

Date: 1 August 2007
 To: Warwick Pascoe
 From: Ian Fraser, Stephen Douglass
 Subject: Memo of Mike Thorley, ECan, dated 27 July 2007, re HDIS

Meridian Energy and South Canterbury Irrigation Trust have asked URS to clarify if there is a difference due to the ECan water balance model interpretation and what has been used in the Hunter Downs Irrigation water balance.

Mike Thorley of Environment Canterbury reviewed the URS Supplementary Mass Balance Modelling Assessment (28 June 2007), and made specific comments regarding the quantitative check and balance undertaken on the Mass-Mixing Modelling Assumptions presented by URS, and the ECan estimates of groundwater recharge provided in Report U07/09. Mr Thorley highlights an error contained in the URS report relating to the additional drainage that is expected to occur under an irrigated land scenario. This error was due to the incorrect interpretation of the ECan report regarding the drainage modelling and runoff calculations. It was not clear that the drainage depths for the dry land and irrigated scenario's needed to be combined.

The following provides a brief update on the implications of this misinterpretation of the ECan drainage volumes with respect to the URS report's overall conclusions with regard to the Mass-Mixing Model.

The URS check and balance assessment used the Pareora catchment as a case study. The assessment provided comparisons between the modelled drainage depths for dryland and irrigated land, and the various assumptions regarding the pathways of drainage water (and the associated nitrate flux) for areas of downlands (loess deposits) and lowlands (alluvial flats).

Drainage Water Lost to Groundwater on the Downlands (Loess)

In the original assessment URS stated that the differences between the drainage water being lost to groundwater under dryland loess and irrigated loess between the URS scenario and the ECan scenario were minor. However, the misinterpretation of the ECan irrigated drainage water results in the URS/GPF drainage figure for irrigated loess (downlands) being 42mm/year less than the ECan drainage figure of 100mm/year for irrigated land (see Table 1).

Table 1: Modelled Drainage Depths under the Downlands (Loess) – Pareora Catchment

Scenario	URS	ECan (U07/09)
Dryland (Loess)	24mm/year	35mm/year
Irrigated (Loess)	58mm/year (20% irrigated drainage from GPF)	100mm/year

Drainage Water Lost as Runoff from the Downlands (Loess) to the Lowlands (Alluvial Flats)

URS mistakenly interpreted the ECan calculations for runoff of drainage water on the downlands (which arises through limiting infiltration on the downlands to 3mm/day) were in isolation from the drainage depths calculated for dryland areas. However, URS now understand that the ECan drainage volume is cumulative, in so far as the volume needs to be added to the dryland drainage volume. As ECan calculated a drainage depth for water that was treated as runoff, it was believed that this value was a discrete value. Nevertheless, the error which originally resulted in the URS modelled drainage runoff of 230mm/year being approximately 100mm/year more than the ECan value, now results in the URS value being slightly less than the ECan value (as shown in the tables below).

Table 2: ECan Excess Drainage Figures for Loess Deposits (Pareora Catchment)

Land Use	Excess Drainage (x10 ⁶)	Land Area (Ha)	Drainage per hectare per year	Drainage per unit area
Dryland	14.96	11,947 ¹	1252.2m ³ /ha/yr	125mm/yr
Irrigated	0.99	762	1299.2m ³ /ha/yr	130mm/yr
Total Irrigated	15.95	11,947		255mm/year

¹ Note: the dryland excess drainage figure is based on the entire catchment area run through the model as being dryland. The 762Ha of irrigated land is already counted in the 11,947Ha of the total catchment, and a dryland drainage figure has also been calculated for this area. Hence, the two values need to be added together. A full description of the ECan methodology would greatly assist in determining the relative contributions of the dryland recharge versus irrigated recharge.

Table 3: Difference between URS and ECan drainage runoff from the Downlands

Scenario	URS	ECan (U07/09)
Total Dryland Runoff (Loess)	78mm/year	125mm/year
Total Irrigated Runoff (Loess)	230mm/year	255mm/year

The ECAN data suggests a total drainage from irrigation of 355 mm y⁻¹ (100 mm as drainage and 255 mm as runoff). The irrigation drainage rates used in the URS report range from 217 to 361 mm y⁻¹, the range is because of the range of soil PAW, rainfall and irrigation type. An average rate of 288 mm y⁻¹ has been used on the downlands by URS with 80% subsequently designated to runoff to the alluvial valleys and 20% to deep infiltration or ponding with subsequent evaporation.

The calculated runoff/excess drainage water by ECan is more than the URS/GPF calculated runoff figures for the dryland and irrigated land scenarios. The disparity between the dryland runoff drainage depth that URS has used was presented in the original report. However, the sum of the two drainage components that ECan uses results in the irrigated runoff drainage depth increasing from 130mm/year to 255mm/year for the Pareora catchment, and is consistent with the URS volume.

The new runoff figure for the ECan data indicates that the URS/GPF modelled figures are in the appropriate range, and given that the URS has calibrated the Mass-Mixing model based on actual nitrate data in the catchment, the assumptions of the modelling appear to be supported by the ECan soil-moisture balance model.

Overall from a mass balance nutrient modelling viewpoint there is very little difference between that ECAN and URS derived figures.