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Barma Water Resources Consulting Pty Ltd



# Focused Review of Floodplain Harvesting Modelling (Macquarie Regulated Valley)

August 2022

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# Executive Summary

Barma Water Resources Consulting was engaged by the NSW Department of Planning and Environment to undertake a focussed review of the modelling of floodplain harvesting diversions for several properties in the Macquarie Regulated Valley below Warren. The review was limited to three specific modelling issues. These were:

- Modelled Flood Mitigation Zone Operation
- Modelled Marebone Overbank Flow Behaviour
- Modelled Irrigator User Planting Behaviour

Based on the review the following conclusions can be made with respect to the modelled estimates of floodplain harvesting diversions for the seven focus properties.

## Sensitivity Assessment

- \* Without any changes, the model currently overestimates flow frequency and floodplain harvesting access at Marebone.
- \* Both Flood Mitigation Zone (FMZ) operation and planting behaviour sensitivity assessment results in small increases in floodplain harvesting diversions for selected users (below 10%).
- \* Importantly floodplain harvesting diversion increases for focus farms also result in decreases for some other users.
- \* At the valley scale floodplain harvesting diversions increased by 1.8% (area sensitivity assessment)
- \* At the valley scale floodplain harvesting diversions increased by 1.3% (flood operation sensitivity assessment)

## Model Improvement

- \* Any incorporation of the changes evaluated in the sensitivity assessment would require recalibration in the model.
- \* Any recalibration will likely reduce magnitude of floodplain harvesting diversion alteration shown in the sensitivity assessment since any increases in differences between observed and simulated diversions and flows caused by changes in planting behaviour or flood mitigation zone operation will need to be corrected.
- \* Differences in modelled floodplain harvesting diversions and those expected by water users are more likely to be caused by behavioural practices that are not captured in the model. For example, storing water in temporary storages. Evidence of these practices would need better quantification before they could be incorporated into the model.

## Recommendation

- \* On balance given the small changes in flood plain harvesting diversions produced by the sensitivity assessment, it is recommended that no changes should be made to the planting behaviour or flood mitigation zone operation contained in the model

# 1. Introduction

Barma Water Resources Consulting was engaged by the NSW Department of Planning and Environment to undertake a focussed review of the modelling of floodplain harvesting diversions for several properties in the Macquarie Regulated Valley below Warren. The review was limited to three specific modelling issues. These were:

- Modelled Flood Mitigation Zone Operation
- Modelled Marebone Overbank Flow Behaviour
- Modelled Irrigator User Planting Behaviour

The review covered modelling associated with seven properties:

- M040
- M052
- M029
- M031
- M061
- M074
- M006

Review findings and conclusions are presented in Sections 2 and 3 of this report.

## 2. Review Findings

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### Flood Mitigation Zone Operation

The performance of the model in replicating storage and release behaviour in the Burrendong Dam Flood Mitigation Zone (FMZ) during several historic floods was reviewed. A concern was raised that if the model released water too quickly from the FMZ when compared to observed behaviour that floodplain harvesting access for users below Warren would be underestimated. This in turn would result in an underestimation of floodplain harvesting diversions.

Comparisons of modelled and observed FMZ storage behaviour are presented in Figure 1 to Figure 6. Modelled results are shown for both the Eligible Works IQQM model and the Current Conditions IQQM model. The figures indicate that there are a number of occasions in which observed volumes seem to be held in the FMZ for about 4 weeks longer than modelled.

In order to determine the effect that longer FMZ storage times would have on floodplain harvesting diversions for the focus properties, a sensitivity analysis of Burrendong Dam FMZ release rates was performed. The results of this are presented in Table 1. The sensitivity assessment results indicate that holding volumes in the FMZ will increase floodplain harvesting diversions for six of the seven focus properties. However, the percentage increases are small. Importantly, although not shown in this table these changes in FMZ releases behaviour cause reductions in floodplain harvesting diversions for properties further upstream. The net effect across the total valley is an increase in floodplain harvesting diversions of just 1.3%

Table 1 - Change in Floodplain Harvesting Diversions (FMZ Sensitivity Assessment)

	<b>Percentage Difference</b>
<b>Property</b>	<b>Drawdown Sensitivity</b>
M040	3.5
M052	4.1
M029	3.6
M031	3.4
M061	11
M074	6.4
M006	-5.2

