.2 (0.020)	16.3 (0.028)

Layer Info

Time Accessed	26 November 2019 12:45PM
Version	2018_v1
Note	Preburst interpolation methods for catchment wide preburst has been slightly altered. Point values remain unchanged.

10% Preburst Depths

Values are of the format depth (ratio) with depth in mm

min (h)\AEP(%)	50	20	10	5	2	1
60 (1.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
90 (1.5)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
120 (2.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
180 (3.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
360 (6.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
720 (12.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.9 (0.004)	1.5 (0.005)
1080 (18.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
1440 (24.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
2160 (36.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
2880 (48.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
4320 (72.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)

Layer Info

Time Accessed	26 November 2019 12:45PM
Version	2018_v1
Note	Preburst interpolation methods for catchment wide preburst has been slightly altered. Point values remain unchanged.

25% Preburst Depths

Values are of the format depth (ratio) with depth in mm

min (h)\AEP(%)	50	20	10	5	2	1
60 (1.0)	0.1 (0.003)	0.3 (0.005)	0.4 (0.006)	0.5 (0.007)	0.7 (0.008)	0.9 (0.009)
90 (1.5)	0.0 (0.000)	0.7 (0.011)	1.2 (0.016)	1.6 (0.019)	1.0 (0.009)	0.5 (0.004)
120 (2.0)	0.0 (0.000)	1.2 (0.017)	2.0 (0.024)	2.7 (0.028)	1.7 (0.014)	1.0 (0.007)
180 (3.0)	0.0 (0.000)	0.9 (0.012)	1.6 (0.016)	2.2 (0.019)	3.6 (0.026)	4.7 (0.029)
360 (6.0)	0.0 (0.000)	1.8 (0.017)	2.9 (0.023)	4.0 (0.027)	5.6 (0.030)	6.8 (0.032)
720 (12.0)	0.0 (0.000)	2.5 (0.018)	4.2 (0.025)	5.8 (0.029)	20.8 (0.084)	32.0 (0.113)
1080 (18.0)	0.0 (0.000)	2.2 (0.013)	3.7 (0.018)	5.1 (0.021)	9.5 (0.032)	12.7 (0.038)
1440 (24.0)	0.0 (0.000)	0.3 (0.002)	0.5 (0.002)	0.7 (0.002)	6.9 (0.021)	11.6 (0.030)
2160 (36.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	1.7 (0.004)	3.0 (0.007)
2880 (48.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	2.0 (0.005)	3.5 (0.007)
4320 (72.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)

Layer Info

Time Accessed	26 November 2019 12:45PM
Version	2018_v1
Note	Preburst interpolation methods for catchment wide preburst has been slightly altered. Point values remain unchanged.

75% Preburst Depths

Values are of the format depth (ratio) with depth in mm

min (h)\AEP(%)	50	20	10	5	2	1
60 (1.0)	26.3 (0.675)	35.6 (0.661)	41.8 (0.650)	47.7 (0.639)	45.7 (0.514)	44.2 (0.441)
90 (1.5)	25.6 (0.573)	56.5 (0.909)	77.0 (1.031)	96.6 (1.105)	96.4 (0.917)	96.2 (0.806)
120 (2.0)	27.1 (0.554)	61.6 (0.896)	84.3 (1.017)	106.2 (1.089)	143.2 (1.213)	171.0 (1.270)
180 (3.0)	39.7 (0.708)	71.9 (0.907)	93.3 (0.969)	113.7 (0.999)	150.7 (1.085)	178.5 (1.120)
360 (6.0)	36.5 (0.507)	70.0 (0.678)	92.2 (0.730)	113.4 (0.755)	146.0 (0.792)	170.3 (0.803)
720 (12.0)	27.3 (0.287)	66.3 (0.481)	92.0 (0.544)	116.8 (0.578)	175.7 (0.710)	219.8 (0.773)
1080 (18.0)	37.0 (0.329)	56.1 (0.342)	68.7 (0.340)	80.8 (0.335)	114.2 (0.387)	139.2 (0.411)
1440 (24.0)	31.0 (0.245)	46.9 (0.253)	57.4 (0.251)	67.5 (0.247)	91.4 (0.274)	109.3 (0.285)
2160 (36.0)	10.3 (0.070)	30.1 (0.138)	43.1 (0.160)	55.7 (0.172)	89.0 (0.225)	114.0 (0.251)
2880 (48.0)	6.0 (0.037)	30.3 (0.125)	46.4 (0.155)	61.8 (0.171)	89.8 (0.203)	110.8 (0.219)
4320 (72.0)	0.1 (0.000)	17.4 (0.064)	28.9 (0.085)	40.0 (0.097)	57.9 (0.115)	71.4 (0.123)

Layer Info

Time Accessed	26 November 2019 12:45PM
Version	2018_v1
Note	Preburst interpolation methods for catchment wide preburst has been slightly altered. Point values remain unchanged.

90% Preburst Depths

Values are of the format depth (ratio) with depth in mm

min (h)\AEP(%)	50	20	10	5	2	1
60 (1.0)	69.8 (1.790)	104.6 (1.942)	127.6 (1.987)	149.7 (2.005)	191.9 (2.160)	223.6 (2.234)
90 (1.5)	118.2 (2.648)	152.7 (2.458)	175.6 (2.353)	197.6 (2.261)	245.2 (2.333)	280.9 (2.354)
120 (2.0)	99.3 (2.026)	145.0 (2.112)	175.3 (2.115)	204.4 (2.096)	264.9 (2.244)	310.3 (2.304)
180 (3.0)	130.9 (2.333)	181.1 (2.284)	214.4 (2.227)	246.3 (2.163)	291.9 (2.102)	326.0 (2.046)
360 (6.0)	106.3 (1.476)	150.2 (1.455)	179.2 (1.420)	207.1 (1.378)	259.5 (1.409)	298.8 (1.409)
720 (12.0)	75.3 (0.792)	135.6 (0.984)	175.5 (1.037)	213.8 (1.059)	267.1 (1.080)	307.1 (1.080)
1080 (18.0)	86.2 (0.767)	131.6 (0.802)	161.6 (0.801)	190.4 (0.790)	215.9 (0.732)	235.1 (0.694)
1440 (24.0)	73.3 (0.580)	110.6 (0.597)	135.3 (0.593)	159.0 (0.582)	201.0 (0.602)	232.5 (0.607)
2160 (36.0)	38.4 (0.260)	82.9 (0.380)	112.3 (0.417)	140.6 (0.435)	184.6 (0.467)	217.5 (0.480)
2880 (48.0)	25.8 (0.158)	81.8 (0.338)	118.8 (0.396)	154.3 (0.428)	180.1 (0.408)	199.4 (0.393)
4320 (72.0)	6.5 (0.035)	44.8 (0.164)	70.2 (0.206)	94.5 (0.230)	107.5 (0.213)	117.2 (0.202)

Layer Info

Time Accessed	26 November 2019 12:45PM
Version	2018_v1
Note	Preburst interpolation methods for catchment wide preburst has been slightly altered. Point values remain unchanged.

Interim Climate Change Factors

	RCP 4.5	RCP6	RCP 8.5
2030	0.869 (4.3%)	0.783 (3.9%)	0.983 (4.9%)
2040	1.057 (5.3%)	1.014 (5.1%)	1.349 (6.8%)
2050	1.272 (6.4%)	1.236 (6.2%)	1.773 (9.0%)
2060	1.488 (7.5%)	1.458 (7.4%)	2.237 (11.5%)
2070	1.676 (8.5%)	1.691 (8.6%)	2.722 (14.2%)
2080	1.810 (9.2%)	1.944 (9.9%)	3.209 (16.9%)
2090	1.862 (9.5%)	2.227 (11.5%)	3.679 (19.7%)

Layer Info

Time Accessed	26 November 2019 12:45PM
Version	2019_v1
Note	ARR recommends the use of RCP4.5 and RCP 8.5 values. These have been updated to the values that can be found on the climate change in Australia website.

Baseflow Factors

Downstream	0
Area (km2)	3779.48325962
Catchment Number	7250
Volume Factor	0.150296
Peak Factor	0.04523

Layer Info

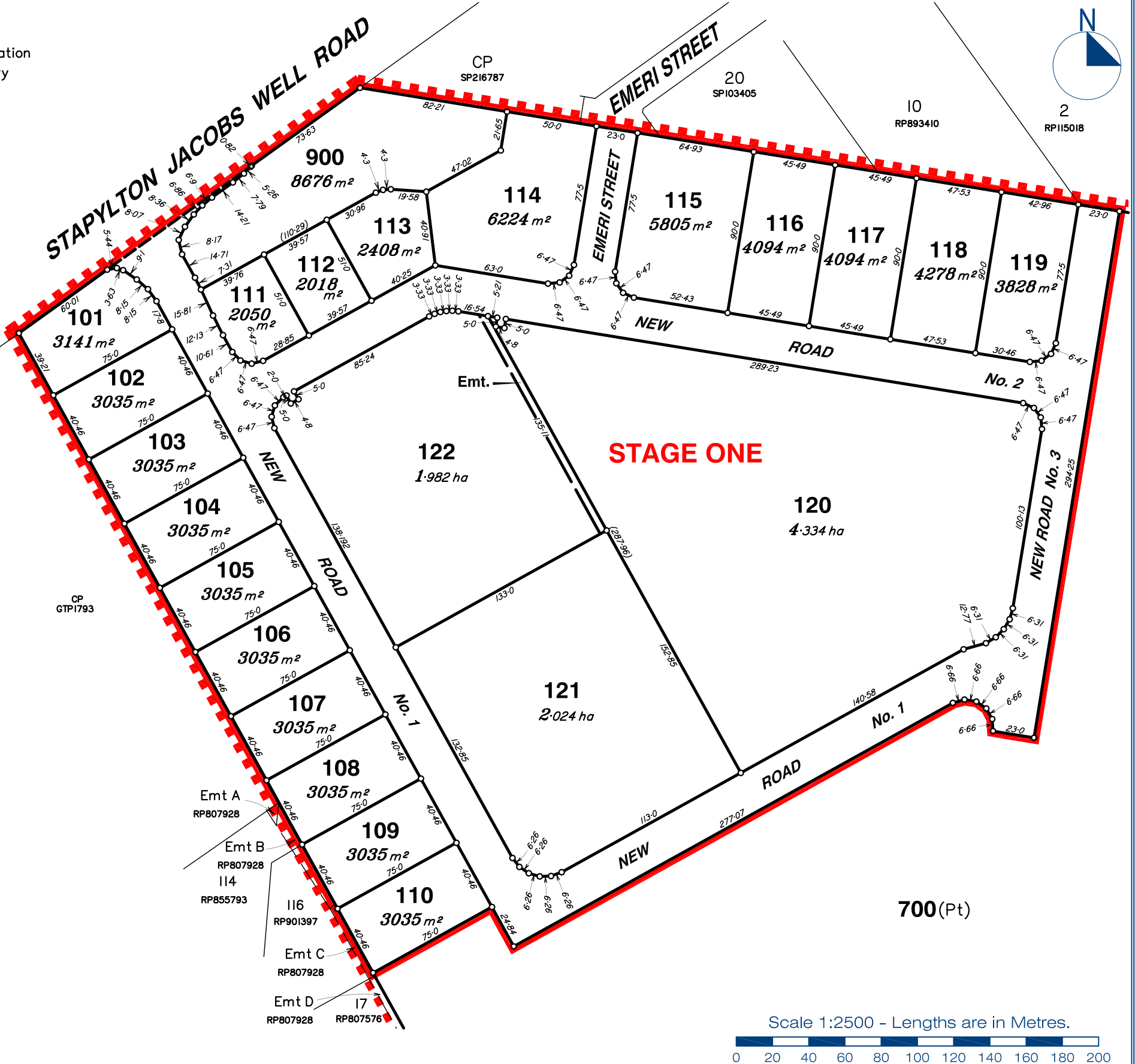
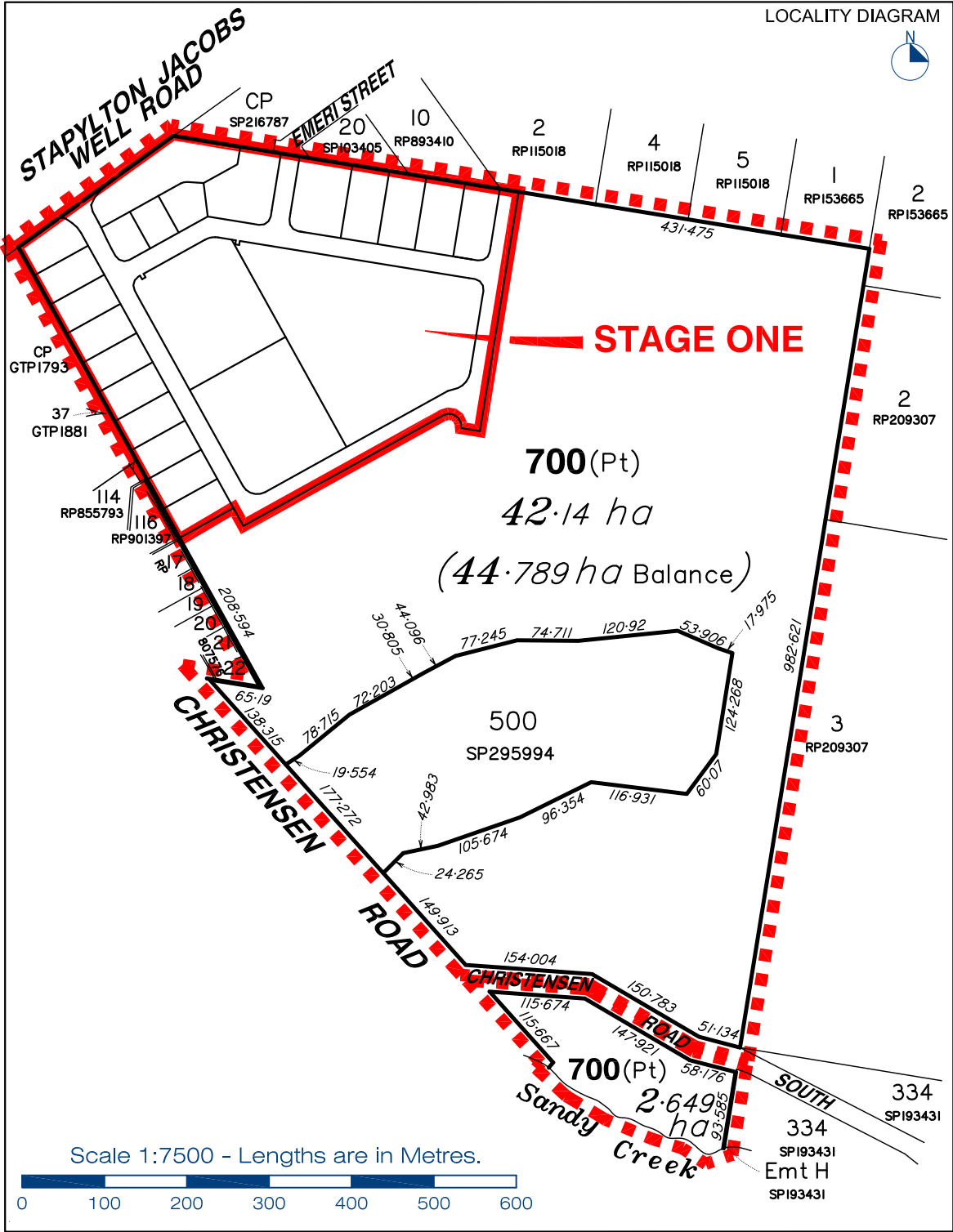
Time Accessed	26 November 2019 12:45PM
Version	2016_v1

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- Download JSON (downloads/5e94d649-e516-45a9-b4fb-f374cf5791a5.json)
- Generating PDF... (downloads/579e9dd3-c6b7-4ec5-8a64-fc262213ce3d.pdf)

Appendix J – Proposed Reconfiguration of a Lot Plan

DEVELOPMENT SUMMARY				
Total Site Area 64.239Ha				
LOT YIELD	STAGE AREA	LOT DENSITY	AVERAGE LOT SIZE	APPROX. AREA & LENGTH OF NEW ROAD
22 Lots	19.34 ha	1.13 Lots/ha	6742m ²	3.636 Ha 1,560m

--- Limit of Application
— Stage Boundary



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Scale at A3:		1:2500			
Date:		18-12-19			
Design:		ICG			
Drawn:		SJH			
Checked:		AWG			
A	18/12/2019	ADD PMTS IN LOTS 120 & 122		SJH	AWG
	14/11/2019	ORIGINAL ISSUE		SJH	AWG
Issue	Date	Description		DRN	CHK

Project:

M38 INDUSTRIAL PARK
YATALA

Client:

FRASERS PROPERTY AUSTRALIA

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Drawing Title:

Proposed Staged
Reconfiguration of
Land STAGE ONE

Cancelling Lot 501 on SP295994

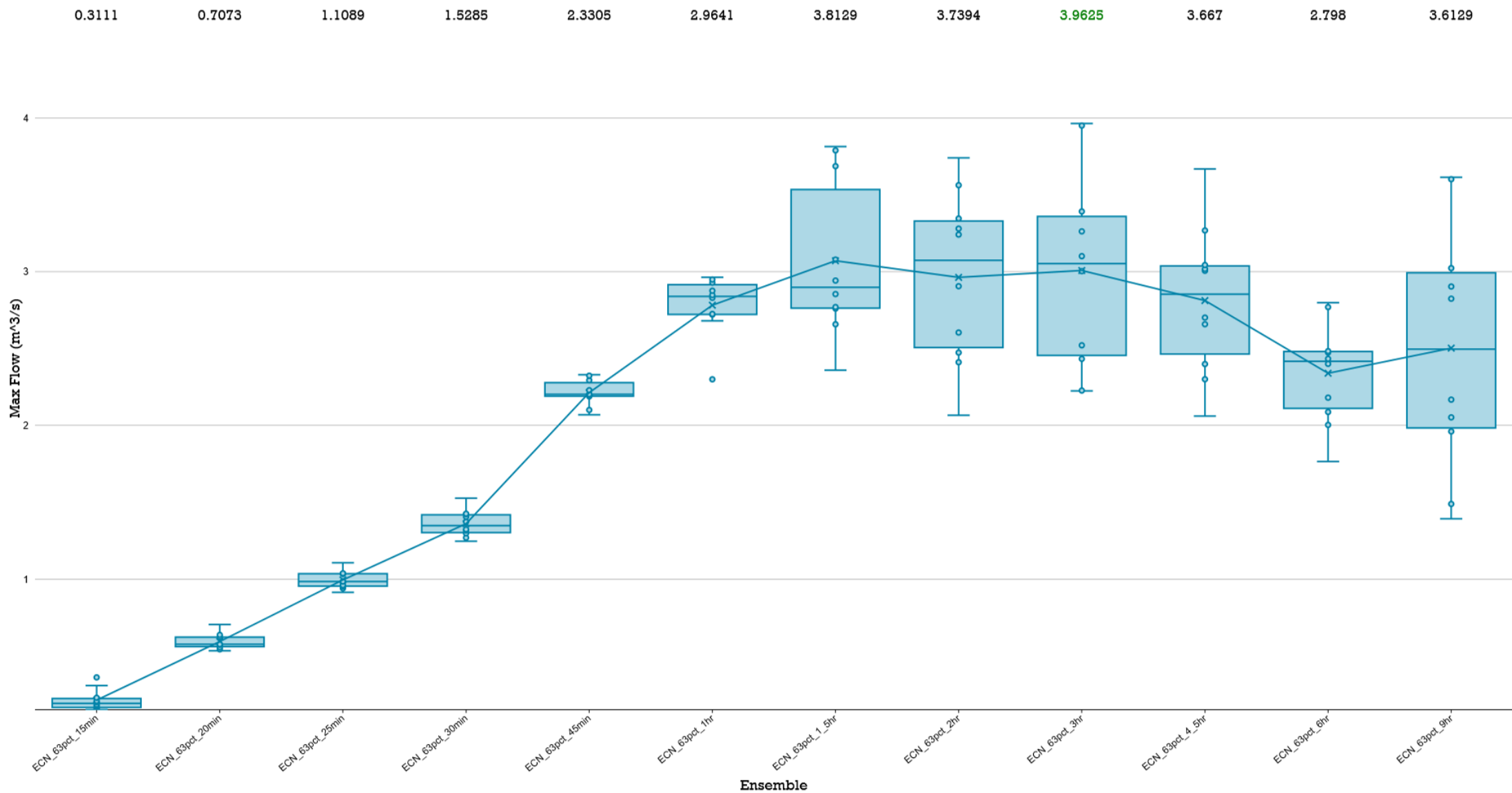
Drawing No:
5941 S ROL 01 A

Revision No:

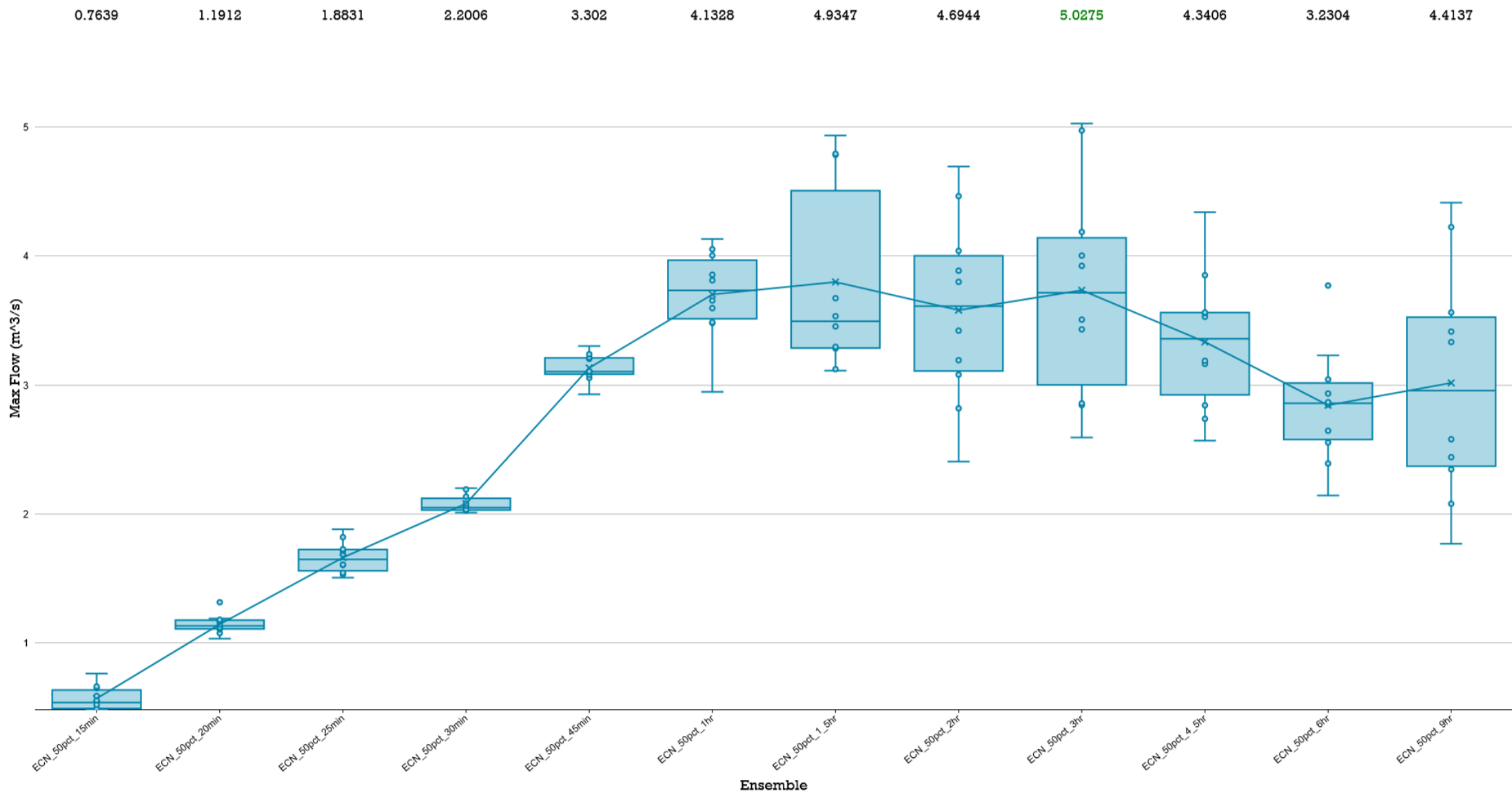
Appendix K – Pre and Post Development Hydrographs

LPoD 1 PRE-DEVELOPMENT

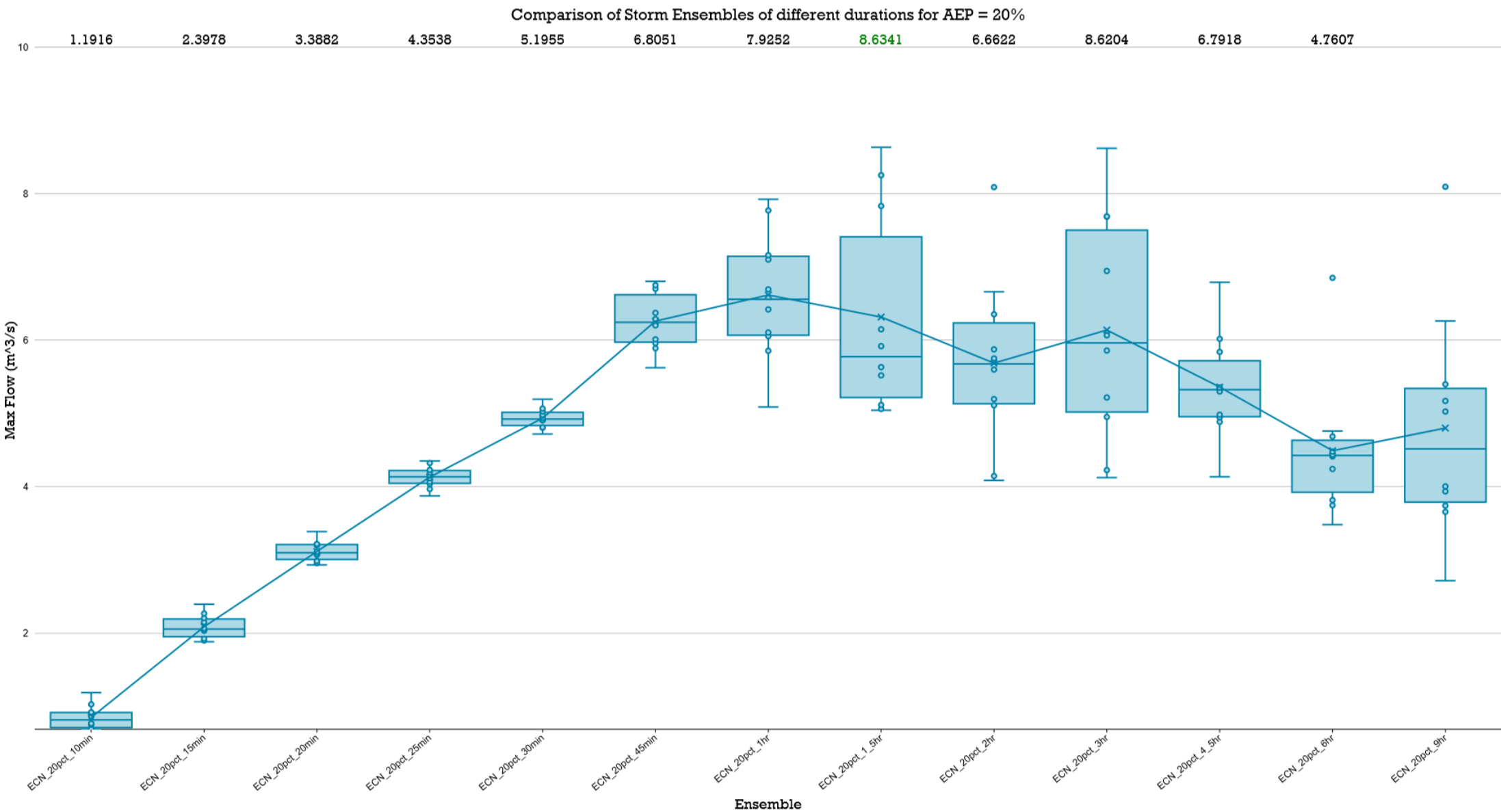
Comparison of Storm Ensembles of different durations for AEP = 63.2%

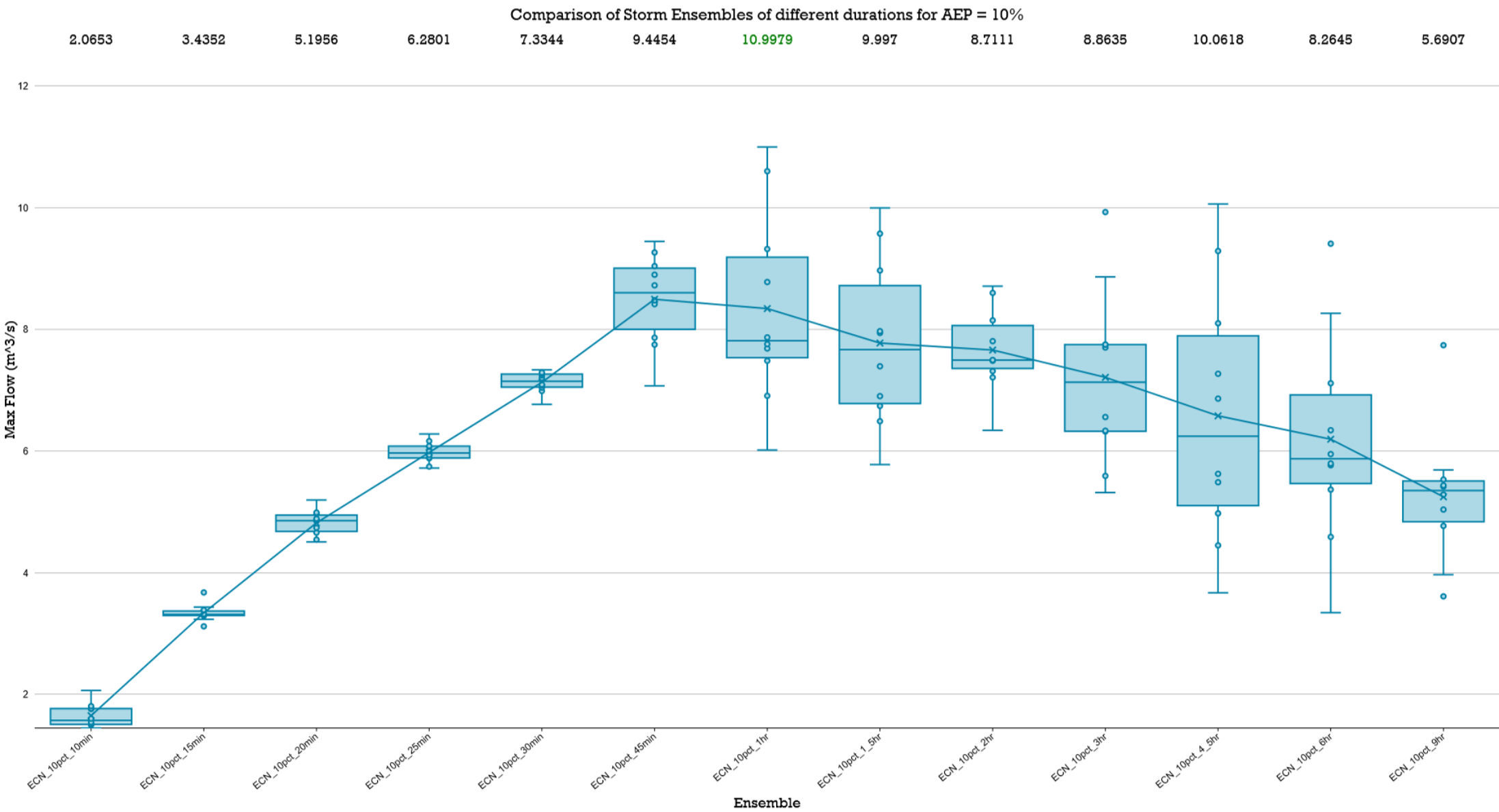


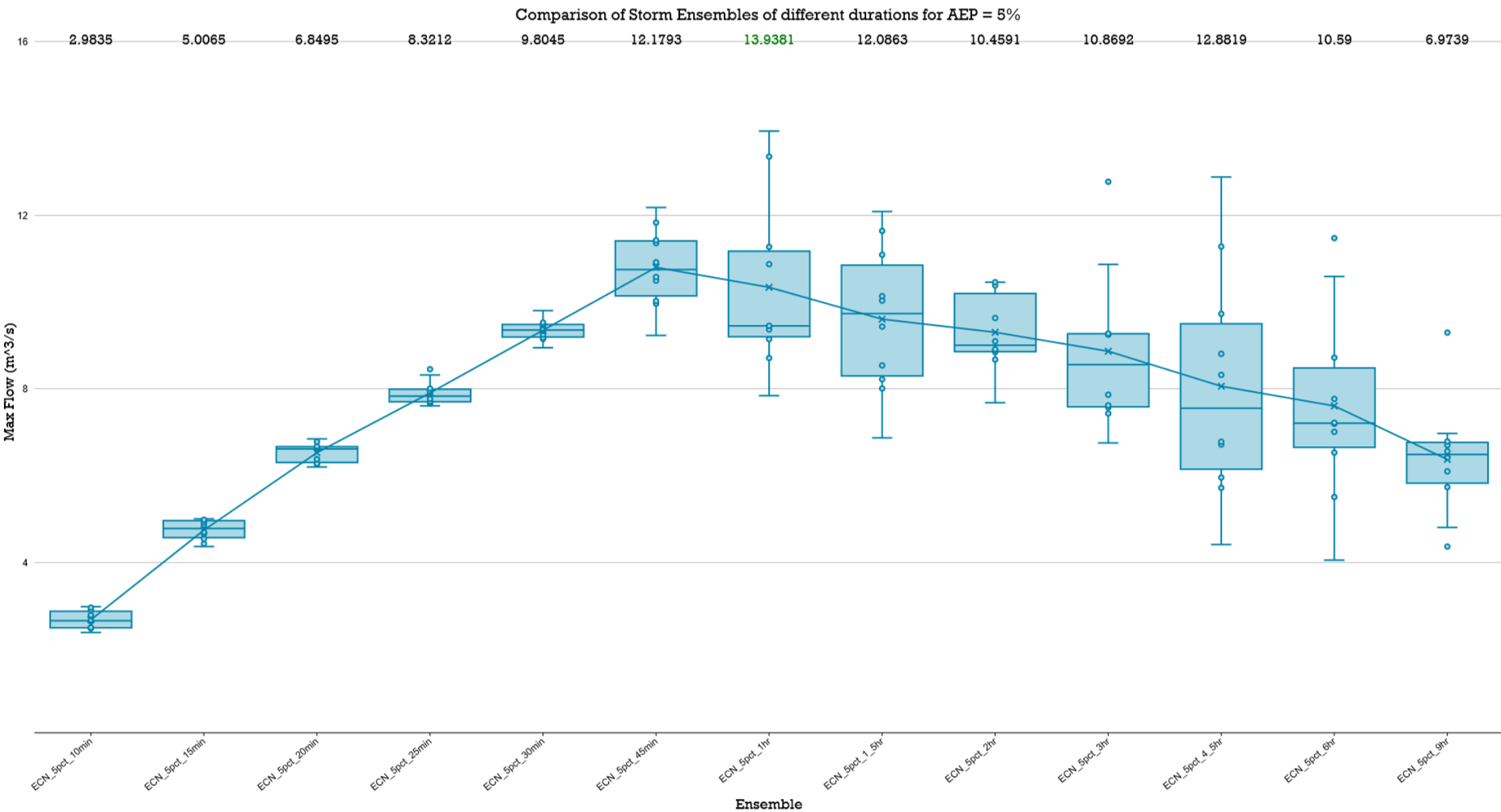
Comparison of Storm Ensembles of different durations for AEP = 50%



