SITE BASED STORMWATER MANAGEMENT PLAN

VANTAGE YATALA – STAGE 2 DEVELOPMENT APPLICATION FOR RECONFIGURING A LOT

ADDRESS
60 Stapylton Jacobs Well Road, Stapylton

REAL PROPERTY DESCRIPTION
Lot 501 on SP295994

PREPARED FOR
Frasers Property (Australia) Pty Ltd

February 2021 (Rev. 2)

gassman development perspectives

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

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 contributing 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% / 1	60	19.4076

MODEL CONDITION	CRITICAL STORM EVENT	PEAK DURATION	PEAK FLOW
Post Developed	AEP / Storm Ensemble #	(mins)	(m^3/s)
LPoD-1	1% / 9	10	23.2979

Table 5.2.2: Critical Storm Event and Duration Summary Table

Refer to ***Appendix L*** 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 2.

Parameter	Value
Catchment	**LPoD-1**
Type	Detention basin (in ground)
Internal Batter Slope on Basin Sides	1 in 3
Basin Floor RL	10.470m AHD
Basin Embankment / Crown R.L	13.000m AHD
Basin Transverse Weir Crest RL	11.640m AHD
Freeboard to Crown (1% AEP WSL)	1.008m
Detention Volume Depth	1.522m to 1% AEP WSL *(measured from floor / IL of basin)*
Detention Volume to Crown	17,109m^3 to RL 13.000m *(deducting 0.30m extended detention)*
Detention Volume to 1% AEP WSL	7,824m^3 to RL 11.992m *(deducting 0.30m extended detention)*
Detention Volume to Weir Crest	5,139m^3 to RL 11.640m *(deducting 0.30m extended detention)*
Low Flow Outlets	• 5 / 900mm x 900mm grated field inlet pits connected to a low flow outlet pipe (450mm diameter at 0.62%) *Top of grate levels set at 0.300m above basin floor at RL10.77m AHD (typical and unless noted otherwise)*
High Flow Outlets	• 25 metre wide broad crested transverse weir *1.17m above basin floor at RL11.640m AHD* *1.70 discharge coefficient for transverse weir* • 3 / 675mm RCP laid at max. grade of 1.324%

Table 5.2.3: Summary of Design Parameters of Proposed Detention System (Stage 2)

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 LPoD-1							
AEP	**63.2%**	**0.5EY**	**20%**	**10%**	**5%**	**2%**	**1%**
Peak Flow (m3/sec)	4.4845	6.4926	9.3301	11.1359	13.9592	16.3402	19.4076

POST-DEVELOPED PEAK FLOWS (MITIGATED) FOR LPoD-1							
AEP	**63.2%**	**0.5EY**	**20%**	**10%**	**5%**	**2%**	**1%**
Mitigated Flow (m3/sec)	3.1637	4.2134	7.0749	10.8745	13.3266	16.2640	18.4156
Max Water Elevation RL	11.458	11.611	11.737	11.812	11.875	11.944	11.992
Peak Duration (min)	25min	30min	30min	60min	60min	30min	30min
Depth to WSL (m)	0.988	1.141	1.267	1.342	1.405	1.474	1.522

Table 5.2.4.1: Summary of XPSTORM Hydrologic / Hydraulic Results Catchment LPoD-1

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 (LPoD-1)							
AEP	**63.2%**	**0.5EY**	**20%**	**10%**	**5%**	**2%**	**1%**
900 x 900mm F.I. (1) (m^3/s)	0.0000	0.0141	0.1818	0.5175	0.5840	0.6499	0.6913
900 x 900mm F.I. (2) (m^3/s)	0.0000	0.0141	0.1818	0.5175	0.5840	0.6499	0.6913
900 x 900mm F.I. (3) (m^3/s)	0.0000	0.0141	0.1818	0.5175	0.5840	0.6499	0.6913
900 x 900mm F.I. (4) (m^3/s)	0.0000	0.0141	0.1818	0.5175	0.5840	0.6499	0.6913
900 x 900mm F.I. (5) (m^3/s)	0.0000	0.0141	0.1818	0.5175	0.5840	0.6499	0.6913
25m High Flow Weir (m^3/s)	0.0000	0.0000	1.2907	3.0316	4.8428	7.1310	8.8652
3/675mm dia Outlet (m3/s)	3.1367	4.1429	4.8752	5.2554	5.5638	5.8835	6.0939
TOTAL (m^3/s)	**3.1367**	**4.2134**	**7.0749**	**10.8745**	**13.3266**	**16.2640**	**18.4156**

Flow Mitigation from Existing Condition (m^3/s)	1.3208	2.2792	2.2552	0.2614	0.6326	0.0762	0.9920
Attenuation Achieved (Y/N)	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**
Flow Mitigation Achieved	29.5%	35.1%	24.2%	2.3%	4.5%	0.5%	5.1%

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

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/s.

5.2.5 DISCUSSION ON MODELLING OUTCOMES

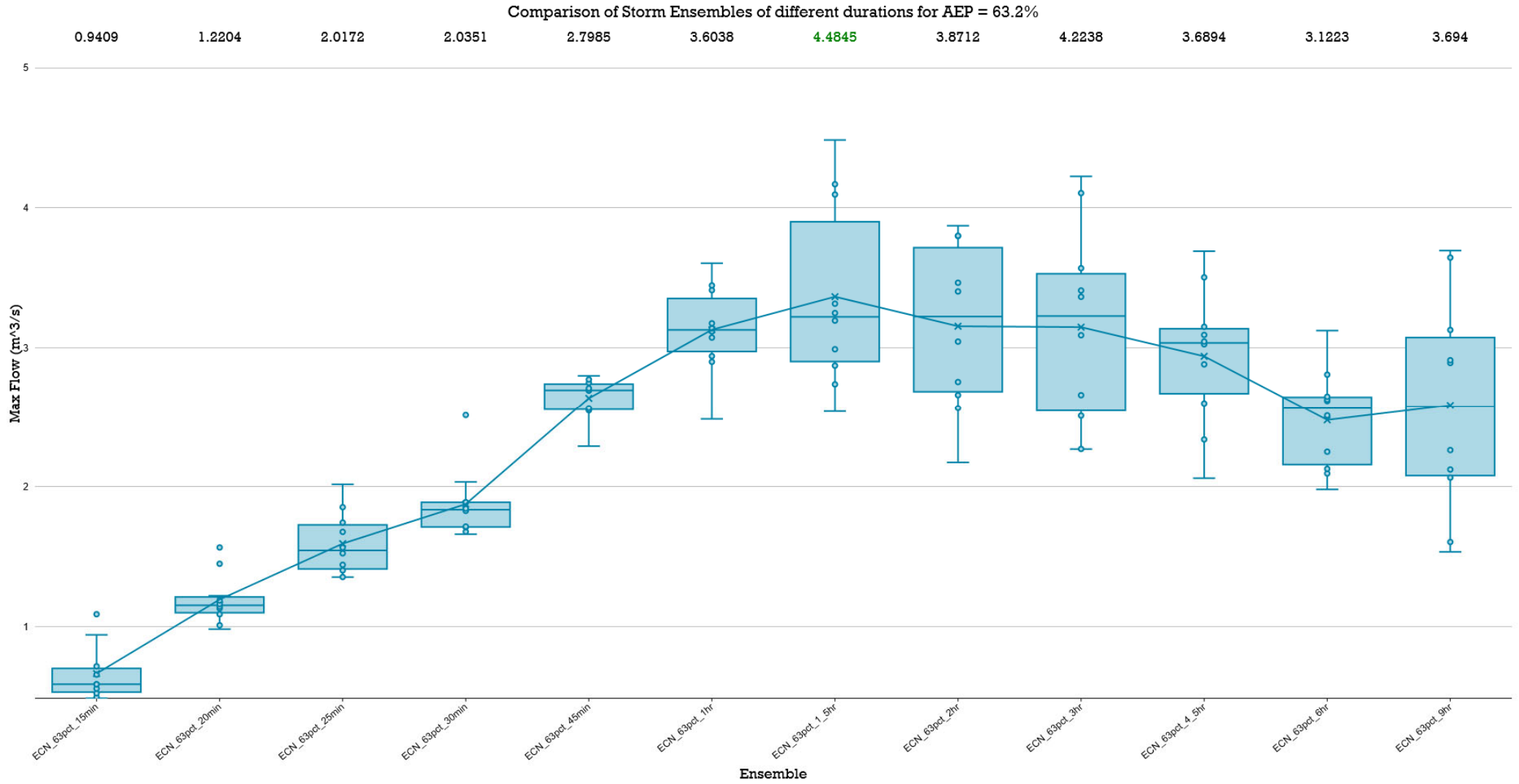
The above hydraulic modelling has confirmed that there is no increase in peak discharge flow rates from the development site to existing infrastructure or downstream / neighbouring properties by implementing the proposed designed detention measures.

All AEP's ranging from 63.2% (equiv. Q_1) to 1% (equiv. Q_{100}) achieve mitigation.

Appendix L – Peak Flow Box & Whisker Plots

LPoD-1 PRE Box & Whisker Plots

Peak Flow Highlighted Green



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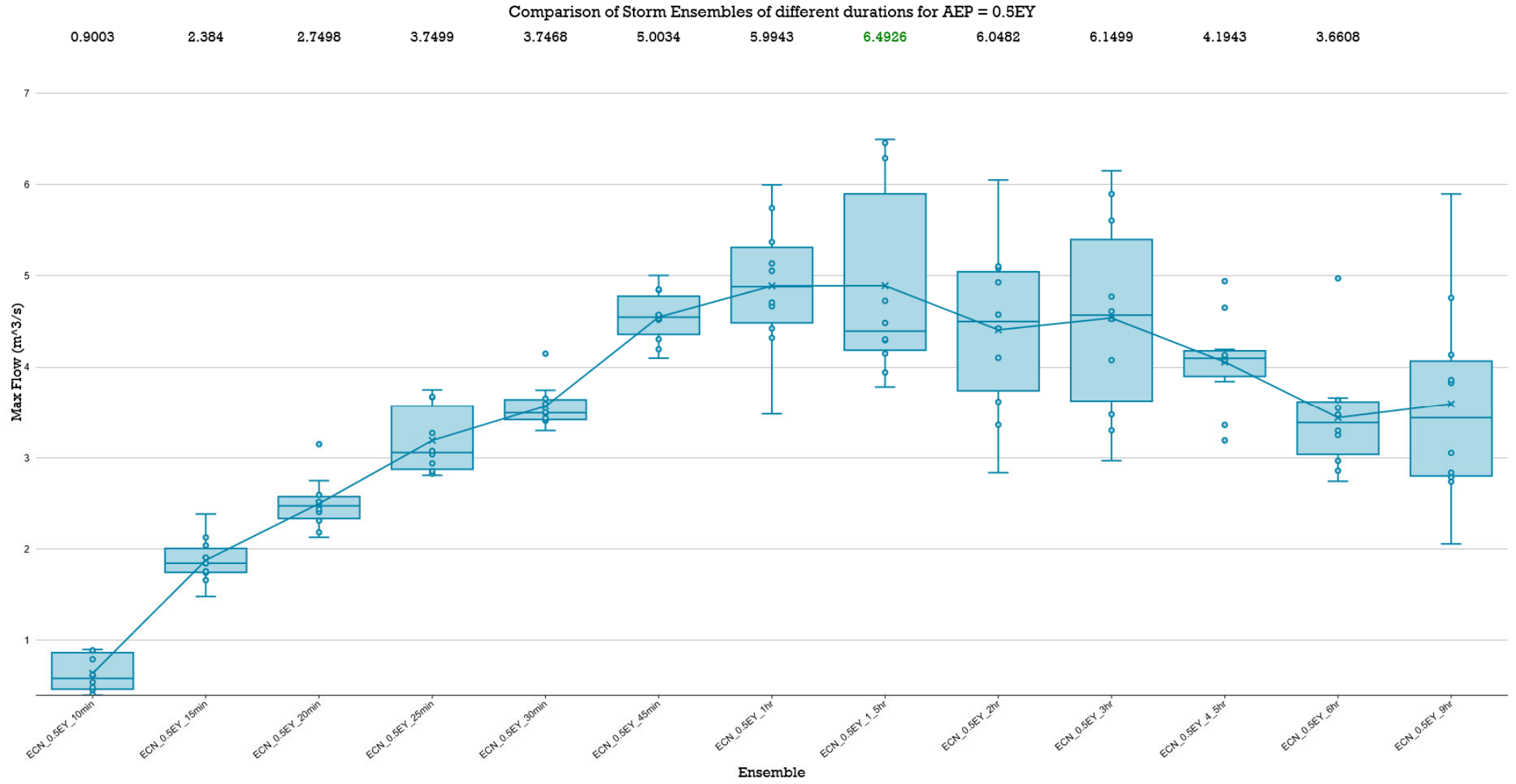