Figure 1 - FMZ Storage Behaviour - Event 1

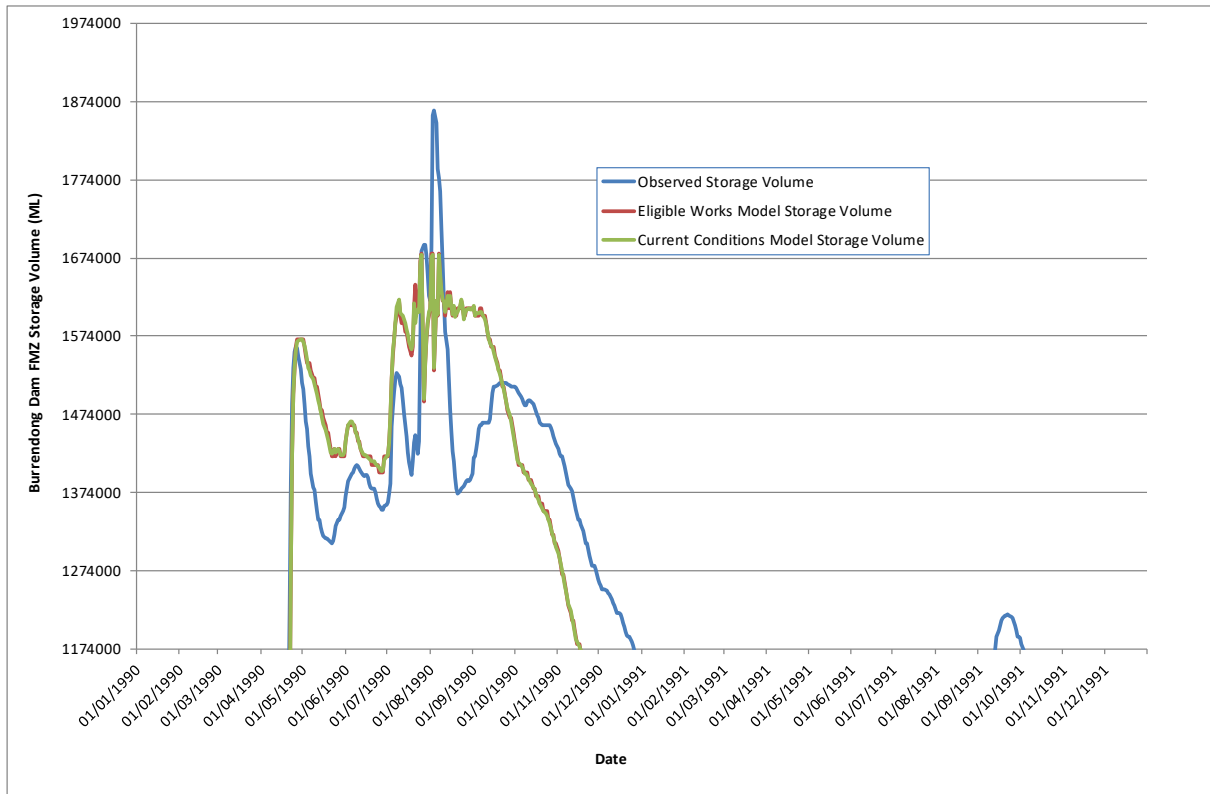


Figure 2 FMZ Storage Behaviour - Event 2

