KUR-World

Appendix 4a

Effluent Irrigation Study

Environmental Impact Statement

Environmental Approval & Compliance Solutions

KUR-World Effluent Irrigation Feasibility Study

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17 November 2017

Reever & Ocean Pty Ltd
PO Box 4949
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Attention: Mark Lawson, Project Manager

Dear Mark

RE: KUR-World Effluent Irrigation Feasibility Study (R02 version)

Please find enclosed the KUR-World Effluent Irrigation Feasibility Study (R02 version). The R02 version supersedes and replaces all previous versions prepared.

Thank you for the opportunity to assist with this project. If you have any questions regarding the enclosed document, please do not hesitate to contact me on (07) 4034 5300 or andrew@natres.com.au.

Yours sincerely
NRA Environmental Consultants

Andrew Butler
Principal Environmental Scientist

Encl: KUR-World Effluent Irrigation Feasibility Study (R02 version)

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NRA Environmental Consultants

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Report Summary	
Key Words	KUR-World, soil, effluent irrigation, MEDLI, surface water
Abstract	The scope of works for the KUR-World Effluent Irrigation Feasibility Study is based on the terms of reference (TOR) for an environmental impact statement: KUR-World Integrated Eco-Resort, October 2016. The report addresses item 10.28(d) of the TOR.

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1. Introduction

1.1 Context

KUR-World is an 'Integrated Eco-Resort' proposed by Reever and Ocean Developments Pty Ltd (R&O). The project site is near Myola, 2.5 km east of Kuranda in the Mareeba Shire. The site comprises 12 titles[1] and covers an area of approximately 680 ha[2] comprising rainforest, regrowth forest and woodland, watercourses and pasture (**Figure 1**).

Preliminary investigations and feasibility works were completed in late 2015. A formal application seeking consideration of the KUR-World Integrated Eco-Resort project ('the project') as a 'Coordinated Project' was submitted on 30 May 2016. The project was subsequently declared a 'Coordinated Project' for which an Environmental Impact Statement (EIS) is required. A final Terms of Reference (TOR) for the EIS was released on the 18 October 2016.

1.1.1 Project description

KUR-World Integrated Eco-Resort will include a combination of short-term and permanent residential options, as well as education, recreation, wellbeing/rejuvenation and rural tourism facilities. The current master plan (Version G, 29 September 2017) features four sequential development stages over 7.5 years commencing in 2018 (**Figure 2**).

Stage 1A (2018):

- Farm Theme Park and Equestrian Centre (Phase 1)
- Residential Precinct: Queenslander Lots (21 lots)
- Organic Produce Garden
- Services and Infrastructure (Phase 1)
- Environmental Area (Phase 1).

Stage 1B (2019-2020):

- Farm Theme Park and Equestrian Centre (Phase 2)
- Residential Precinct: Lifestyle Villas (56 lots)
- Open Space
- KUR-Village (Phase 1)
- Four Star Business and Leisure Hotel and Function Centre (Phase 1, 60 rooms)
- Residential Precinct: Premium Villas (39 lots)
- Rainforest Education Centre and Adventure Park
- Services and Infrastructure (including a sewerage treatment plant, access road from Haren Road to Rainforest Education Centre) (Phase 2)
- Environmental Area (Phase 2).

Stage 2 is planned to start immediately after the completion of Stage 1 and be constructed

[1] The property data presented is based on the publicly available DNRM tenure data at the time of reporting. A submission has been made and is currently being processed by the Department of Natural Resources and Mines (DNRM) to combine lots and remove road easements within the project area (*pers. comm.* Stephen Whitaker, Planner, Cardno, 11 October 2017).

[2] This is the total land area within the proposed property boundary, including easements and road access area

over a further two year period from 2021-2022. Stage 2 will include:

- KUR-Village (Phase 2)
- Four Star Business and Leisure Hotel and Function Centre (Phase 2, 210 rooms)
- Sporting Precinct
- Golf Club House and Function Centre
- Golf Course
- Residential Precinct: Premium Villas (154 lots and 60 units)
- Services and Infrastructure (Phase 3)
- Environmental Area (Phase 3).