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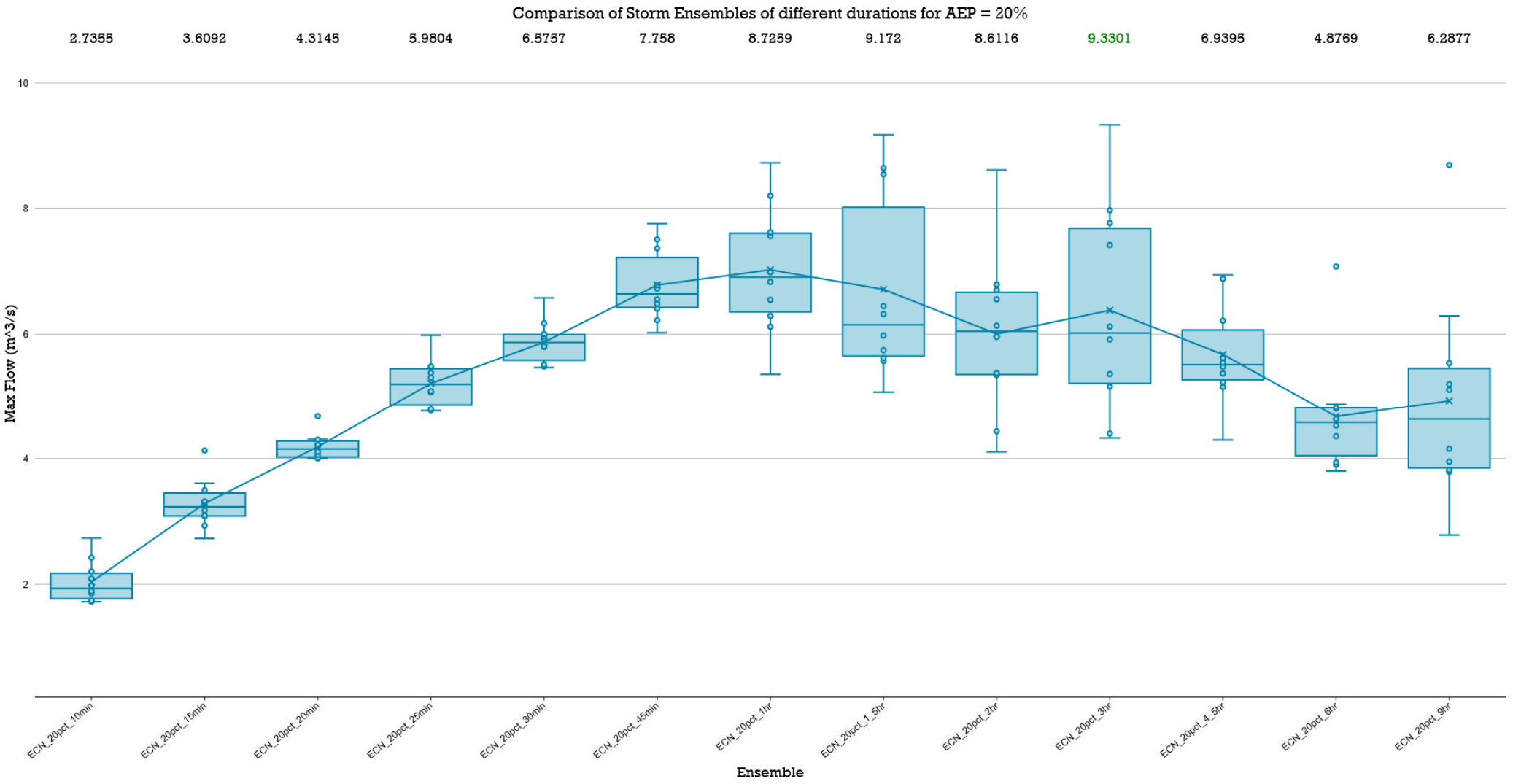

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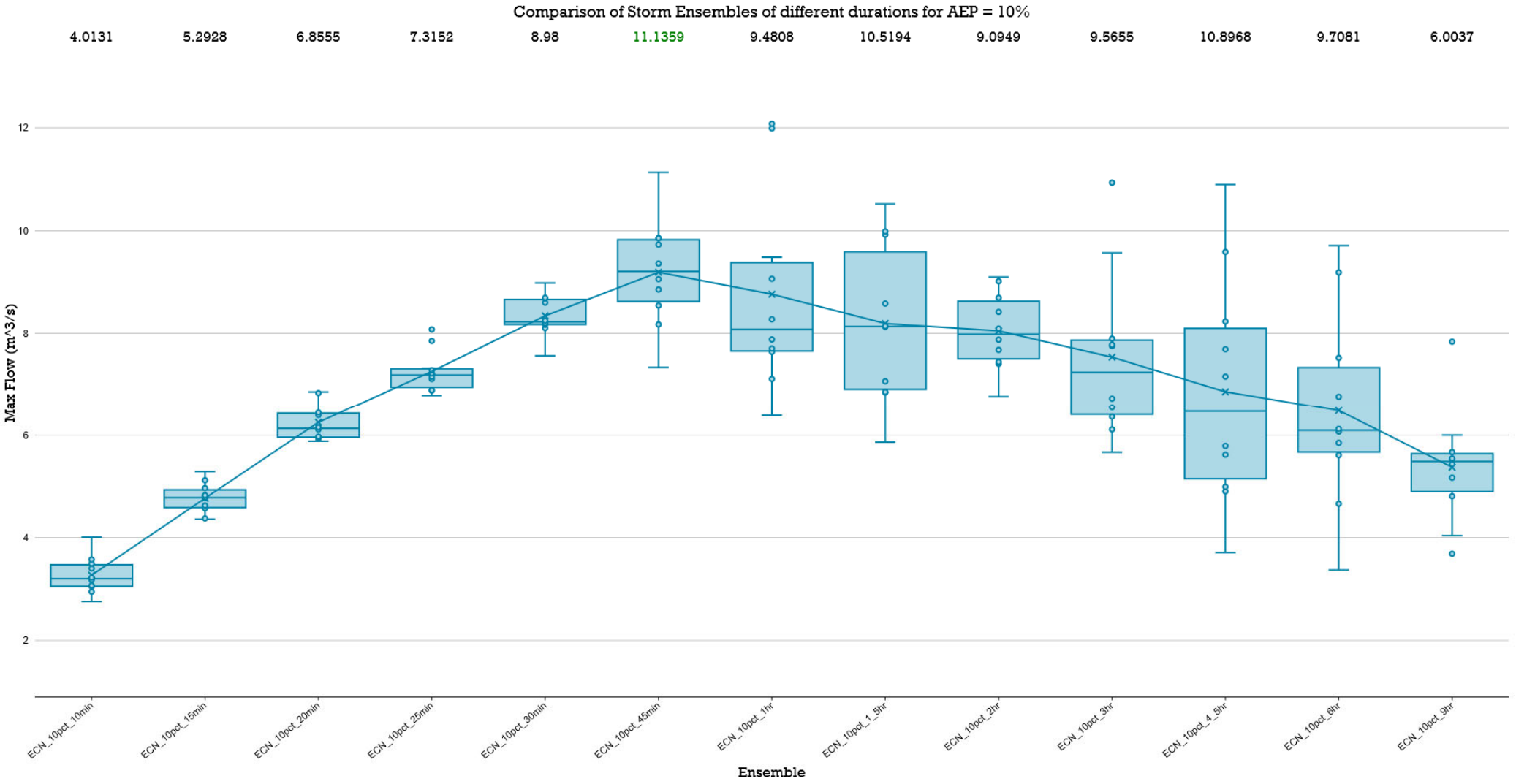

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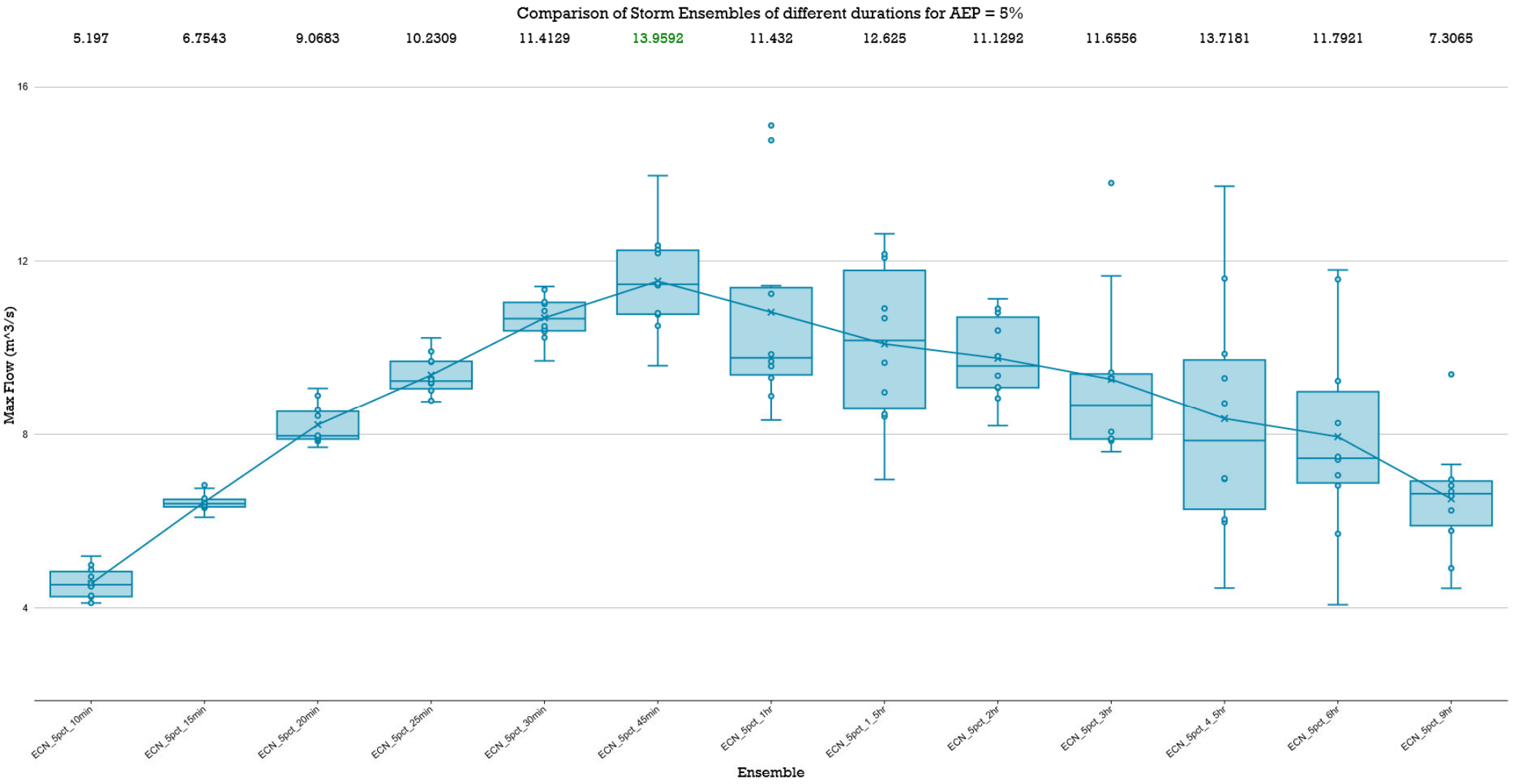

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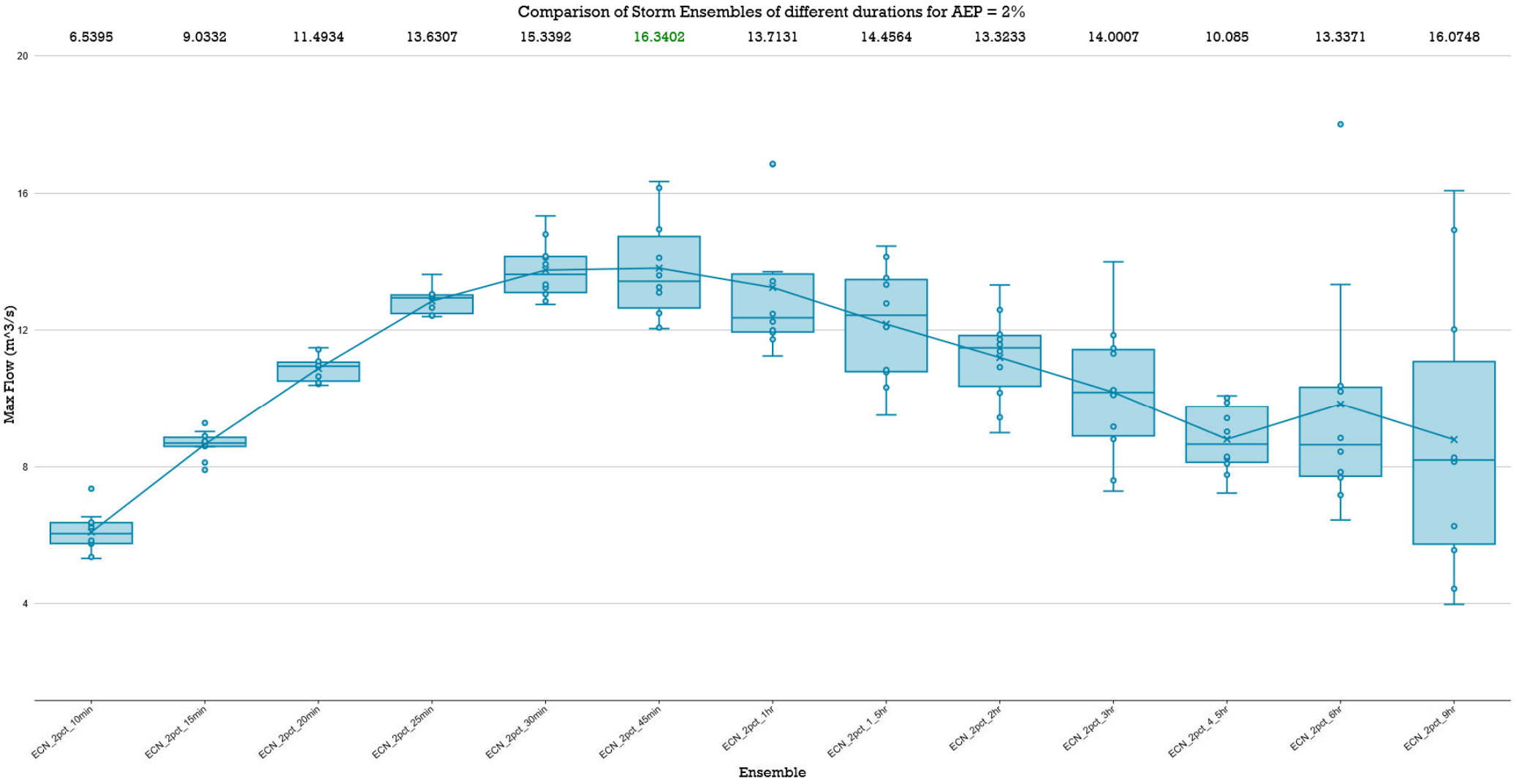