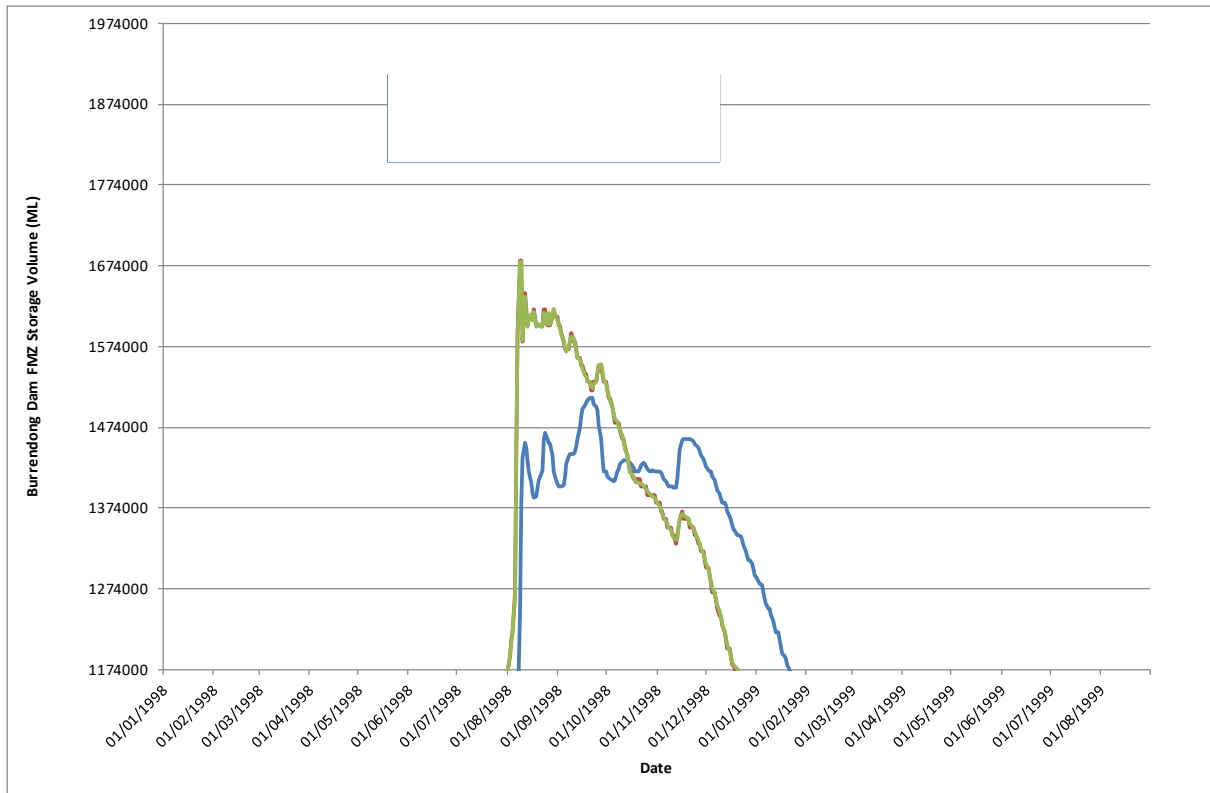


Figure 3 FMZ Storage Behaviour - Event 3