Stage 3 is planned to start immediately after the completion of Stage 2 and be constructed over a one year period in 2023-2024. Stage 3 will include:

- Health and Wellbeing Retreat (60 rooms)
- Residential Precinct: Premium Villas (93 lots)
- Five-Star Eco-Resort (200 rooms)
- KUR-World Campus
- Services and Infrastructure (Phase 4)
- Environmental Area (Phase 4).

1.1.2 Site description

The project area comprises 12 lots (all zoned rural under the Mareeba Shire Council (MSC) Planning Scheme July 2016 (MSC 2016). Details of each lot are provided in **Table 1** and shown on **Figure 1**.

Table 1: Lots comprising the project area

Lot/Plan*	Area (ha)
Lot 22 N157227	37.26
Lot 1 RP703984	16.19
Lot 2 RP703984	48.31
Lot 17 N157227	57.71
Lot 18 N157227	63.01
Lot 19 N157452	39.60
Lot 95 N157452	34.05
Lot 20 N157423	70.62
Lot 131 N157491	64.75
Lot 129 NR456	65.89
Lot 43 N157359	64.51
Lot 290 N157480	64.75

Source: State of Queensland (Department of Natural Resources and Mines (DNRM)), 11 October 2017.

*The property data presented is based on the publicly available DNRM tenure data at the time of reporting. A submission has been made, and is currently being processed by the Department of Natural Resources and Mines (DNRM), to combine lots and remove road easements within the project area (*pers. comm.* Stephen Whitaker, Planner, Cardno, 11 October 2017). This excludes easements that may occur between lots.

The northern portion of the project area is characterised by low undulating rises dissected by steep gullies. The topography in this area varies between 340 m Australian Height Datum (AHD) to 360 mAHD. Historical aerial photograph interpretation shows the majority of the northern portion (Lots 1, 2, 17, 18, 19 and 22) was largely or partially cleared of vegetation during a number of clearing episodes commencing prior to the 1940s and continuing until the early 1990s. No large scale clearing occurred between the early 1990s and 2014, when approximately 46 ha of regrowth were cleared to re-establish pasture.