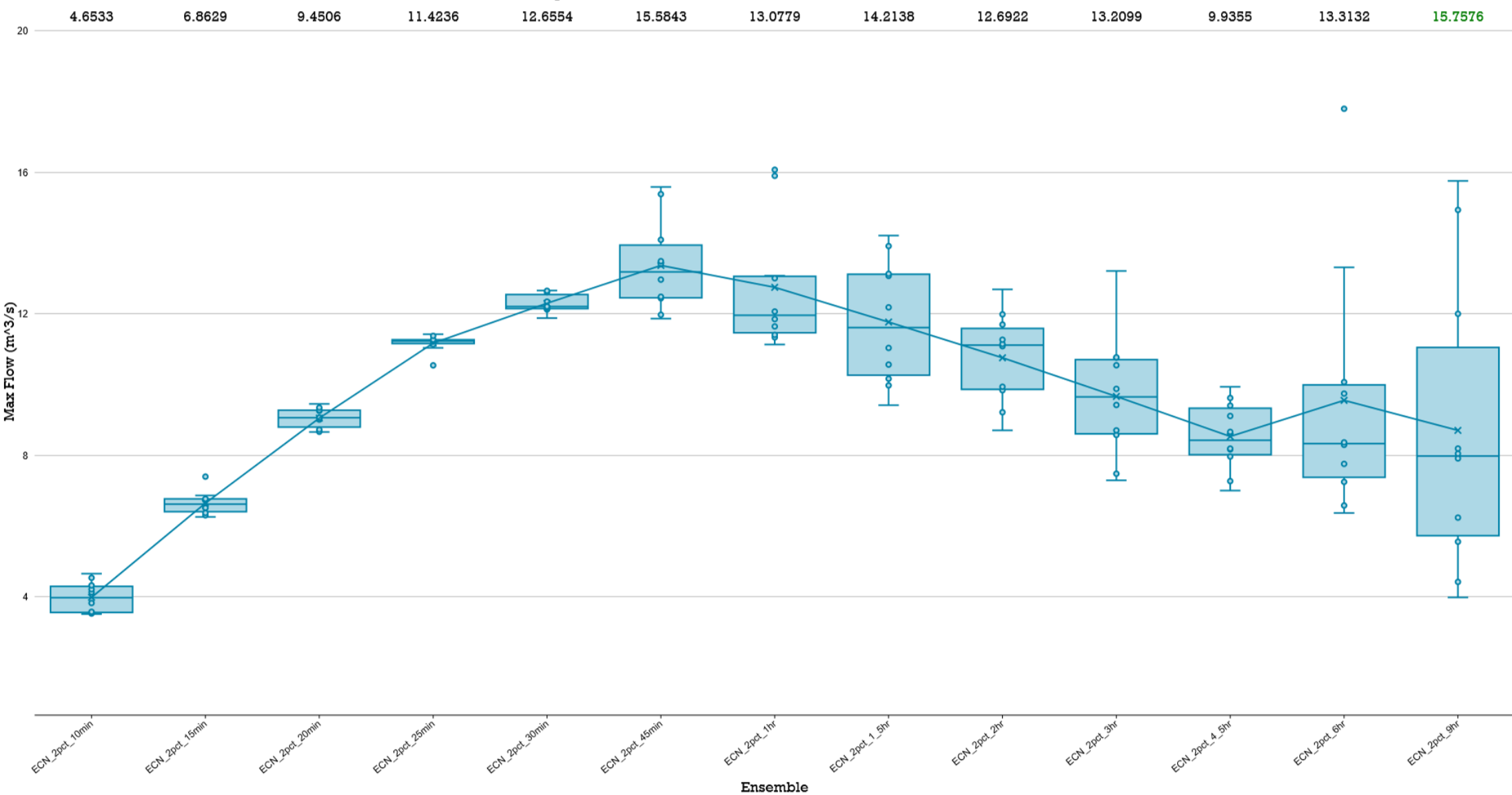
BOX & WHISKER PLOTS



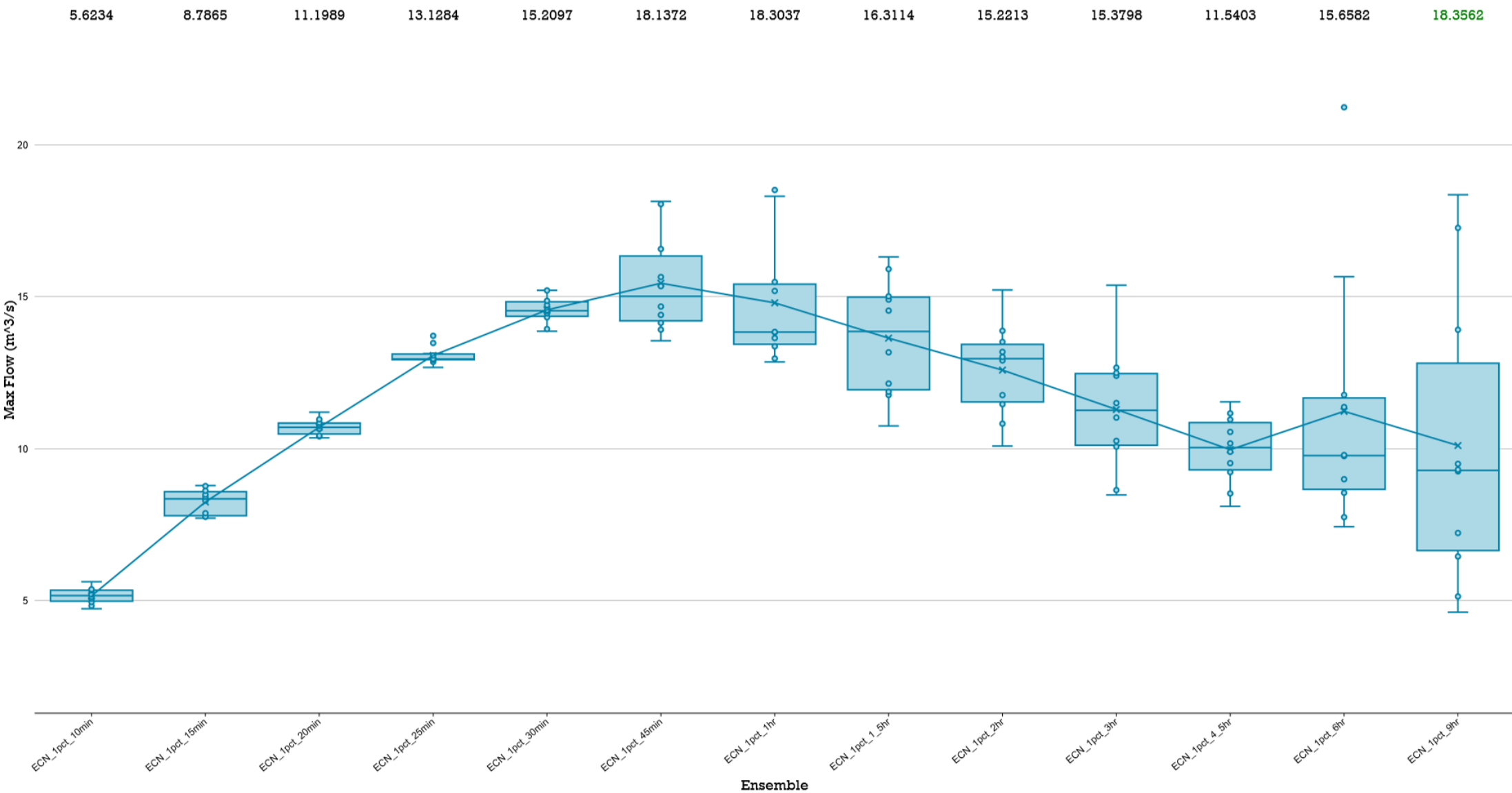




Comparison of Storm Ensembles of different durations for AEP = 2%



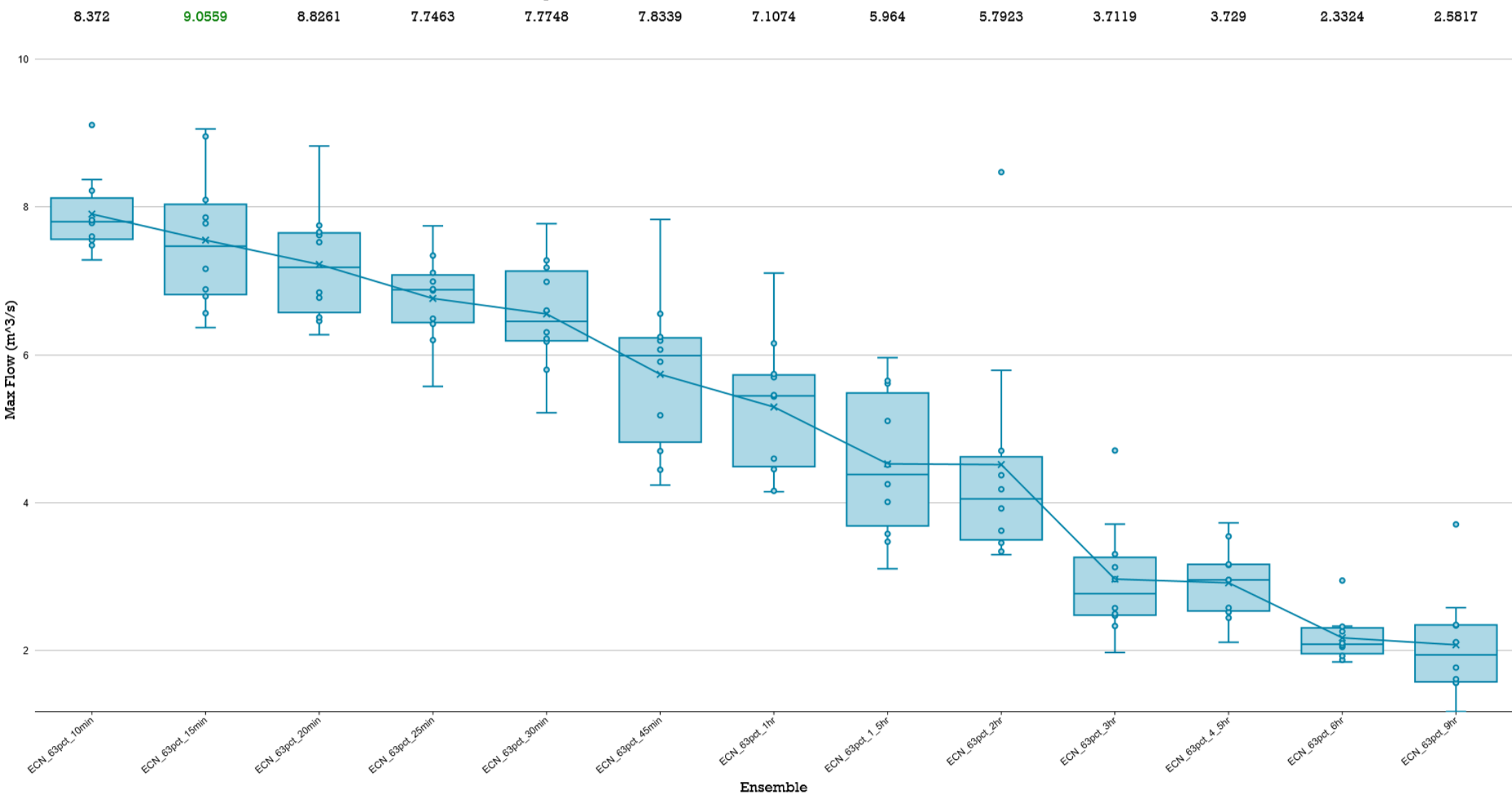
Comparison of Storm Ensembles of different durations for AEP = 1%



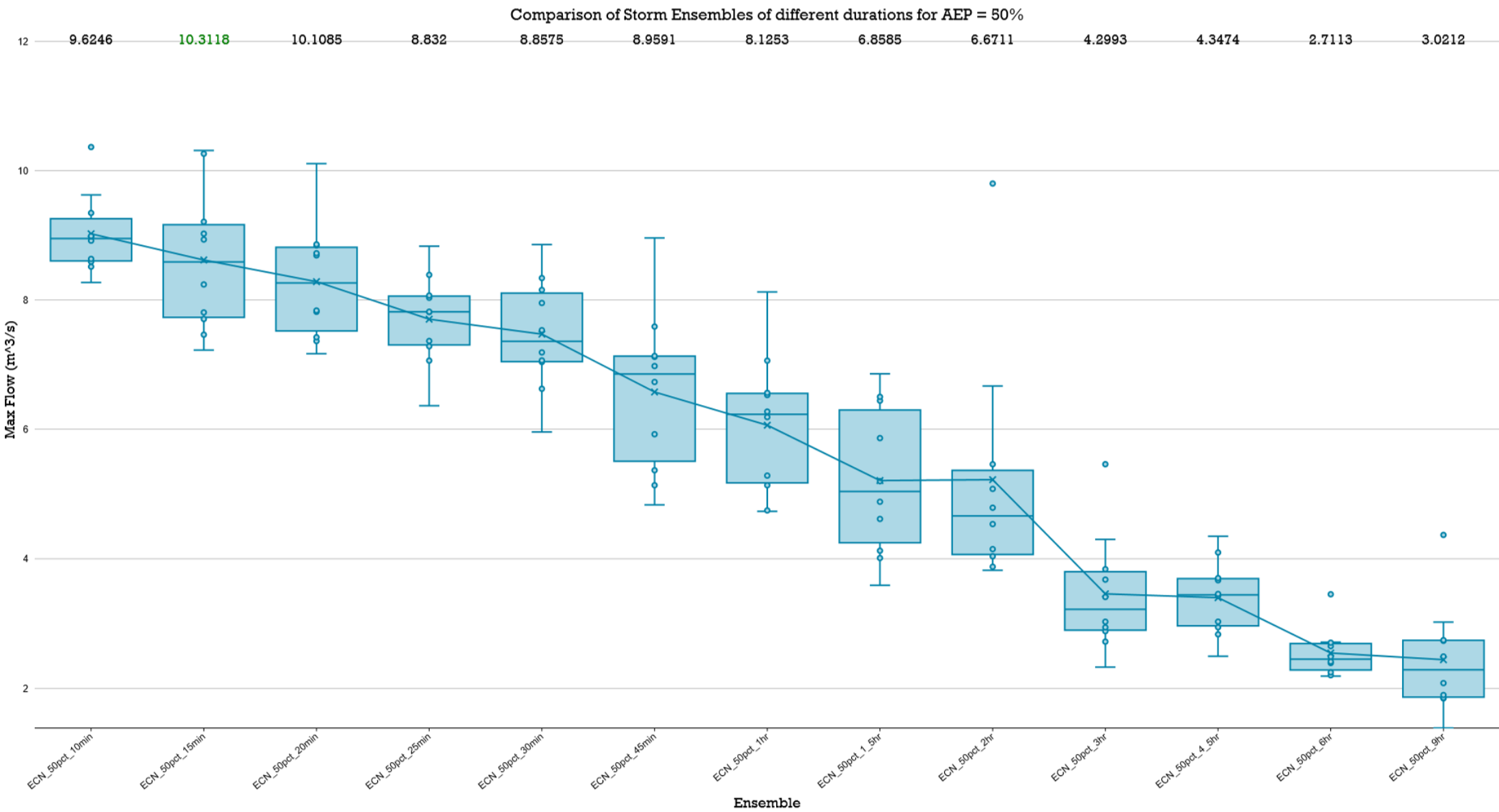
BOX & WHISKER PLOTS

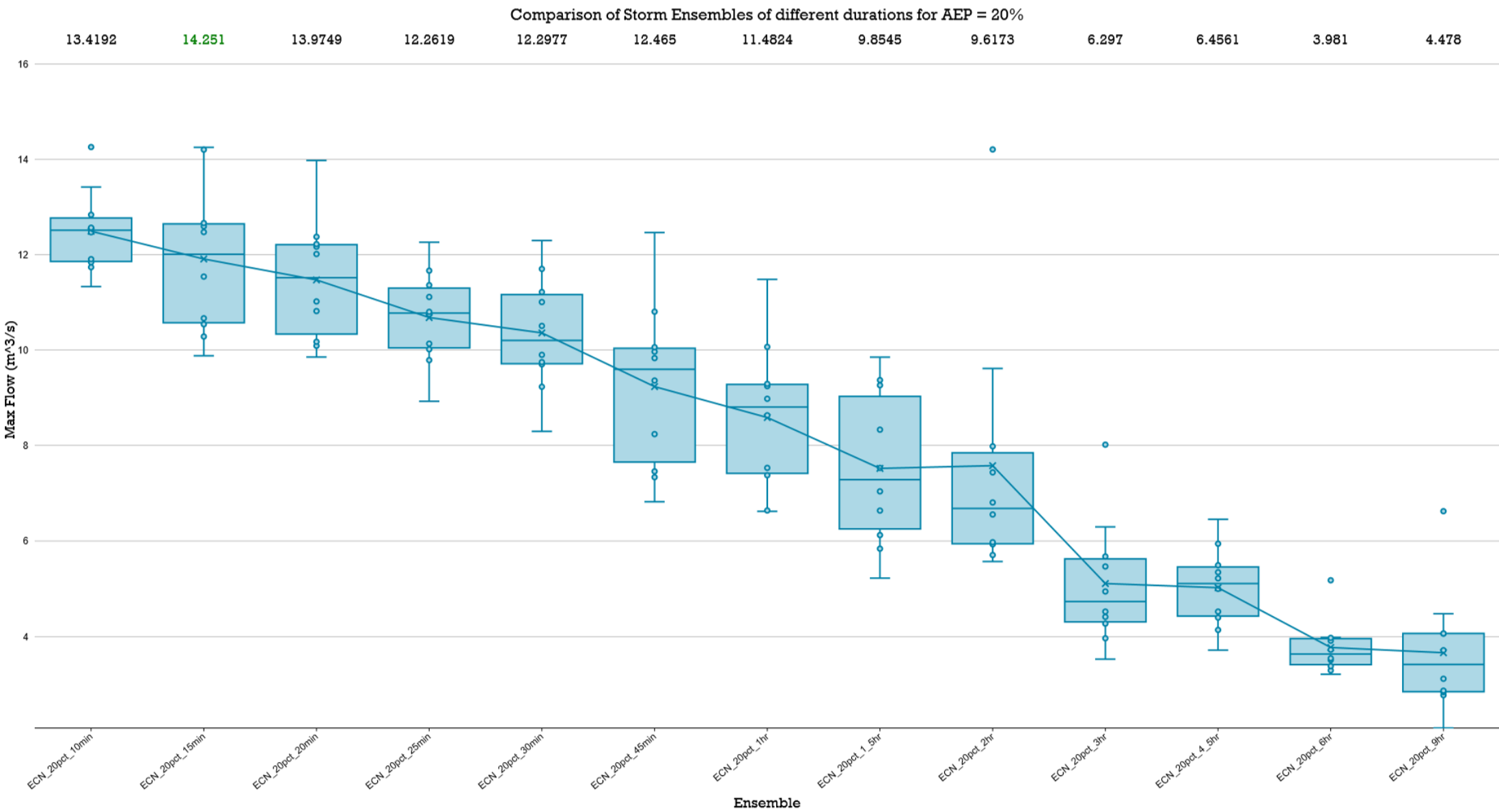
LPoD 1 POST-DEVELOPMENT

Comparison of Storm Ensembles of different durations for AEP = 63.2%

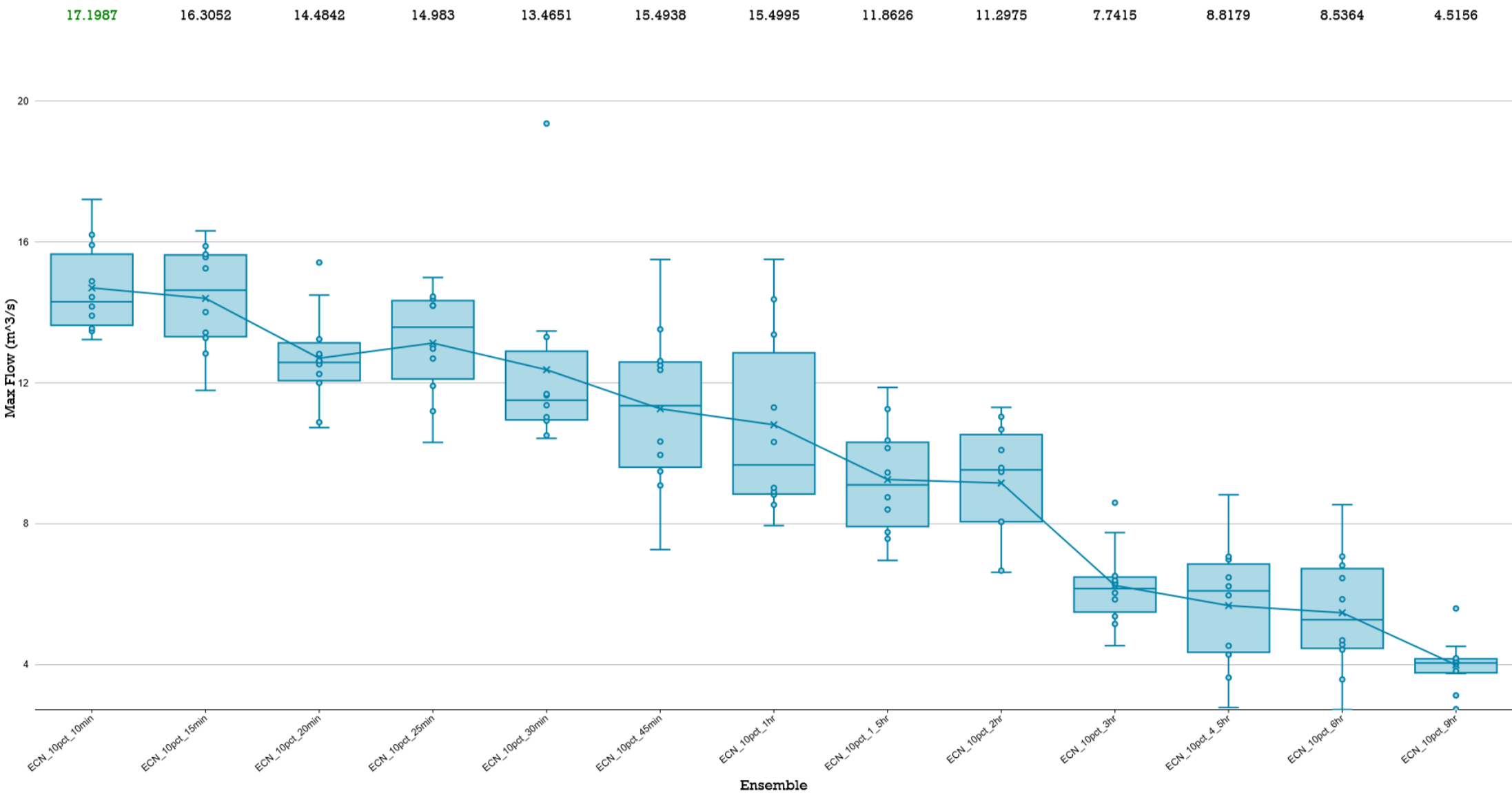


BOX & WHISKER PLOTS

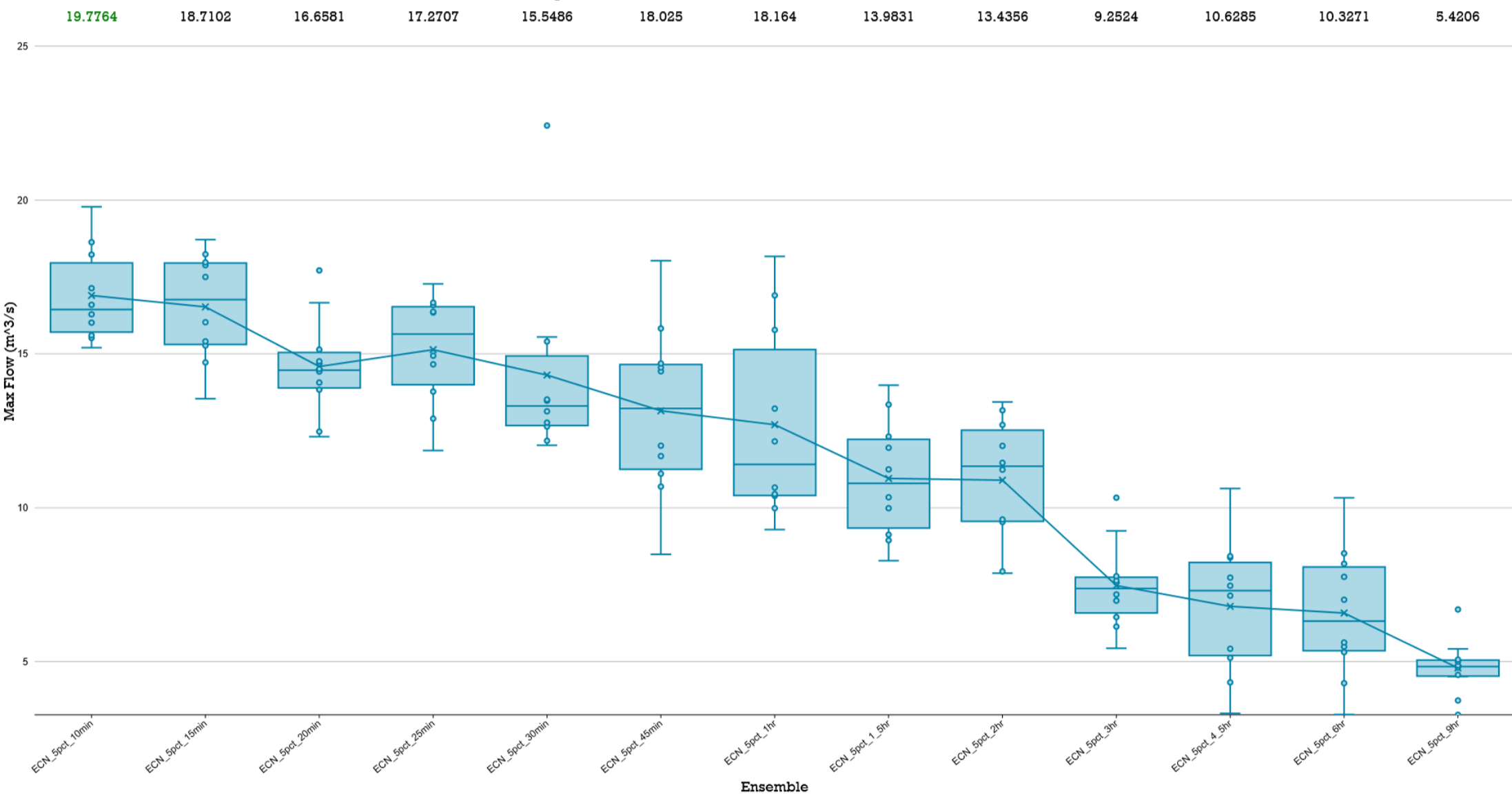




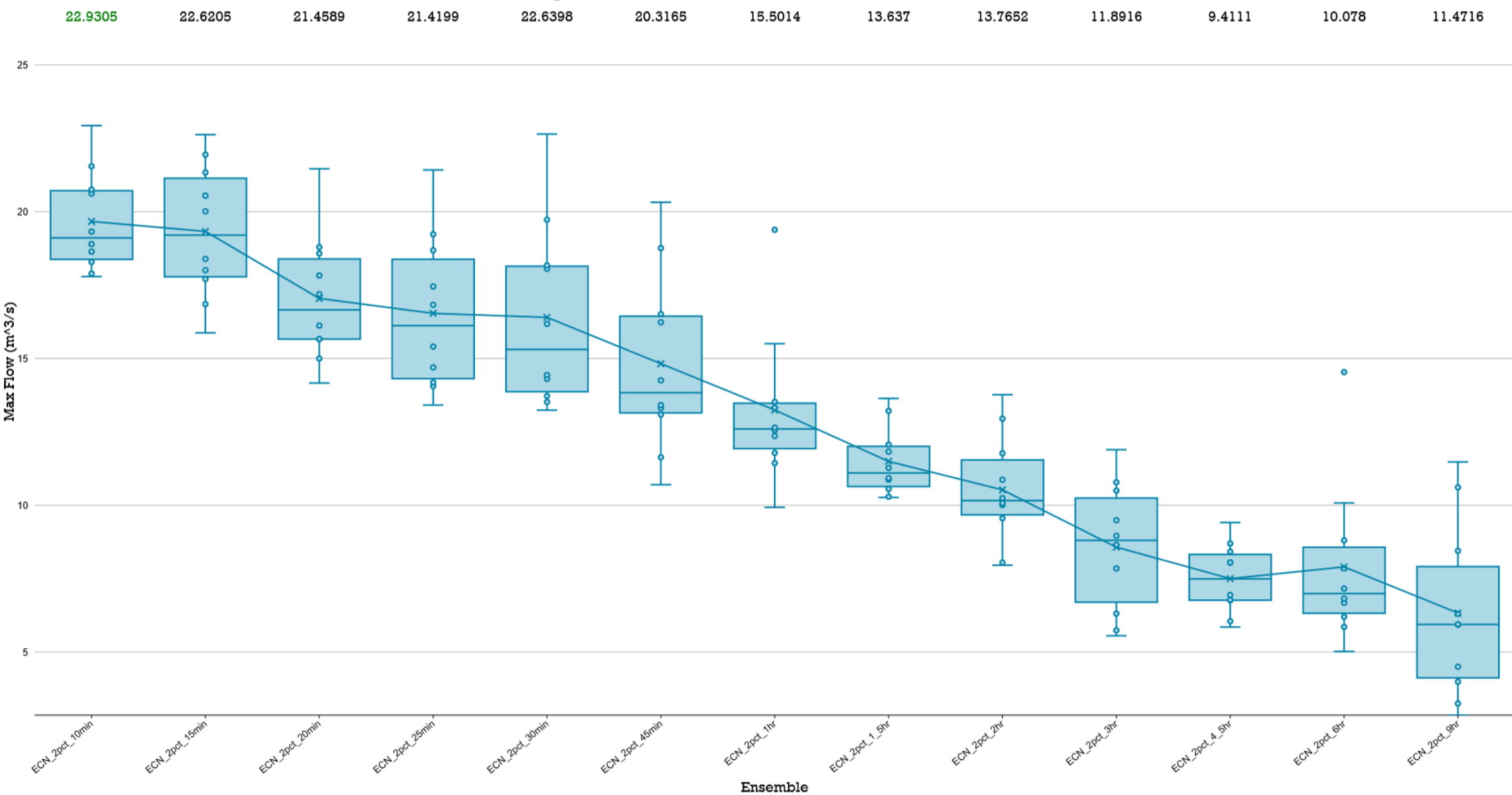
Comparison of Storm Ensembles of different durations for AEP = 10%