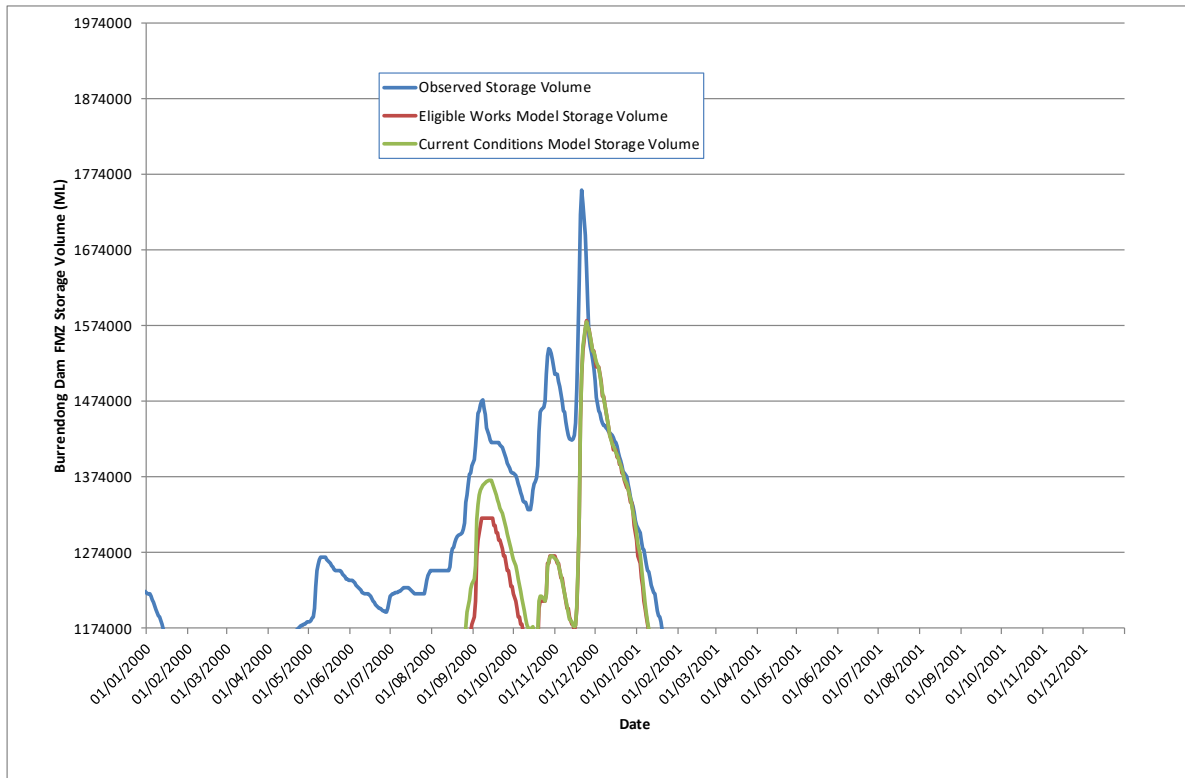


Figure 4 FMZ Storage Behaviour - Event 4

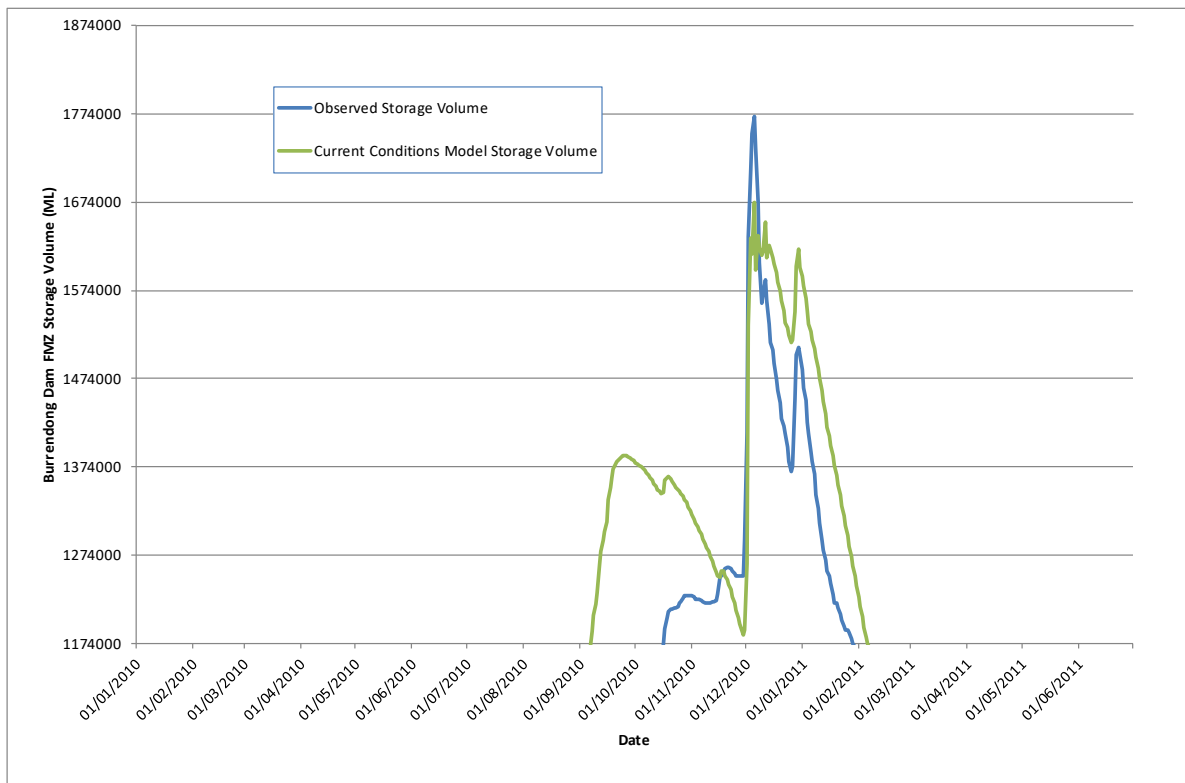