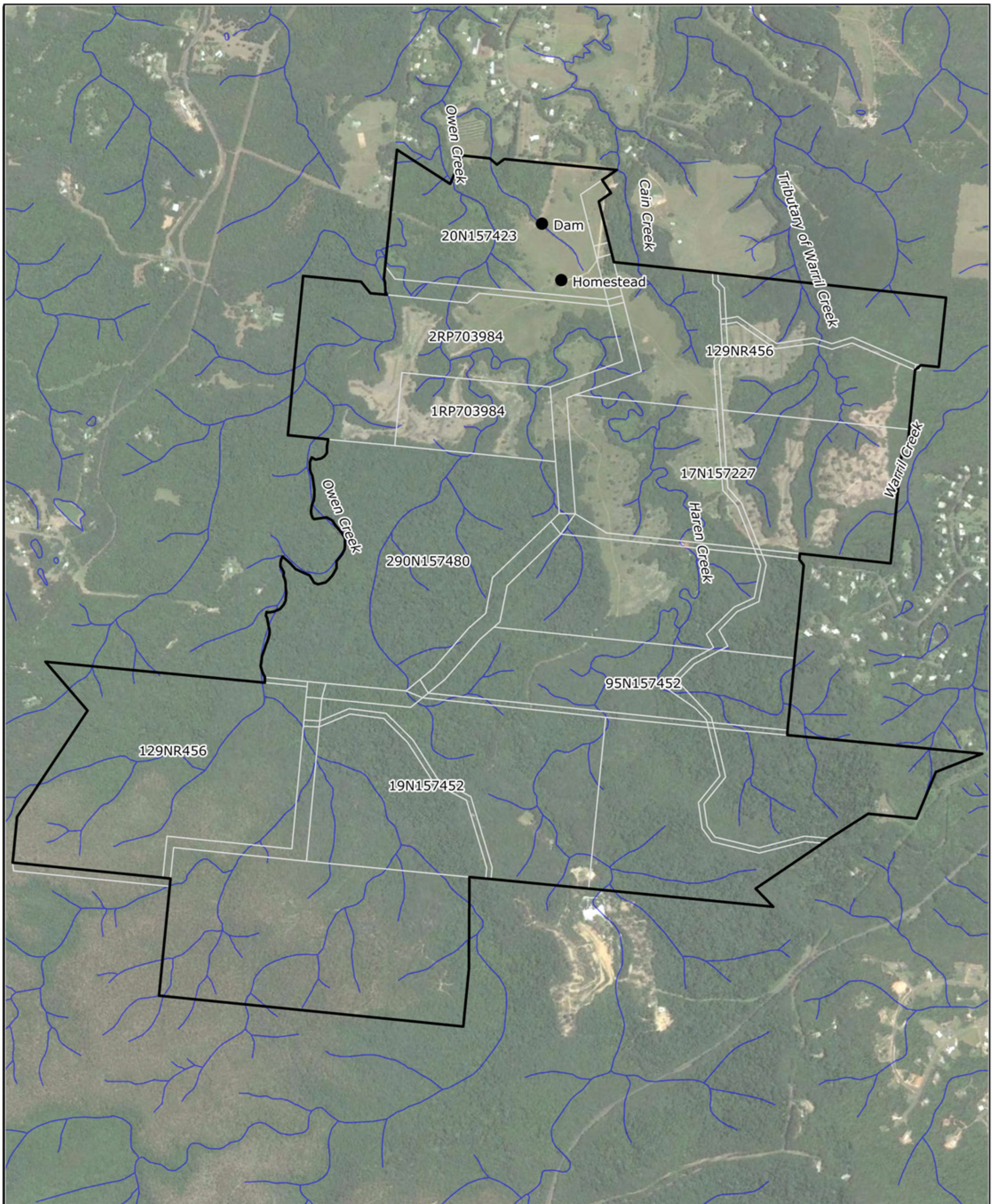

Figure 1: KUR-World project area

Project: KUR-World Effluent Irrigation Feasibility Study

KUR-World project area

Lot boundary

Drainage

N

0 500 1000

metres

Source:
© State of Queensland (Department of Natural Resources and Mines) 2017. Updated data available at http://qldspatial.information.qld.gov.au/catalogue//, Google Earth

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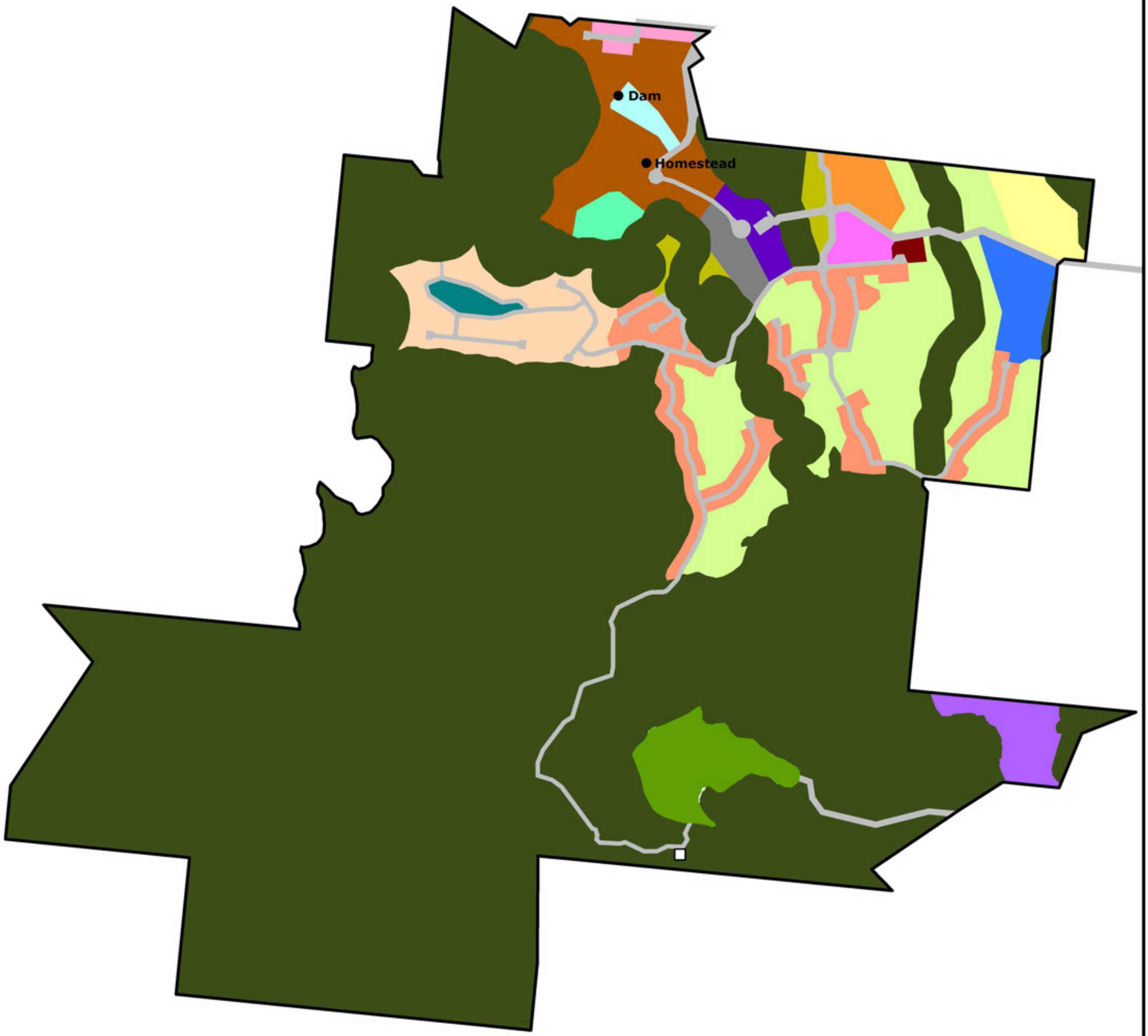