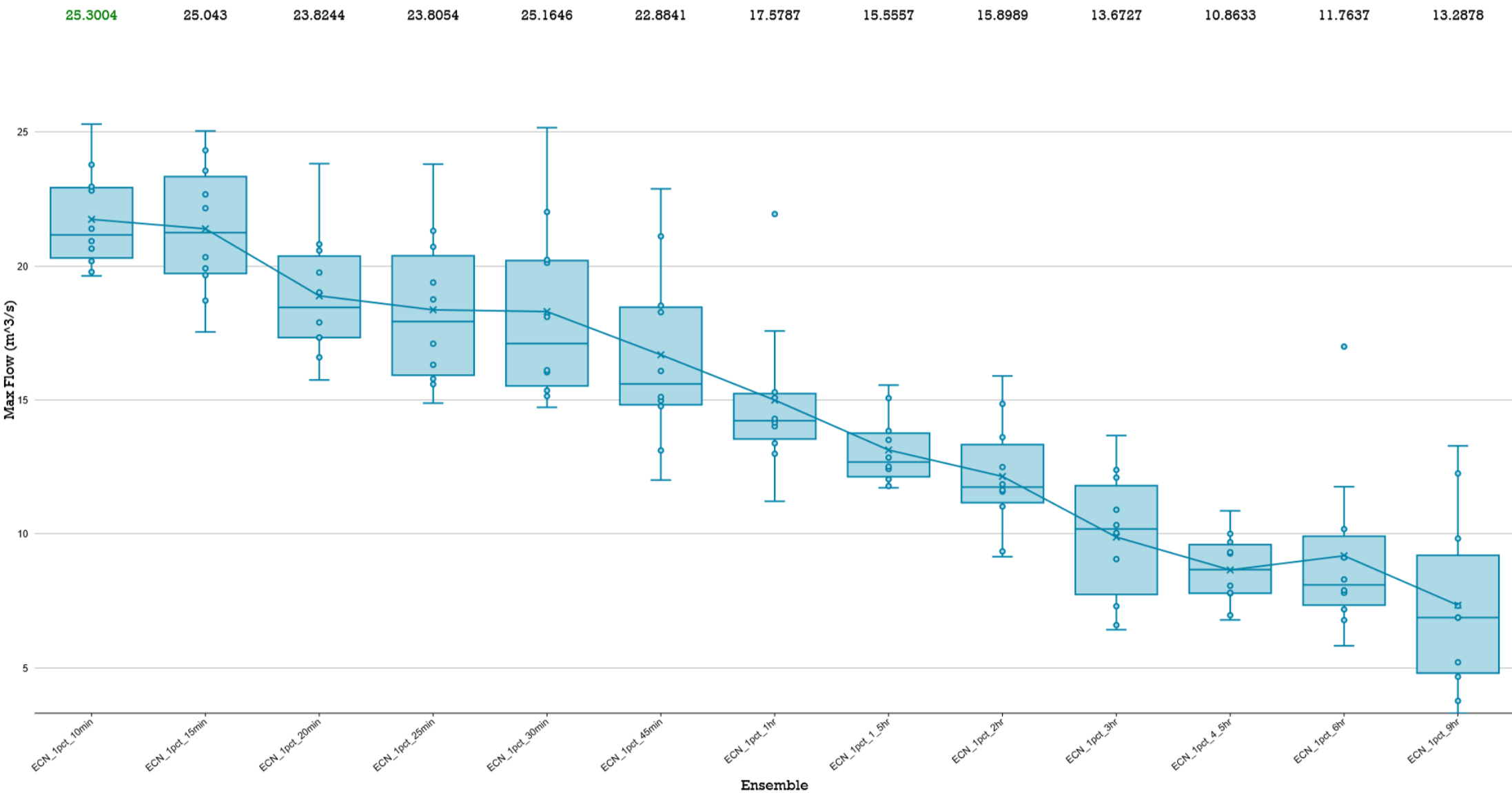
Comparison of Storm Ensembles of different durations for AEP = 5%



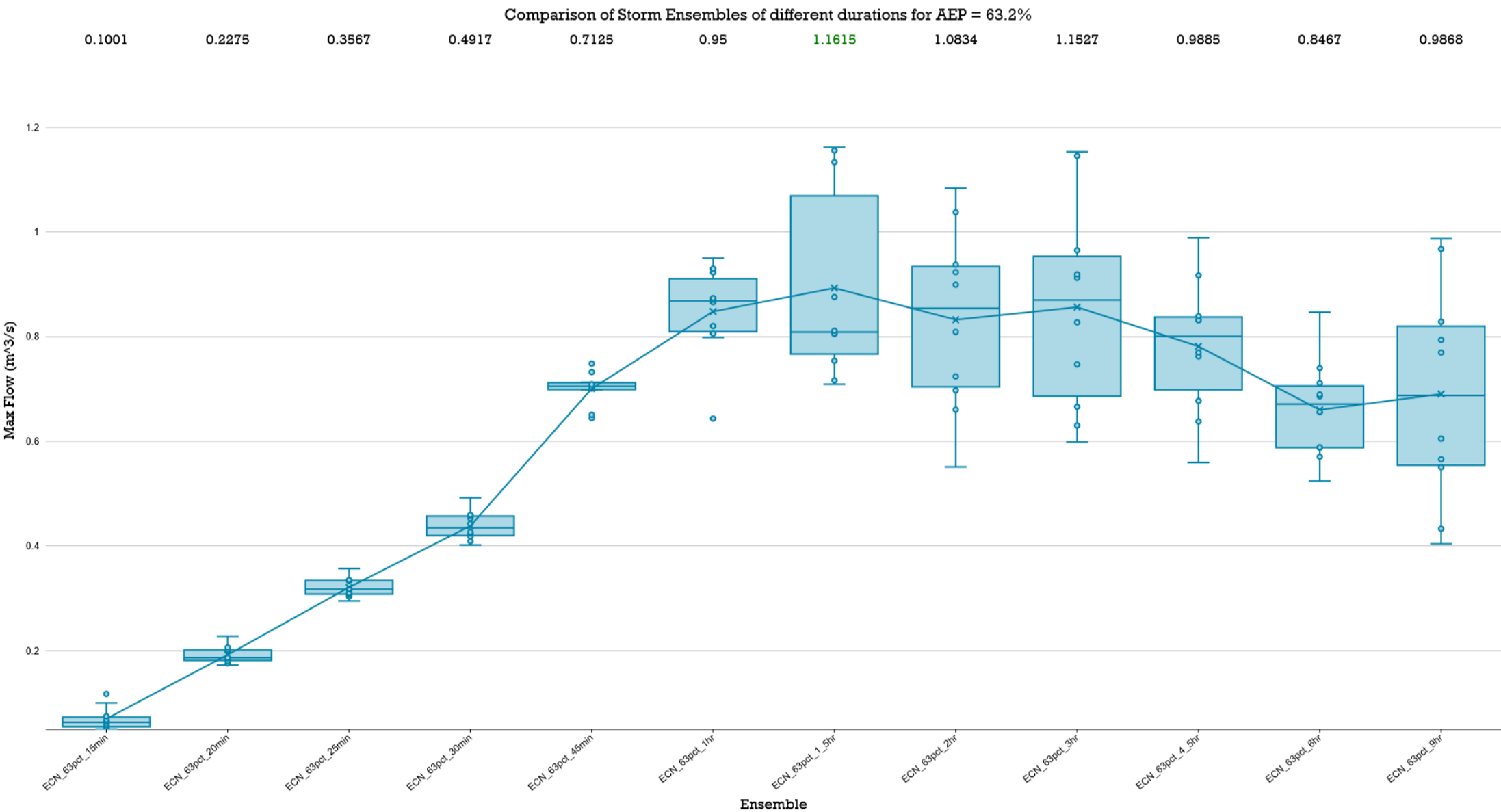
Comparison of Storm Ensembles of different durations for AEP = 2%

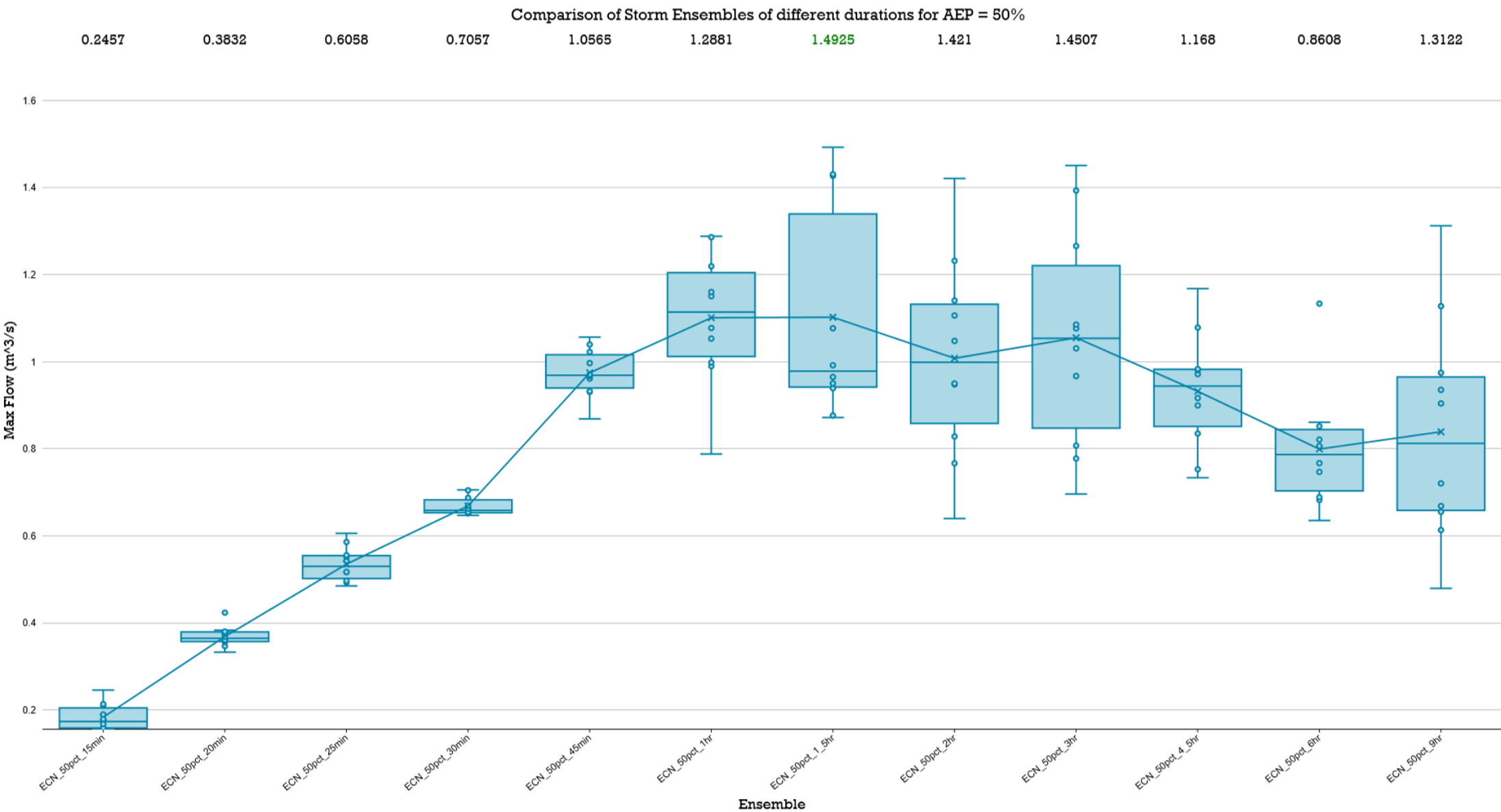


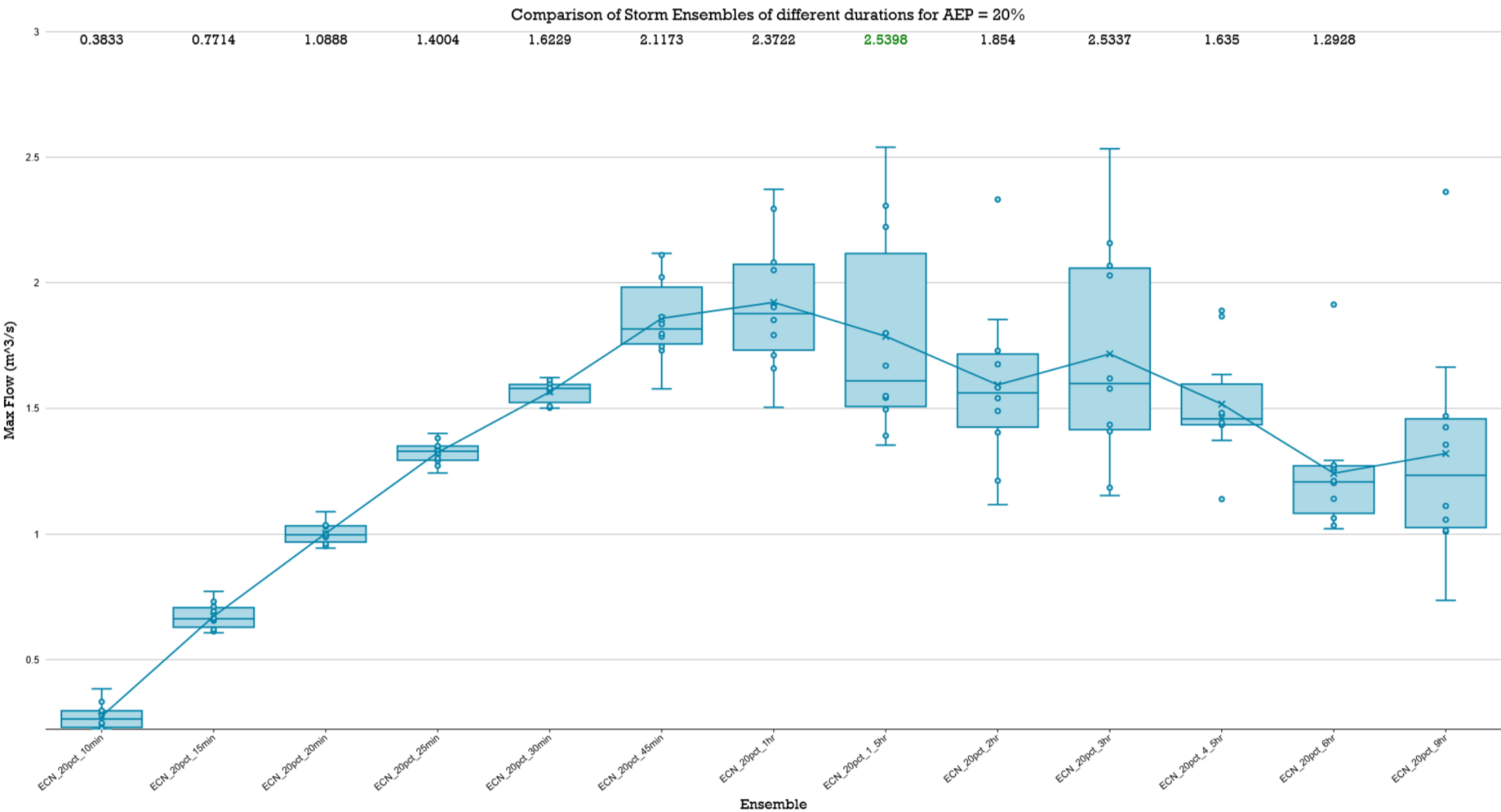
Comparison of Storm Ensembles of different durations for AEP = 1%



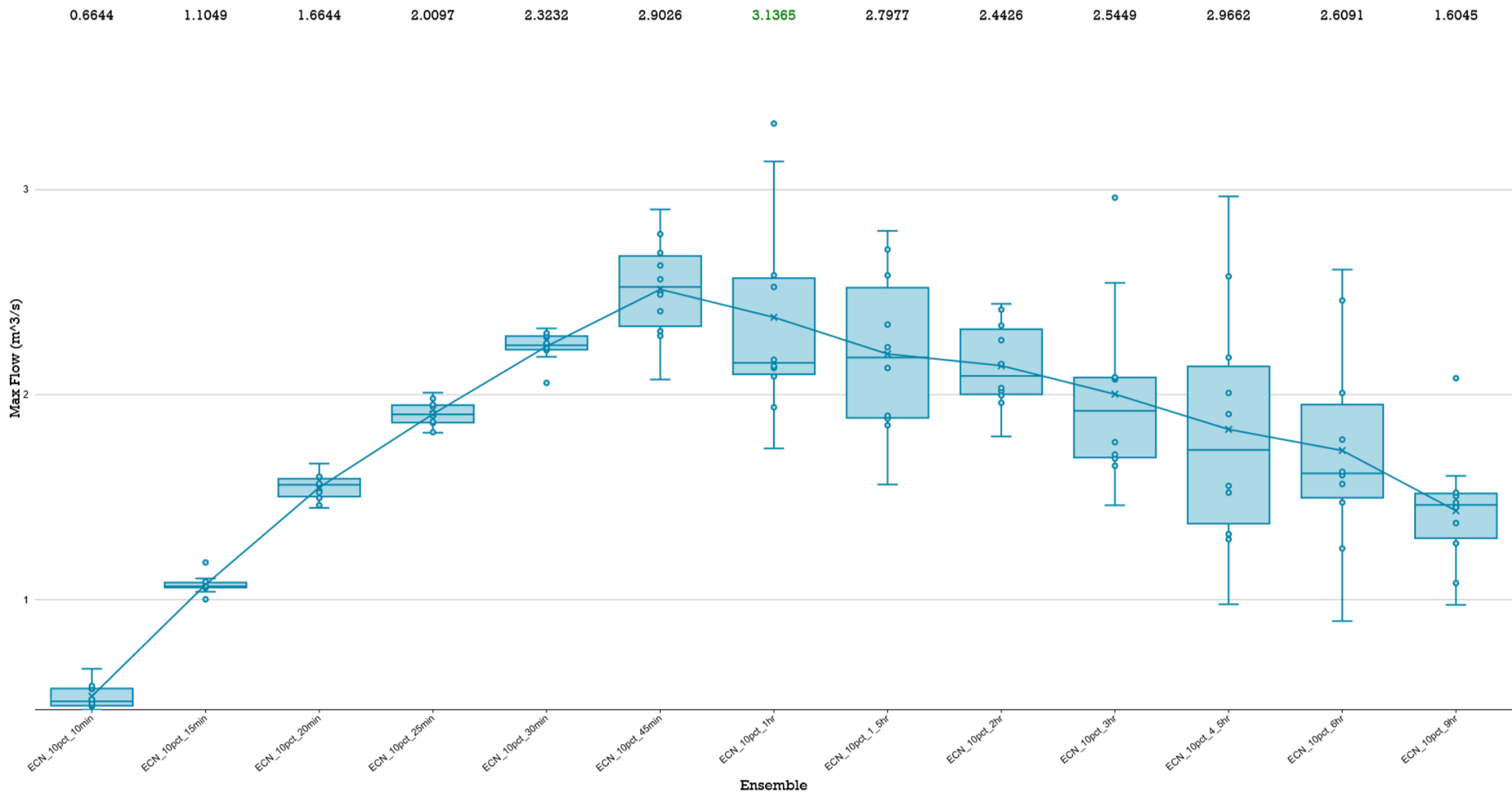
LPoD 2 PRE-DEVELOPMENT



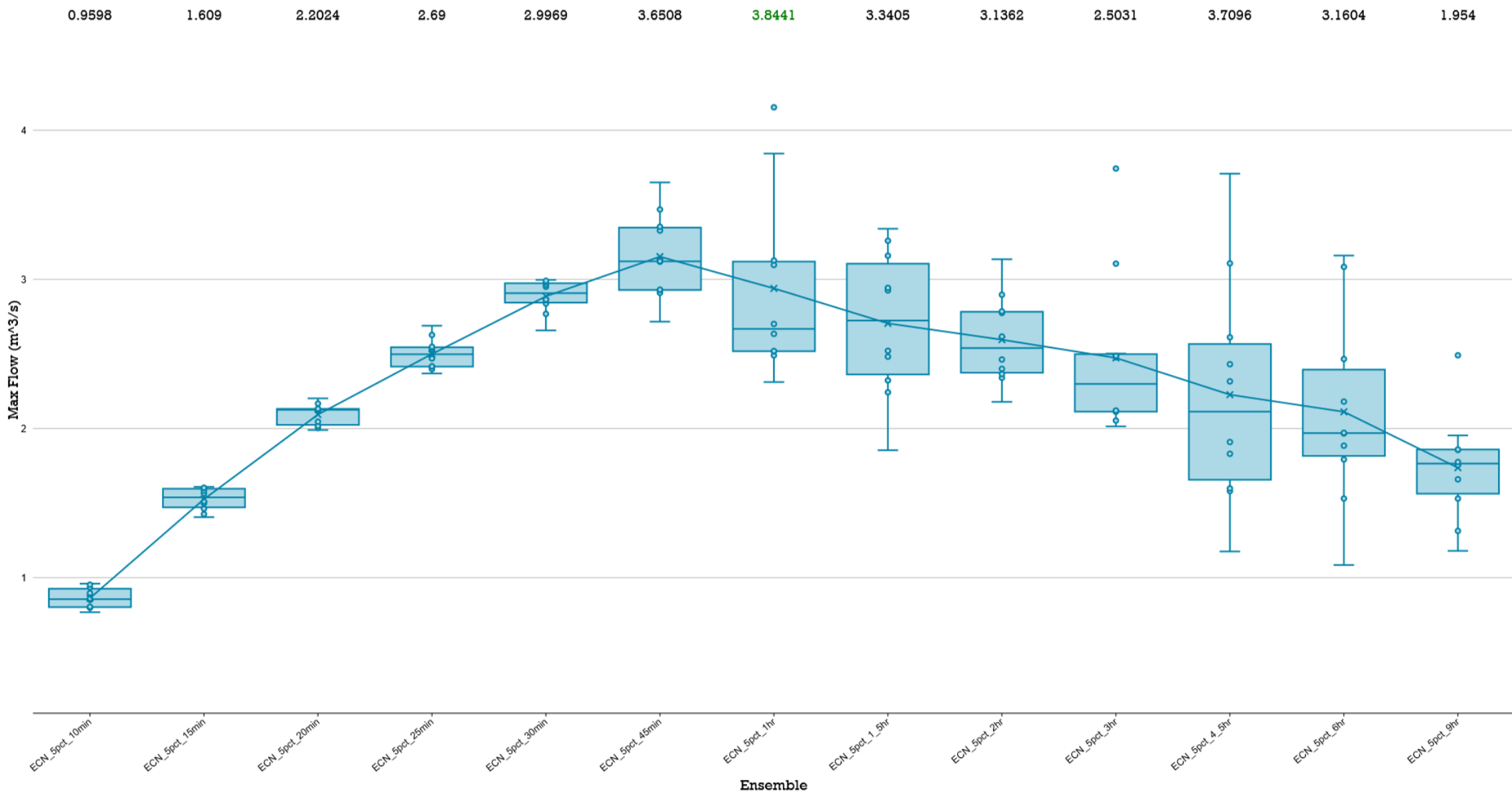




Comparison of Storm Ensembles of different durations for AEP = 10%

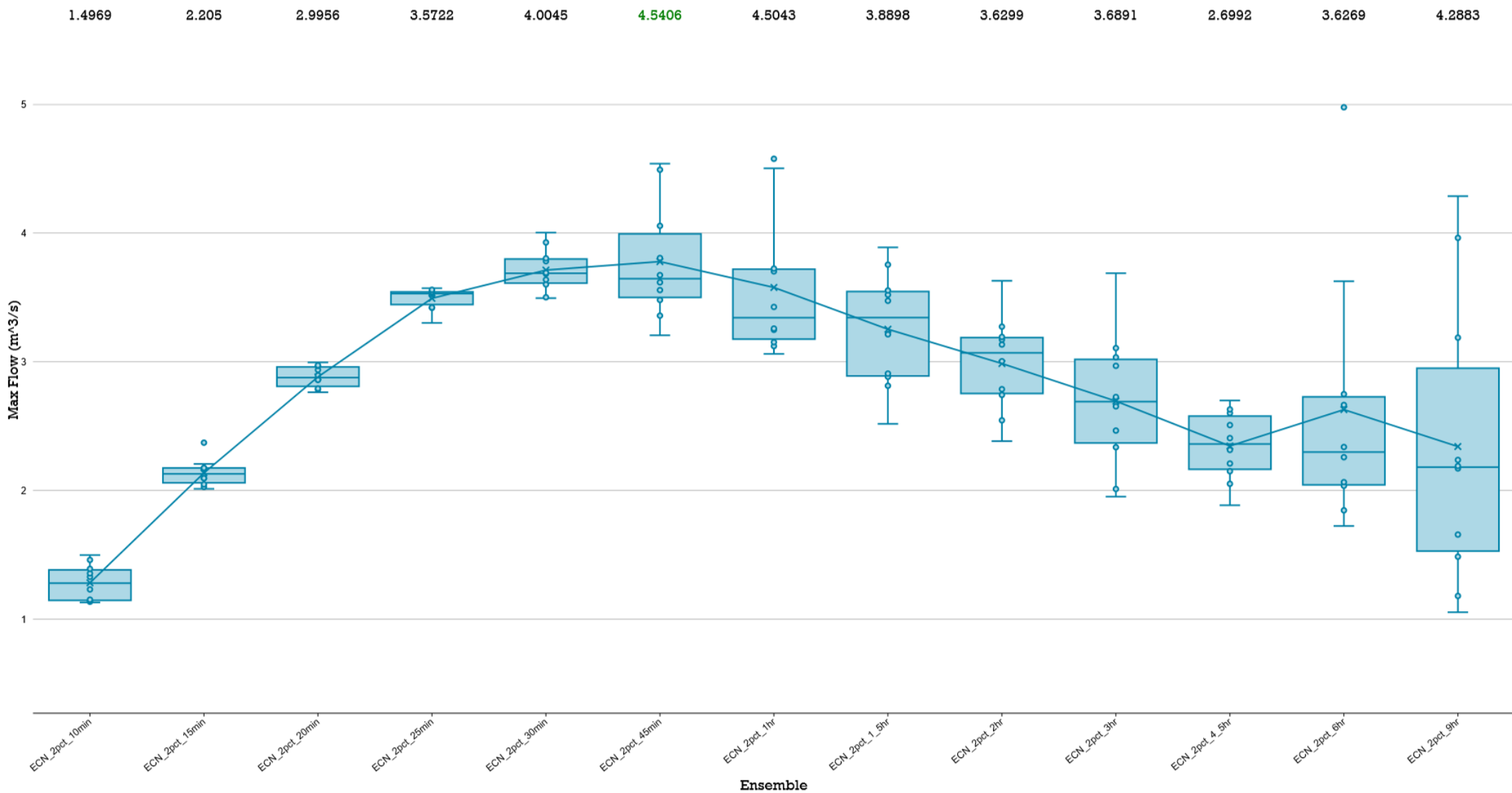


Comparison of Storm Ensembles of different durations for AEP = 5%

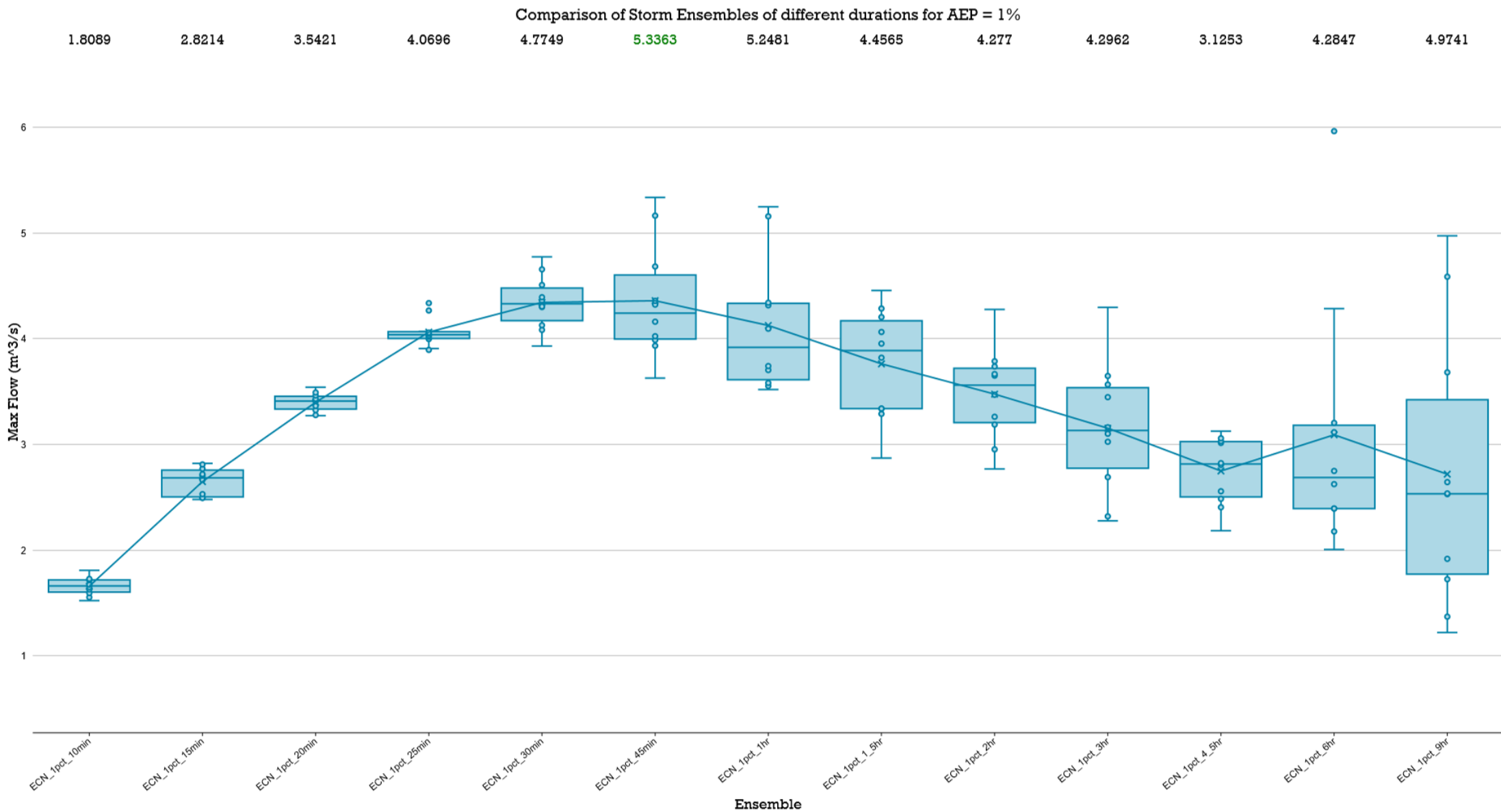


BOX & WHISKER PLOTS

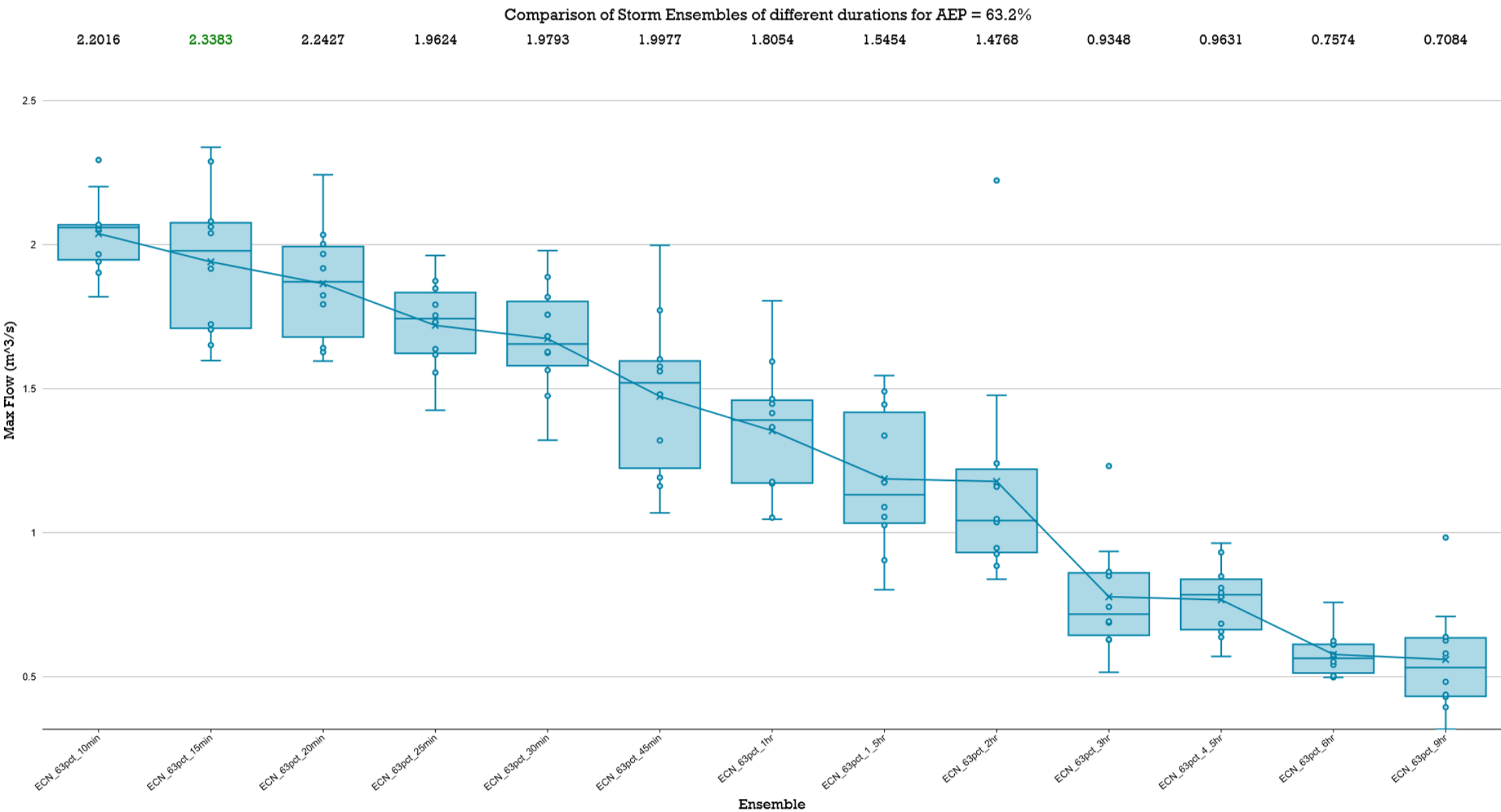
Comparison of Storm Ensembles of different durations for AEP = 2%