Figure 5 FMZ Storage Behaviour - Event 5

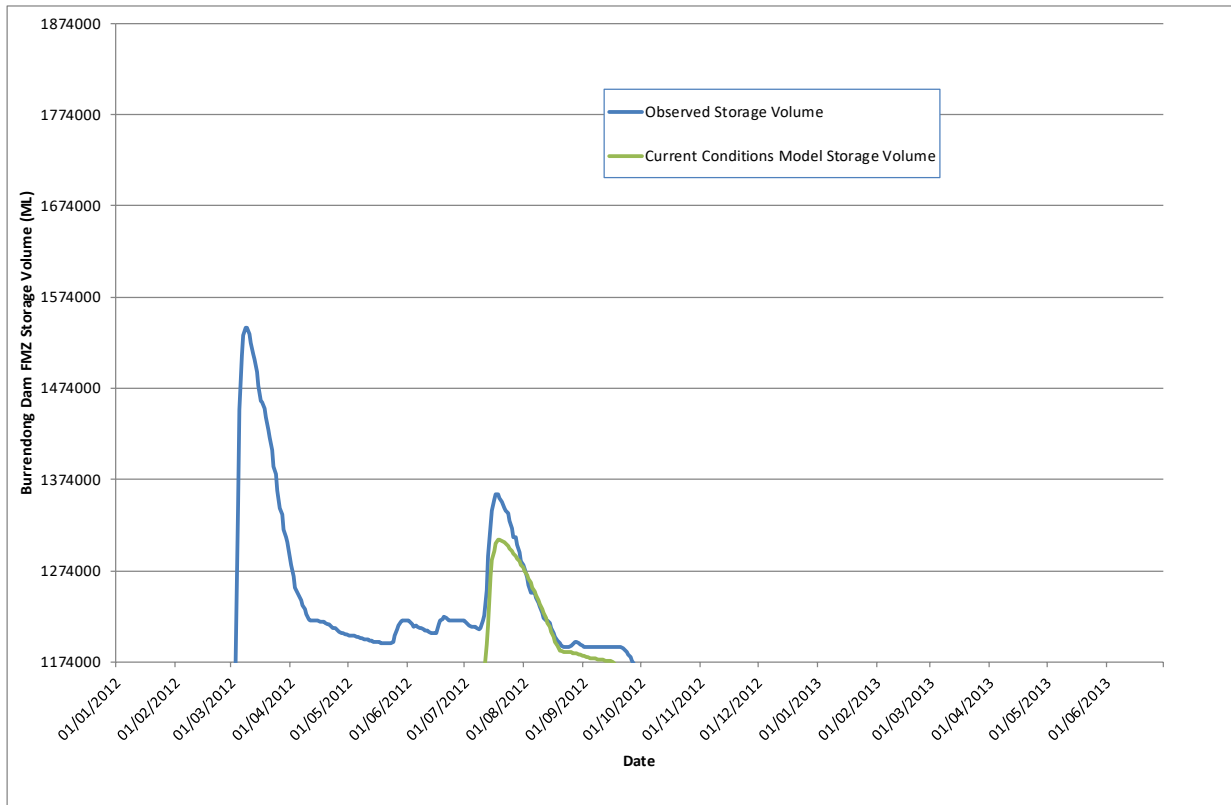
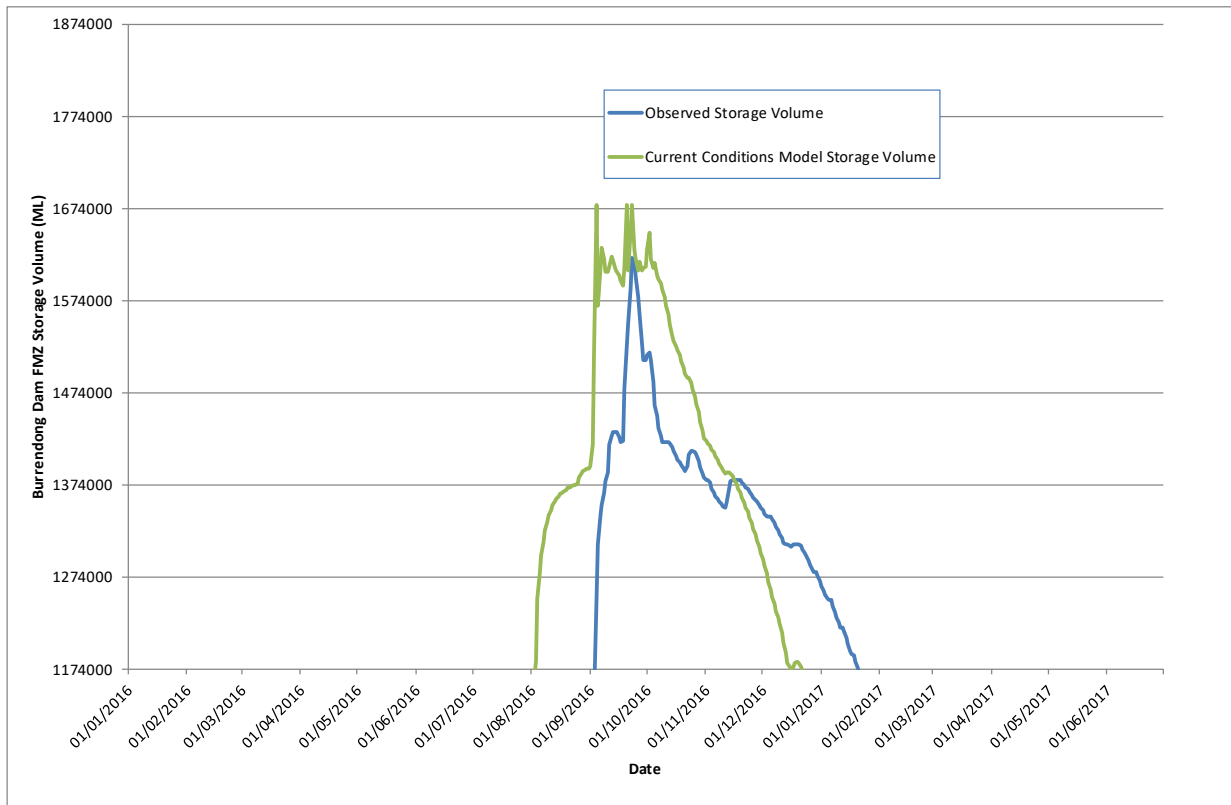