Figure 2: KUR-World master plan

Project: KUR-World Effluent Irrigation Feasibility Study

Kur-World project area

KUR-World Masterplan Revision G

Lifestyle Villas
Queenslander Lots
Premium Villas
KUR-Village
Five Star Eco Resort
Golf Course
Golf Clubhouse and Function Centre
Business and Leisure Hotel and Function Centre
Health and Wellbeing Retreat
Sporting Precinct
Farm Theme Park and Equestrian Centre
KUR-World Campus
Rainforest Education
Open Space
Produce Garden
Glamping
Service / Infrastructure
Dam
Road
Helipad
Environmental Area

N

0 500 1000

metres

Source:
© State of Queensland (Department of Natural Resources and Mines) 2017, Updated data available at http://qldspatial.information.qld.gov.au/catalogue//

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Date: November 2017

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Current development comprises a homestead, cattle yards, animal enclosures, a dam and a weir on Haren Creek. New fencing has been constructed since 2014 and a number of paddocks established. Cattle have access to creeks for watering.

The two largest streams within the project area traverse the northern section: Owen Creek (along the western boundary) and its tributary, Haren Creek. A tributary of Warril Creek arises in the eastern section of the site and the headwaters of Cain Creek lie inside its northern boundary (**Figure 1**).

Grazing of cattle and horses is occurring on all cleared areas within the northern portion. While many of the paddocks are fenced to the top of the creek banks, cattle ingress to waterways is still occurring in places, resulting in trampling of riparian zones.

The southern portion of the site (Lots 20, 43, 95, 129, 131 and 290) is generally characterised by gently to steeply inclined topography (between RL 340 mAHD to RL 430 mAHD) dissected by a number of smaller waterways. Remnant vegetation dominates this area, with aerial photograph analysis suggesting a lack of recent clearing activity (at least since the 1930s). Small areas of historical disturbance are evident in Lots 43, 95, 129 and 131.

All-Terrain Vehicle tracks occur within the southern portion, in particular within Lots 29 and 131. Lot 129 displays disturbance impacts from an outdoor activity (Paintball) venue encroaching from beyond the southern boundary of the project area.

1.2 Scope

The scope of works for the KUR-World Effluent Irrigation Feasibility Study is based on the requirements outlined in the letter *Request for an expanded fee proposal to address additional elements in relation to the Terms of reference for an environmental impact statement: KUR-World Integrated Eco-Resort, October 2016*. The report is to address the following item from the TOR.