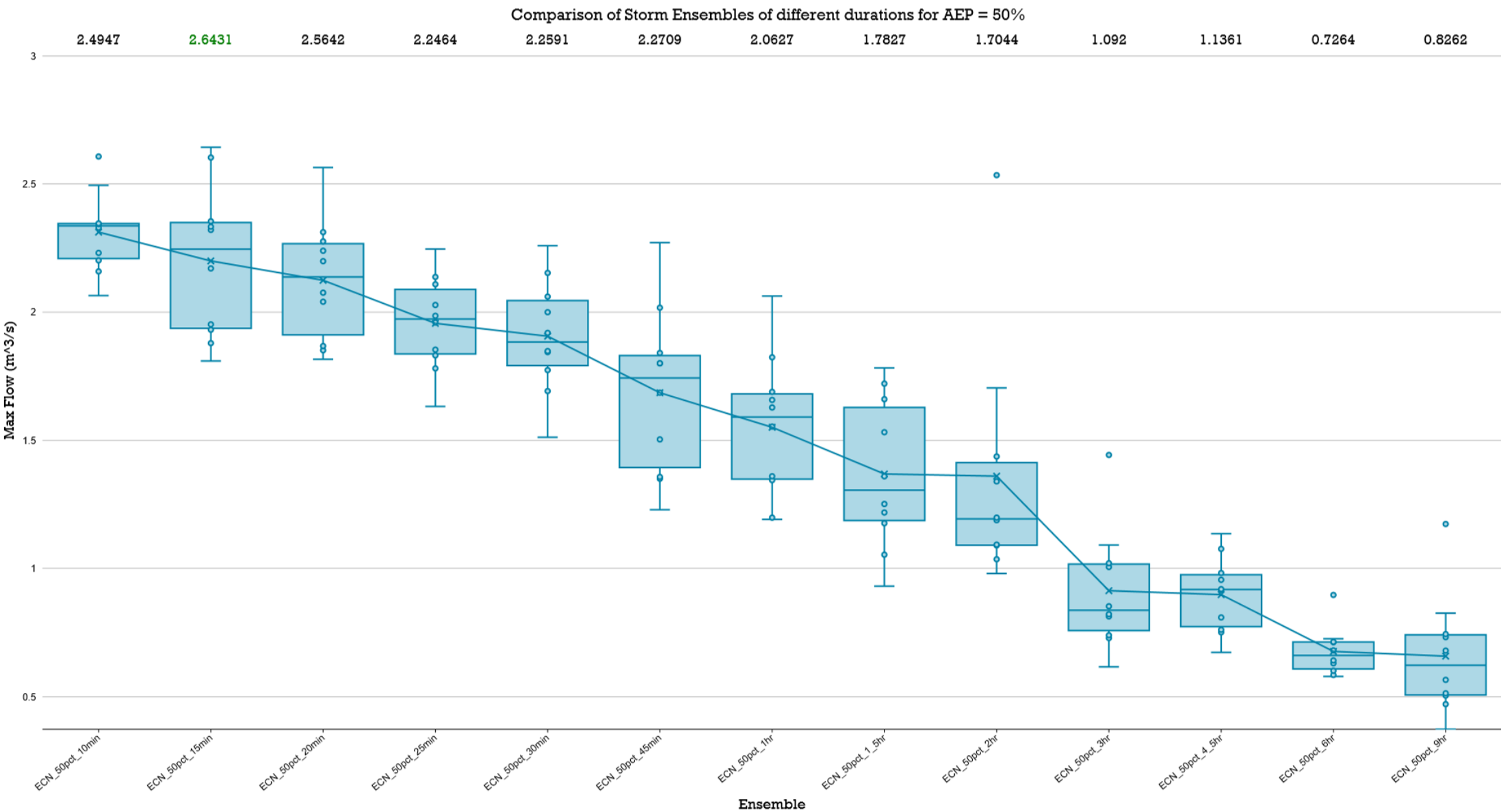


BOX & WHISKER PLOTS

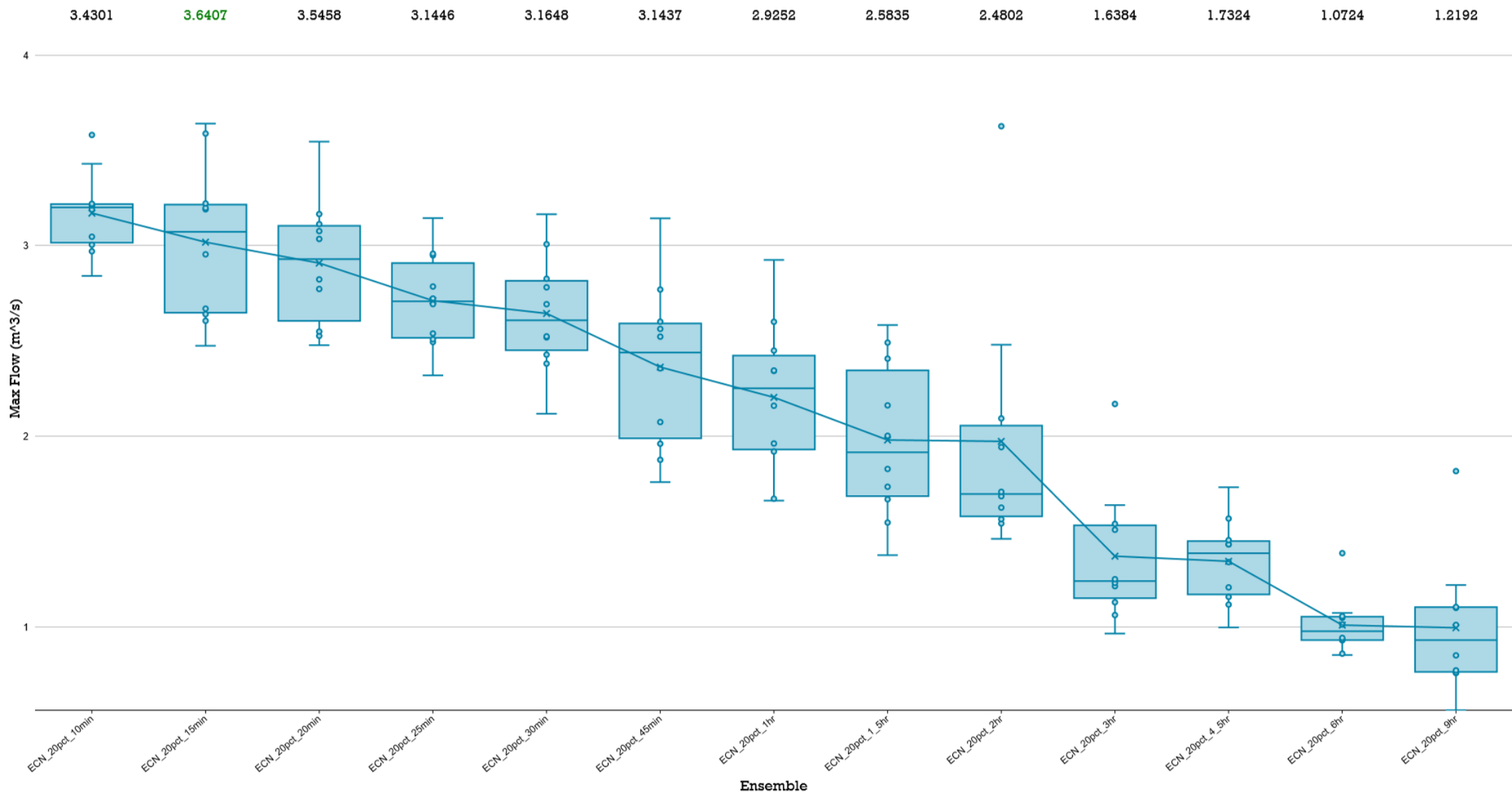


LPoD 2 POST-DEVELOPMENT



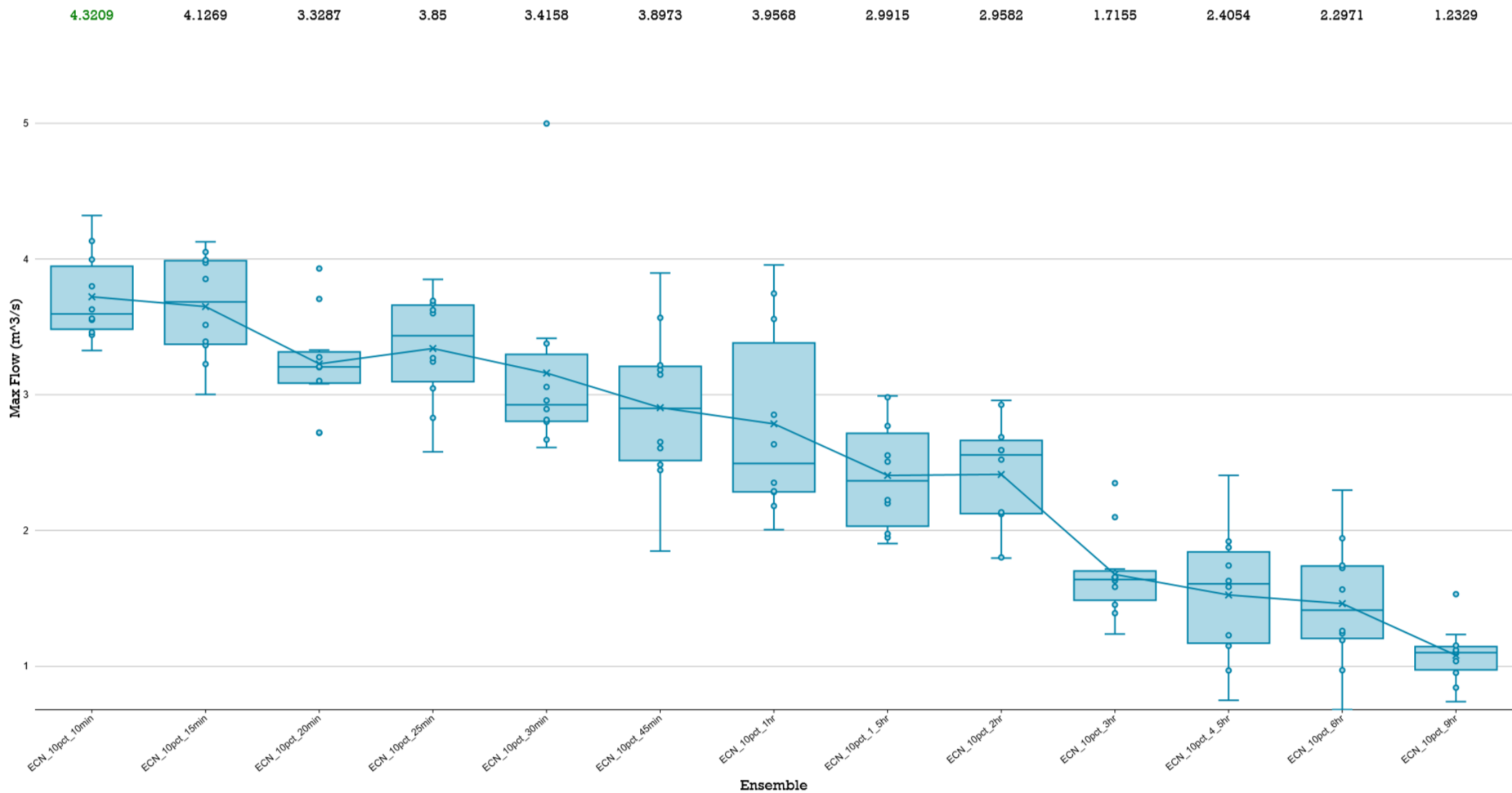


Comparison of Storm Ensembles of different durations for AEP = 20%

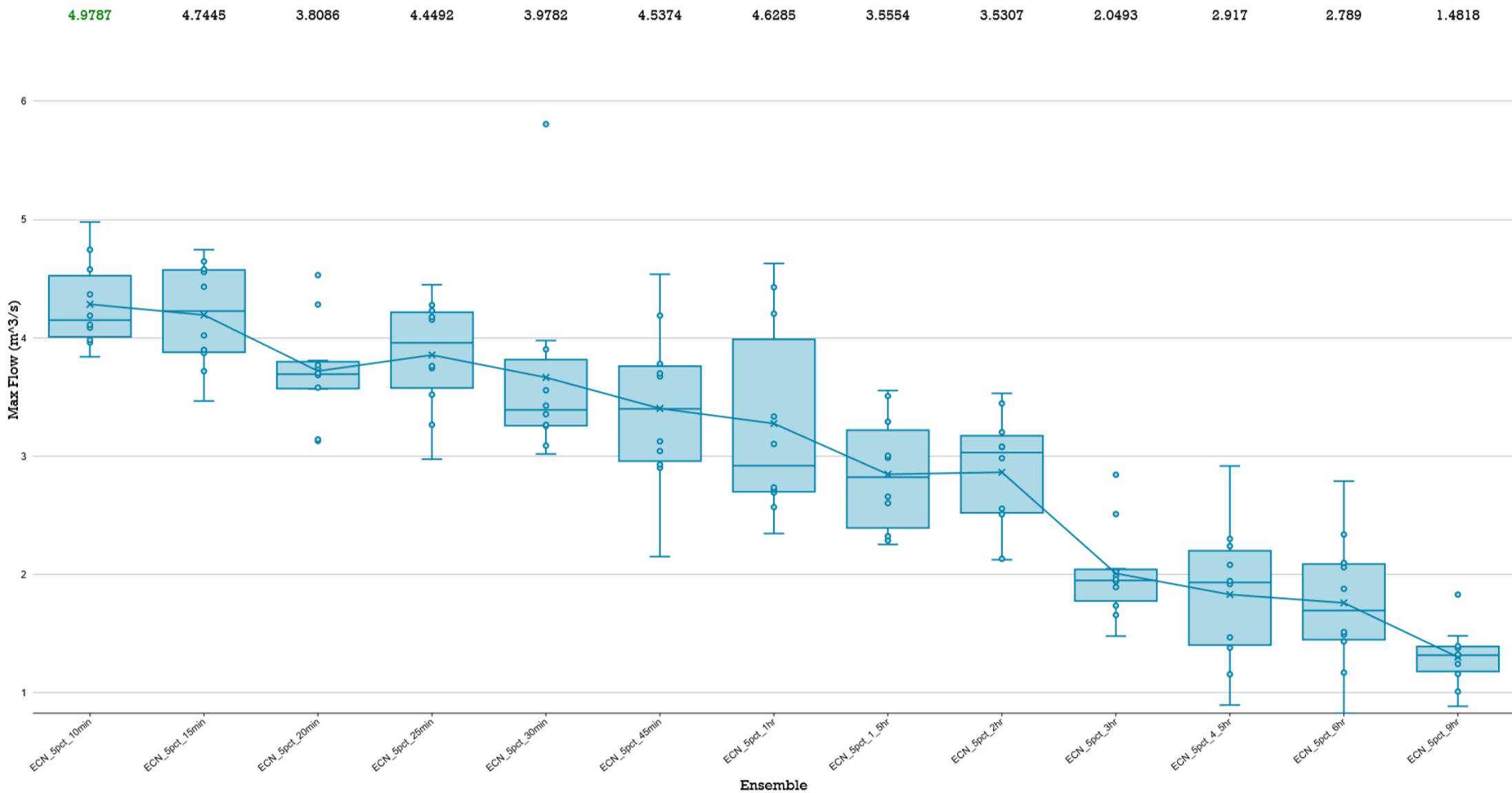


BOX & WHISKER PLOTS

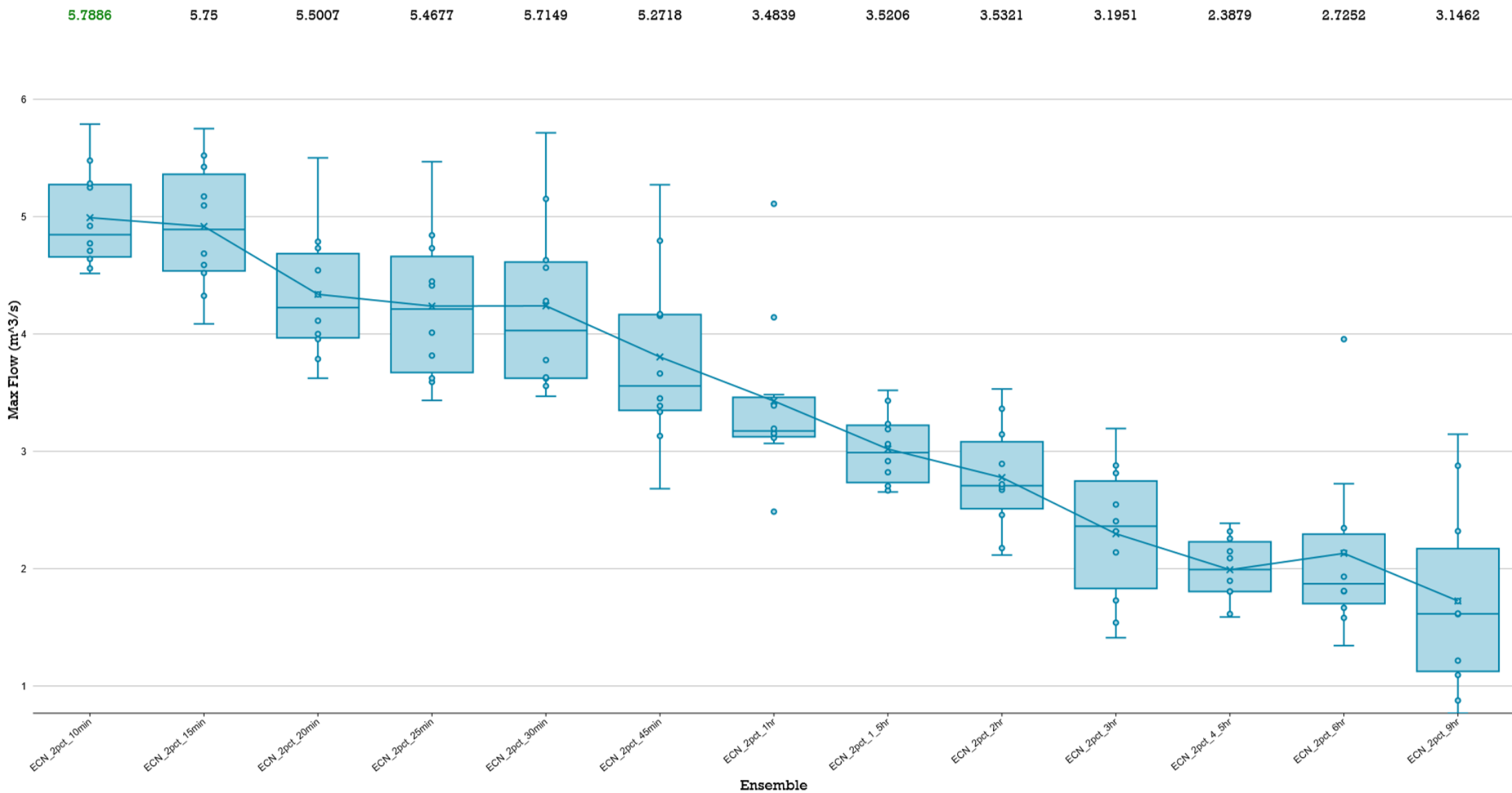
Comparison of Storm Ensembles of different durations for AEP = 10%

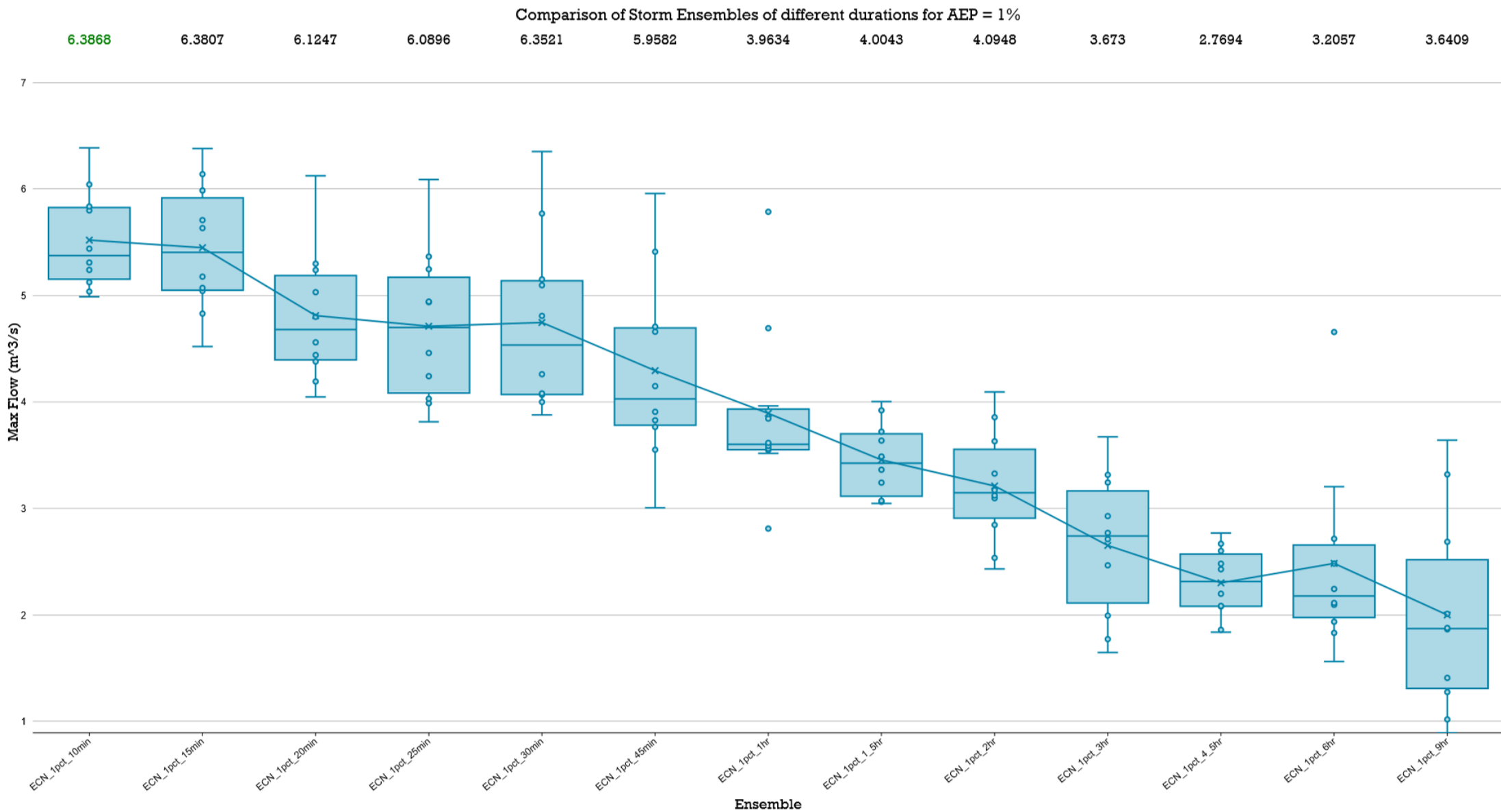


Comparison of Storm Ensembles of different durations for AEP = 5%

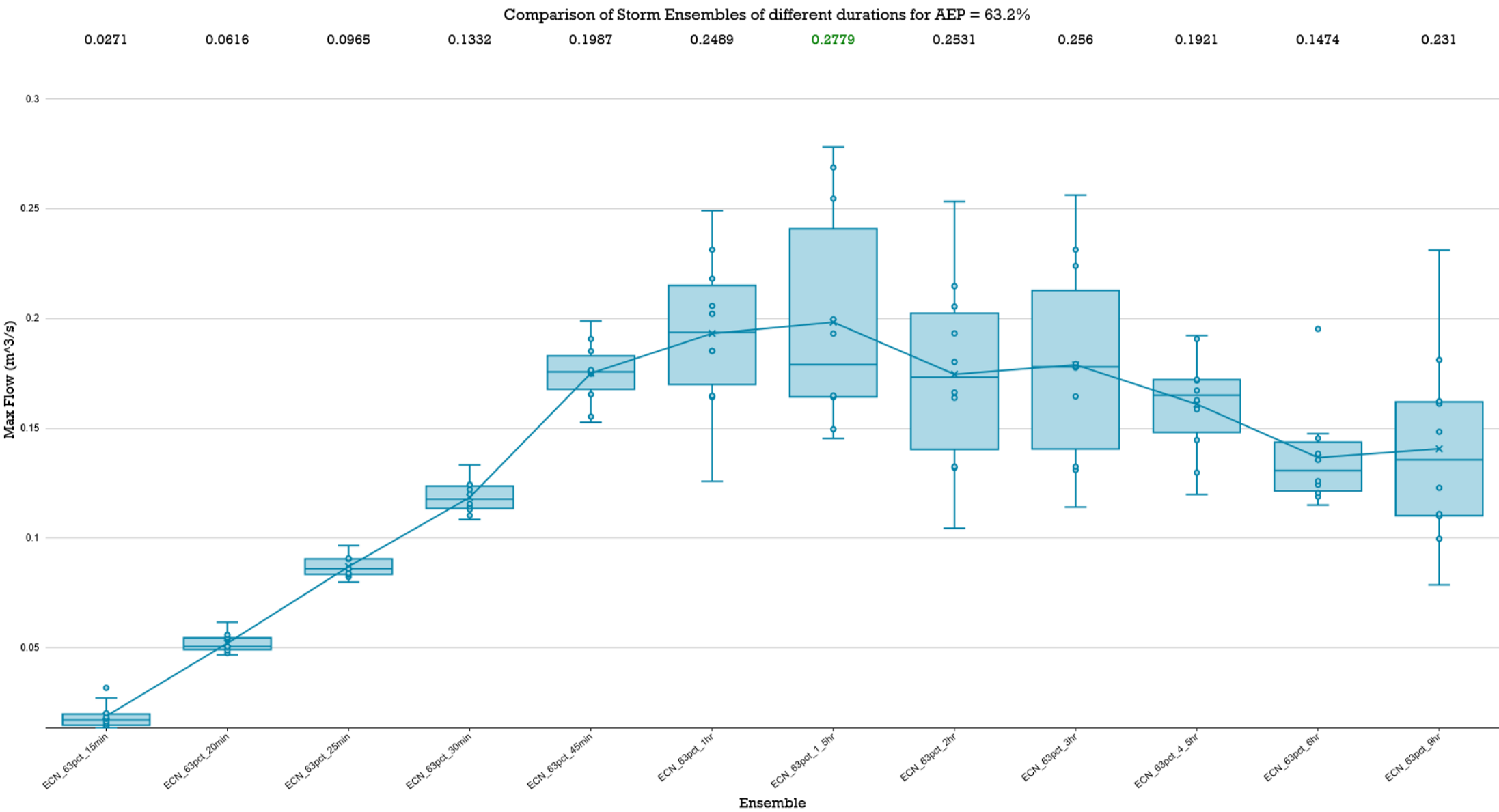


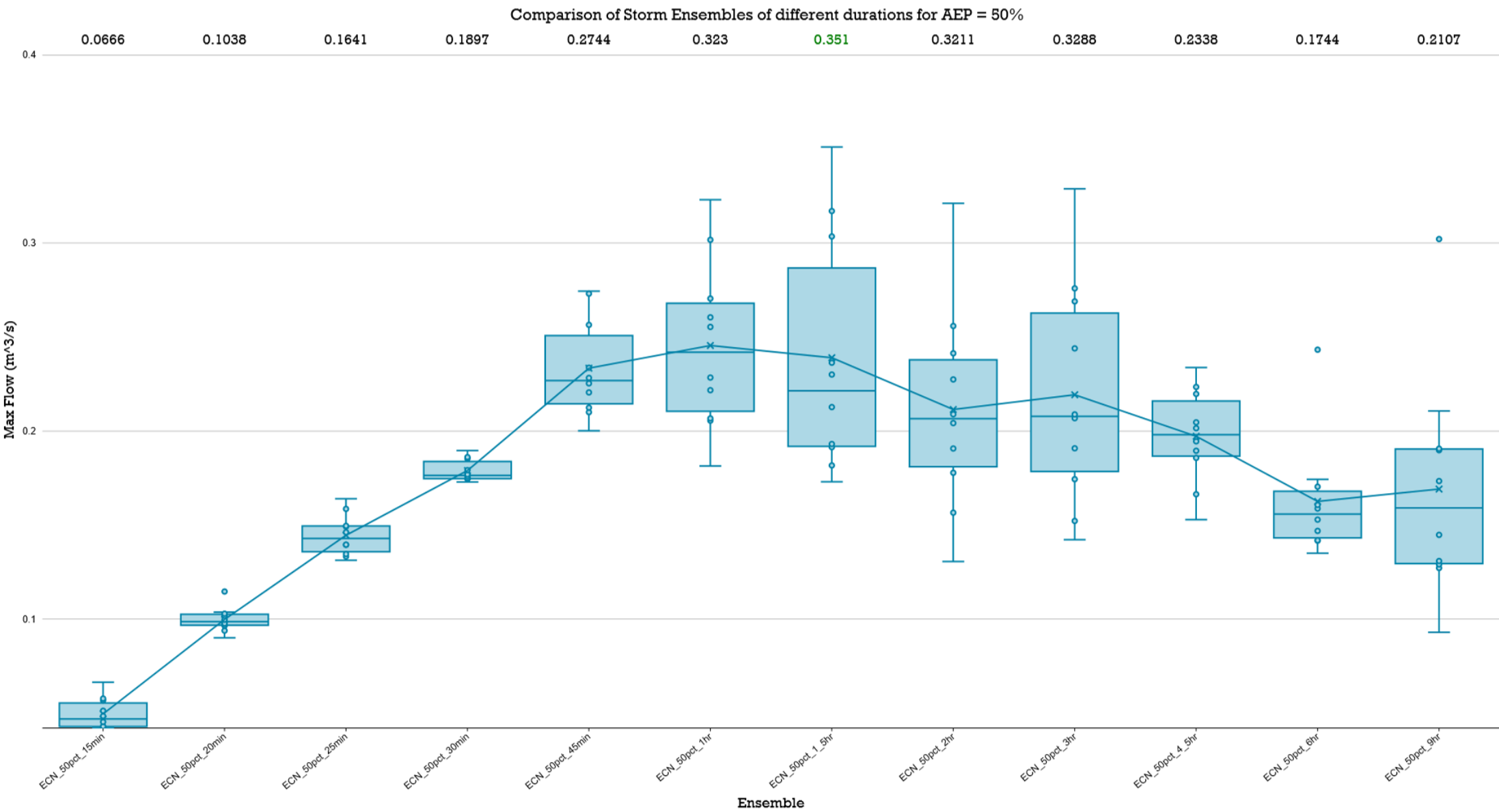
Comparison of Storm Ensembles of different durations for AEP = 2%