Figure 6 FMZ Storage Behaviour - Event 6





## Frequency of Overbank Flows at Upstream Marebone

The model is configured so that when flows upstream of Marebone exceed 3,500ML/D focus properties have access to floodplain flows. An assessment of how the frequency of access using this metric compared for the model and observed flows has been undertaken. Results are presented in Table 2 and Figure 7. Table 2 also includes information provided from two focus farm users.

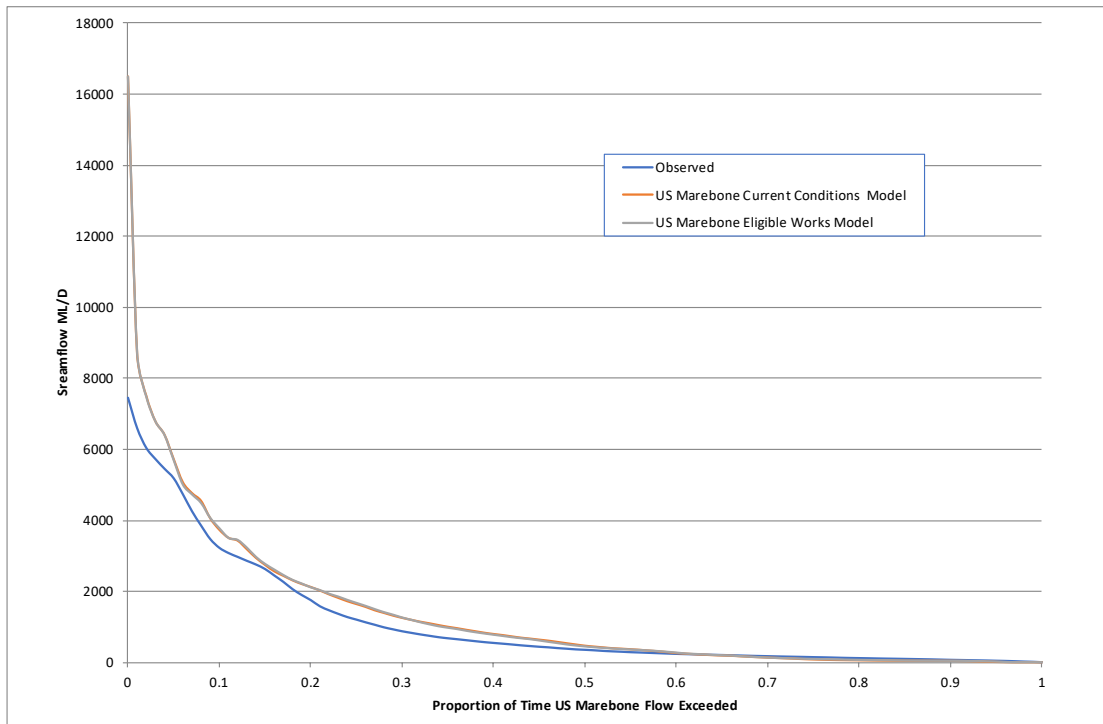
A number of observations are apparent from the results in Table 2 and Figure 7. Model simulated flows at Upstream Marebone occur more frequently than observed flows. This means that the model appears provides more access to floodplain harvesting flows than observed for the focus properties. This also remains true when modelled flows are compared to the data provided for focus farms by water users.

Given that the model appears to overestimate observed flows upstream of Marebone, no additional assessment of the model performance in simulating flows at Marebone, and the effect on floodplain harvesting diversion estimates was deemed necessary.

