RIVER MEDWAY (FLOOD RELIEF) ACT 1976

Inquiry into the Environment Agency's Revised Scheme for the Leigh Flood Storage Area, Kent.

Summary Proof of Evidence by Andrew Irvine

1 April 2021

1. My name is Andrew Irvine and my current role at the Environment Agency is Team Leader, Partnerships and Strategic Overview. I am the lead operator for the Leigh Flood Storage Area. I have held the role of the FSA operator for approximately 10 years and the lead operator for 4 years.

2. The FSA is an online flood storage reservoir, regulated under the Reservoirs Act 1975. It has a storage capacity of 5.56 million m^3. The FSA consists of 1.3km long embankment and associated flow control structure consisting of three radial gates spanning the Medway. The impounding area covers an area of 278 hectares stretching from Leigh upstream to Penshurst.

3. The Medway constantly flows though the FSA and the control structure. The control structure influences upstream levels at all times either by automatic gate movement in normal flows or by the intervention of an operator in times of flood flow. The FSA is kept empty until used to store flood water.

4. During non-flood conditions the FSA is designed to operate automatically. The gates will move automatically to maintain water levels between the range of 24.1-24.2m AOD upstream.

5. The FSA is operated in accordance with the Leigh Flood Storage Area Operating Procedures by an Environment Agency operator. The Operating Procedures ensure effective use of the FSA; ensure that the FSA storage volume is not exceeded; and that reservoir safety is maintained at all times.

6. The Operating Procedures set a maximum impounding level which allows for additional freeboard (the gap between the top of the water and the top of the embankment) and state that the reservoir embankment must not overtopped.

7. For the majority of flood events, capturing the peak flows in the FSA is achieved by operating the radial gates to prevent outflow exceeding approximately 75 m^3/s, a fixed flow rate.

8. During larger flood events the FSA operator must take decisions about how the gates are operated and what flows to pass through the structure to optimise the use of the FSA.

9. The Revised Scheme will increase the overall storage volume of the FSA. An experienced operator supported by the Operating Procedures operates the gates flexibly within set parameters. This flexibility enables operators to store flood water effectively for a wide range of flood events.

10. The Operating Procedures define two modes of operation: first, fixed flow when an operating plan is developed based on a fixed outflow of 75m^3/s and second, variable flow when an operating plan is developed based on the operator defining an initial outflow and modifying outflow for the duration of the flood event. There are three fundamental reasons to move to variable flow operation:
    - To conserve reservoir capacity;
    - To reduce flood risk downstream;

- For safety reasons.

11. The operator's positioning of the gates is determined by following the operating plan and aiming to achieve a target outflow for any given event.

12. The relationship between outflow and inflow for the flood duration and the interventions made by the FSA operator determines the volume of water stored within the FSA, the duration of flood water storage and the rate of rise of flood water in the FSA.

13. An FSA operator is on standby 24 hours a day 365 days a year. The operator works within a wider Environment Agency incident response command and control structure. How the FSA is to be operated is recorded in the operating plan during the early stages of a developing flood event.

14. During a flood event the operator records all decisions and communications made in a log book. Key operational data is also recorded within the Reservoir Balance Sheet. The operator also relies upon a suite of forecasting and operational planning tools such as meteorological data and the River Medway Flood Forecast Model. During a flood event the FSA operator must monitor the catchment conditions in the Medway.

15. In the early stages of a flood the operator will produce an operating plan which sets out the likelihood and magnitude of a forecast flood event. It documents how the FSA is intended to be operated to manage the flood using either a fixed or variable flow regime and gives an estimate of the expected duration of impounding and the FSA capacity that will be utilised.

16. In the preceding days to a flood event, which may be up to a week in advance of potential flooding, the operator will use the River Medway Flood Forecasting Model to estimate flood flows. The Model provides an estimated flow and flood level upstream of the FSA.

17. During the flood, the operator switches from using forecast information to using live data of river flows, river levels and rainfall to modify the operating plan. The operator uses a set of operating tools to continually assess the scale of the flood, the available storage volume and the impact upon the resulting outflows from the FSA.

18. The Reservoir Balance Sheet records the operation of the FSA; monitors the storage area, upstream and downstream catchment conditions; and supports the operator in decision making, in particular when to employ fixed or variable operation.

19. Once the decision to operate the FSA to store flood water has been made, the operator will notify upstream landowners.

20. Flooding of land or property may already be occurring upstream of the FSA before impoundment.

21. Once the peak of a flood has passed the FSA is drawn down in the same managed way that it is filled in that the river flow and level data upstream and downstream of the reservoir control structure is monitored and movement of the radial gates made according to the Operating Procedures. The drawdown time of the reservoir will depend on the scale of flood event but will also depend on the outflow used.

22. Two flood events in December 2013 and December 2019 show how we use fixed and variable flows.

23. The December 2013 flood event required the operator to employ the variable flow regime. The 48 hour flood volume was calculated following the event as 21,837,280m^3. The volume of FSA is 5,600,000m^3. This is four times the volume of water that can be stored in the FSA so the operator had to plan when to begin storing water and what outflow was effective to make use of the storage volume without exceeding capacity.

24. While it was not possible to store the entire flood volume it was still possible to make use of the storage volume and reduce the risk downstream. Although there was some flooding of property in Hildenborough and Tonbridge, were it not for the operation of the FSA further properties in this area could have flooded.

25. On 24 December 2013 the FSA began storing flood water from 05:15 reaching a peak flood storage volume at 20:00. Water was stored for approximately 36 hours with complete drawdown of the reservoir by 06:45 on 26 December.

26. This is useful in reviewing the photograph on the first page of Mr Storey's Joint Statement of Case which shows flooding at Rogues Hill Bridge at 09:00 on 24 December. When that photograph was taken, the FSA was just 25% full. The peak flood inflows directly upstream of the FSA were experienced at approximately 10:00. Since the peak flood inflows at the FSA occurred at 10:00 it supports the conclusion that flooding at this location was driven by flooding upstream of Penshurst and not water being stored in the FSA.

27. By comparison, during a more recent flood event in December 2019 the FSA was operated under the fixed flow regime. On this occasion it was only necessary to store flood water to a level of 27.08m AOD, approximately 60% capacity.

28. What is similar to the 2013 event is that the peak of flooding upstream of the FSA was experienced considerably earlier than when the FSA was storing water to its peak.

29. Mr Storey's objection to the Application states that water levels at Bridge House reached their maximum at 19:00 on 20 December. At this time, the FSA was storing water to a level of 25.52m AOD, which is just 18% of the FSA volume. This is some 14 hours before the FSA reached its peak impounding level for this event. This again shows that the onset of flooding at

Bridge House and Rogues Hill is primarily from flood flows directly from the Medway into the flood plain and not as a consequence of storage in the FSA.

30. I have demonstrated here how the FSA is effectively operated under the existing Scheme using the well exercised Operating Procedures in a range of flood events scenarios.

31. The Revised Scheme will not change the overarching operational principles but will require minor updates to the Operating Procedures and the operating tools such as the RBS to incorporate a revised maximum impounding water level. This will enable FSA operators to effectively use the new FSA volume to manage flood events that would previously have resulted in greater flooding in Tonbridge and Hildenborough.

Andrew Irvine