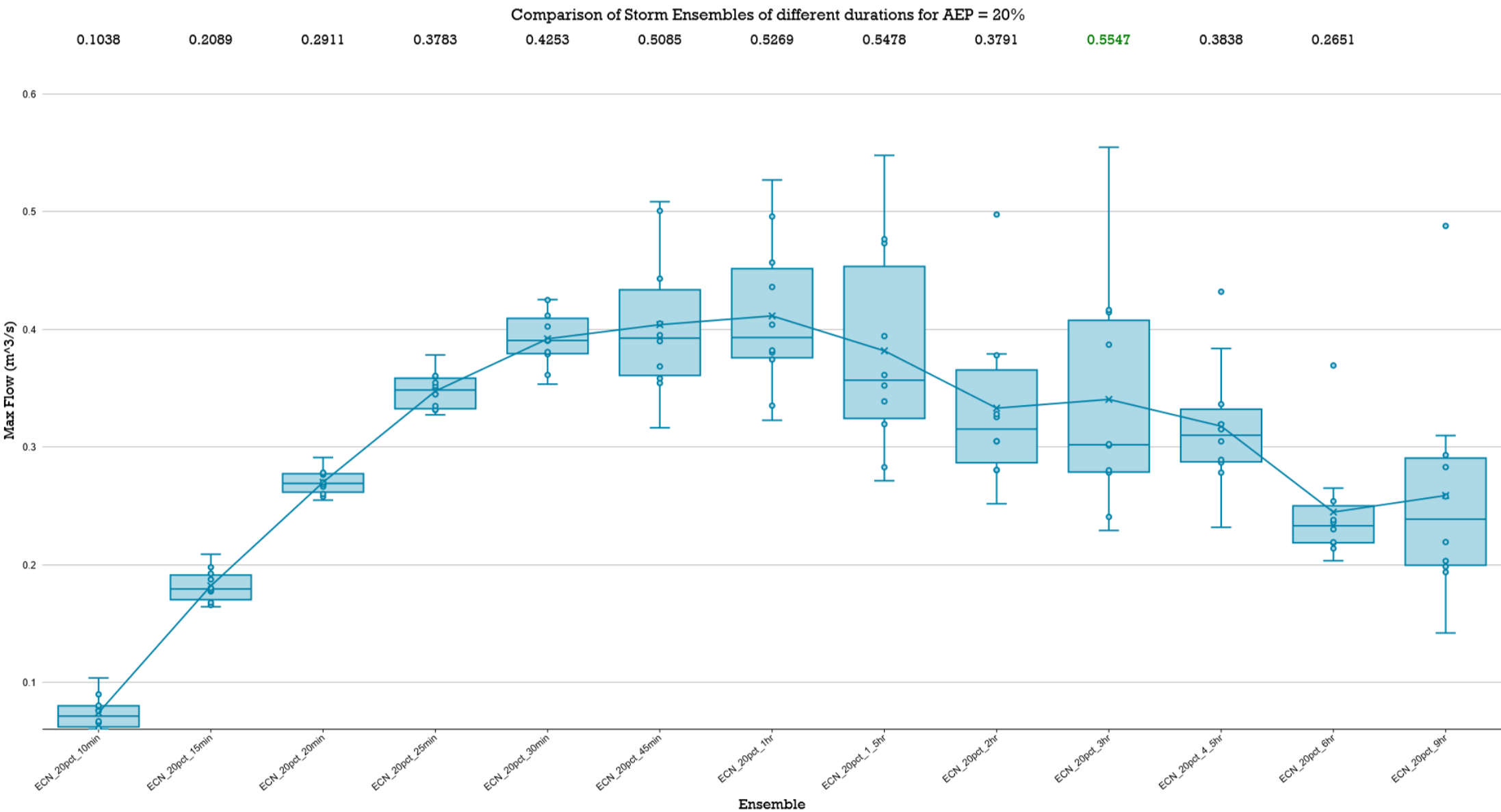


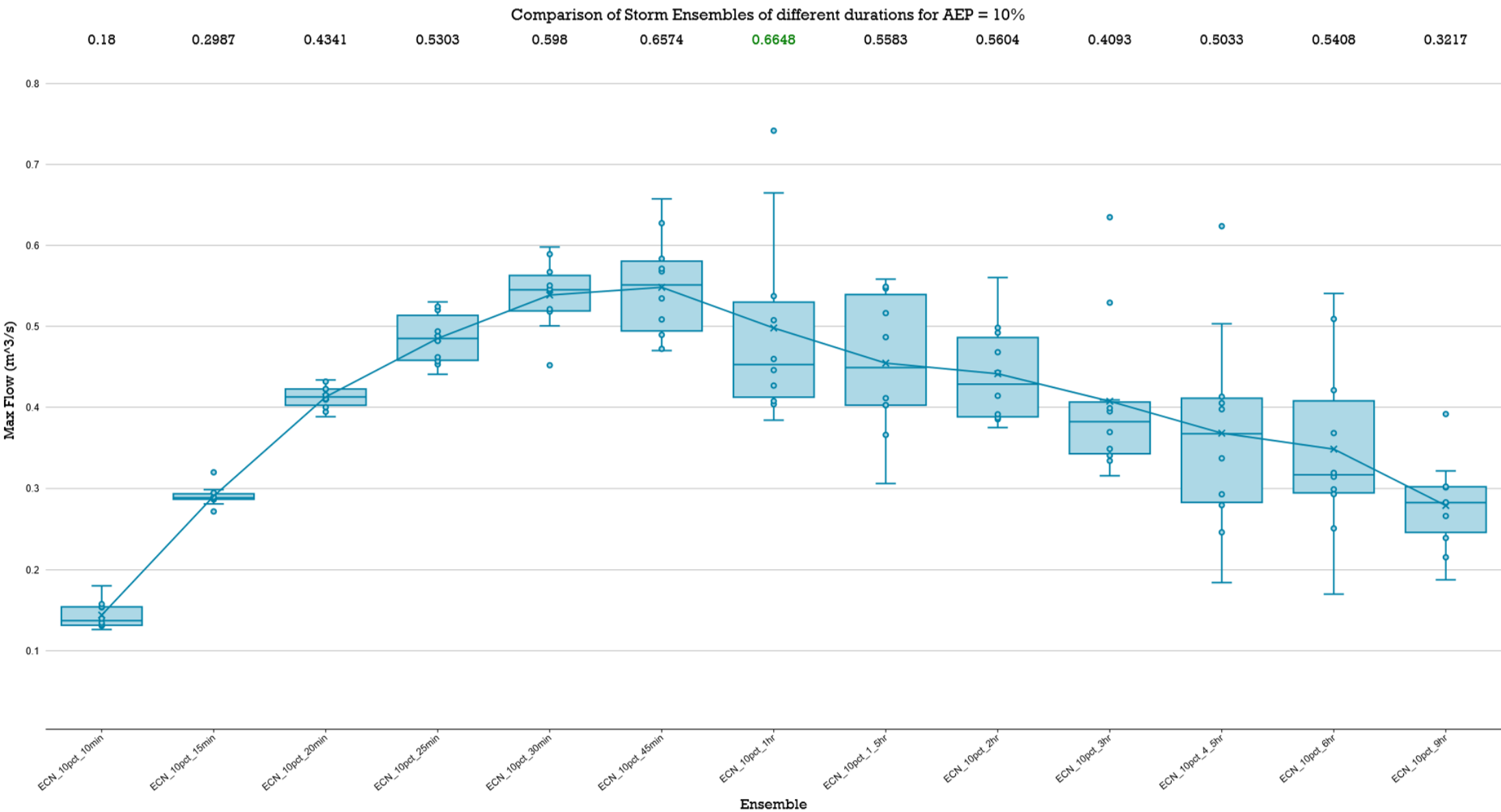


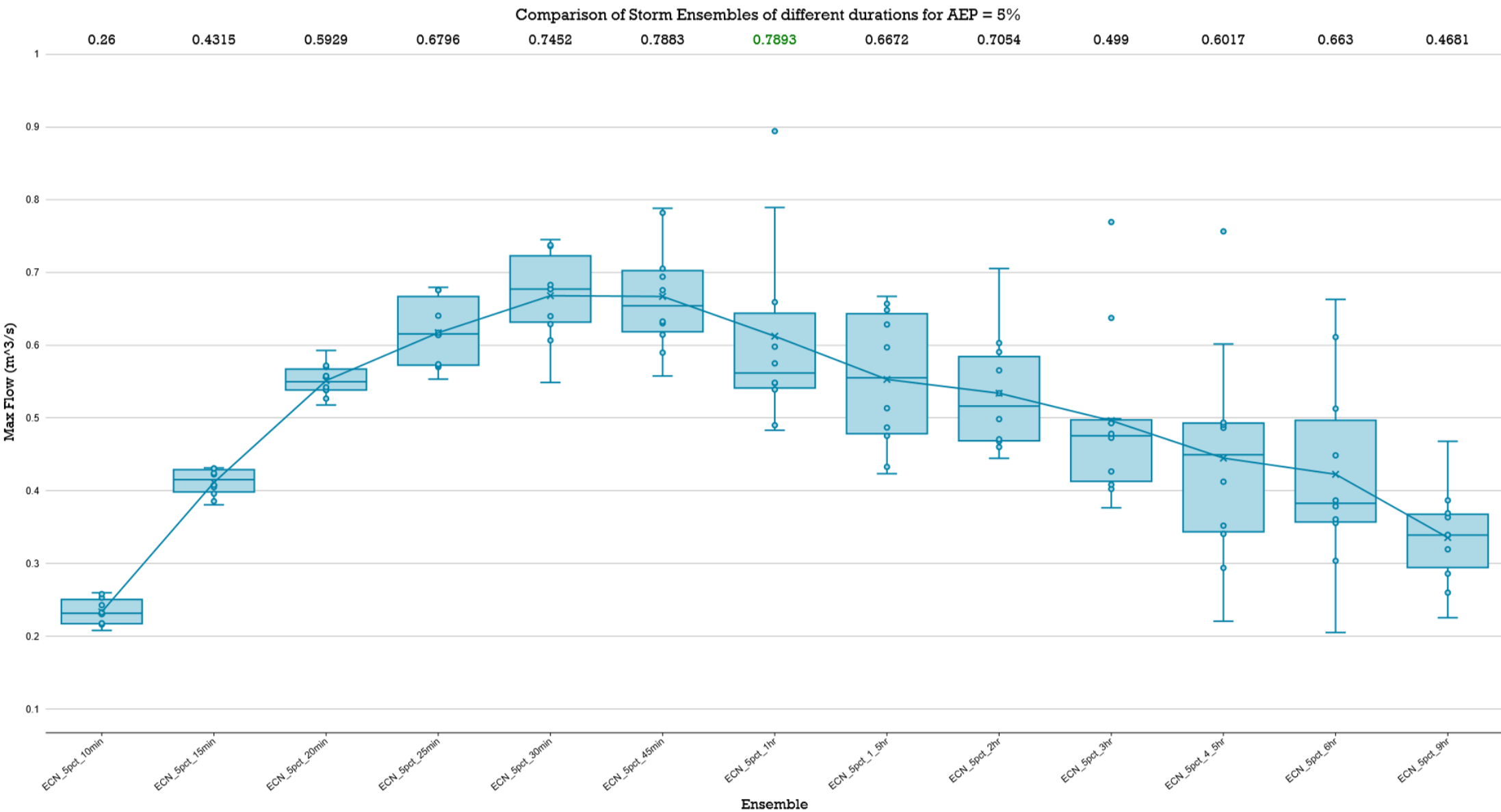
LPoD 3 PRE-DEVELOPMENT

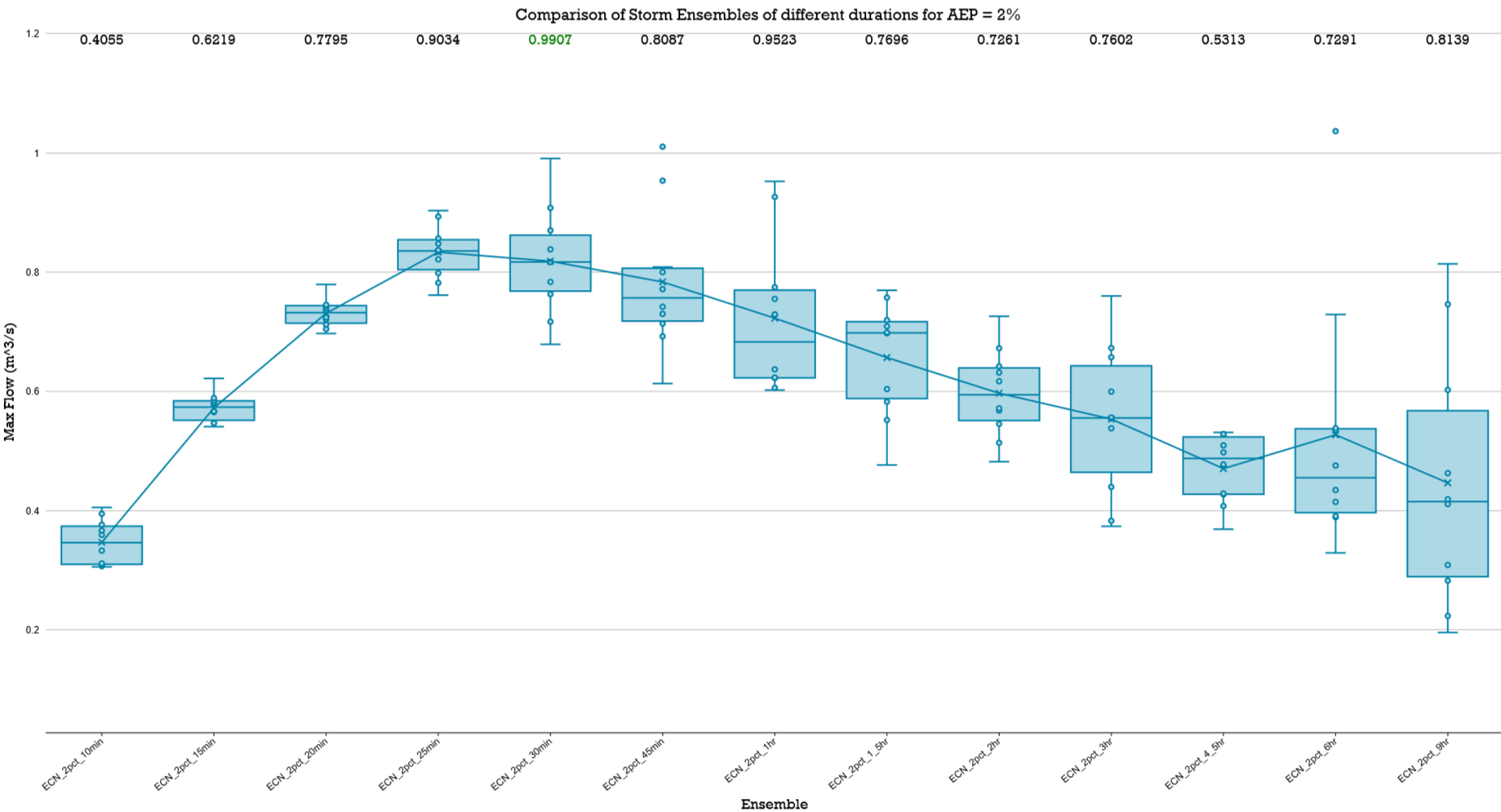


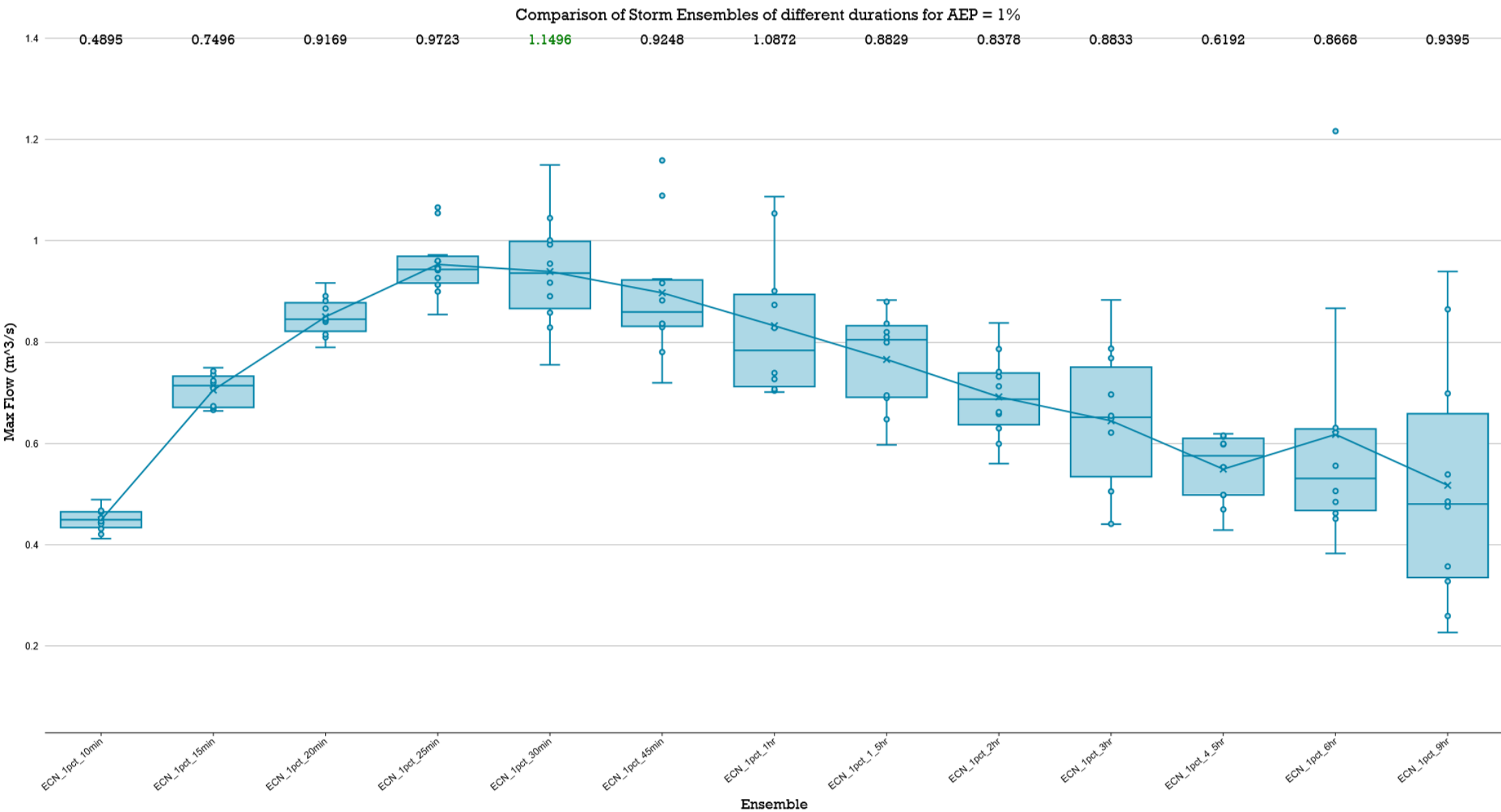




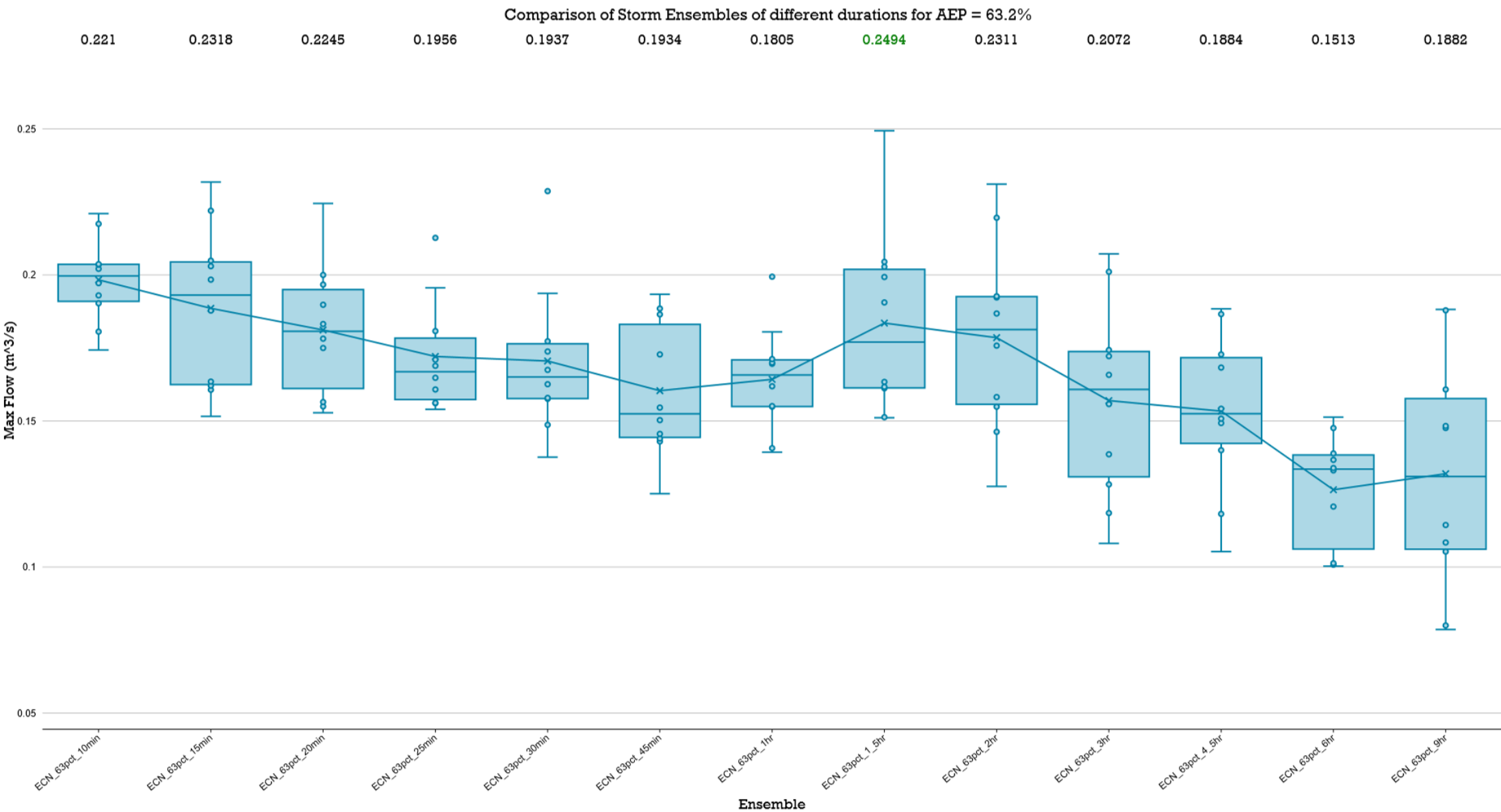


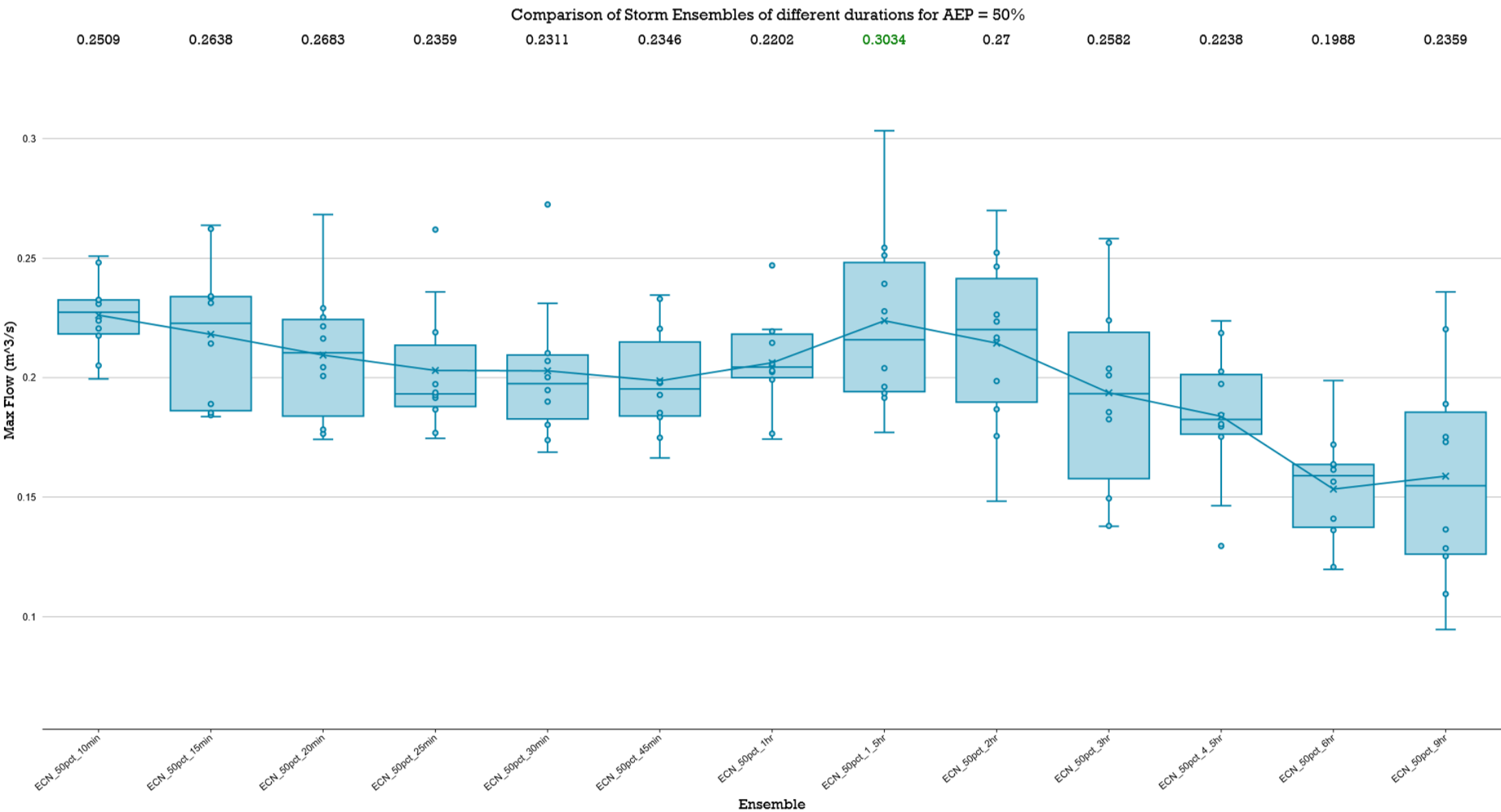


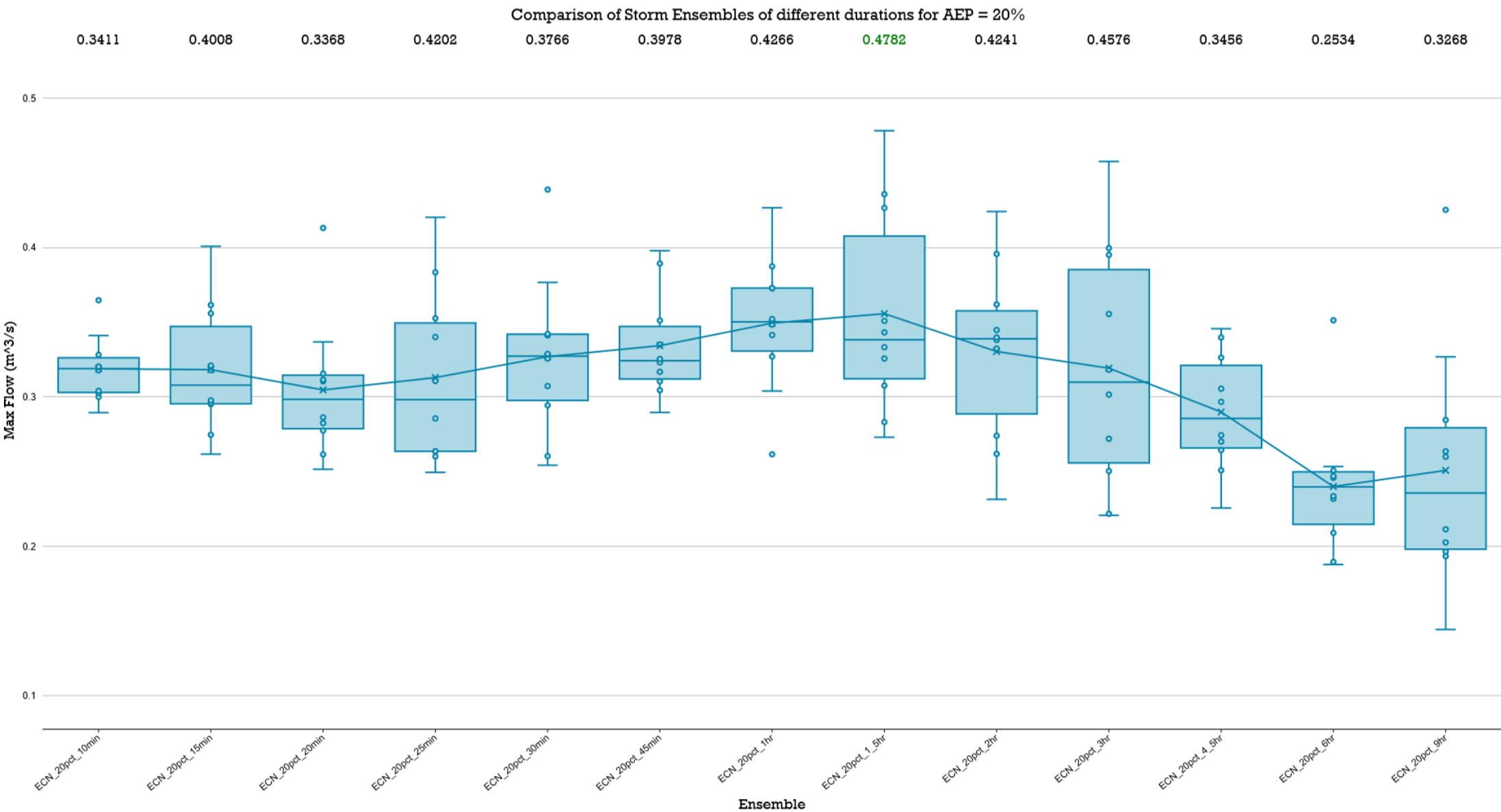


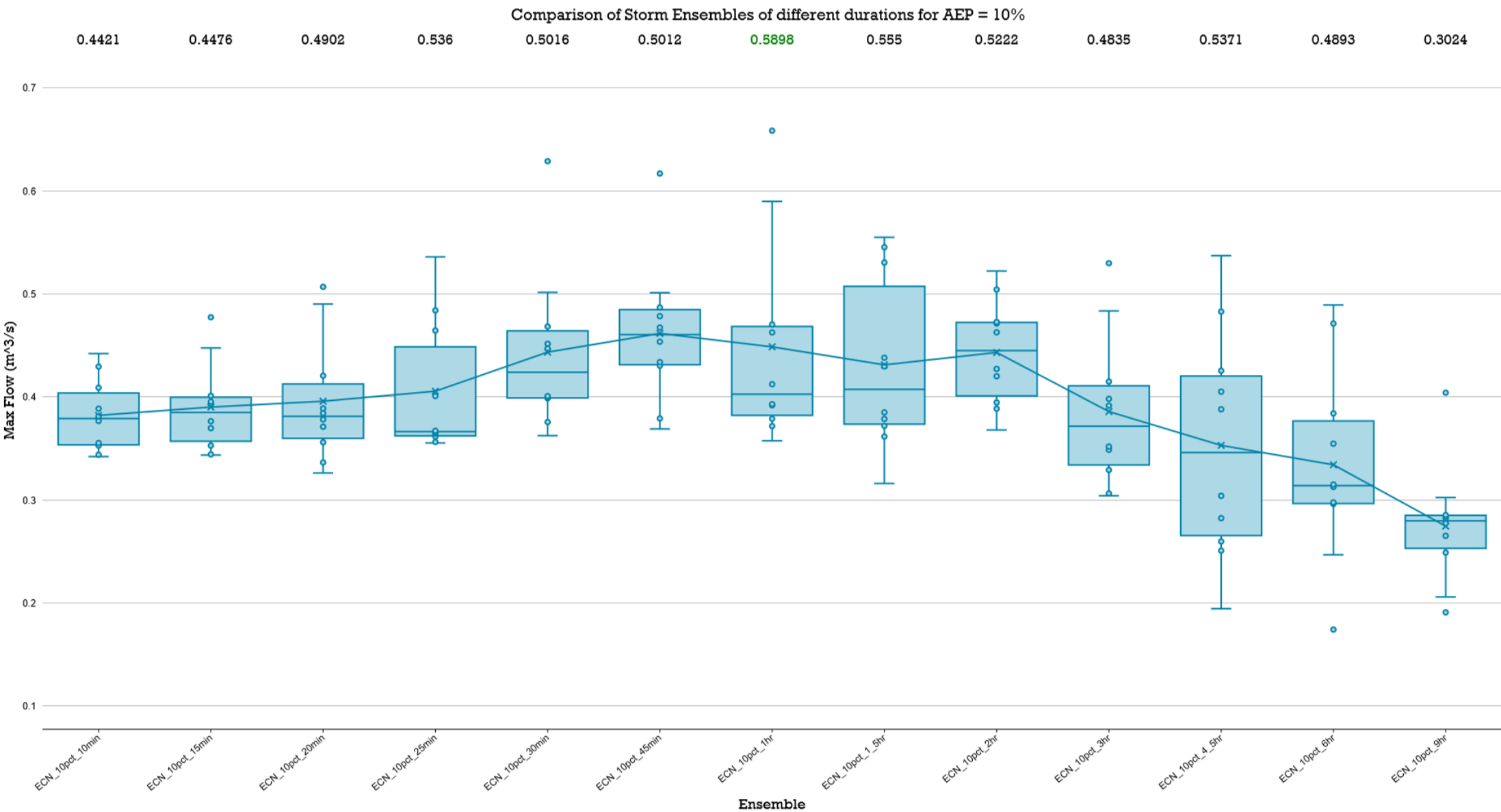