Table 2 - Upstream of Marebone Days Above 3,500ML/D

<b>Days above 3,500ML/D at US Marebone</b>	<b>1990/91</b>	<b>1998/99</b>	<b>2000/01</b>	<b>2010/11</b>	<b>2012/13</b>	<b>2016/17</b>
Observed Flows (US Marebone Bk)	135	127	91	131	60	111
US Marebone Current Conditions Model	153	174	144	184	53	179
US Marebone Eligible Works Model	151	177	140			
User Supplied Data- Marebone (Days of Access Provided Data)	210	150	90	70	45	150
User Supplied Data - Fairview (Days of access Provided Data)	40	60	20	21		21

Figure 7 - Upstream Marebone Flow Duration Curve



## Planting Behaviour Analysis

### Summer Areas

The model plants a summer cotton crop on a nominated planting date. The area planted is based on assessment of water available at the planting date, and expected resource available during the planting season. The area planted is constrained by the maximum developed area of the farm. A comparison of modelled summer planted areas was made with observed areas for each focus farm. A combined comparison was also made. Comparison results for each individual focus farm are presented in Appendix 1. Results for the combined focus farms are presented below. In Figure 8 and Figure 9

1. The blue bars represent Cotton Areas determined from Satellite imagery
2. The orange bars represent Cotton Areas determined from the eligible works model
3. The yellow bars represent Cotton Areas determined from the current conditions model

The results of Figure 8 indicate that the model appears to over predict summer cotton areas in years where the resource is plentiful, but under predict areas in years of resource scarcity. This trend was also observed for individual focus farms as shown by the results in the attached Appendix.

In order to determine the effect of this on flood plain harvesting diversions the planting decision in the model was modified by increasing the minimum planted summer area. The results of this are shown by the green bars in Figure 9. The results indicate an improvement in the match between modelled summer planted areas and those observed from Satellite imagery. The effect of this on floodplain harvesting diversions was determined after an assessment of winter area production.

## Winter Areas

The model plants little to no winter areas. This is mainly due to the length of the Cotton growing season, assumed planting dates and developed area constraints within the model meaning that double cropping cannot take place. There was no satellite imagery available at the time of this review to verify water users winter planting behaviour. Further effort in obtaining observed winter planted area information should be made by the Department.

In order to evaluate the effect of incorporating larger planted and irrigated winter areas in the model the maximum area constraint was removed so as to allow double cropping to occur. The effect of this together with the modified summer planting decisions is presented in the next section.

## Effect on Floodplain Harvesting Diversions

The combined effect of altering the modelled summer planting behaviour and allowing increases winter cropping on floodplain harvesting diversions is shown in Table 3. Floodplain Harvesting diversions increase for five of the seven focus properties. As with the FMZ sensitivity assessment, increases for Focus Farms are also accompanied by some decreases at other properties, with the net effect being a nett valley increase in floodplain harvesting diversions of 1.8%.