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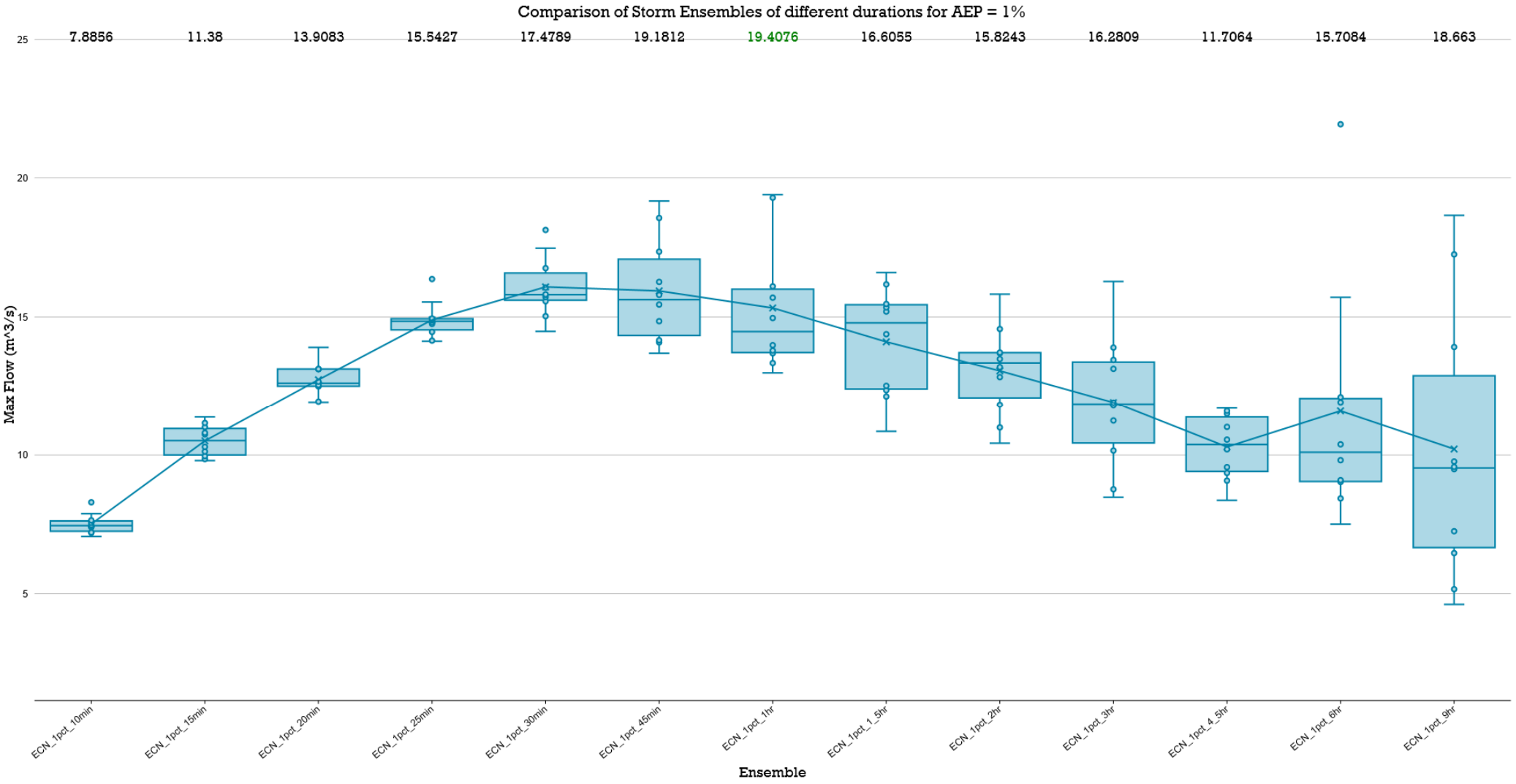
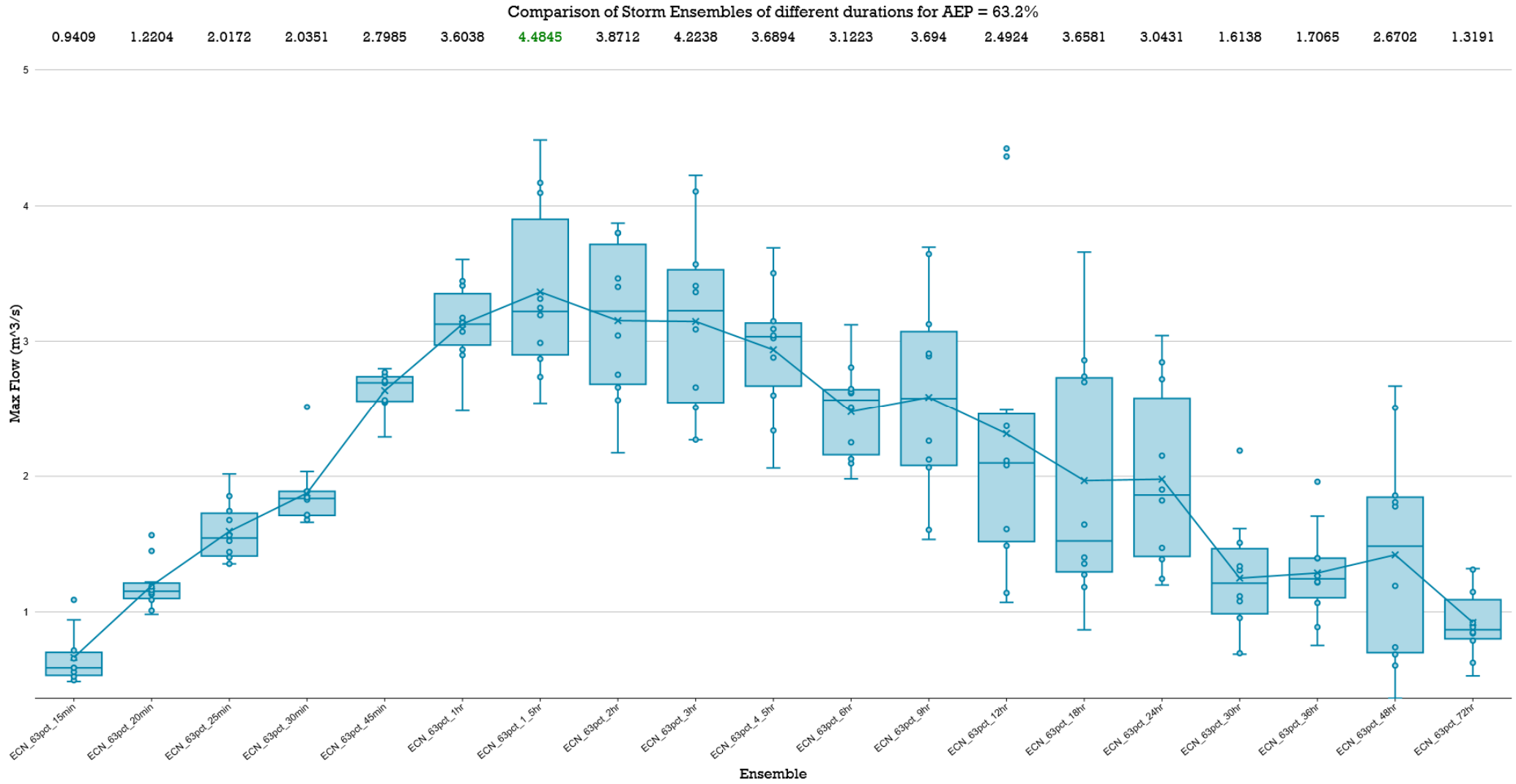


LPoD-1 PRE Box & Whisker Plots (72 HR DURATION)

Peak Flow Highlighted Green



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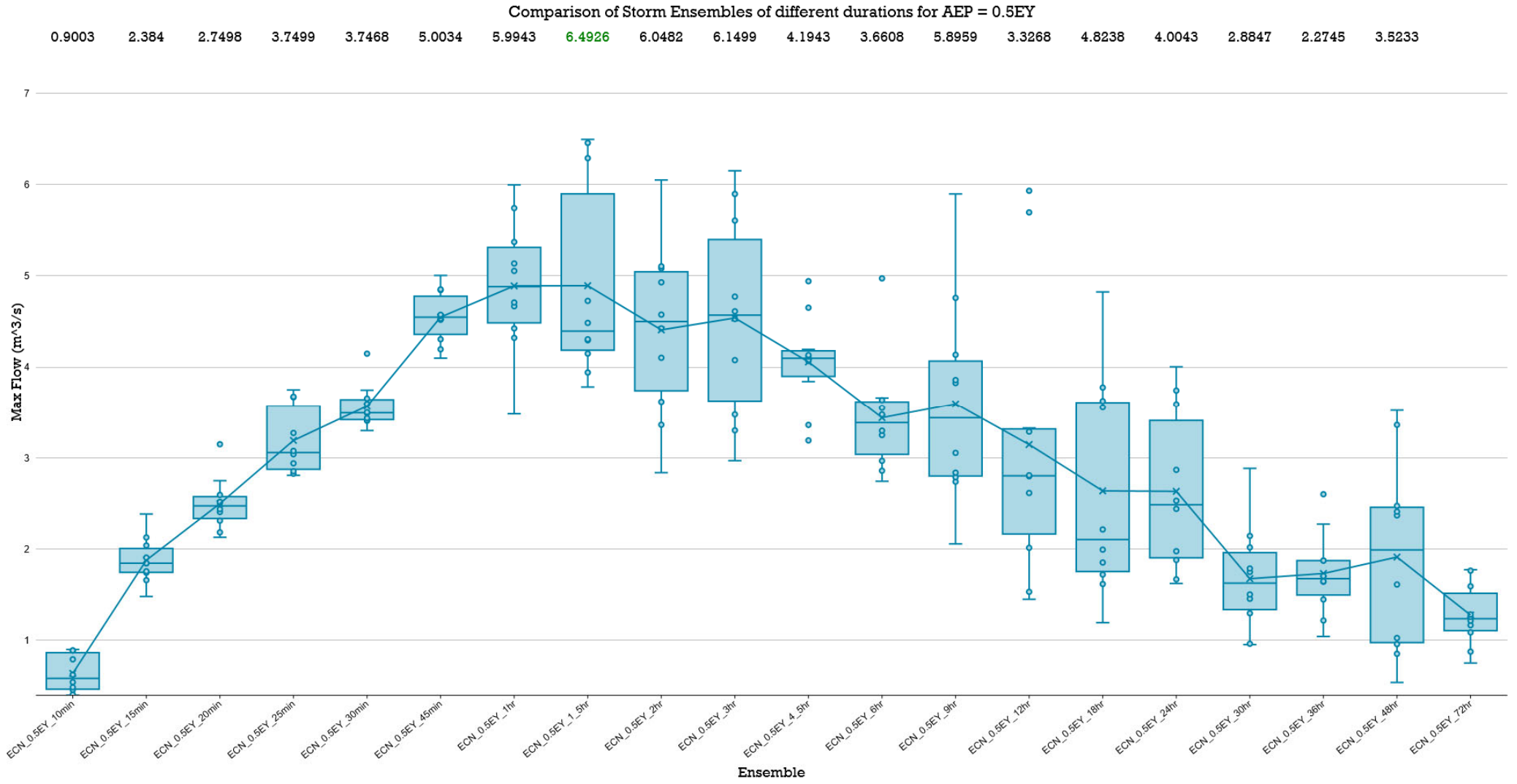