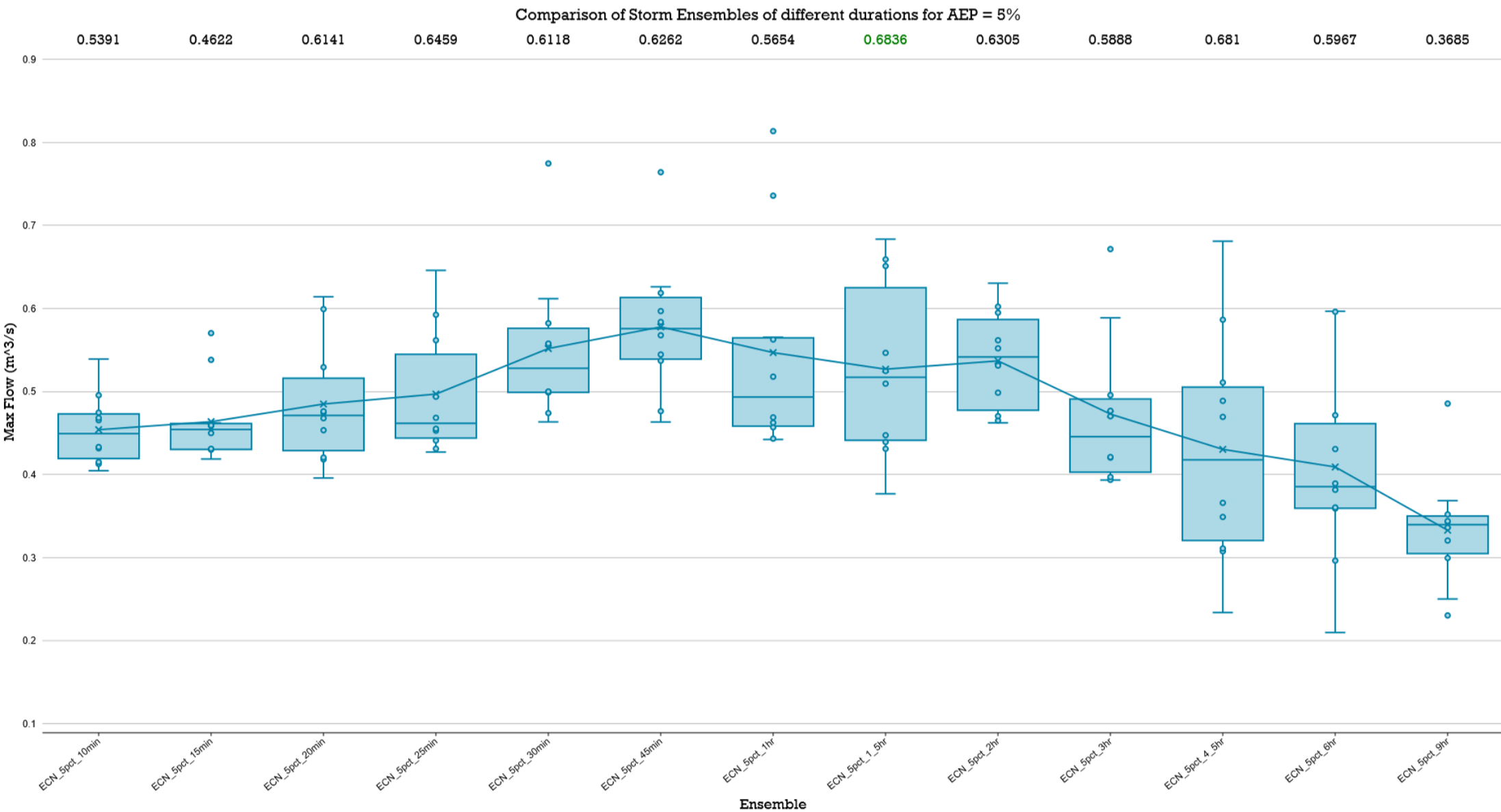
LPoD 3 POST-DEVELOPMENT

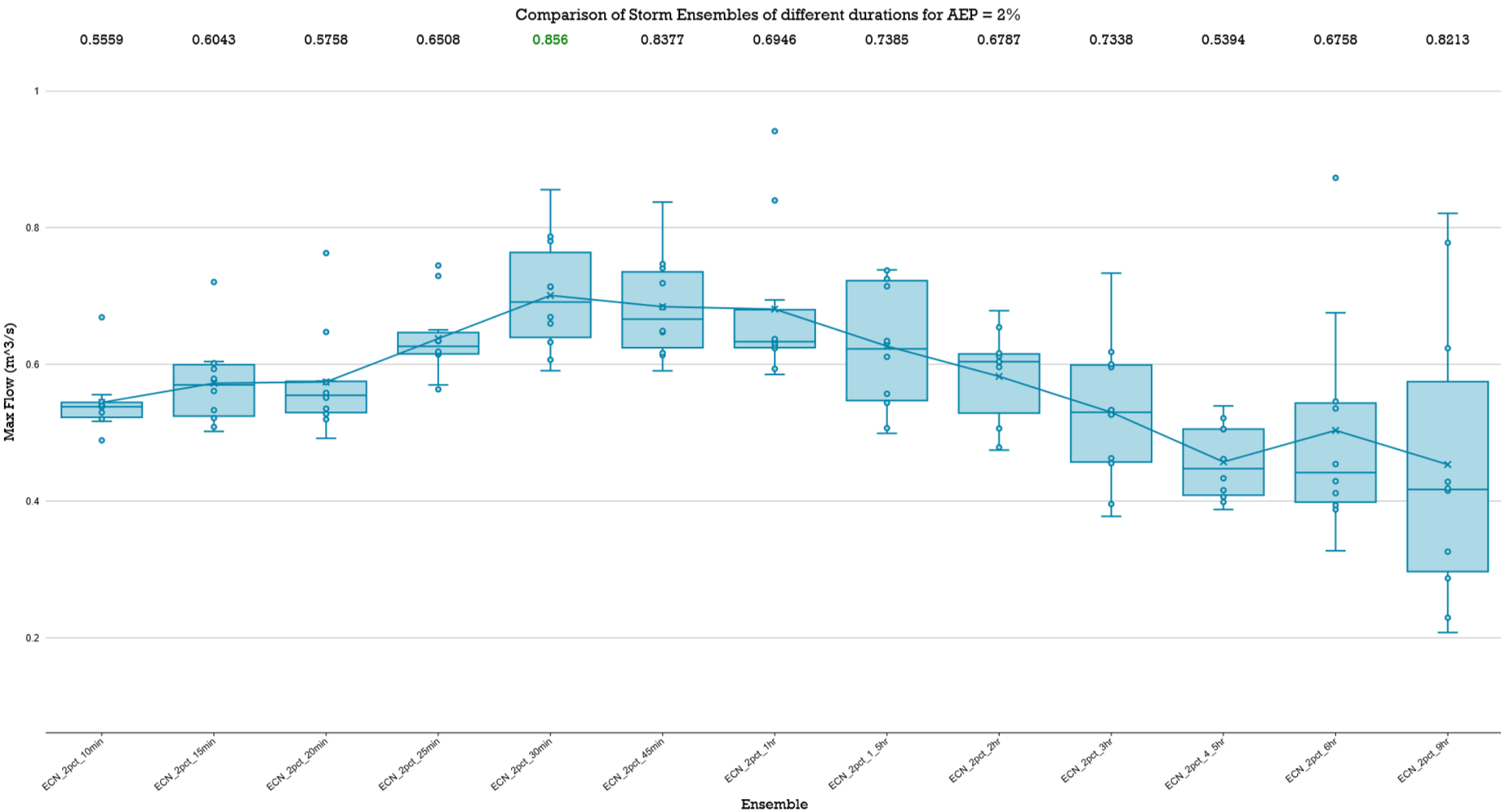


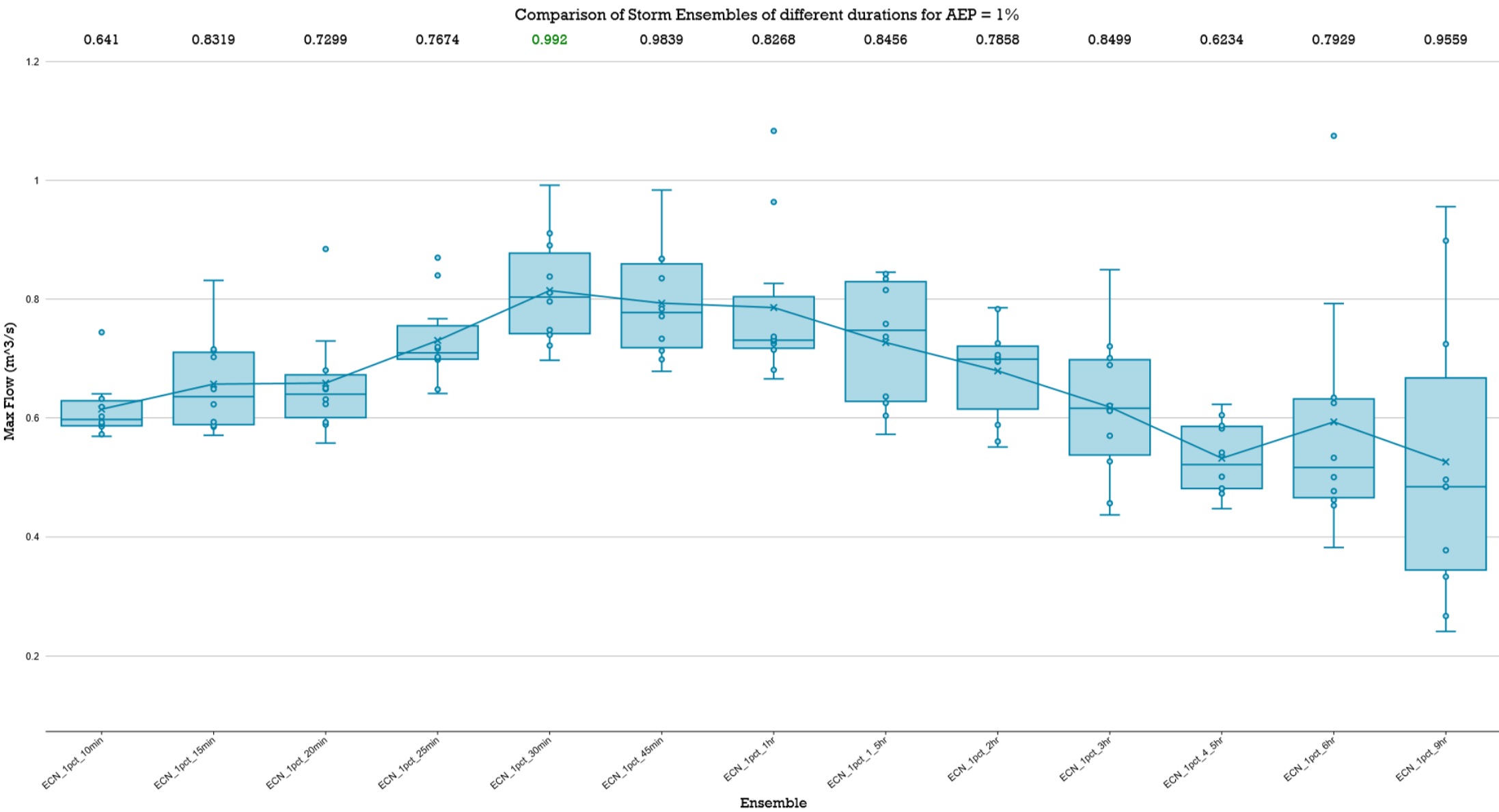




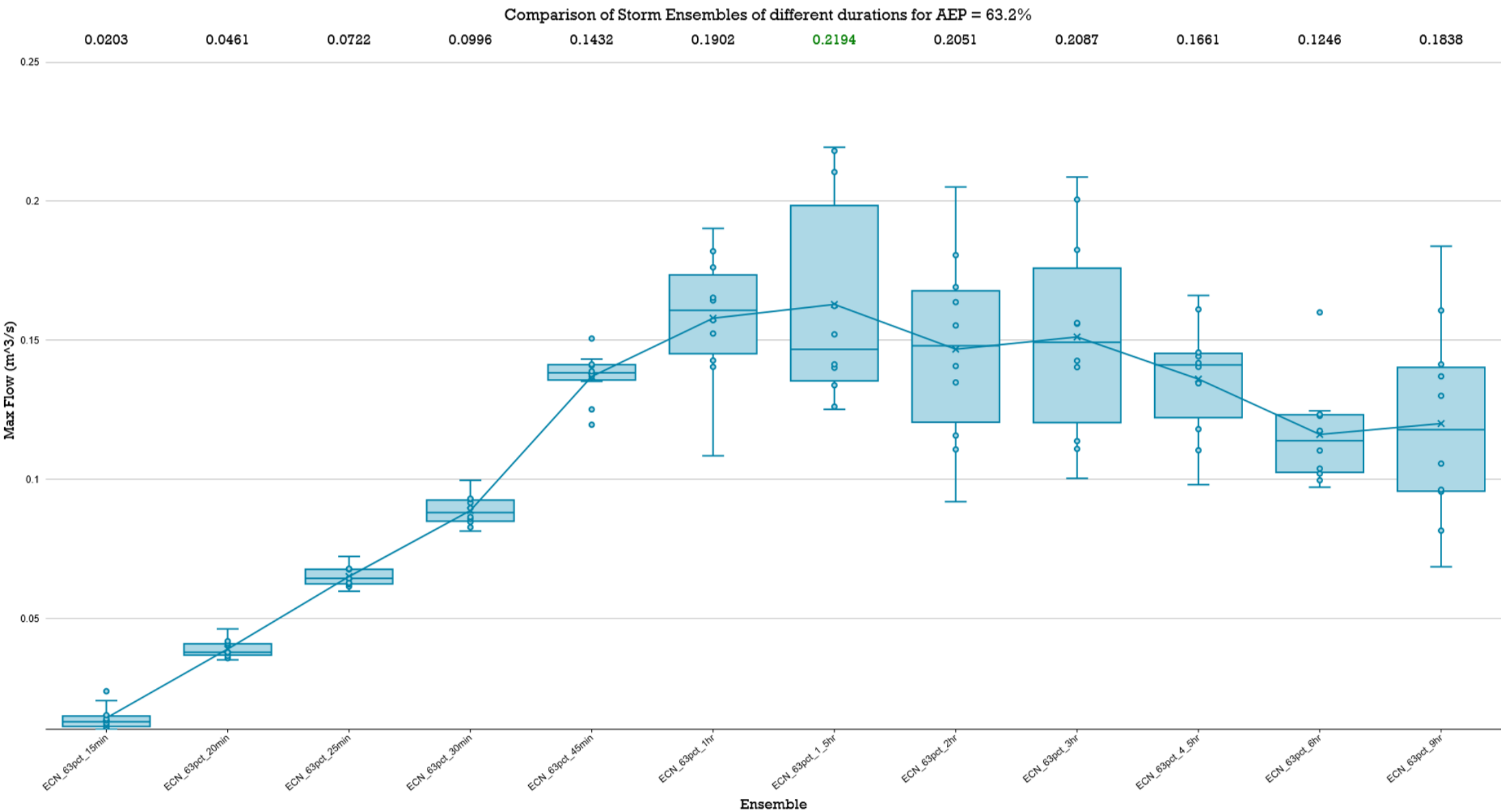


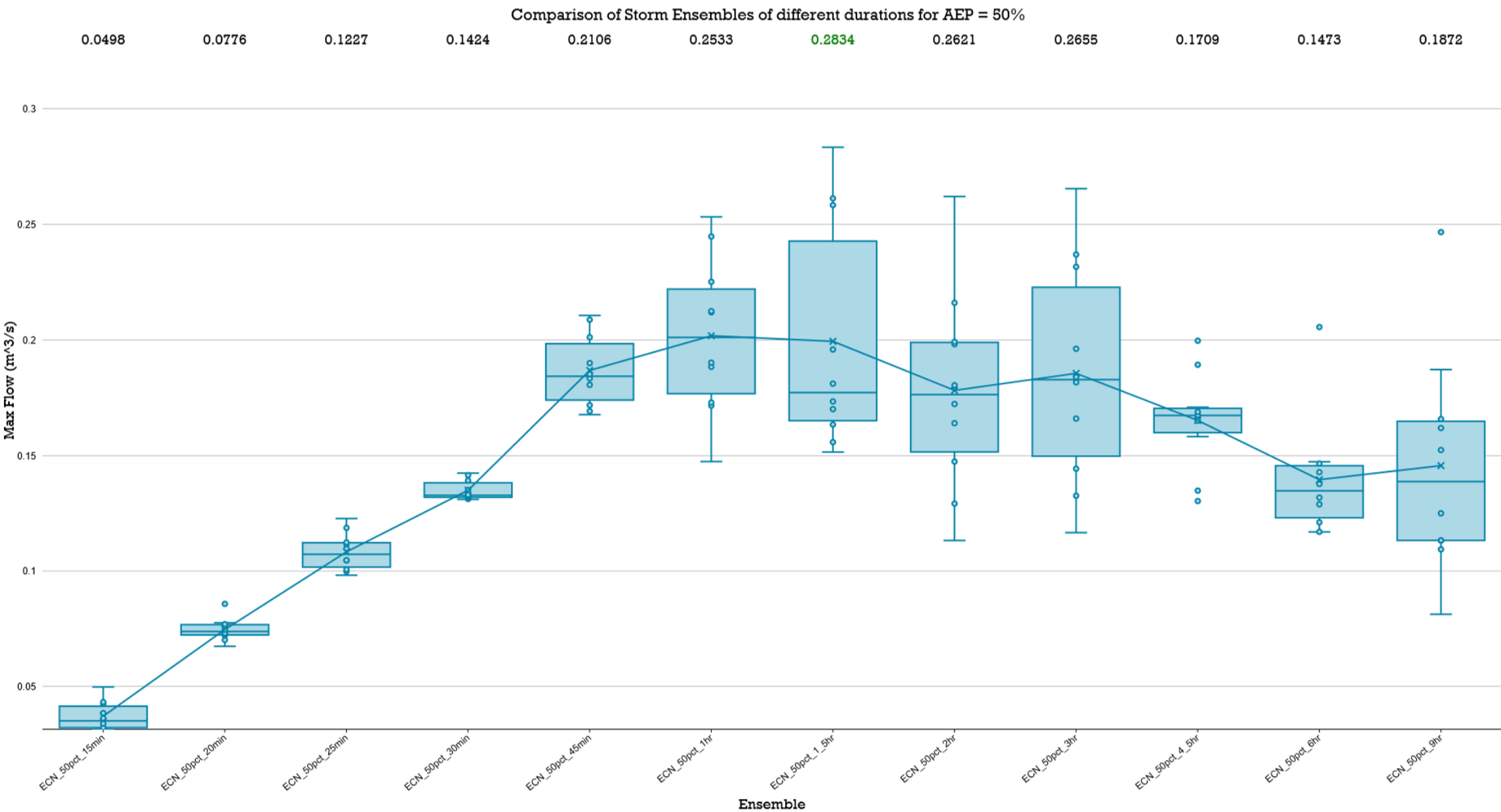


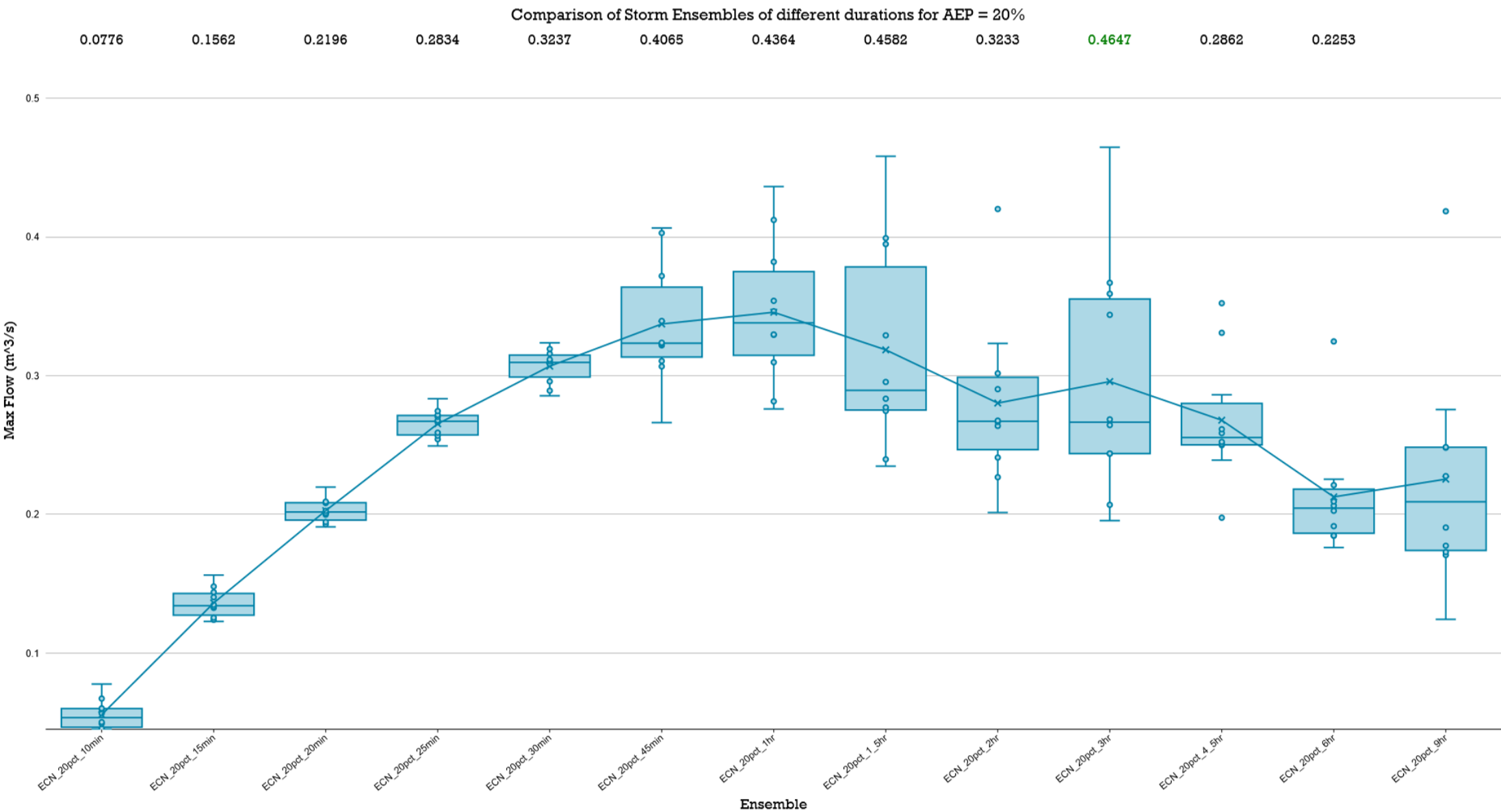


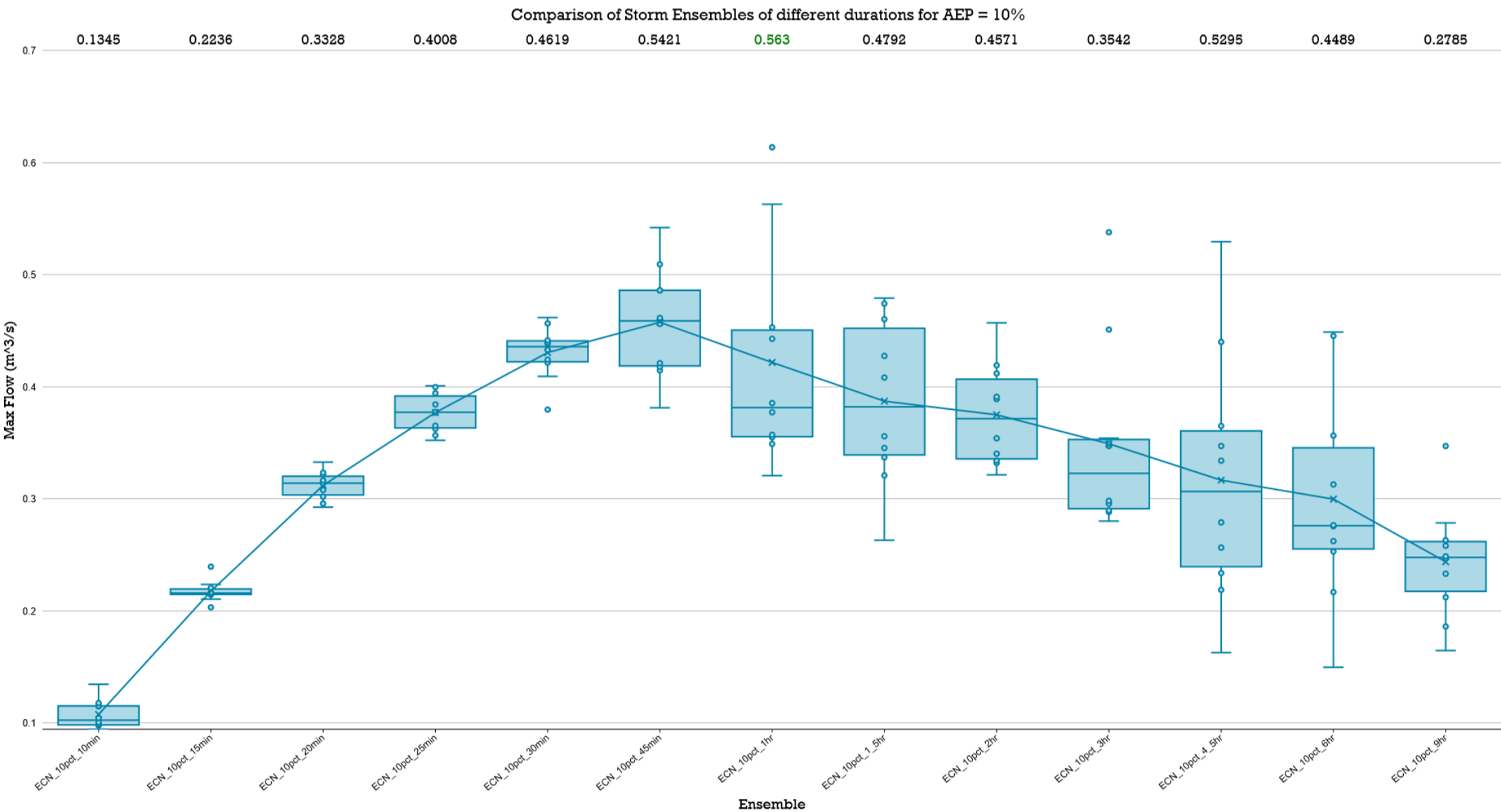


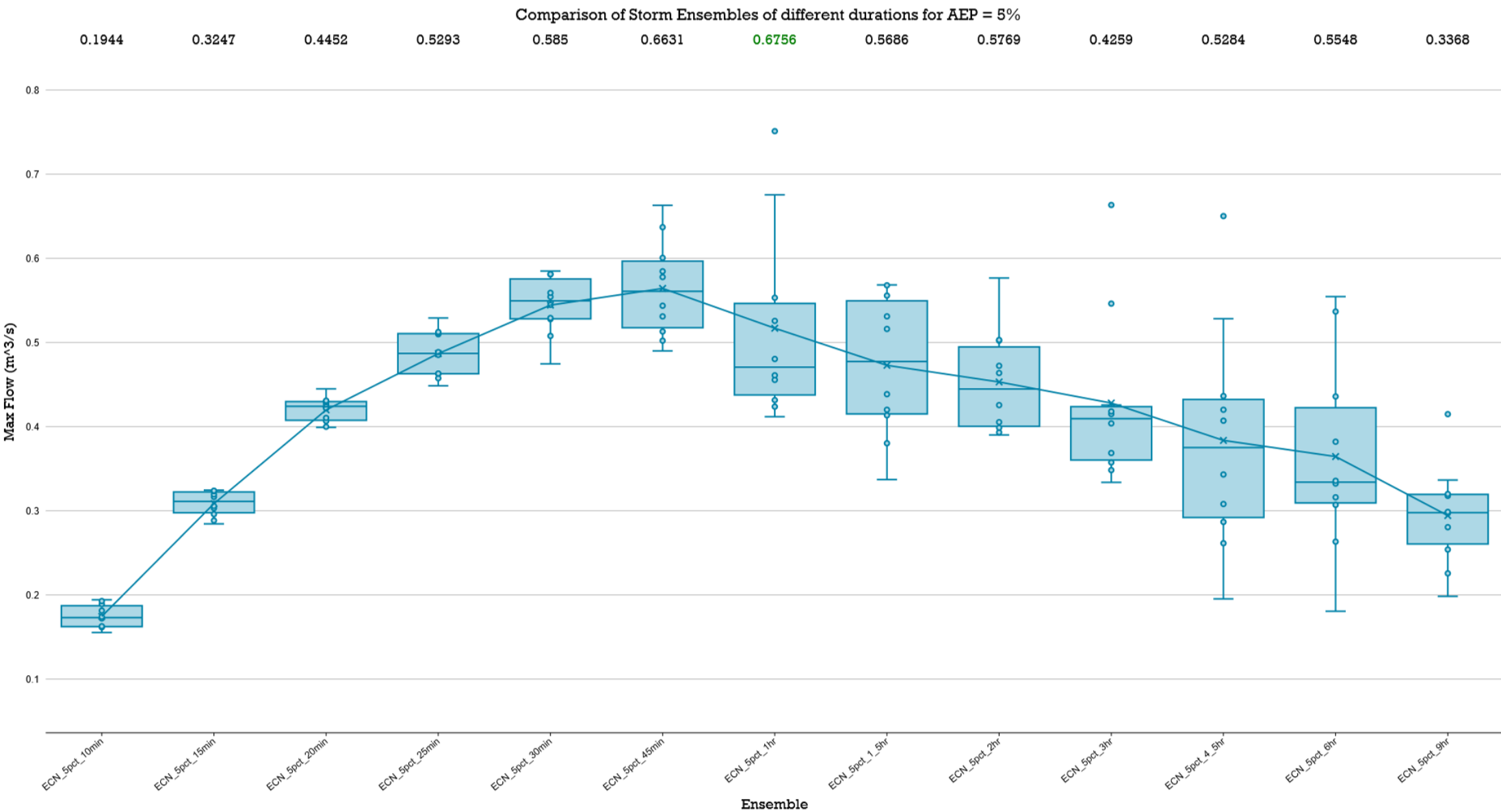
LPoD 4 PRE-DEVELOPMENT

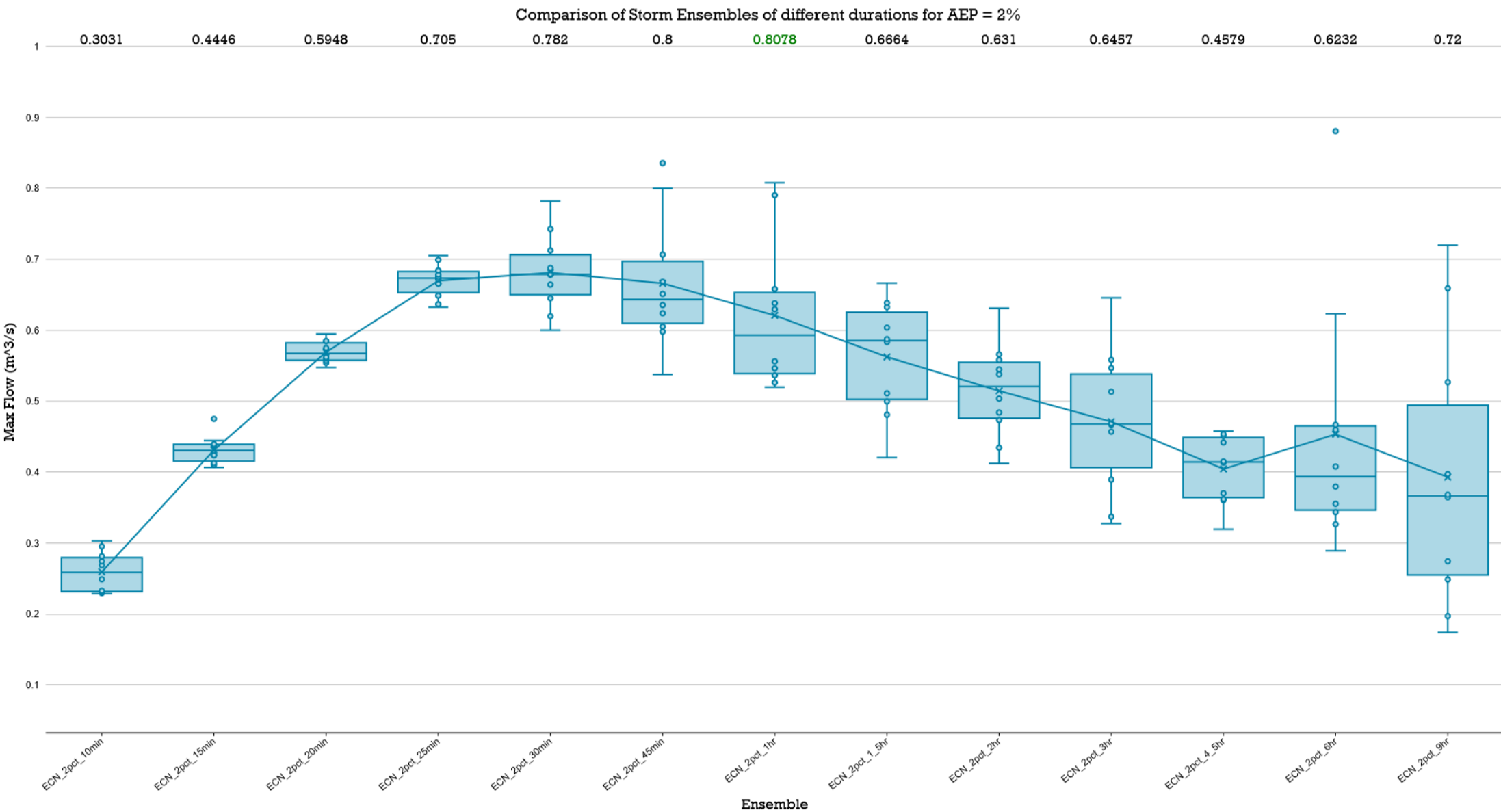