10.28(d). The proposed disposal and/or re-use of the treated effluent and the management of such use. An irrigation plan should be provided detailing where the use of treated effluent is likely. Details of the likely impacts of treated effluent on groundwater quality should also be provided.

It is understood that the Kuranda waste water treatment plant (WWTP) has insufficient capacity to receive waste water from KUR-World and that, at full development during peak demand, there may be a shortfall of raw water for non-potable uses (such as for Golf Course irrigation). Waste water will therefore be treated on-site (via a purpose built WWTP from Stage 1B onwards) and treated waste water effluent is considered an important resource for supplementing non-potable water supply.

NRA has undertaken work to assess the suitability of the site for effluent irrigation, the capacity of the plant soil system to assimilate the nutrients and salt applied (and potential risks to groundwater quality) and the capacity of the effluent irrigation systems to utilise the effluent generated by the project.

2. Methods

Determining the feasibility of using effluent for land irrigation requires an assessment of the suitability of the land for receiving effluent irrigation and an assessment of the capacity of the soil/plant system to assimilate inputs (water, salt and nutrients) from effluent application in the long-term.

2.1 Suitability of land for disposal of treated effluent through irrigation

Data on topography and soil types documented in the *KUR-World Geology and Soils Technical Report* (NRA 2017c) has been used to assess site suitability for irrigated land use. The assessment methods used to determine land suitability for receiving treated waste water are based on those used for effluent or water treatment waste disposal on land (such as DPI NSW 2004, EPA NSW 2000, Hazelton & Murphy 2007) and agricultural land suitability protocols (for example, in Malcolm *et al*. 1999). This includes considerations of:

- topography and landform including slope (associated with risks of generating run-off and accelerated soil erosion[3])
- soil characteristics (associated with depth, drainage, physico-chemical characteristics, susceptibility to erosion)
- buffer zones (particularly around waterways).

The following terms are used, where required, to differentiate between acceptable and unacceptable properties (after Bond 2002).

- Severe limitation (limitation so great that no waste water irrigation should be considered).
- Moderate limitation (irrigation will require careful management or site preparation).
- Slight or no restrictions (no significant limitations to irrigation).

Moderate limitations can be overcome with appropriate management, but any property that indicates a severe limitation is unsuited to effluent irrigation.

2.1.1 Soil physical and chemical properties

Soil depth

Soil depth should be sufficient to store the water applied so that plants can access it. Without careful irrigation control, the water holding capacity of the soil can be exceeded, resulting in deep percolation or subsurface flow on slopes, particularly where weathered parent material has a low permeability. The following classes based on DPI NSW (2004) and Hazelton and Murphy (2007) have been used.

- Soil profile depth >1 m – slight or no limitation.
- Soil profiles depth 0.5 m-1.0 m – moderate limitation
- Soil profile depth <0.5 m – severe limitation.

[3] Erosion risk will be mitigated by applying irrigation to either established grazing paddocks or amenity turf. Both provide a high degree of groundcover, which minimises erosion risks from irrigation application.

Soil drainage properties

Extremes of hydraulic conductivity (KSat) can result in excessive run-off, waterlogging or leaching. Hazelton and Murphy (2007) proposed the following classes based on the top 1 m of soil.

- KSat 20-80 mm/hr – slight or no limitation.
- KSat 5-20 mm/hr or 80-150 mm/hr – moderate limitation.
- KSat <5 mm/hr or >150 mm/hr – severe limitation.

Soil salinity and sodicity

The soils are non-saline and non-sodic, and no assessment was necessary for these potential limitations. The risk of salt accumulation as a result of effluent irrigation is modelled as part of the plant soil system capacity assessment described in **Section 2.2** below.