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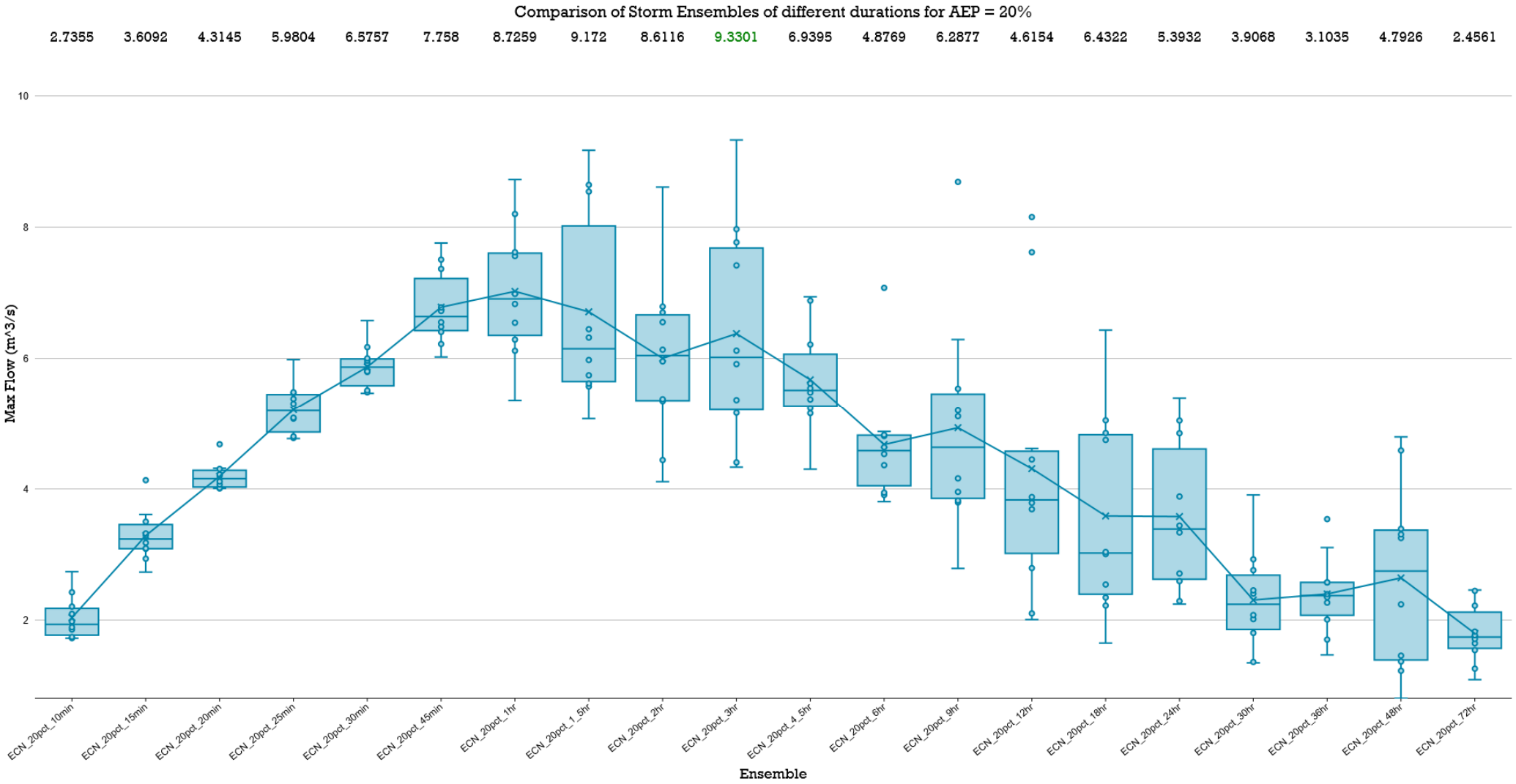

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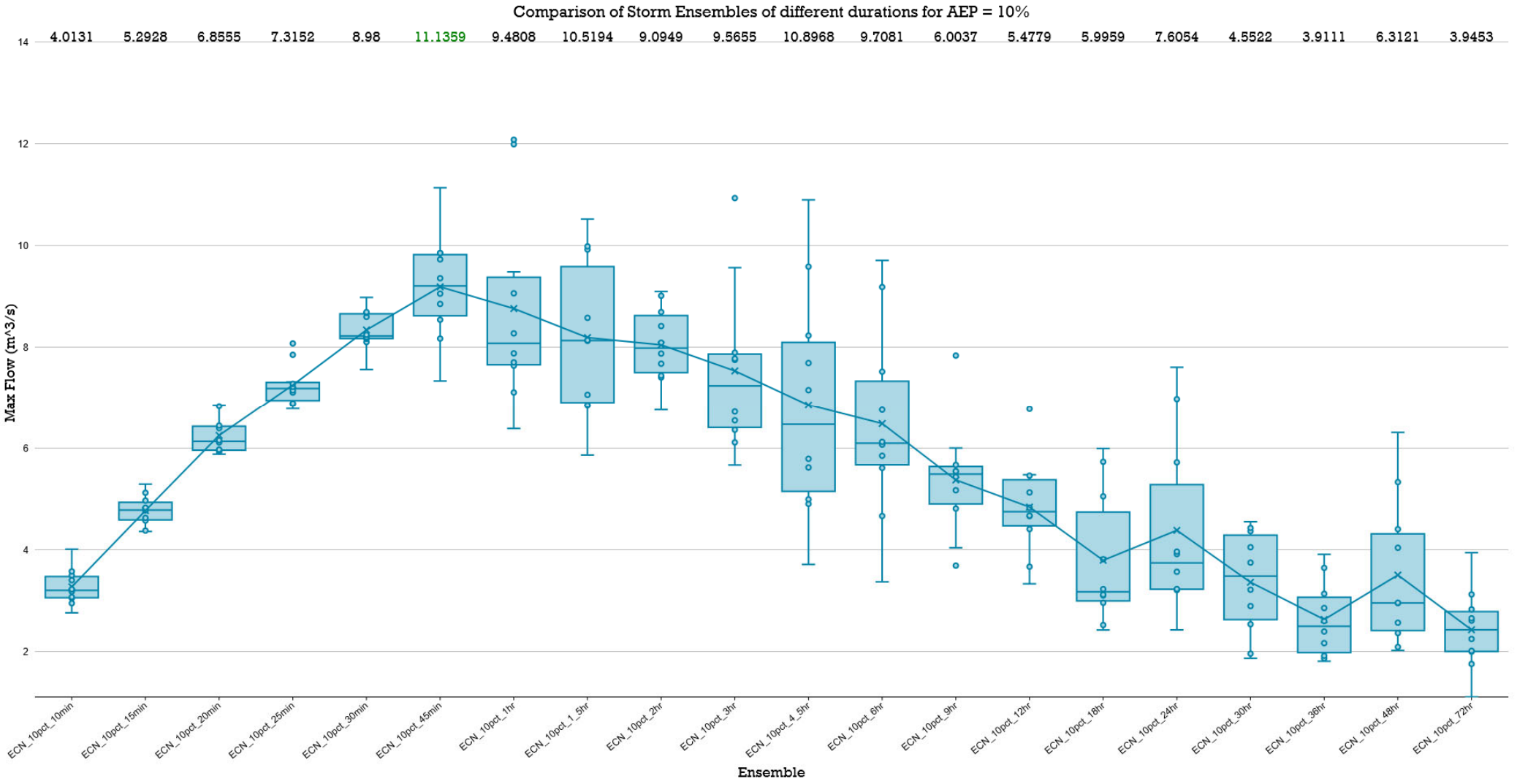

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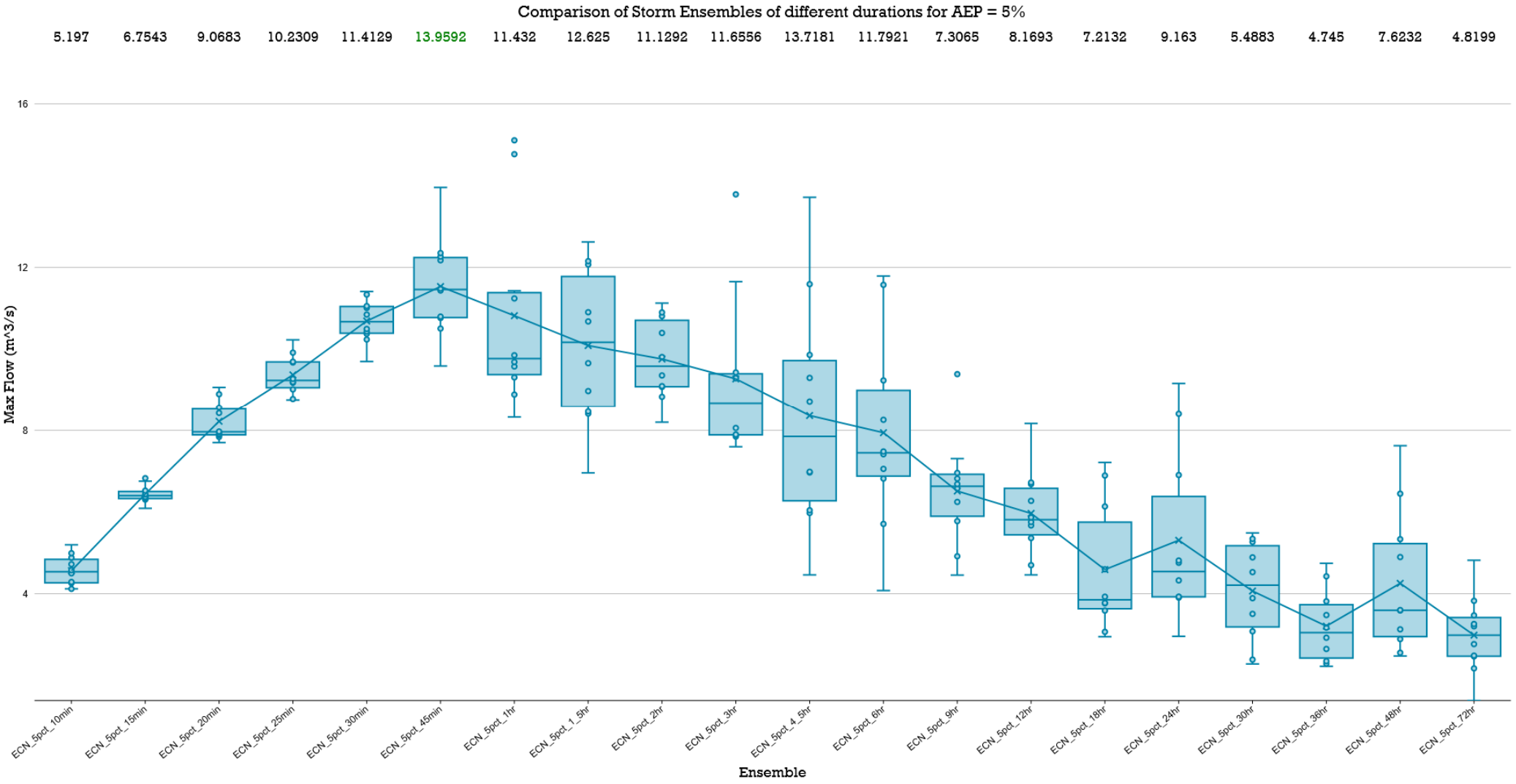

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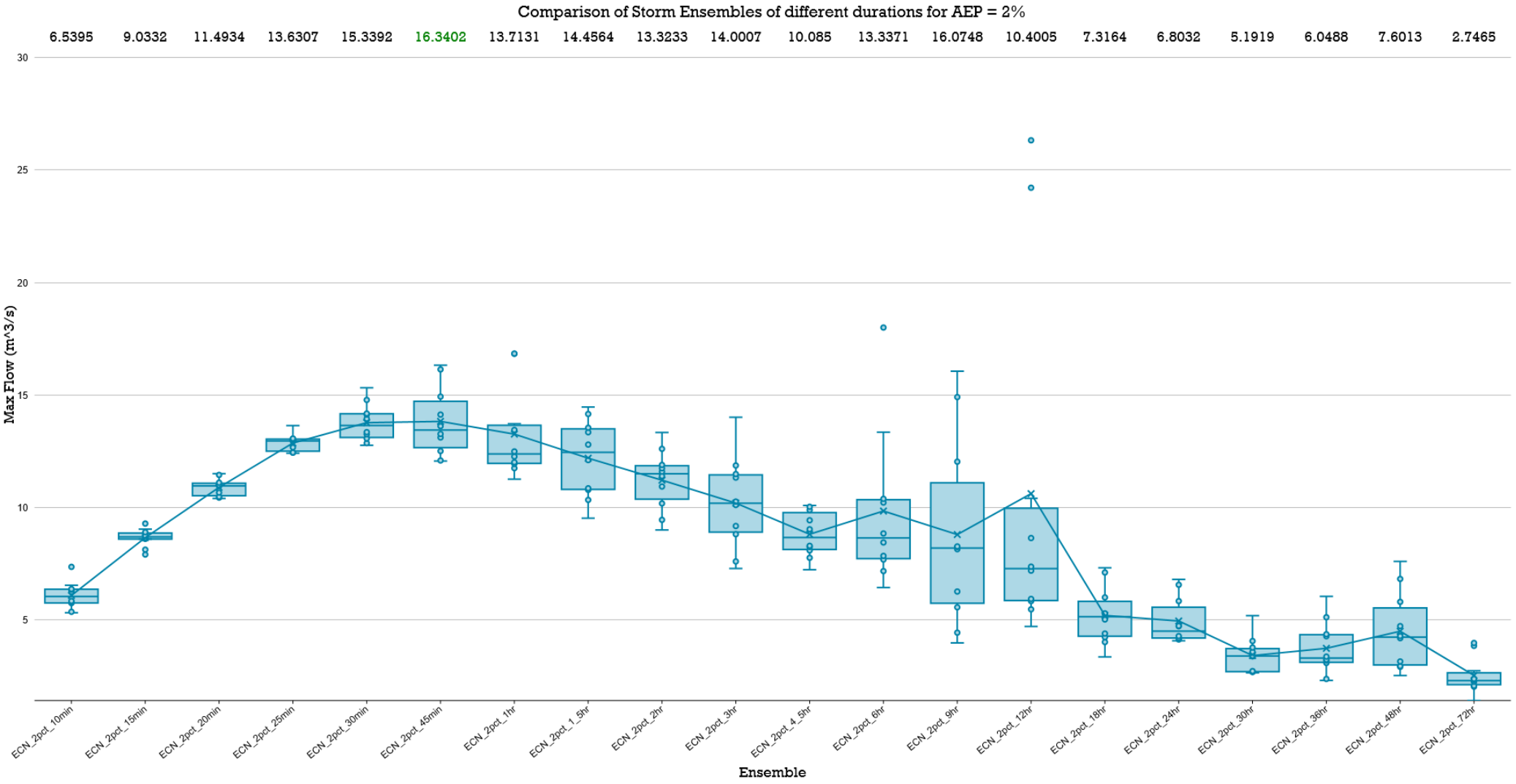