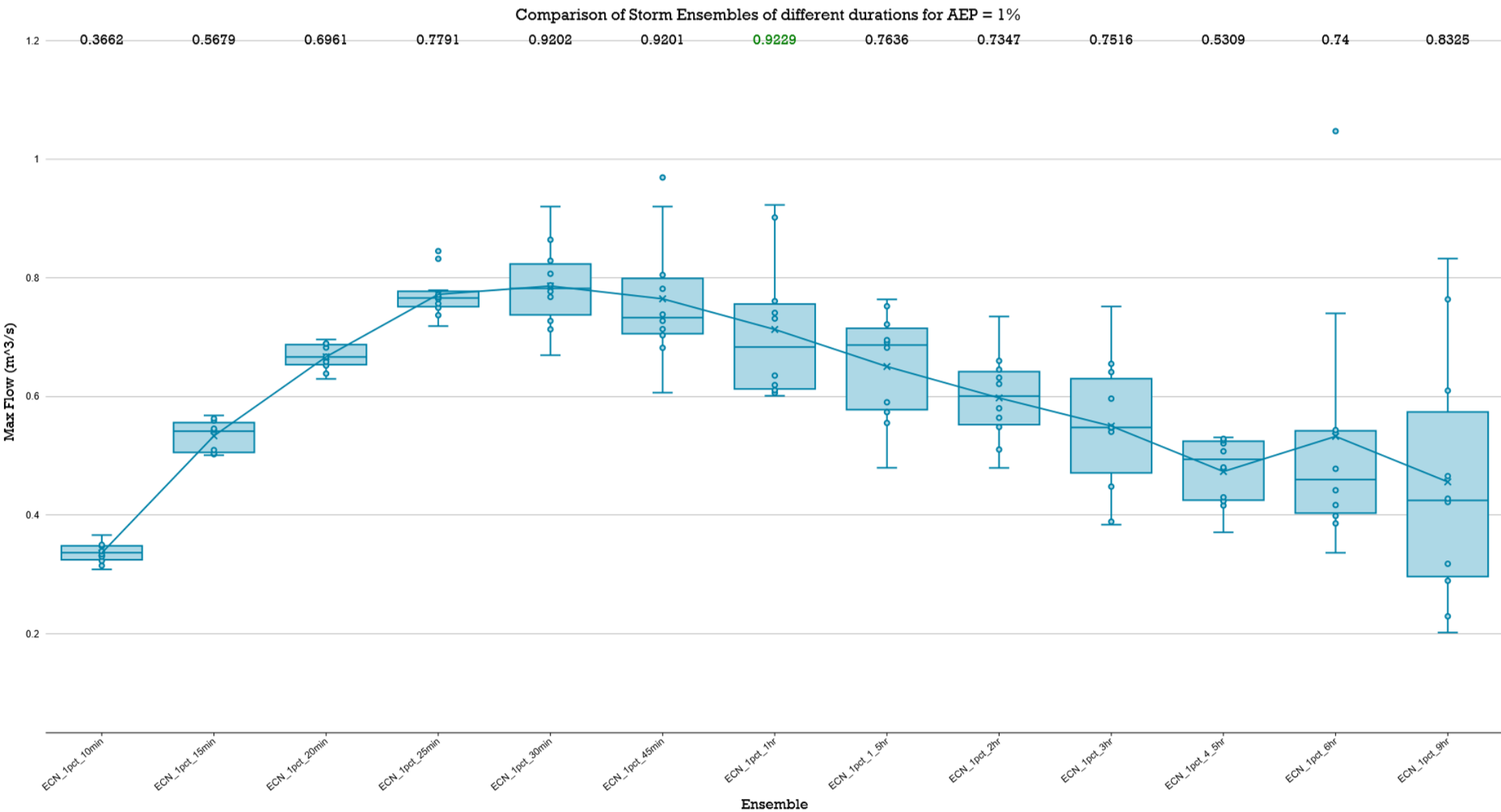




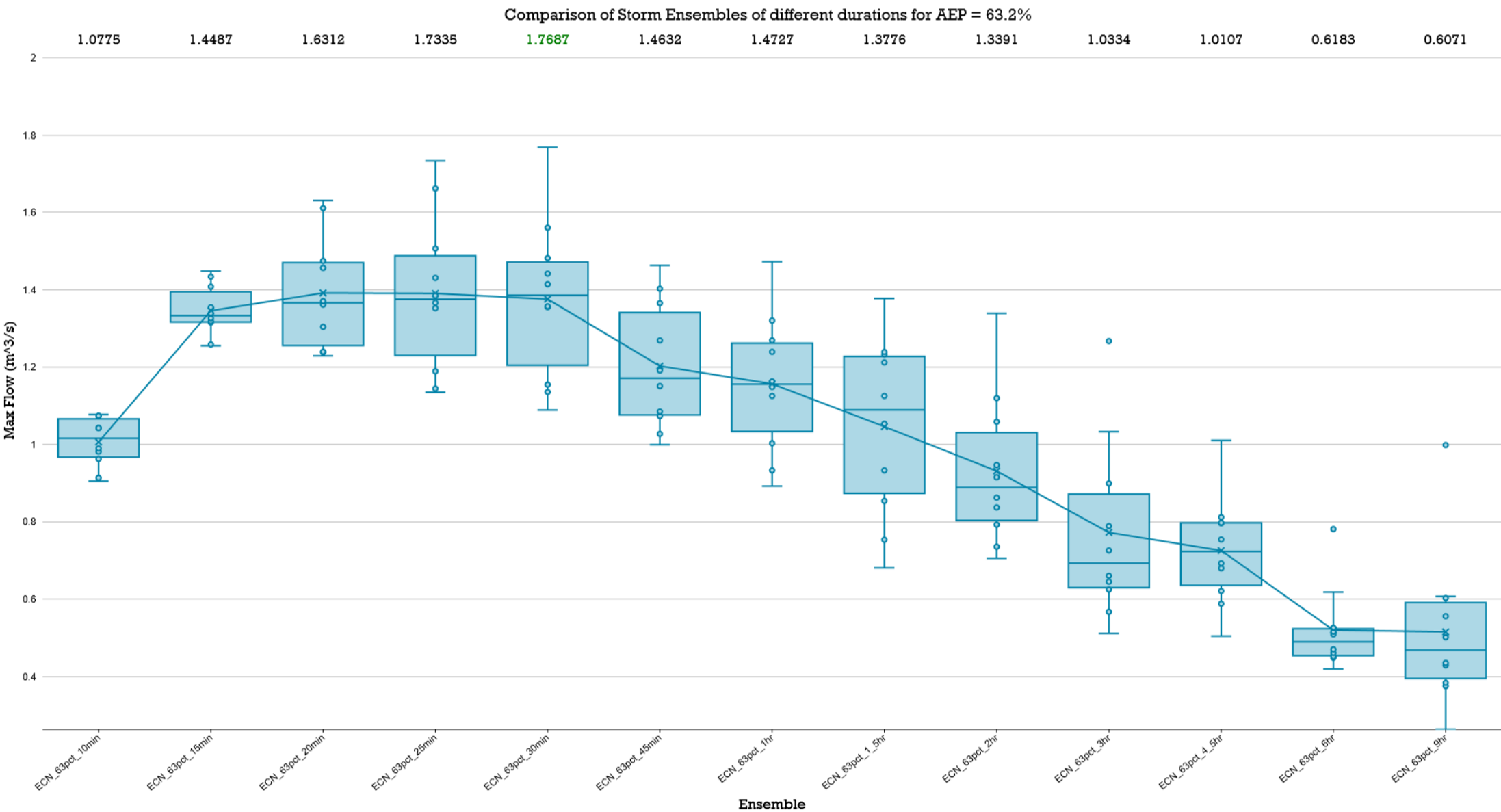


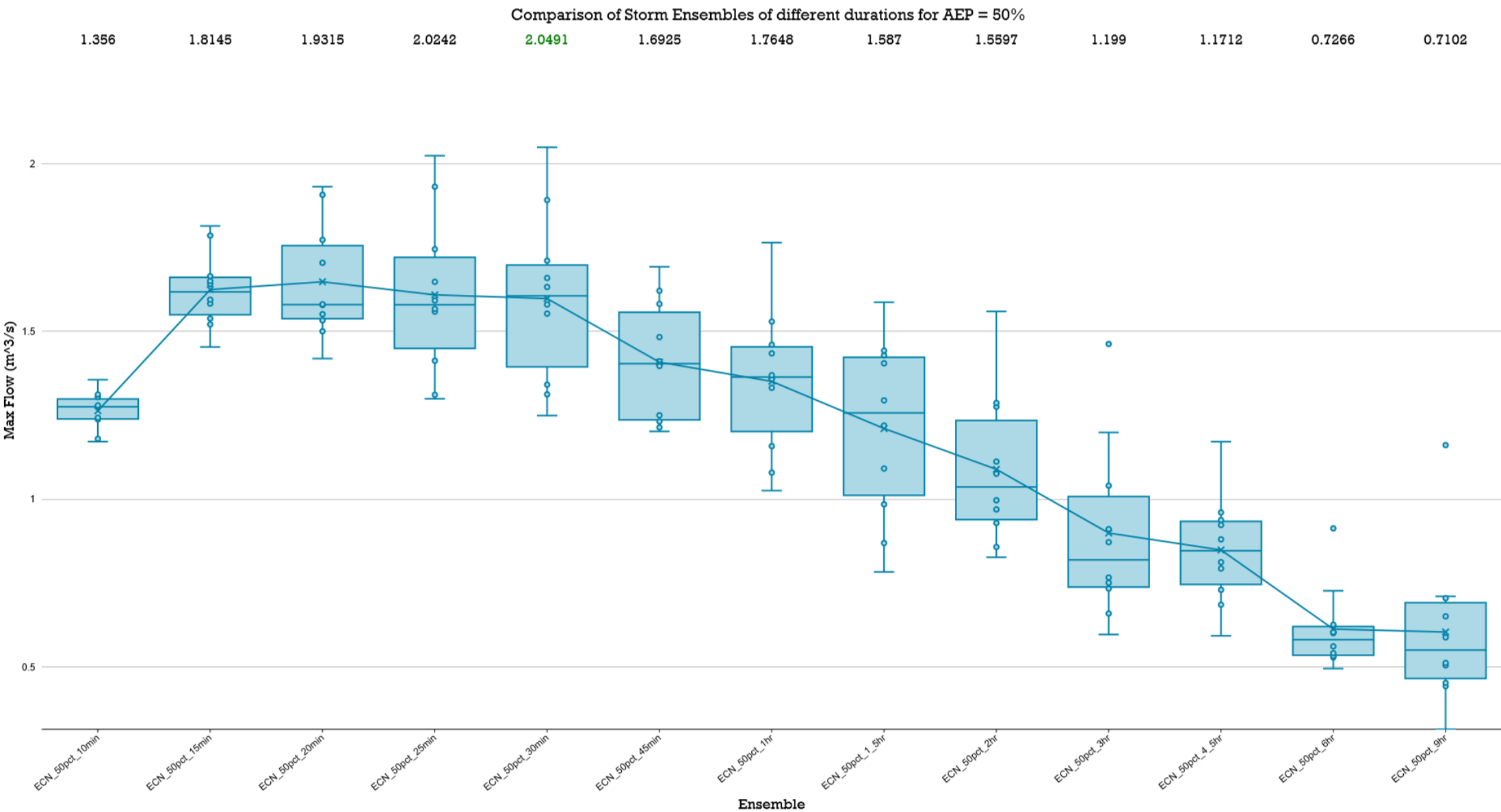


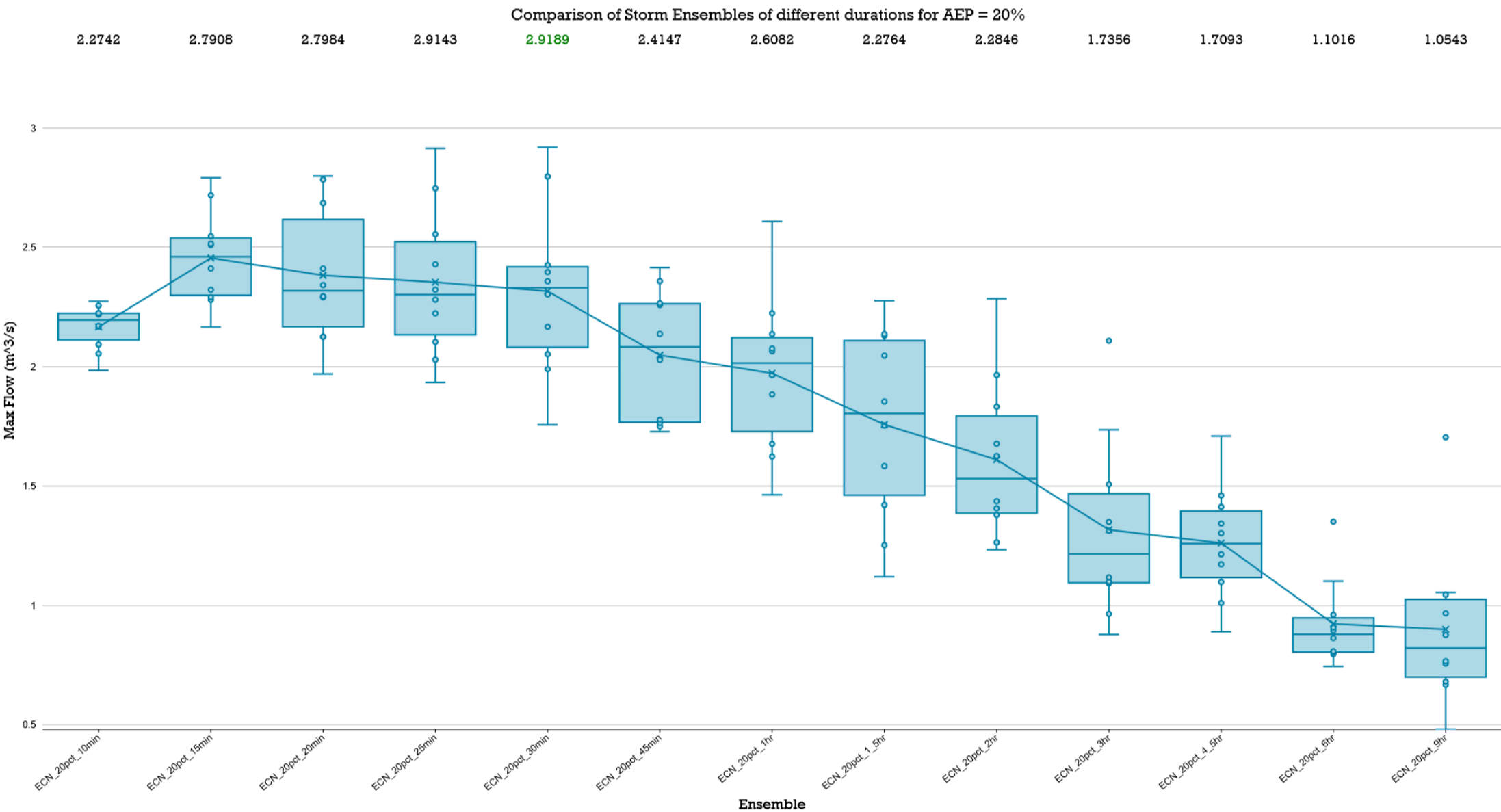




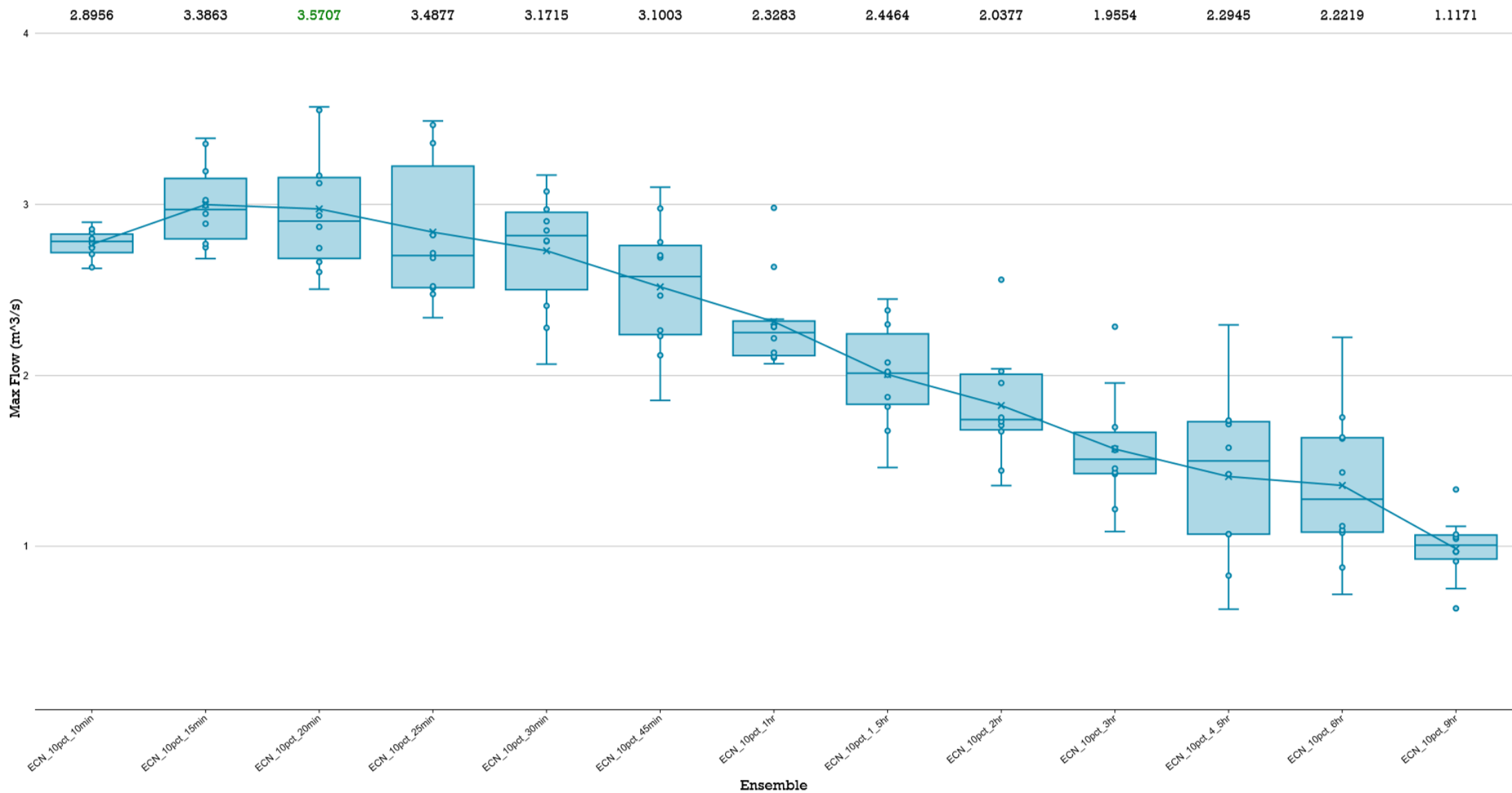
LPoD 5 PRE-DEVELOPMENT



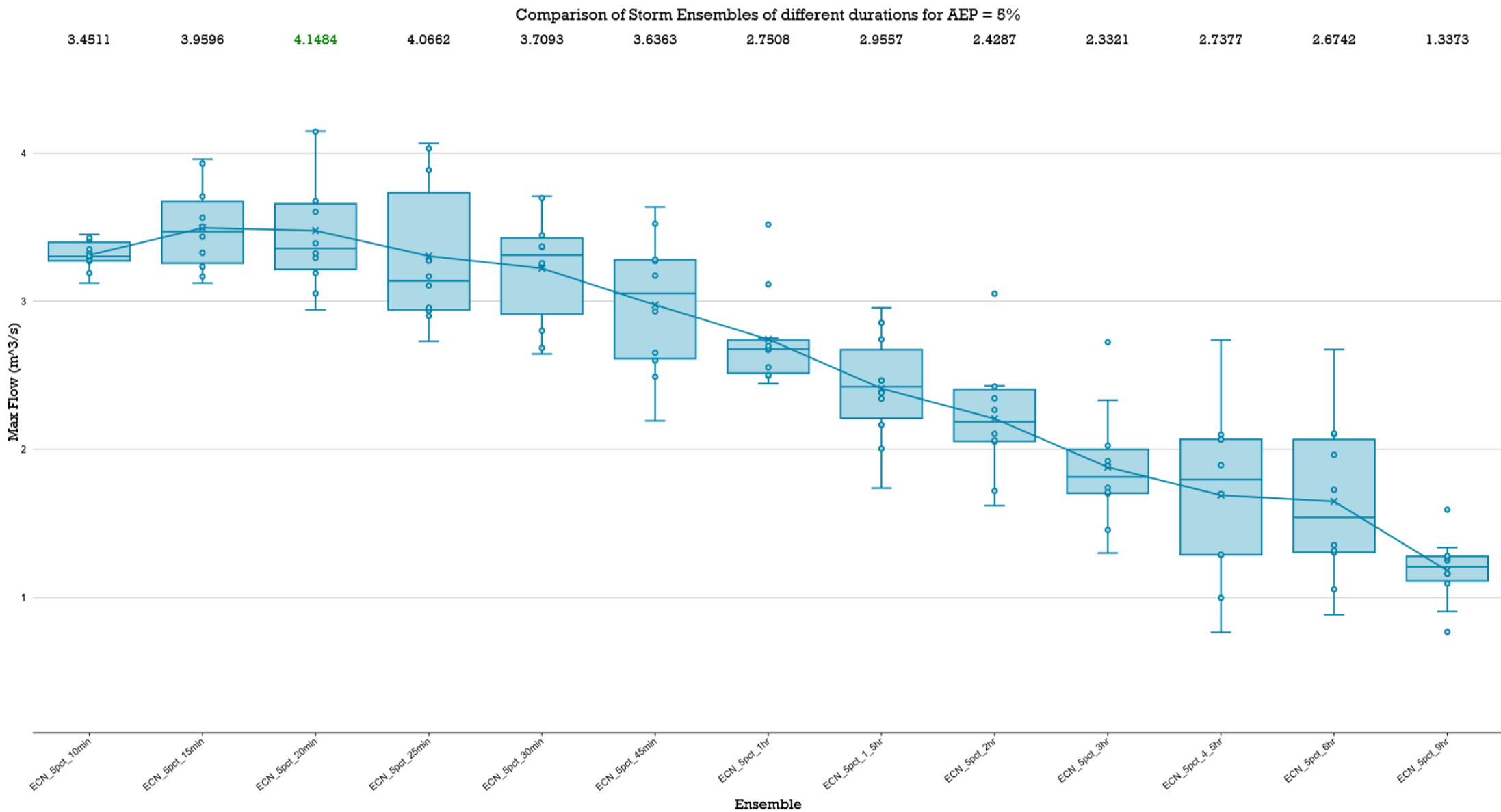


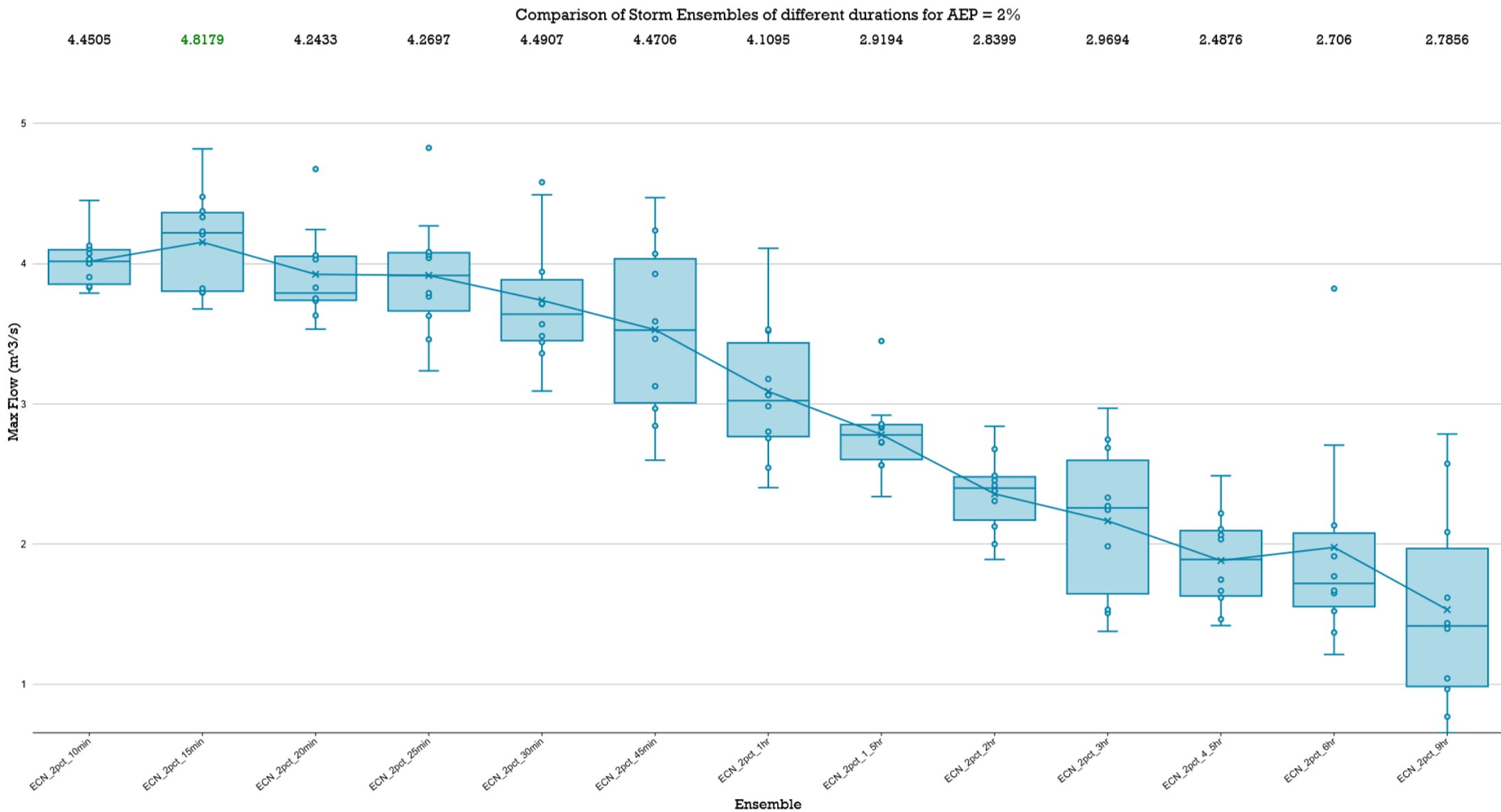


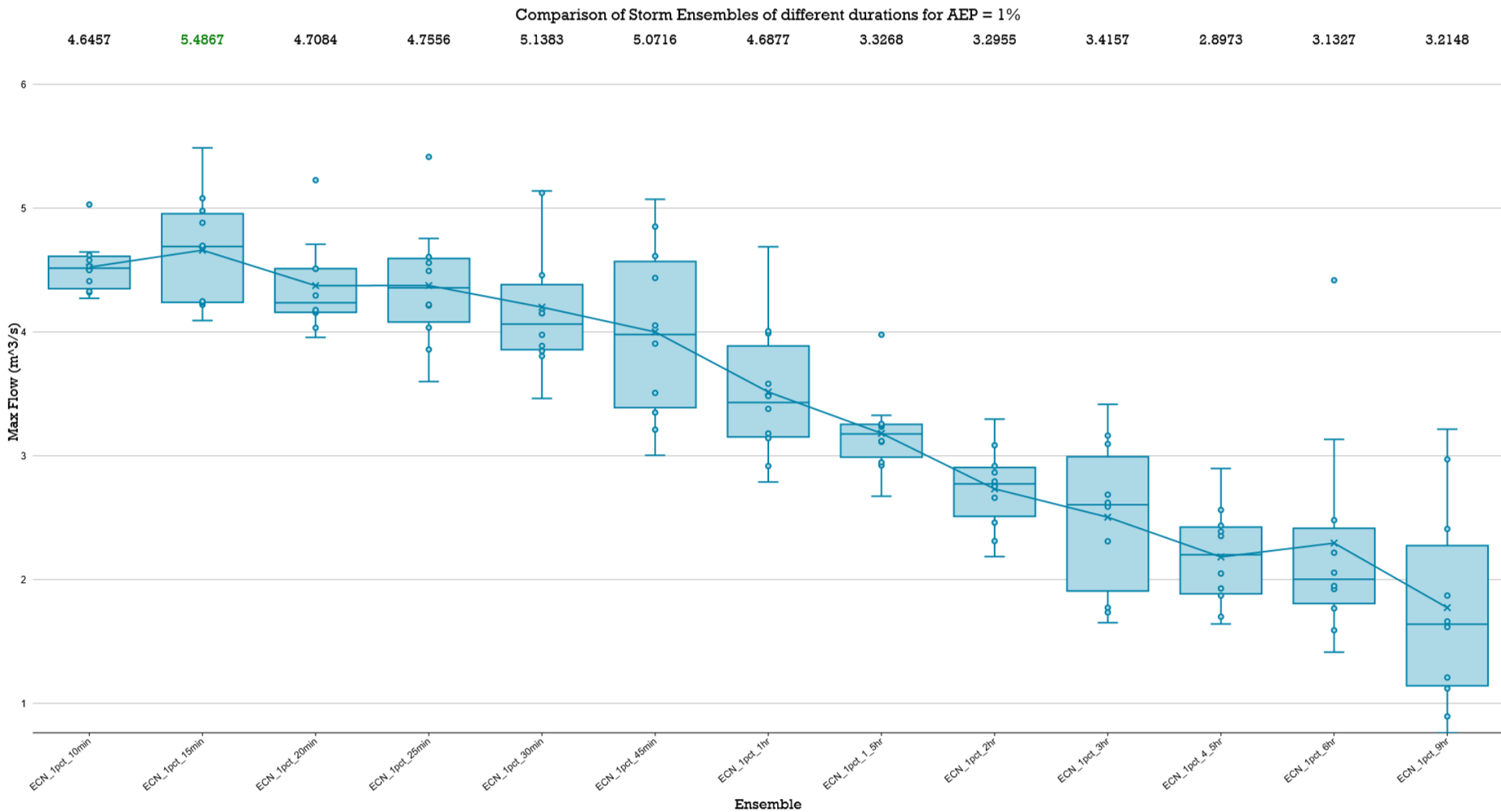
Comparison of Storm Ensembles of different durations for AEP = 10%