Nutrient retention capacity

DPI NSW (2004) and Hazelton and Murphy (2007) proposed limitation classes for soil cation exchange capacity (CEC) on the basis that soils used for effluent irrigation should have good capacity for nutrient retention to minimise the potential for leaching. The KUR-World WWTP is expected to produce low strength effluent (via tertiary treatment). Some of the key nutrients in tertiary treated effluent (namely orthophosphate and nitrate) are negatively charged and are not retained on negatively charged soil exchange sites measured by CEC. The potential for phosphate retention and the leaching of nitrate and phosphorus under effluent irrigation is modelled as part of the plant soil system capacity described in **Section 2.2** below, and soil CEC has not been used as a measure of site suitability.

2.1.2 Topography

Hazleton and Murphy (2007) provide slope classes for effluent irrigation. For sprinkler irrigation, slopes of between 6-12% or >12% are considered to have moderate or severe limitations respectively. Trickle irrigation is better suited to steeper slopes (DPI NSW 2004) and can be considered on slopes of 20%. The New South Wales biosolids guidelines (EPA NSW 2000) recommend biosolids should not be applied to agricultural land where slopes are >18% because of risks associated with run-off from the application site. Provided there is good ground cover (such as that provided by turf or pasture), water erosion is unlikely to be a limitation in slopes of below 8% and would be expected to be a severe limitation in slopes >35% (Malcolm *et al*. 1999).

The following classes have been developed considering the landscape setting and proposed land use at KUR-World.

- Slopes up to 12% – slight or no restriction.
- Slopes 12 – 20% – moderate limitation.
- Slopes >20% – severe limitation.

2.1.3 Buffers

Buffers around water courses are required to protect known conservation values. Buffers have been determined based on protection of habitat and water quality. The habitat buffers applied are based on those identified in the Flora and Fauna Technical Report (NRA 2017b).

There is no guidance in Queensland on the necessary buffer distances between effluent irrigation and watercourses. In New South Wales (DPI NSW 2004), site-specific buffers are recommended for low order streams and intermittent watercourse like those at KUR-World.

NRMMC *et al.* (2006) states that vegetated buffer strips of 2-30m are effective in reducing sediment transport from agricultural land.

The potential of run-off from irrigated areas entering watercourses will be managed by irrigation scheduling (see further discussion in **Section 2.2.5**). In many locations, because of the steep sided nature of drainage lines, areas immediately adjacent to the drainage lines would not be regarded as suitable for irrigation. However, a buffer set back of 10 m from water courses has been applied to protect other areas. This is also consistent with policies limiting vegetation clearance around low order watercourses in the Queensland *Vegetation Management Act* 1999.

2.2 Soil plant system capacity

The model for effluent disposal using land irrigation (MEDLI V2.0) developed by the Queensland Department of Science, Information Technology and Innovation (DSITI) has been used to assess the feasibility of using effluent irrigation at KUR-World. It has also been used to simulate different management scenarios to optimise resource recovery and minimise off-site impacts.

The following sections detail the inputs and assumptions made during MEDLI modelling.

2.2.1 Location and climate

The model runs were based on SILO[4] datasets constructed by DSITI from observational records provided by the Bureau of Meteorology. The climate file covered 50 years from 1966-2016.

2.2.2 Waste estimation

It has been assumed that the WWTP will be commissioned as part of the Stage 1B development, but that small scale on-site packaged plants can be used for Stage 1A.

Waste estimation was based on the MEDLI scenario for a municipal sewage treatment plant (STP). It is based on inputs of the number of equivalent persons (EP) and waste production per EP (which gives average dry weather flow or ADWF). High and low range ADWF estimates for each stage of the project were provided by project engineers; Arup (Sam Koci, Arup *pers. comm.* 25 September 2017).

MEDLI allows wet weather flow to be estimated based on a range of pre-set stormwater 'infiltration efficiencies'. For design purposes, the project engineers have assumed peak wet weather flow of five times ADWF in line with design guidelines in the *Operational Design Manual D7* (FNQROC 2014). In MEDLI, this is equivalent to an 'average' infiltration efficiency. This was used as a base setting for all simulations.

As well as simulations for average infiltration efficiency, the effect of improved stormwater ingress management ('low' infiltration efficiency in MEDLI equivalent to peak wet weather flow of 2.5 times ADWF) was also simulated.