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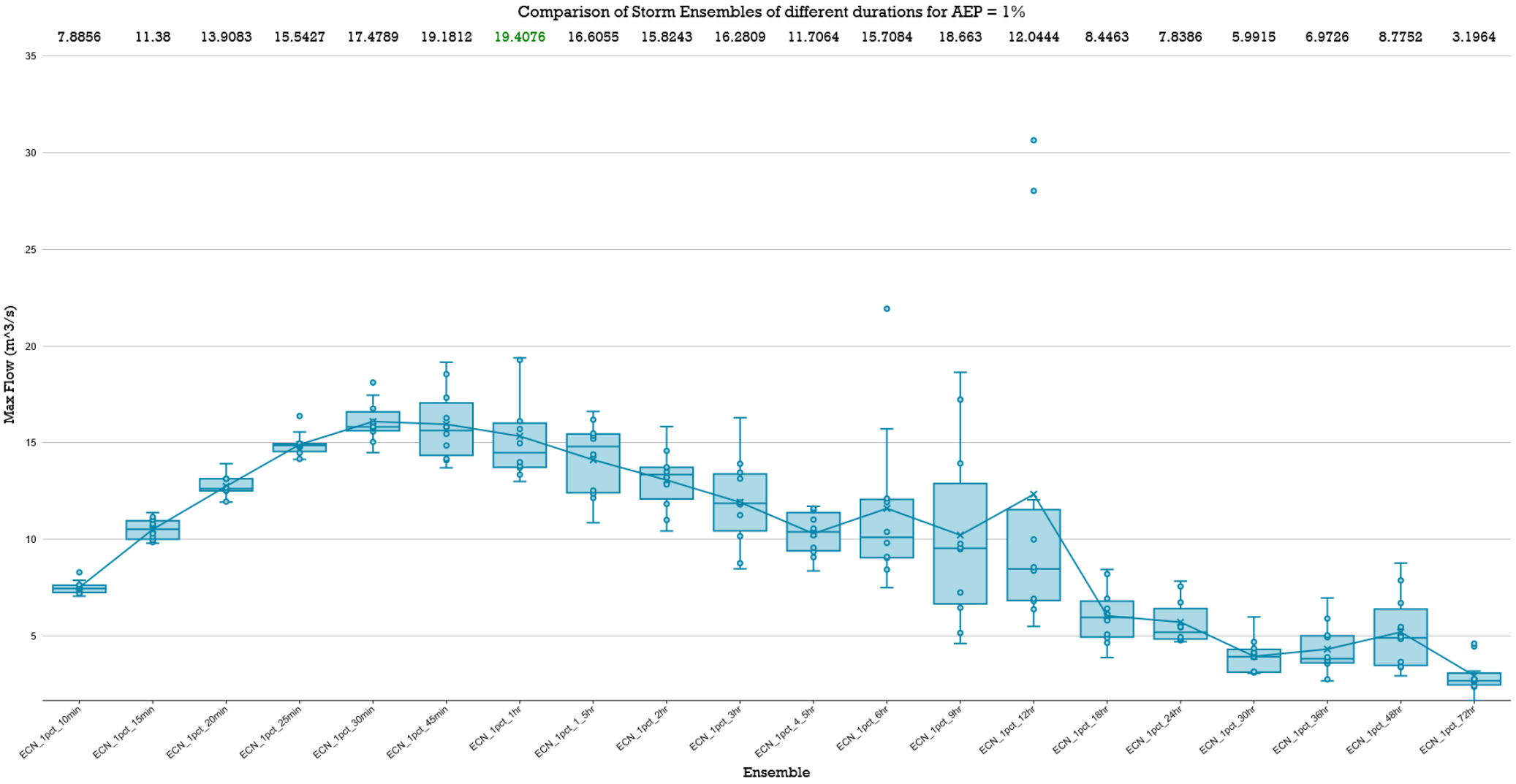
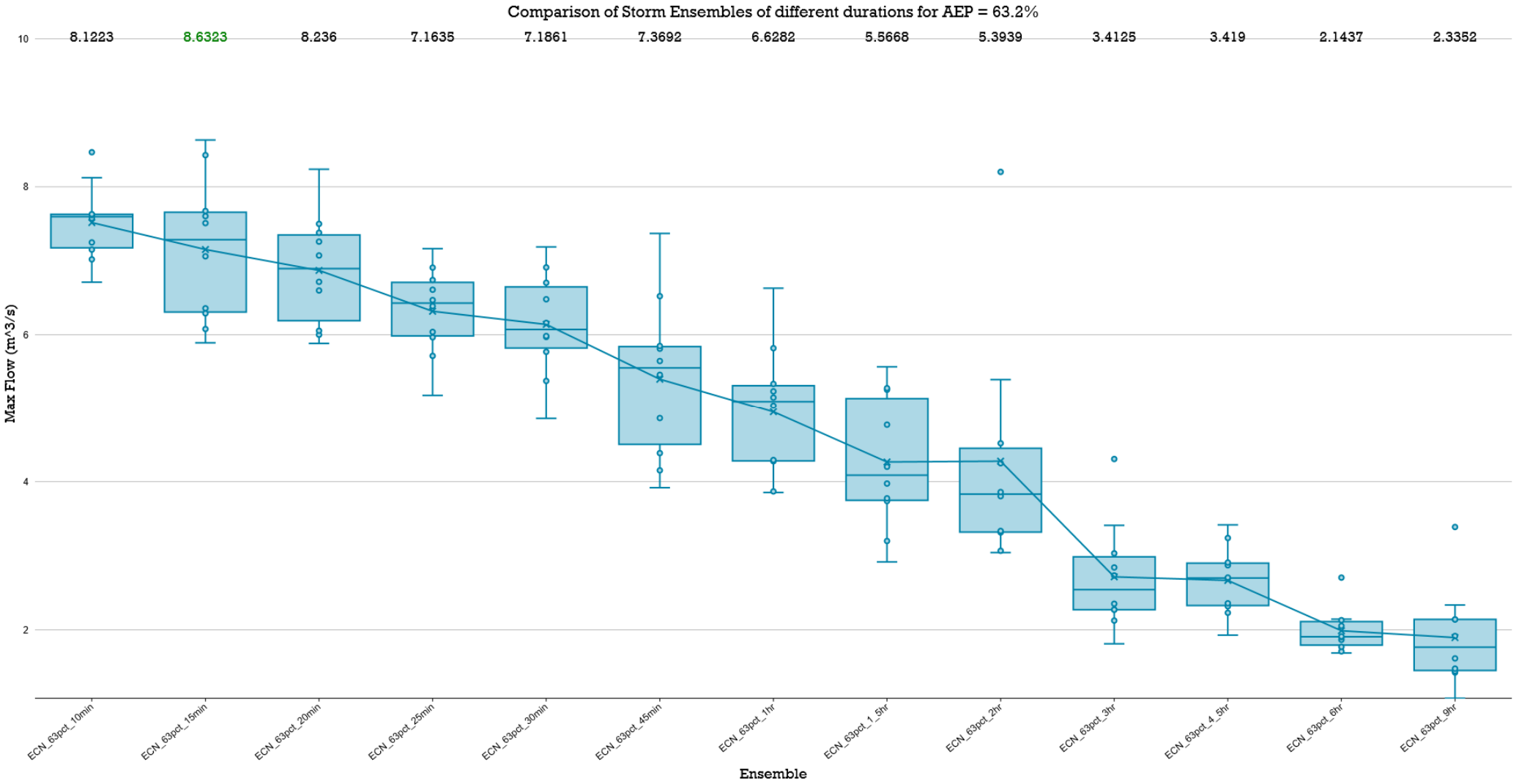


LPoD-1 POST Box & Whisker Plots

Peak Flow Highlighted Green



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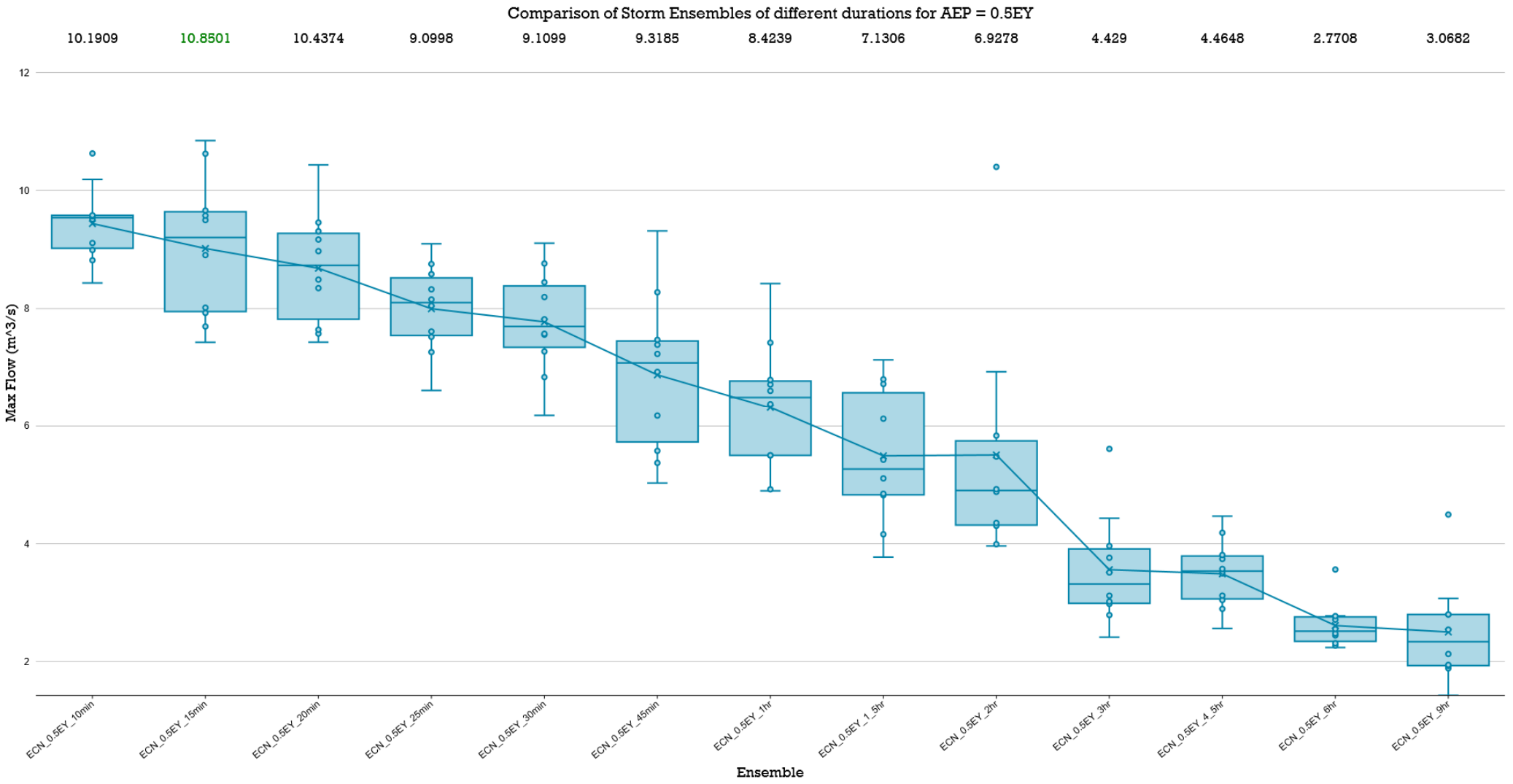

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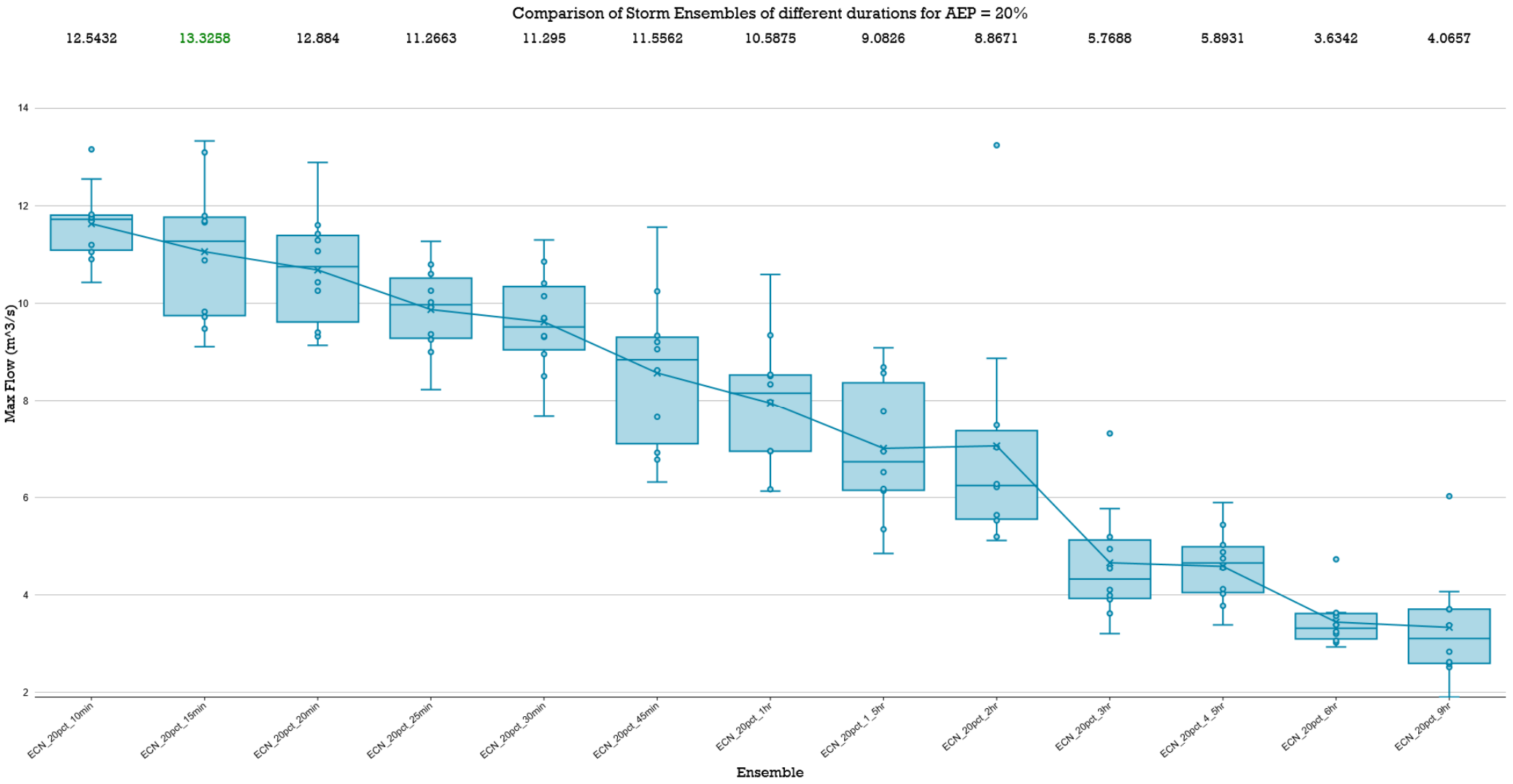