BOX & WHISKER PLOTS

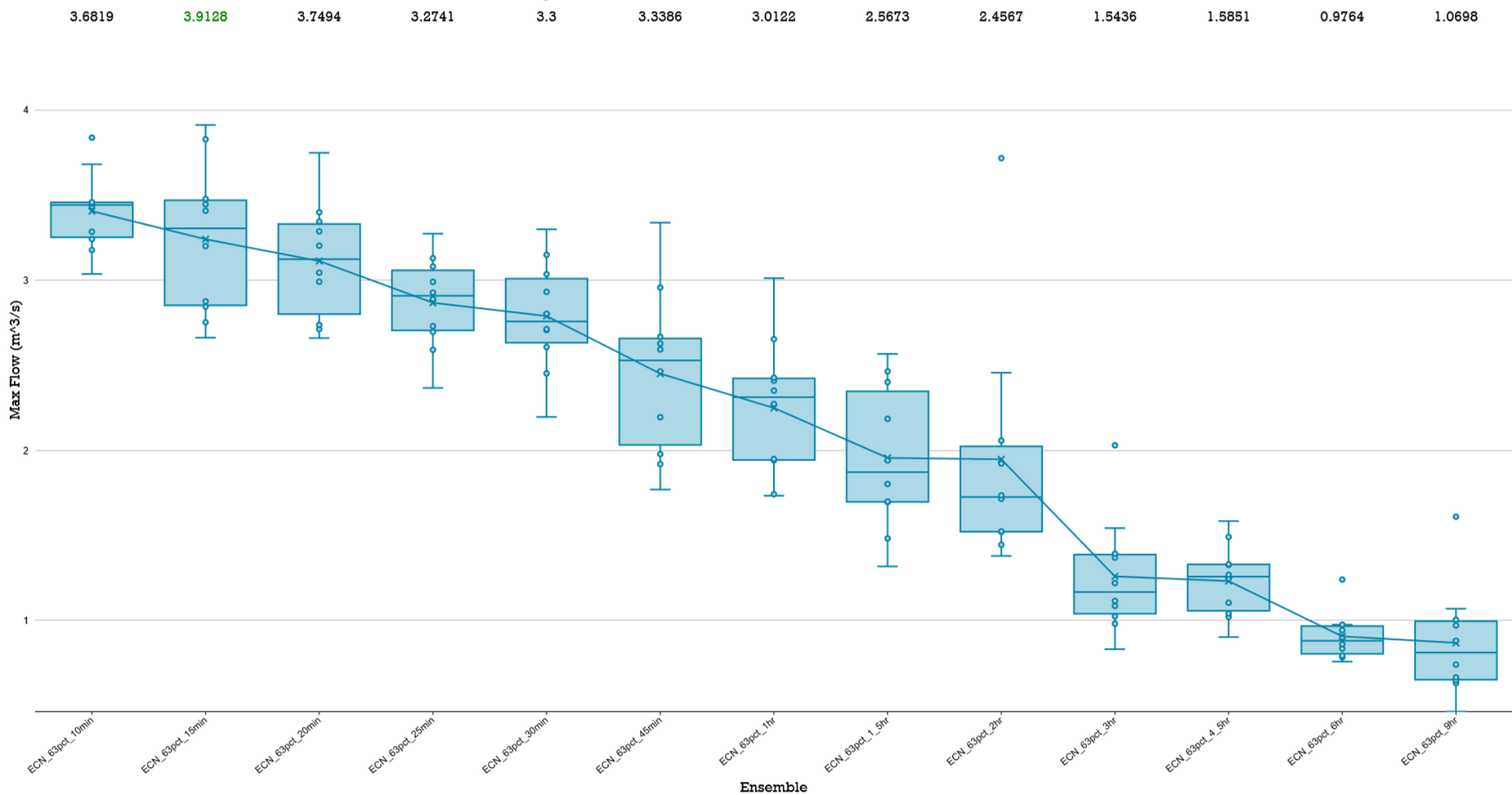


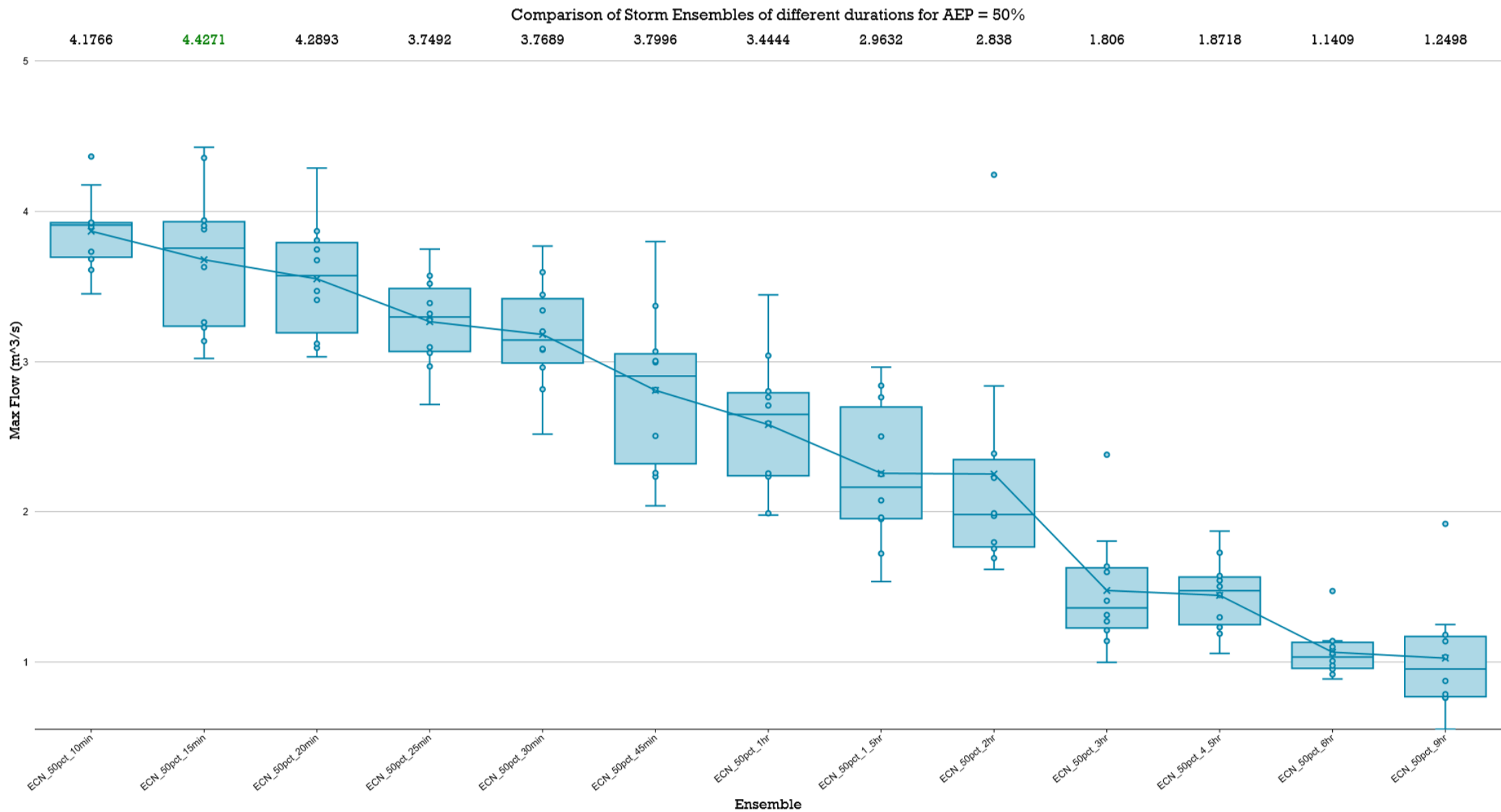


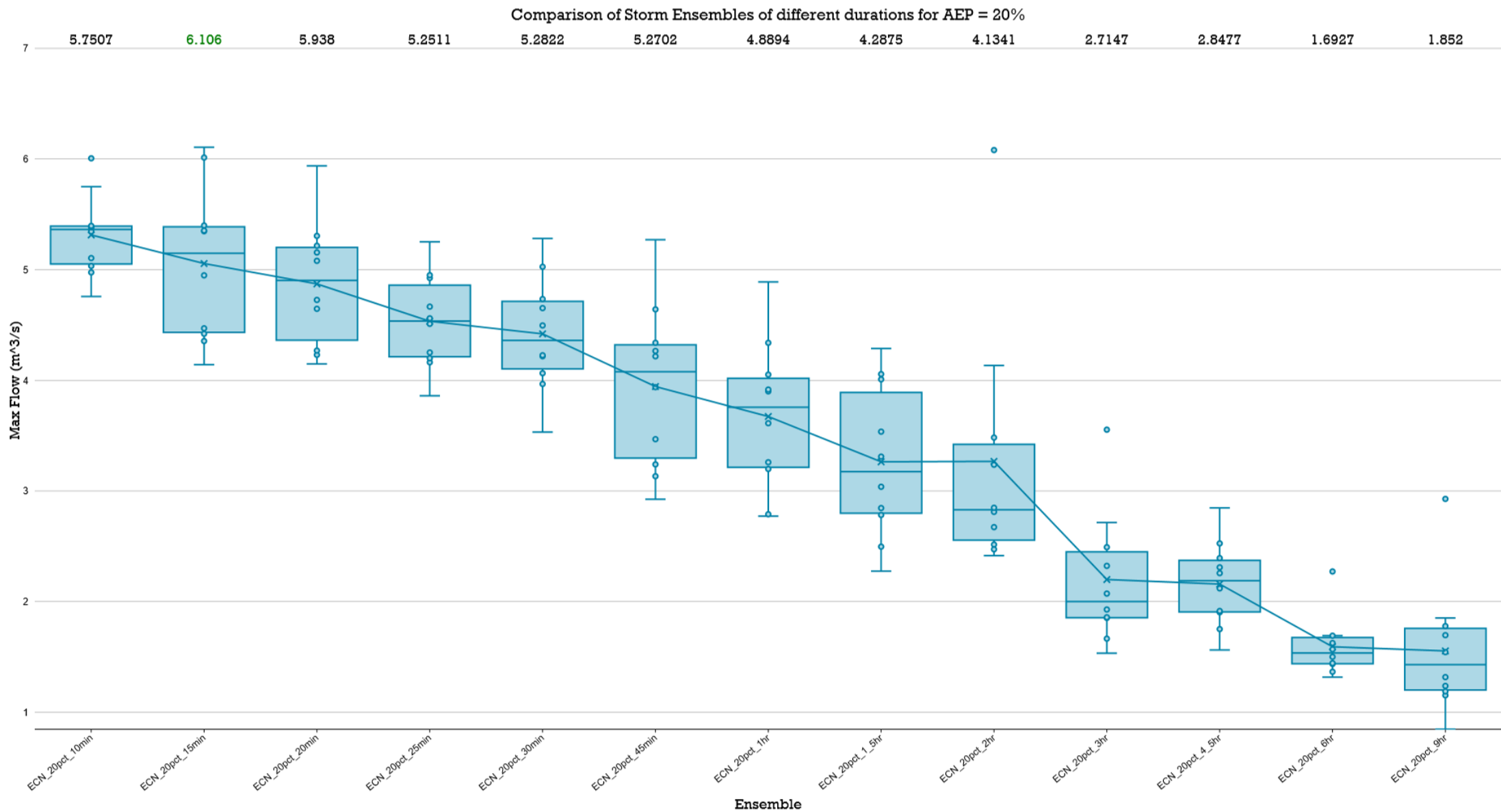


LPoD 5 POST-DEVELOPMENT

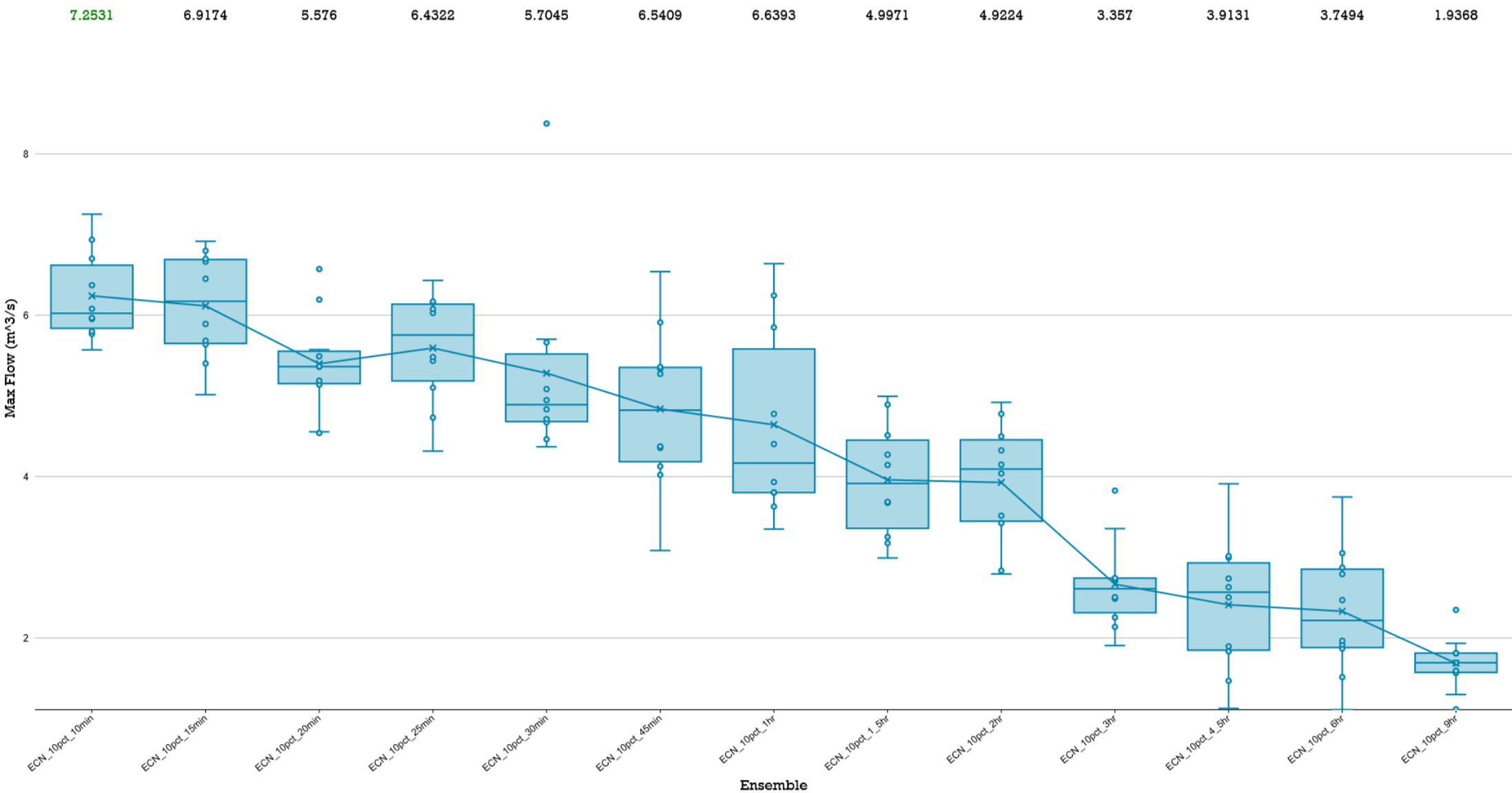
Comparison of Storm Ensembles of different durations for AEP = 63.2%



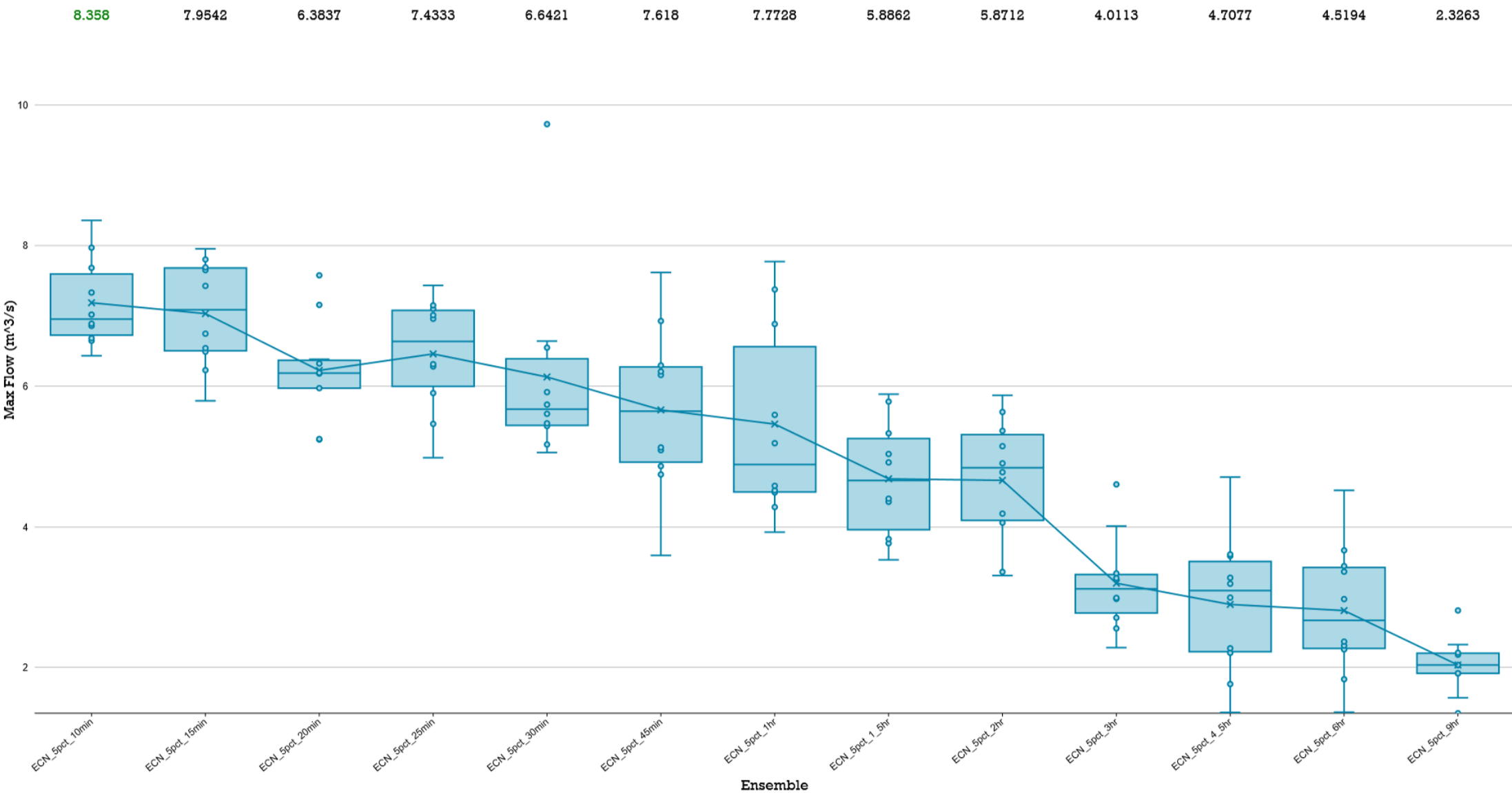




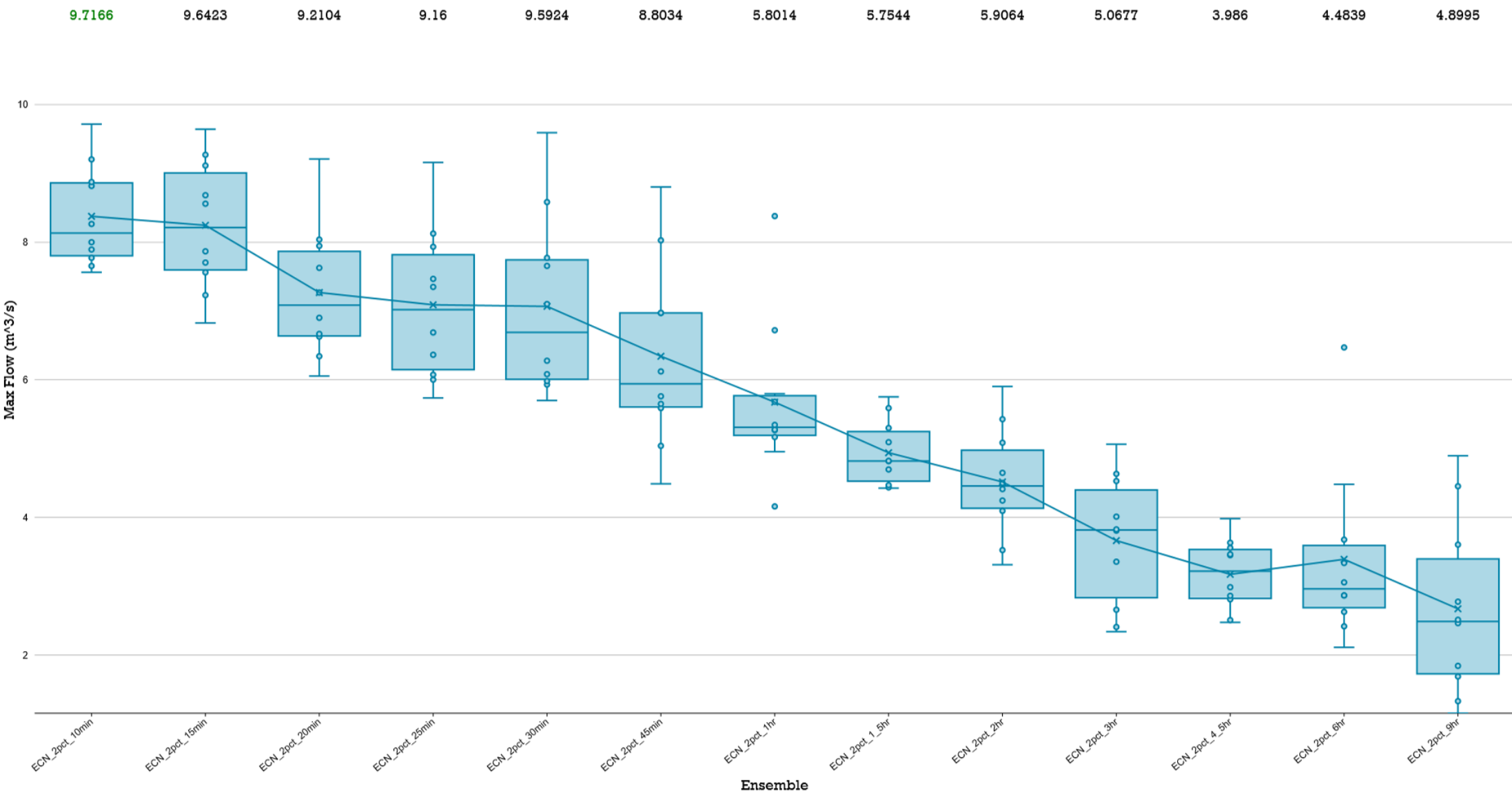
Comparison of Storm Ensembles of different durations for AEP = 10%



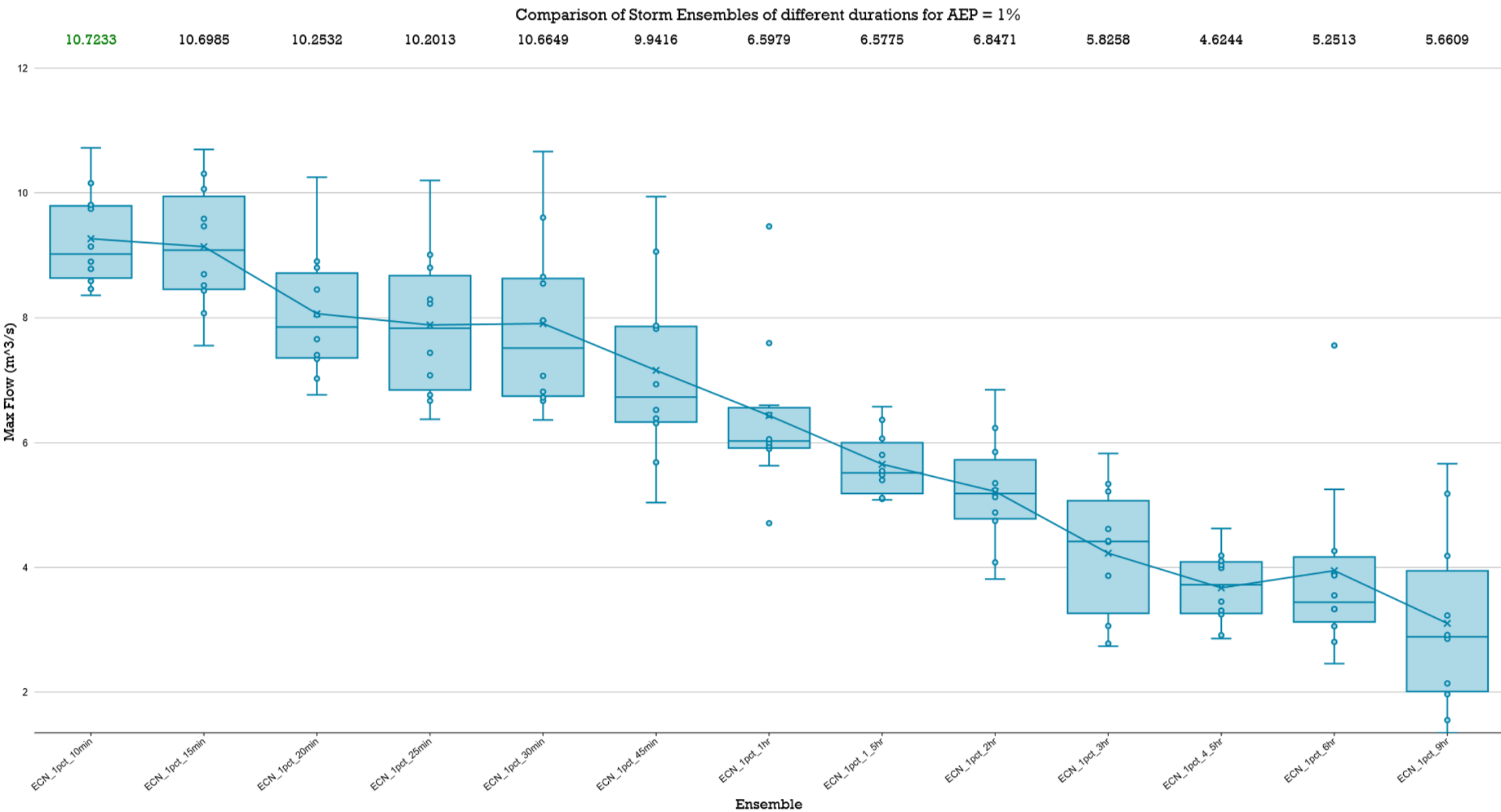
Comparison of Storm Ensembles of different durations for AEP = 5%



Comparison of Storm Ensembles of different durations for AEP = 2%



BOX & WHISKER PLOTS



Appendix L – Mitigation Results

HYDROLOGICAL PEAK FLOW SUMMARY [STAGE 1] - CATCHMENT LPoD-5

EVENT	PEAK <i>UNMITIGATED</i> FLOW	PEAK <i>MITIGATED</i> FLOW m3/s	TARGET FLOW (PRE-DEV) m3/s	PRE-DEVELOPED PEAK STORM		PASS?	STORM	
				DURATION	ENSEMBLE #		DURATION	ENSEMBLE
63pct	3.913	1.095	1.769	ECN_63pct_30min	1	Yes	ECN_63pct_30min	Storm 1
50pct	4.427	1.225	2.049	ECN_50pct_30min	1	Yes	ECN_50pct_3hr	Storm 3
20pct	6.106	1.746	2.919	ECN_20pct_30min	1	Yes	ECN_20pct_3hr	Storm 3
10pct	7.253	3.441	3.571	ECN_10pct_20min	8	Yes	ECN_10pct_1hr	Storm 10
5pct	8.358	4.138	4.148	ECN_5pct_20min	9	Yes	ECN_5pct_1hr	Storm 1
2pct	9.717	4.598	4.818	ECN_2pct_15min	8	Yes	ECN_2pct_6hr	Storm 1
1pct	10.723	5.231	5.487	ECN_1pct_15min	8	Yes	ECN_1pct_6hr	Storm 1

BASIN OUTLET CONFIGURATION SUMMARY [STAGE 1]

OUTLET CONFIGURATION FLOWS PER CONDUIT (m3/s)							
1	2	3	4	5	6	7	TOTAL
0.000	0.000	0.352	0.352	0.352	0.041	0.000	1.095
0.000	0.000	0.379	0.379	0.379	0.090	0.000	1.225
0.000	0.136	0.471	0.471	0.471	0.199	0.000	1.746
0.000	1.708	0.503	0.503	0.503	0.223	0.000	3.441
0.000	2.309	0.529	0.529	0.529	0.243	0.000	4.138
0.000	2.671	0.552	0.552	0.552	0.272	0.000	4.598
0.000	3.164	0.589	0.589	0.589	0.302	0.000	5.231
EMERGENCY WEIR	F.I. 1.5 x 2.0m	F.I. (1) 0.6 x 0.6	F.I. (2) 0.6 x 0.6	F.I. (3) 0.6 x 0.6	225 dia ORIFICE	NOT USED	

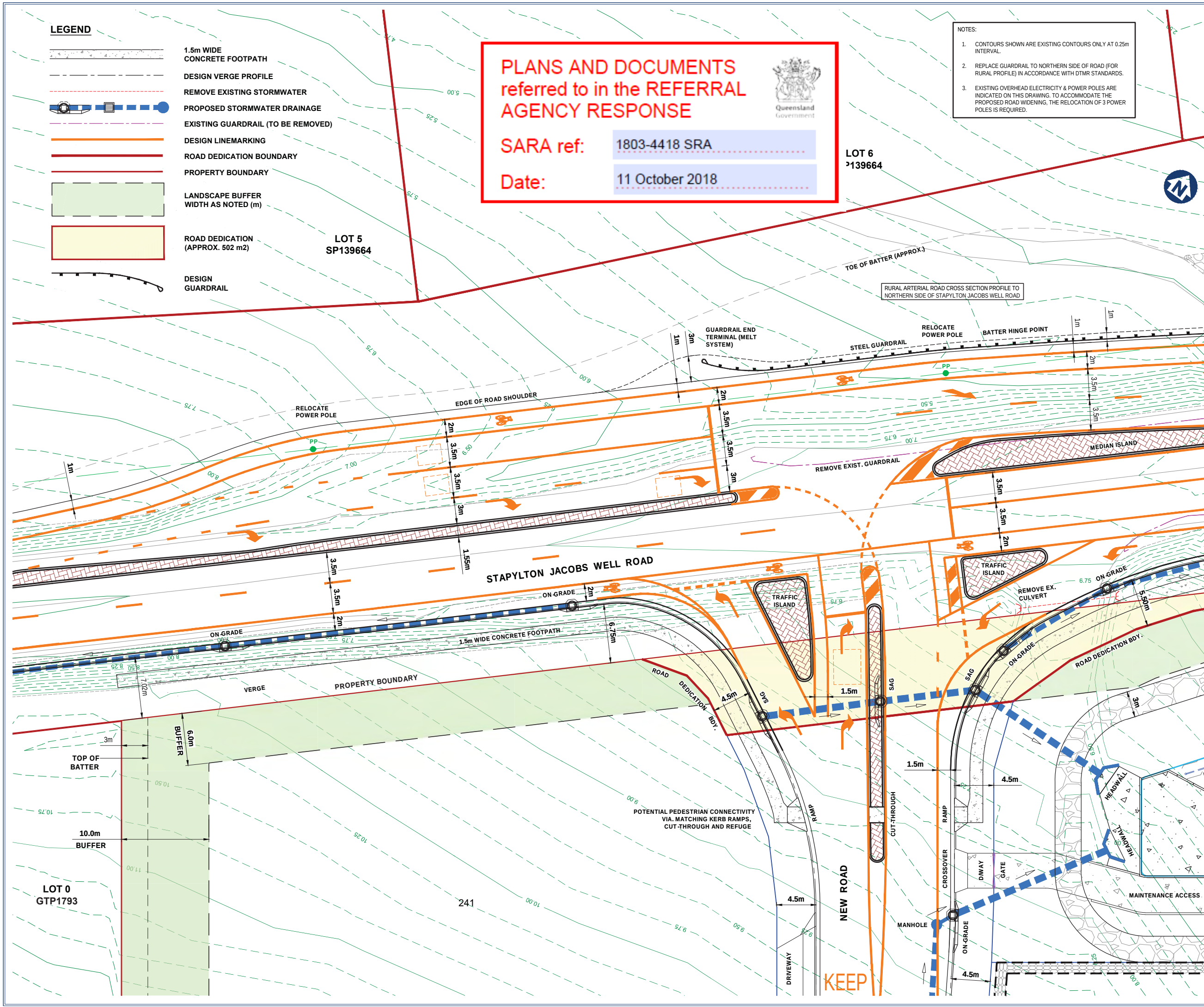
FLOW MITIGATION SUMMARY [STAGE 1]

EVENT	PEAK <i>MITIGATED</i> FLOW m3/s	TARGET FLOW (PRE-DEV) m3/s	MITIGATED BY m3/s	MITIGATED BY %	MITIGATED?
63pct	1.095	1.769	0.674	38.1%	Y
50pct	1.225	2.049	0.824	40.2%	Y
20pct	1.746	2.919	1.173	40.2%	Y
10pct	3.441	3.571	0.130	3.6%	Y
5pct	4.138	4.148	0.011	0.3%	Y
2pct	4.598	4.818	0.220	4.6%	Y
1pct	5.231	5.487	0.256	4.7%	Y

BASIN AND WATER LEVEL SUMMARY [STAGE 1]

DETENTION BASIN		BASIN INVERT LEVEL (IL)	IS WATER DEPTH COMPLIANT TO QUDM 2017 RECOMMENDATIONS?		PROPOSAL
Water Depth (m)	WSL R.L.				
0.835	6.635	5.800	N/A	N/A	PROVIDE CoGC STANDARD 1.8 METRE HIGH CHAINMESH FENCING TO PERIMETER OF DRAINAGE RESERVE TO RESTRICT PUBLIC ACCESS
0.920	6.720	5.800	N/A	N/A	
1.257	7.057	5.800	N/A	N/A	
1.379	7.179	5.800	N/A	N/A	
1.456	7.256	5.800	NO	D < 1.20m ?	
1.557	7.357	5.800	N/A	N/A	
1.689	7.489	5.800	NO	D < 1.50m ?	

Appendix M – Stapylton Jacobs Well Rd Approved Intersection Plans



PLANS AND DOCUMENTS
referred to in the REFERRAL
AGENCY RESPONSE

SARA ref: 1803-4418 SRA

Date: 11 October 2018

- NOTES:
1. CONTOURS SHOWN ARE EXISTING CONTOURS ONLY AT 0.25m INTERVAL.
 2. REPLACE GUARDRAIL TO NORTHERN SIDE OF ROAD (FOR RURAL PROFILE) IN ACCORDANCE WITH DTMR STANDARDS.
 3. EXISTING OVERHEAD ELECTRICITY & POWER POLES ARE INDICATED ON THIS DRAWING. TO ACCOMMODATE THE PROPOSED ROAD WIDENING, THE RELOCATION OF 3 POWER POLES IS REQUIRED.

Client: KS8 Pty. Ltd.

Site Address: 60 STAPYLTON JACOBS WELL ROAD, STAPYLTON

RPD:

Lot / Plan: 1 on RP6882
240 on W31320
4 on RP6843

Parish: Albert
County: Ward
Local Authority: City of Gold Coast Council

Level Datum: AHD
Meridian: IS216853
Contour Interval: -
PSM: -
RL: -

ISSUED FOR APPROVAL
NOT FOR CONSTRUCTION

DRAWING TO BE READ IN CONJUNCTION WITH GENERAL NOTES

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DRAWING TITLE
FUNCTIONAL ROAD
LAYOUT PLAN AND
STORMWATER DRAINAGE
LAYOUT PLAN
SHEET 1 OF 2

Issue	Date	Description	IG	MG	DRN	CHK
B	24-07-18	AMENDMENTS AS PER DTMR REQUEST	IG	MG		
A	18-07-18	ORIGINAL ISSUE	IG	MG		

SCALE IN METRES

0 2 4 6 8 10m

1:200 @ A1

Scale at A1: 1:200

Designed: IG

Drafted: IG

Approved: MG

RPEQ: 16939

Signed: *[Signature]*

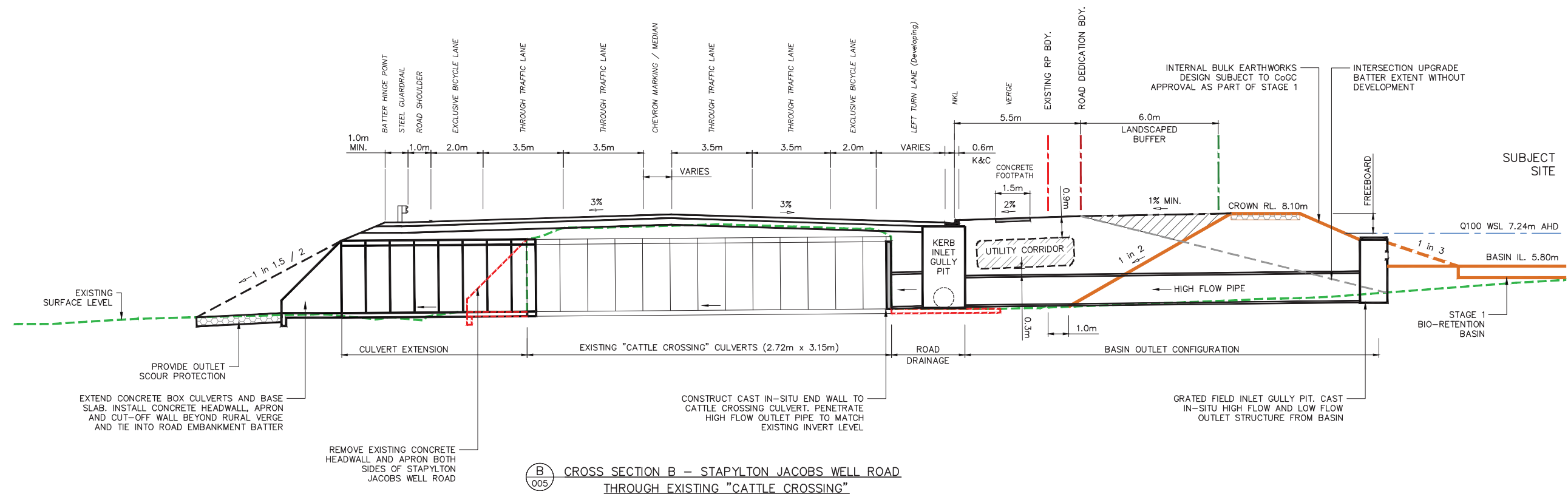
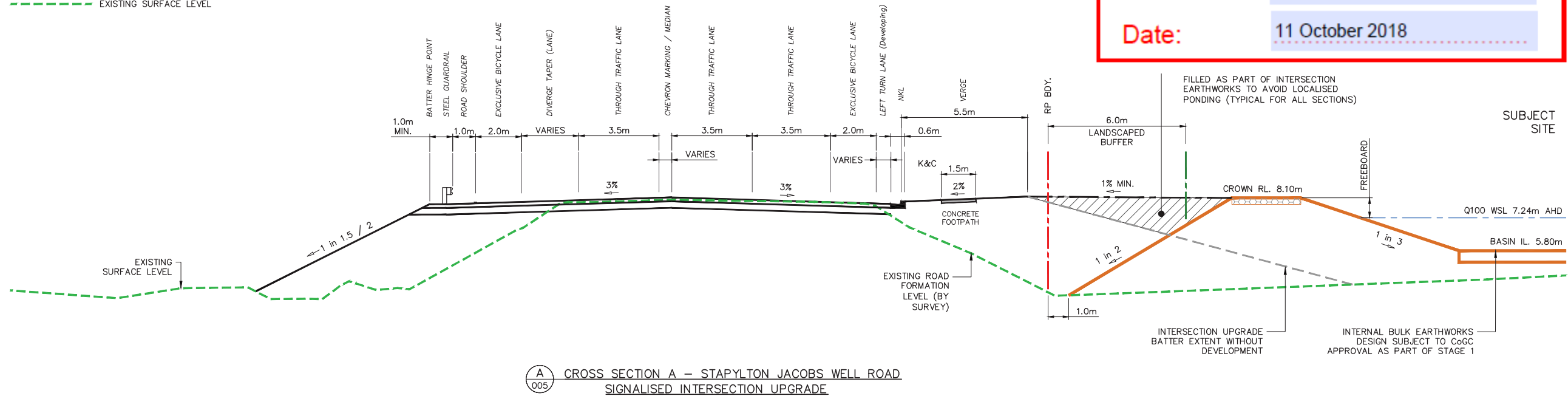
Date: 24-07-18

Drawing No: 5738 ENG BE1 SK-004

Rev. No: B

LEGEND

- DTMR WORKS
- STAGE 1 BULK EARTHWORKS
- EXISTING SURFACE LEVEL



PLANS AND DOCUMENTS referred to in the REFERRAL AGENCY RESPONSE



SARA ref: 1803-4418 SRA

Date: 11 October 2018

Client:

KS8 Pty. Ltd.

Site Address:

60 STAPYLTON JACOBS
WELL ROAD, STAPYLTON

RPD:

Lot / Plan: 1 on RP6882
240 on W31320
4 on RP6843
Parish: Albert
County: Ward
Local Authority: City of Gold Coast
Council
Level Datum: AHD
Meridian: IS216853
Contour Interval: -
PSM: -
RL: -

ISSUED FOR APPROVAL
NOT FOR CONSTRUCTION

DRAWING TO BE READ IN CONJUNCTION WITH GENERAL NOTES

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DRAWING TITLE

TYPICAL CROSS SECTIONS
OF STAPYLTON JACOBS
WELL ROAD

Issue	Date	Description	IG	MG	DRN	CHK
B	24-07-18	AMENDMENTS AS PER DTMR REQUEST	IG	MG		
A	18-07-18	ORIGINAL ISSUE	IG	MG		

SCALE IN METRES



Scale at A1: 1:100

Designed: IG

Drafted: IG

Approved: MG

RPEQ: 16939

Signed: *[Signature]*

Date: 24-07-18

Drawing No: 5738 ENG BE1 SK-006 Rev. No: B