Figure 8 - Summer Planted Areas

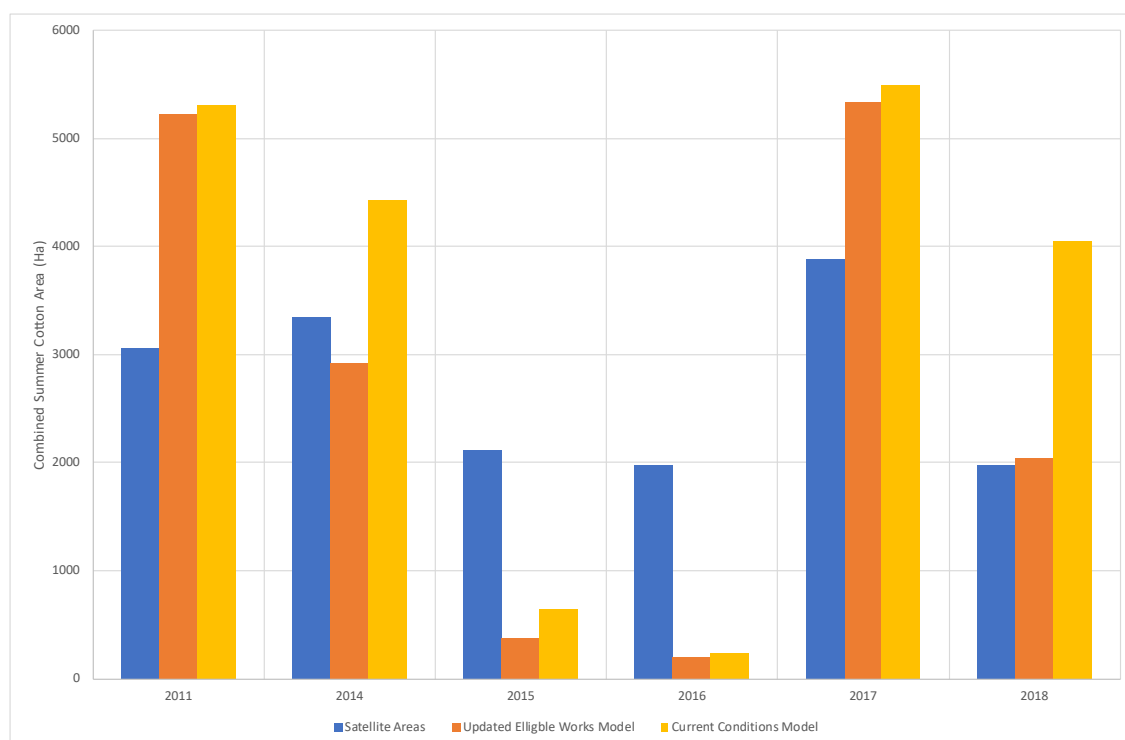


Figure 9 - Summer Planted Areas (Sensitivity)

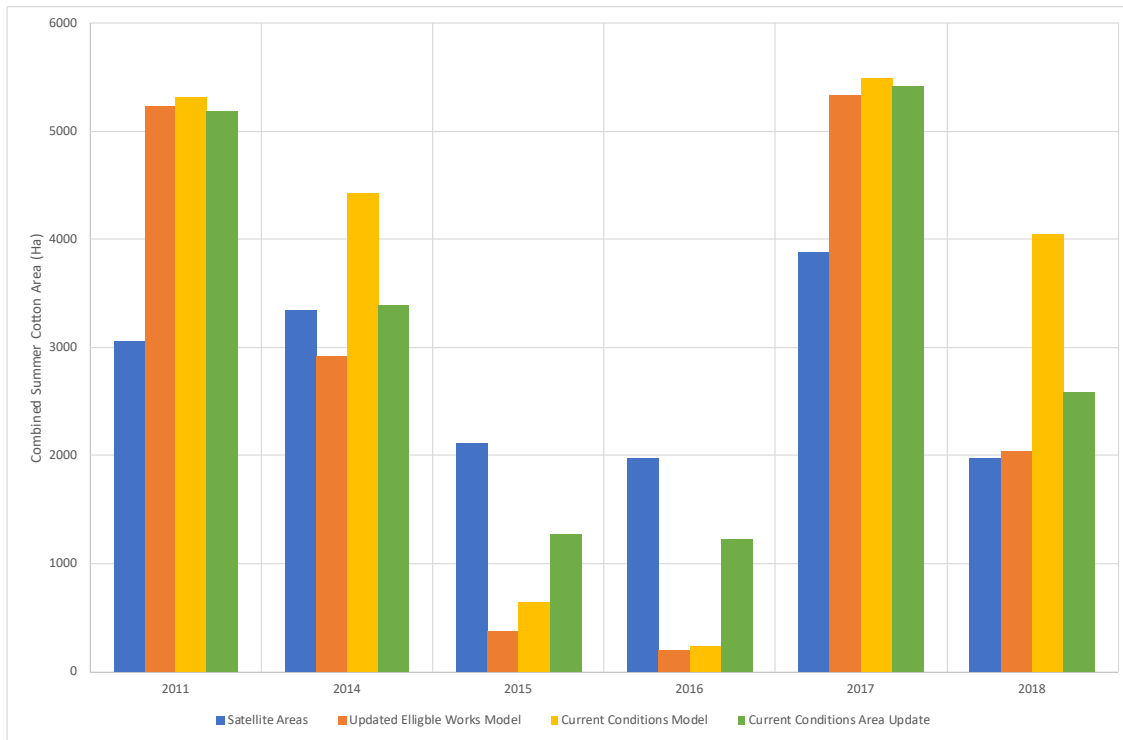


Table 3 - Change in Floodplain Harvesting Diversions (Planted Area Sensitivity Assessment)

	Percentage Difference
Property	Area Sensitivity
M040	-2
M052	8.8
M029	3.2
M031	4.6
M061	1.1
M074	-0.1
M006	2

# 4. Review Conclusions and Recommendations

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## Conclusions and Recommendations

Based on the analysis and findings in the preceding Chapter the following conclusions can be made with respect to the modelled estimates of floodplain harvesting diversions for the seven focus properties.

### Sensitivity Assessment

- \* Without any changes, the model currently overestimates flow frequency and floodplain harvesting access at Marebone
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### Recommendation

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# Appendix 1