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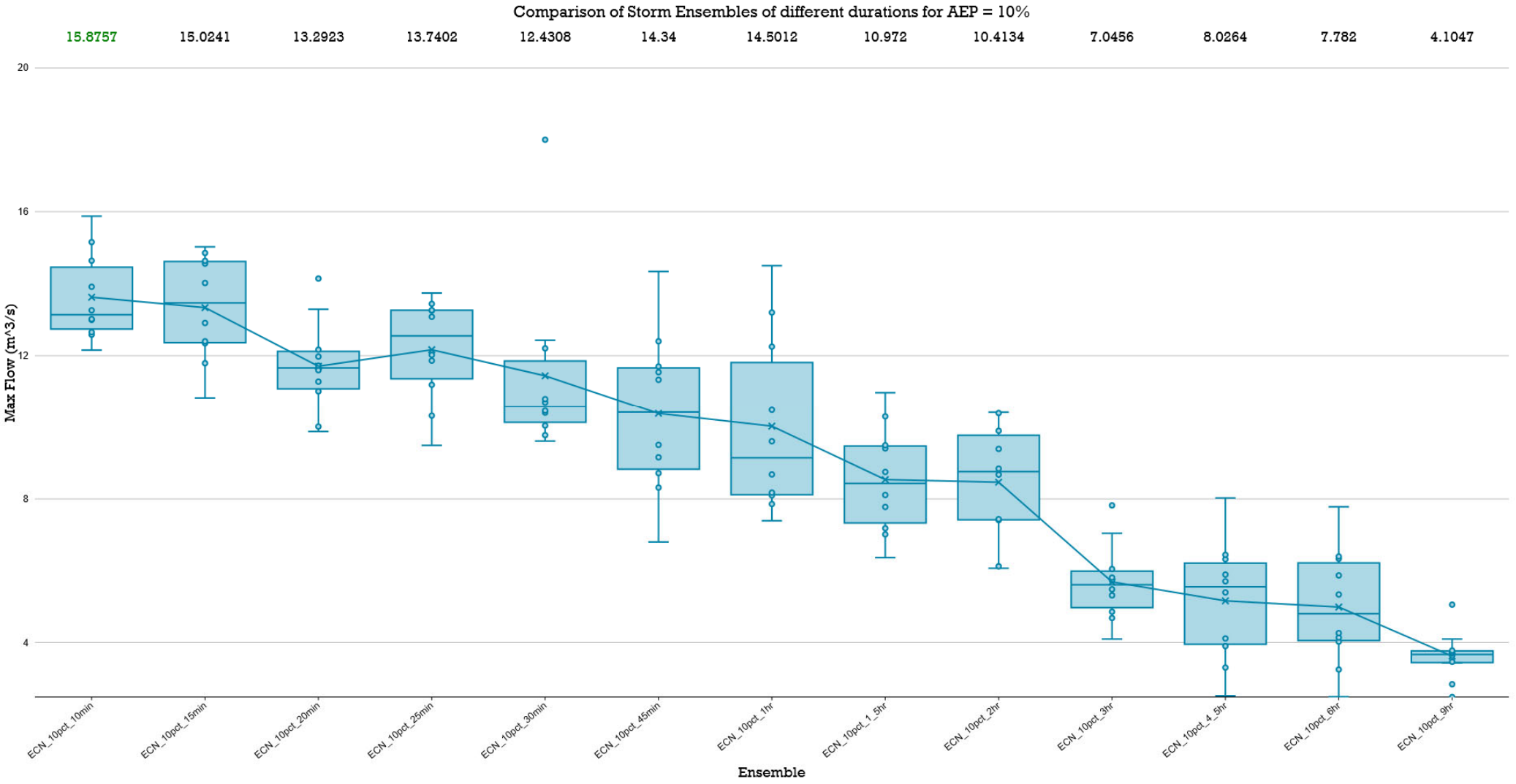

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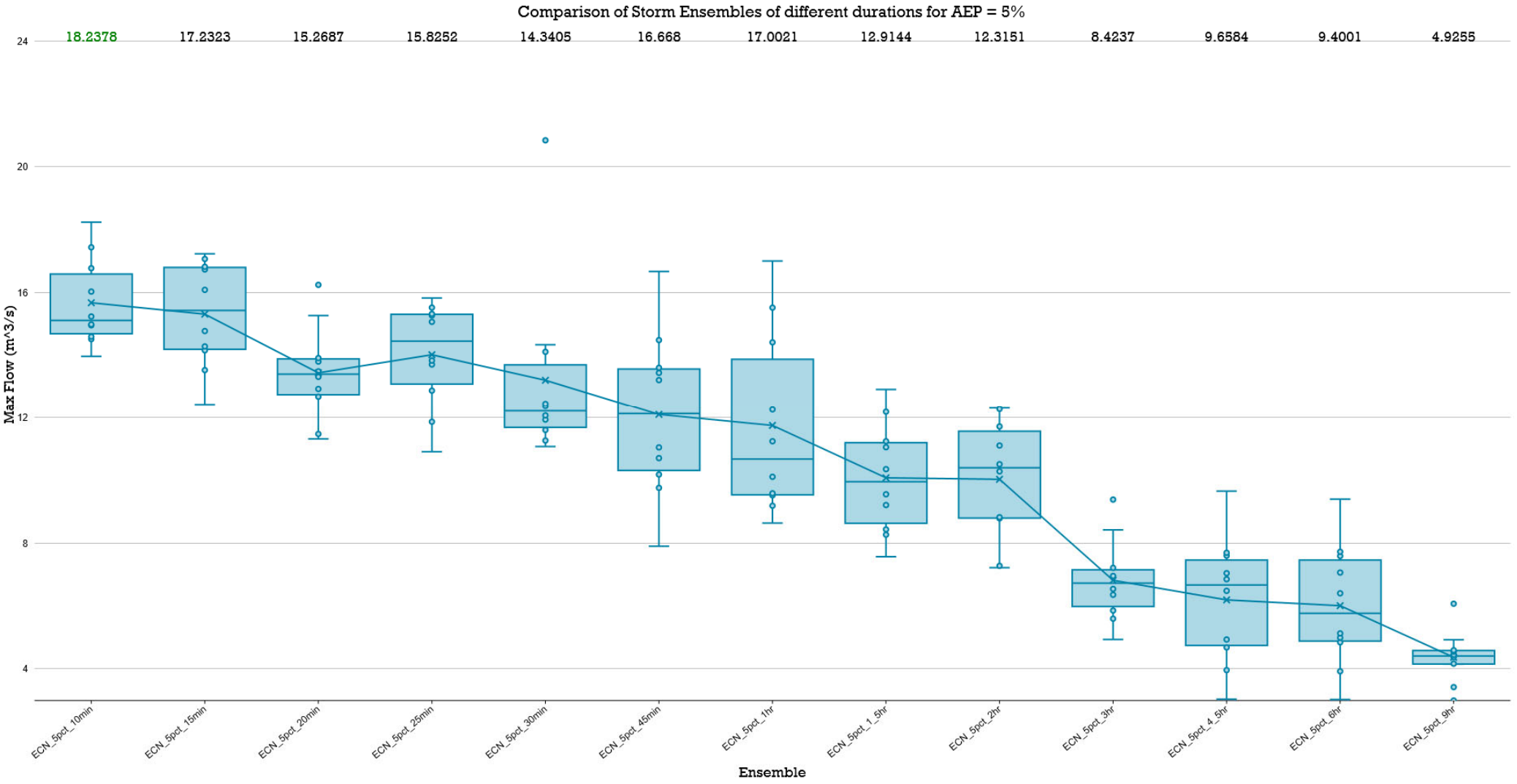

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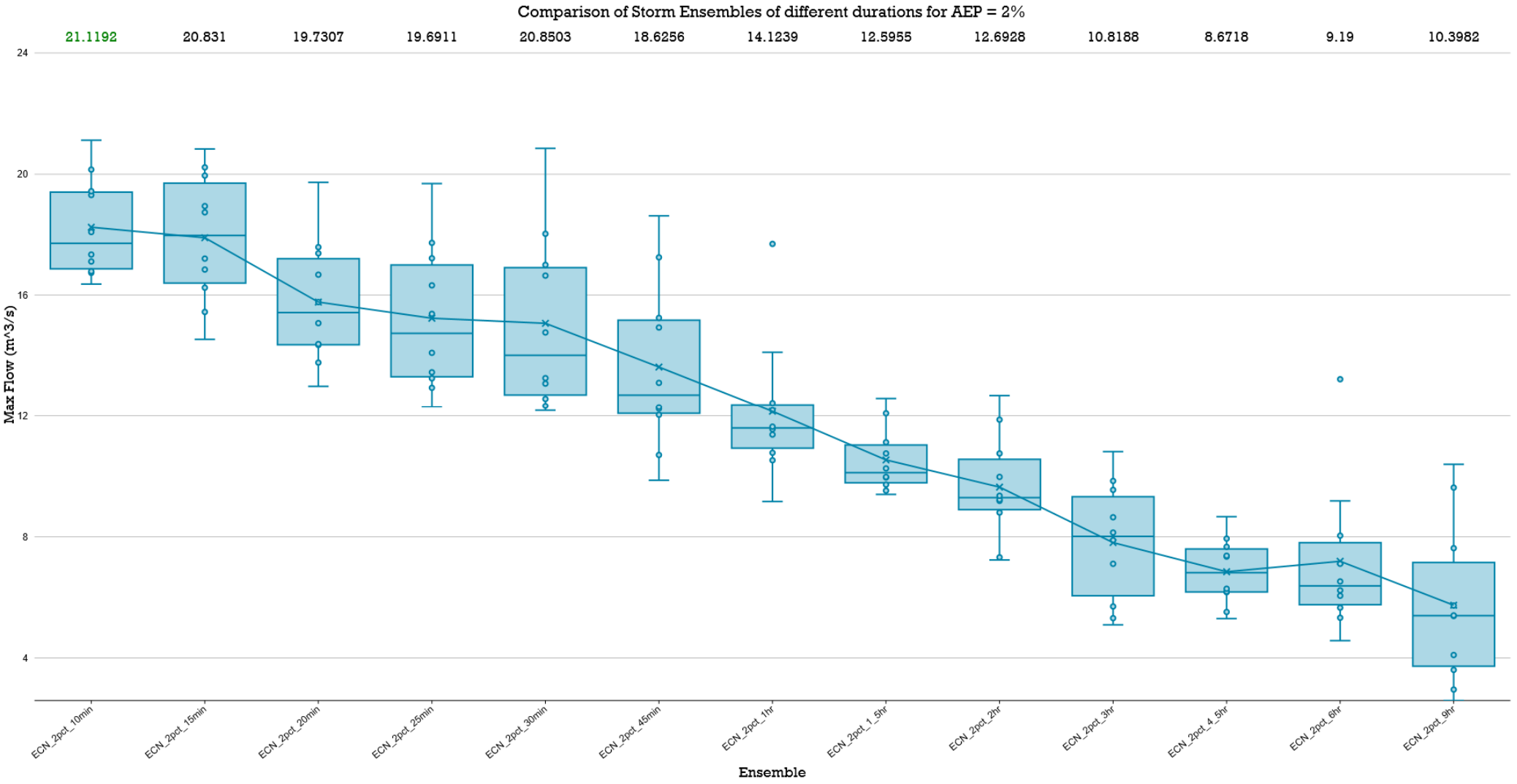

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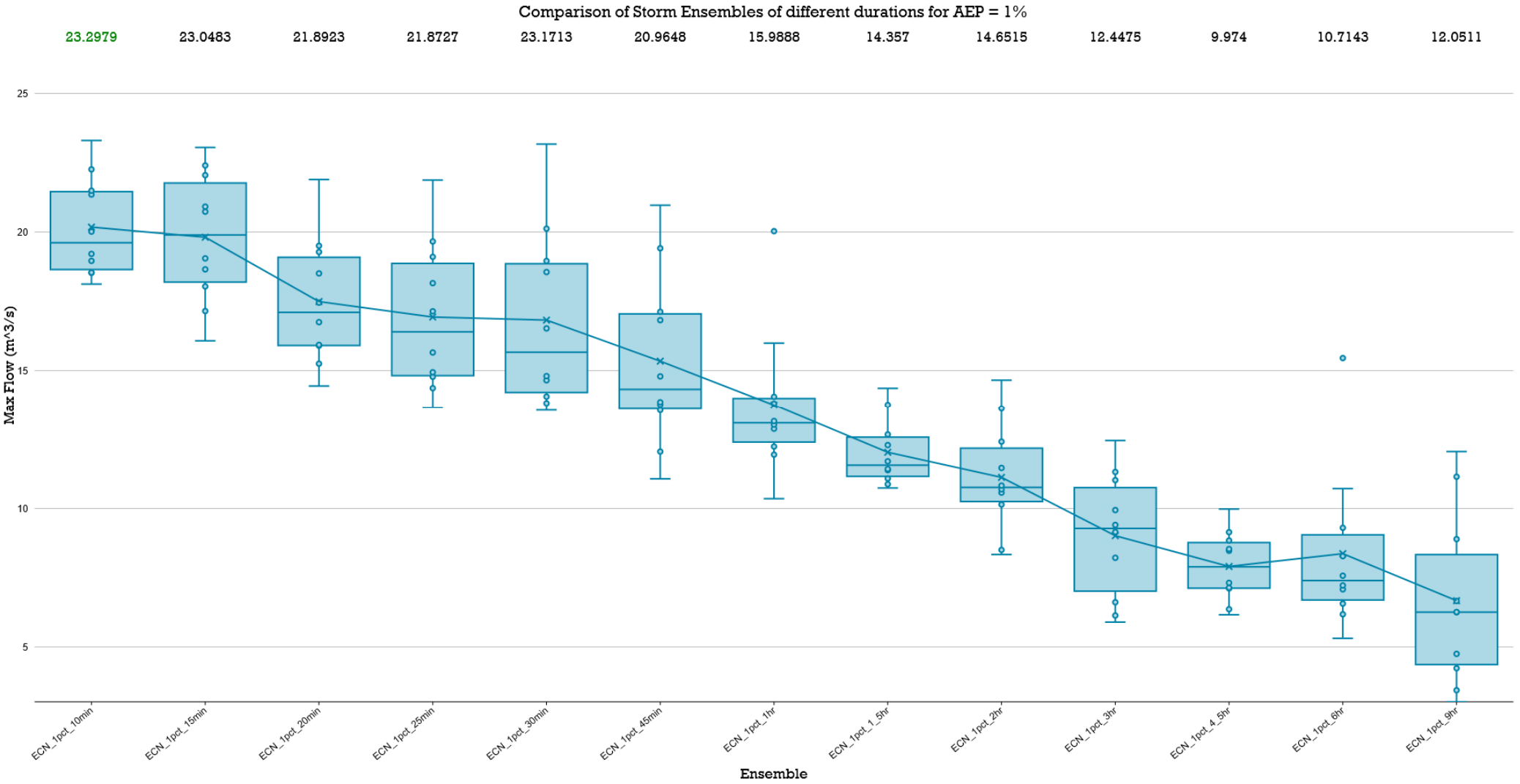
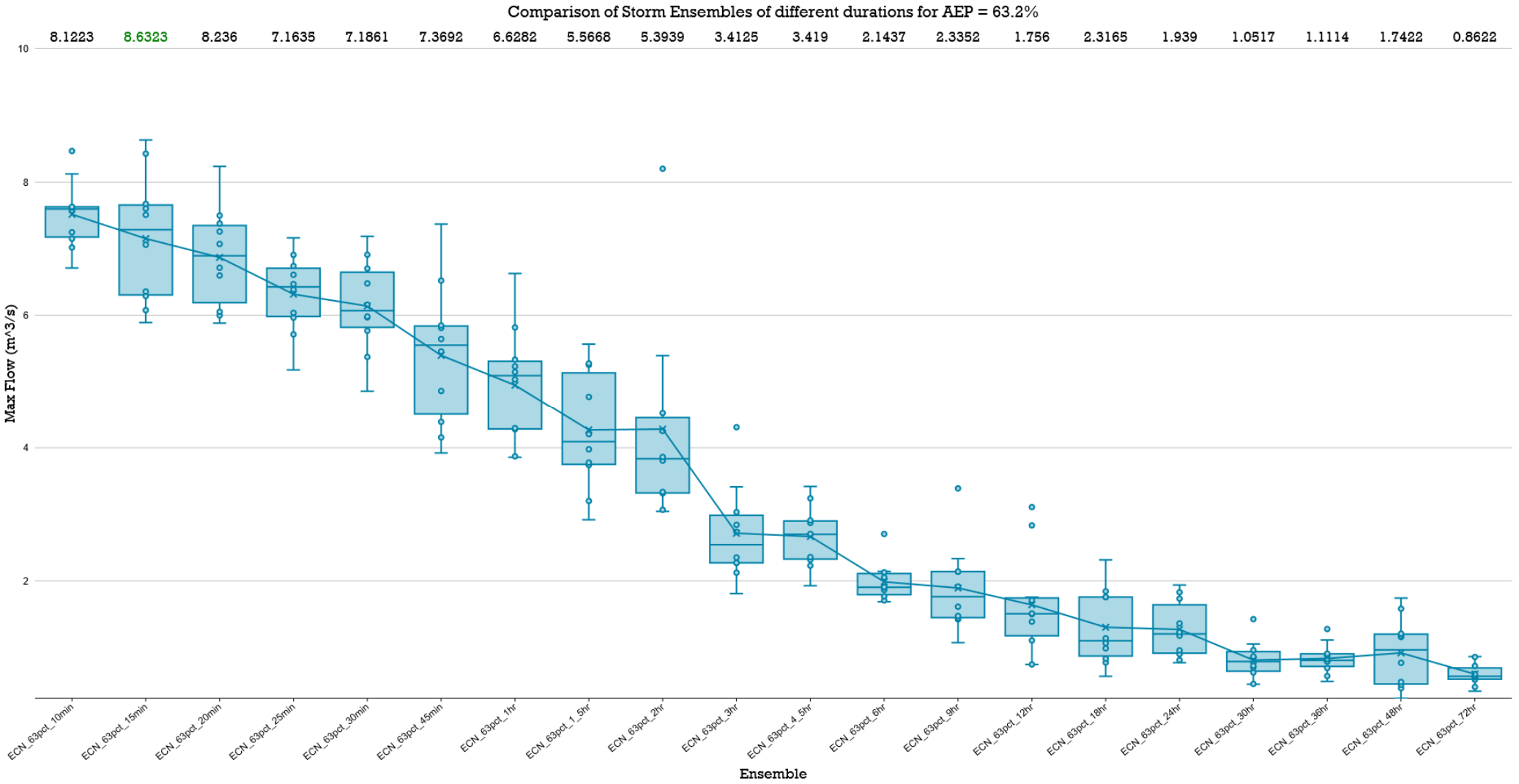


LPoD-1 POST Box & Whisker Plots (72 HR DURATION)

Peak Flow Highlighted Green



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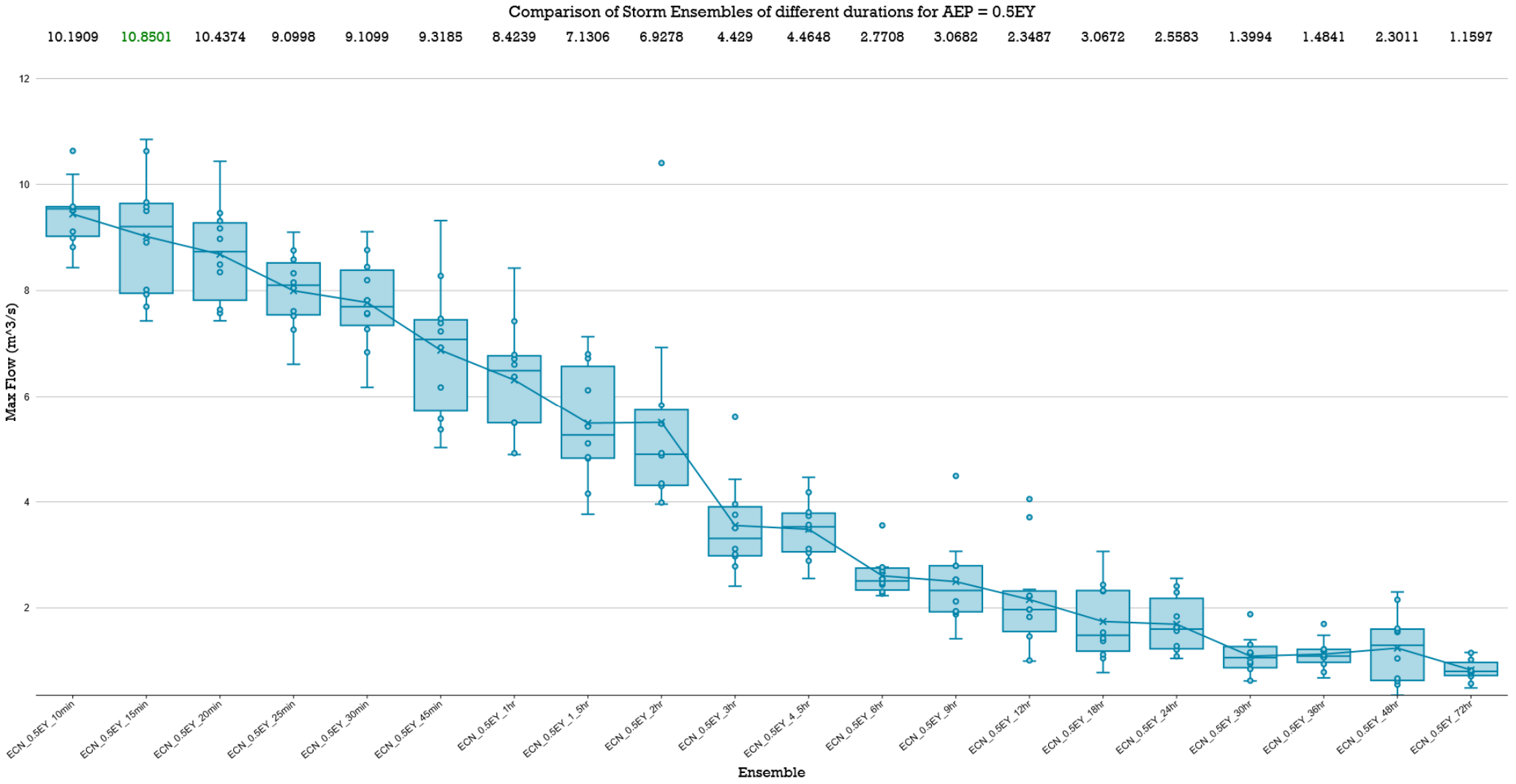

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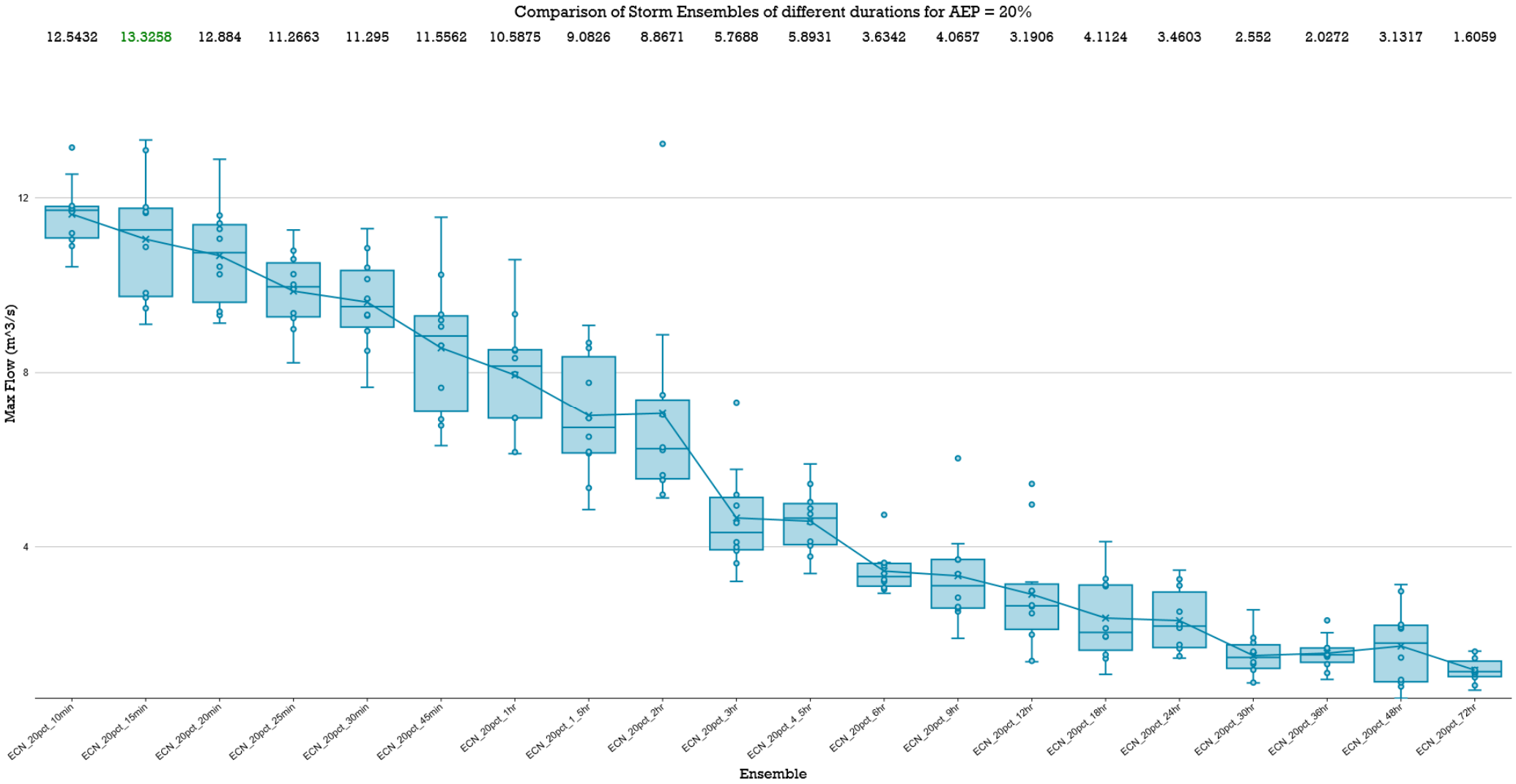

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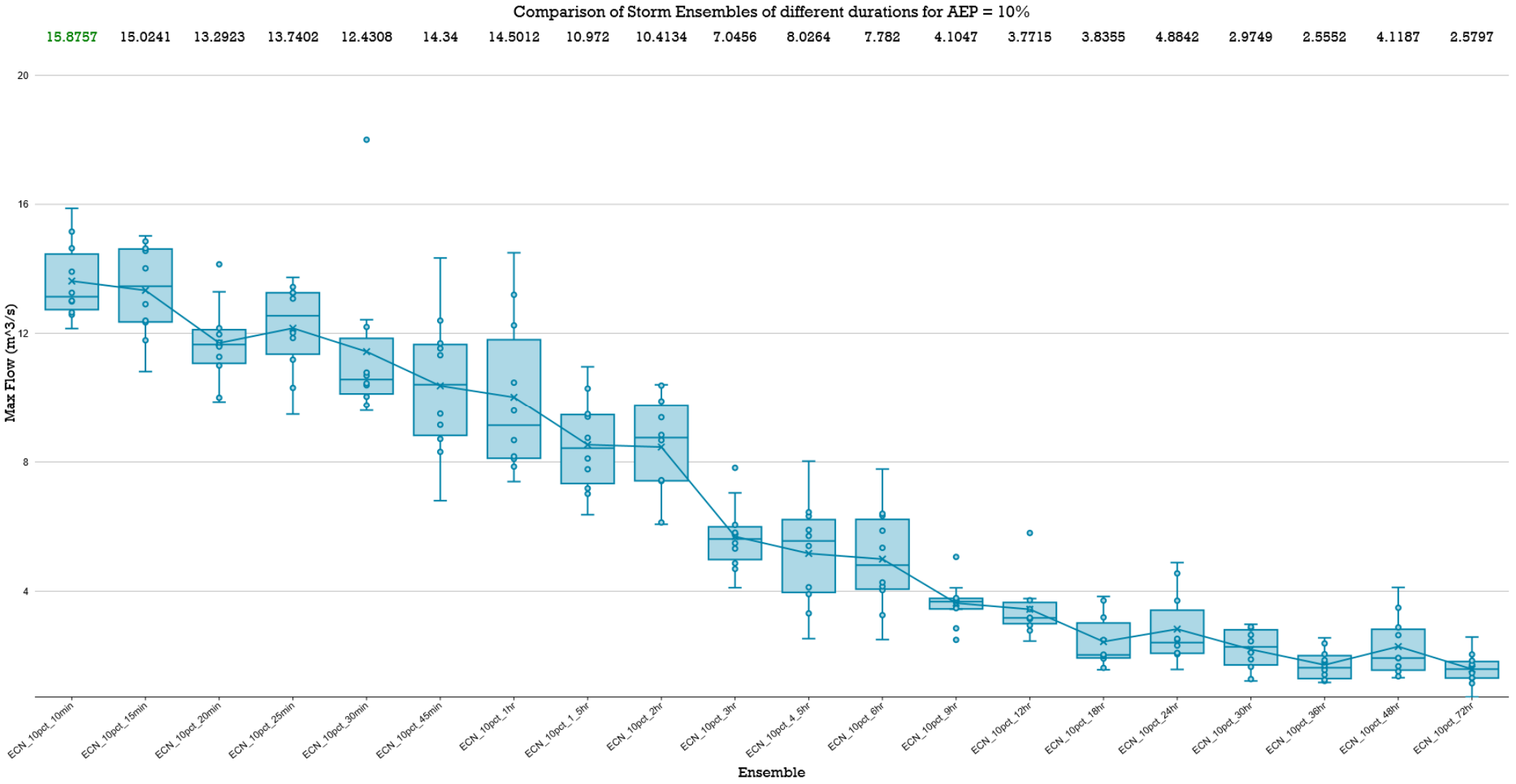
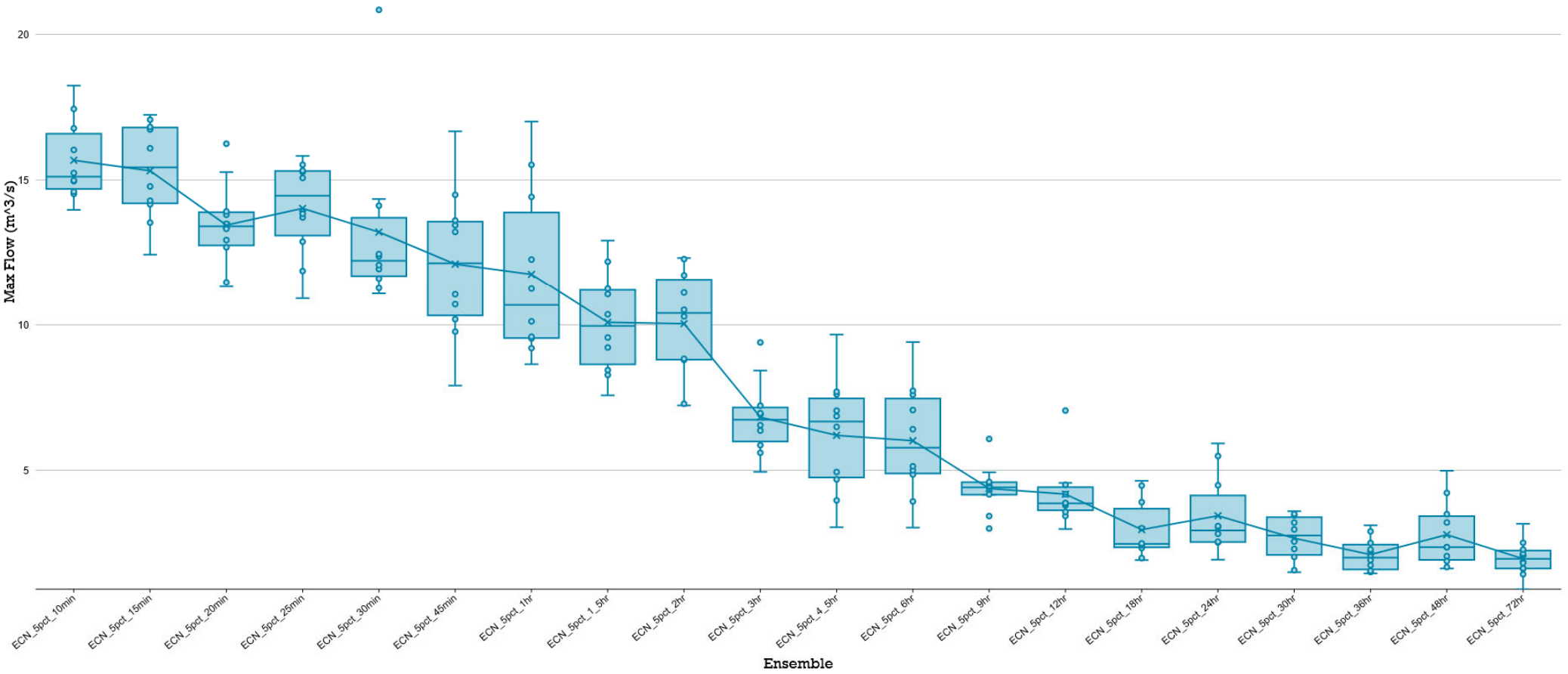


LPoD-1 POST Box & Whisker Plots (72 HR DURATION)

Peak Flow Highlighted Green

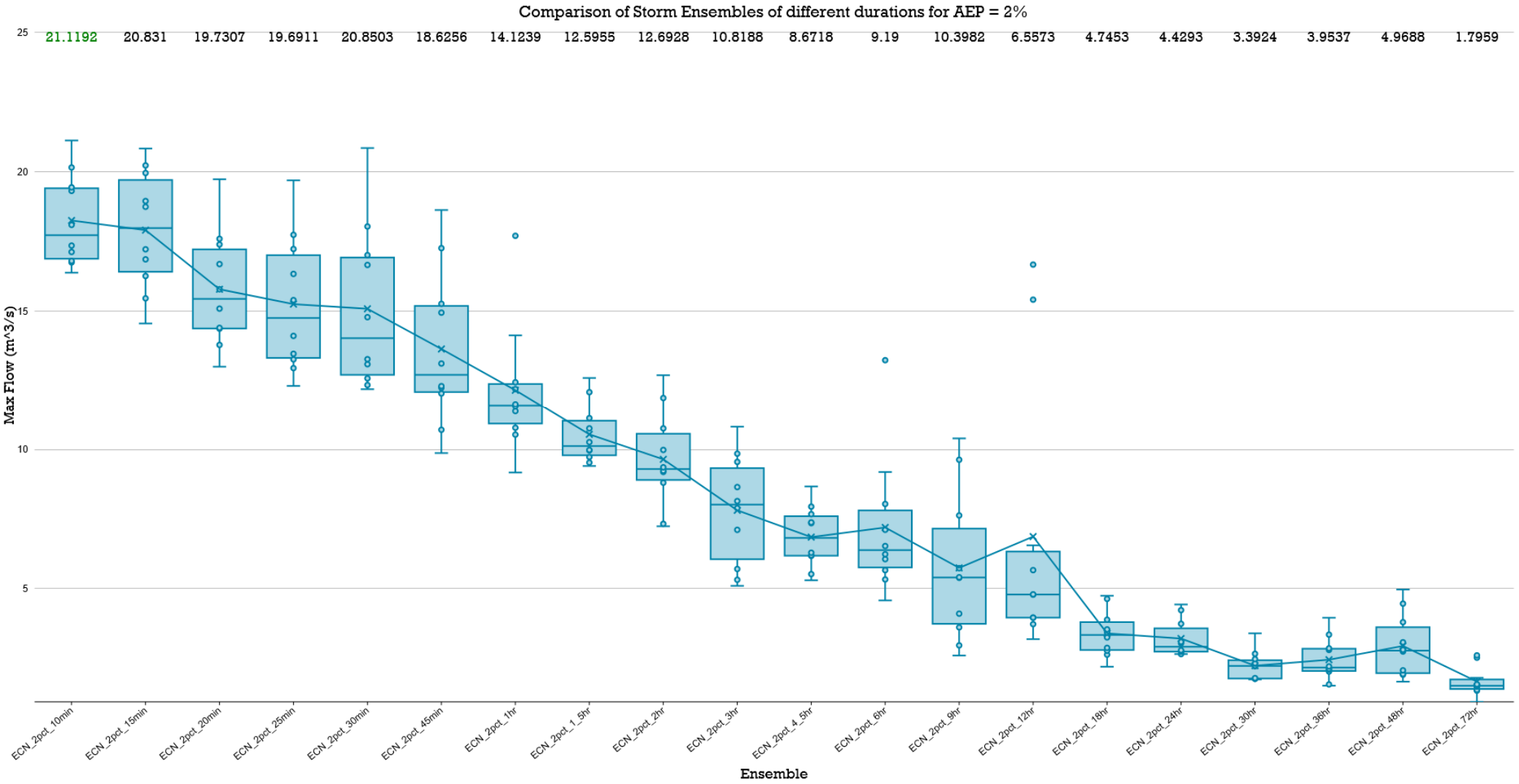
Comparison of Storm Ensembles of different durations for AEP = 5%

ECN_5pct_10min	ECN_5pct_15min	ECN_5pct_20min	ECN_5pct_25min	ECN_5pct_30min	ECN_5pct_45min	ECN_5pct_1hr	ECN_5pct_1_5hr	ECN_5pct_2hr	ECN_5pct_3hr	ECN_5pct_4_5hr	ECN_5pct_6hr	ECN_5pct_9hr	ECN_5pct_12hr	ECN_5pct_18hr	ECN_5pct_24hr	ECN_5pct_30hr	ECN_5pct_36hr	ECN_5pct_48hr	ECN_5pct_72hr
18.2378	17.2323	15.2687	15.8252	14.3405	16.668	17.0021	12.9144	12.3151	8.4237	9.6584	9.4001	4.9255	4.5602	4.6299	5.9171	3.5871	3.1008	4.9793	3.1517



LPoD-1 POST Box & Whisker Plots (72 HR DURATION)

Peak Flow Highlighted Green



LPoD-1 POST Box & Whisker Plots (72 HR DURATION)

Peak Flow Highlighted Green

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

ECN_1pct_10min	ECN_1pct_15min	ECN_1pct_20min	ECN_1pct_25min	ECN_1pct_30min	ECN_1pct_45min	ECN_1pct_1hr	ECN_1pct_1_5hr	ECN_1pct_2hr	ECN_1pct_3hr	ECN_1pct_4_5hr	ECN_1pct_6hr	ECN_1pct_9hr	ECN_1pct_12hr	ECN_1pct_18hr	ECN_1pct_24hr	ECN_1pct_30hr	ECN_1pct_36hr	ECN_1pct_48hr	ECN_1pct_72hr
23.2979	23.0483	21.8923	21.8727	23.1713	20.9648	15.9888	14.357	14.6515	12.4475	9.974	10.7143	12.0511	7.646	5.4895	5.1063	3.9156	4.558	5.7366	2.0902