It is understood that some treated effluent will be recycled through a dual reticulation system for non-potable uses such as toilet flushing. Whilst this has benefits for reducing raw water resource requirements, because this is redirected through the WWTP after use, it does not reduce effluent volume production. Other uses for non-potable water that do not lead to a

[4] Scientific Information for Land Owners – https://www.longpaddock.qld.gov.au/silo/about.html.

return of water to the waste water stream may be possible (wash down, facilities maintenance other than irrigation), and a further 10% reduction in ADWF has been simulated to show how this might affect effluent management for Stage 1B and beyond.

Stage 1A

For Stage 1A, it is assumed that on-site primary or secondary treatment (Biolytix, Biocycle or similar) will achieve effluent quality at the upper range of secondary treatment (as described in ANZECC & ARMCANZ 1997 and supported by work on performance of on-site packaged plants by Goonetilleke *et al.* 2000 and Dubber and Gill 2012, 2014), with reasonable nitrification. Effluent was therefore assumed to have total nitrogen (TN) content of 50 mg/L (with effluent TN consisting of 45% nitrate N, 25% ammonium N and 30% organic N), total phosphorus (TP) of 12 mg/L and total dissolved solids (TDS) of 520 mg/L.

Waste water volumes were as follows:

- Low range ADWF – 0.05 ML/day or 185 EPs at 270 L/day
- High range ADWF – 0.08 ML/day or 296 EPs at 270 L/day.

Stages 1B to 3 inclusive

For all other stages up to full development, it is assumed that the WWTP will include tertiary treatment (nutrient removal) achieving at worst 5 mg/L TN and 1 mg/L TP (Sam Koci, Arup, *pers. comm.* 15 August 2017). The average proportion of N species present in the effluent has been calculated based on the author's experience of similar sized plants and is assumed to be 73% nitrate N, 2% ammonium N and 25% organic N. Better effluent quality is achievable[5], but for the purposes of soil capacity and nutrient leaching potential, a conservative approach has been taken (the benefit of improved nutrient removal for other aspects of effluent management is discussed later in this report).

Waste water volumes were as follows for Stage 1B.

- Low range ADWF – 0.39 ML/day or 1,444 EPs at 270 L/day.
- High range ADWF – 1.04 ML/day or 3,852 EPs at 270 L/day.

Waste water volumes were as follows for Stage 2.

- Low range ADWF – 0.74 ML/day or 2,741 EPs at 270 L/day.
- High range ADWF – 1.68 ML/day or 6,222 EPs at 270 L/day.

Waste water volumes were as follows for Stage 3 (ultimate).

- Low range ADWF – 0.82 ML/day or 3,037 EPs at 270 L/day.
- High range ADWF – 1.81 ML/day or 6,704 EPs at 270 L/day.

2.2.3 Wet weather storage

When plant demand is low (for example during the wet season or extended rain periods), effluent cannot be applied to land without the risk of run-off or excessive leaching. The MEDLI model allows for wet weather storage to be included in the simulations. MEDLI can be used to model the water balance of existing or proposed infrastructure where the volumes are fixed. It can also be used in 'multi run' mode to estimate the optimum storage volume or

[5] The author is aware of a small WWTP in north Queensland servicing a mixture of rural, residential, commercial and tourism properties of similar capacity (c. 1,400 EP) that achieves average TN, TP and TDS concentrations of 3.5 mg/L, 0.2 mg/L and 580 mg/L respectively.

combination of storage volume and irrigation area required. These different approaches were used for different stages of the development.

Stage 1A

FNQROC (2014) states that to *accommodate the on-site sewerage facility, required for a dwelling with five or less bedrooms and a range of associated facilities, a minimum* [irrigation] *area of 2000 m*^{2} *shall be required*.

The lot sizes proposed for Stage 1A do not provide sufficient area for on-site disposal via irrigation, and effluent from individual systems will therefore be collected, stored and irrigated through a single facility (with the plan to ultimately connect such a collection point to the main WWTP in Stage 1B).

The multi run facility in MEDLI has been used to examine possible combinations of storage capacity and land area to optimise re-use (minimise discharge). Tank storage for Stage 1A has been simulated in MEDLI. However, default settings in MEDLI assume wet weather storage will be ponded. The following model conditions were applied to simulate tank storage.

- Drawdown set to equal depth to outlet to allow complete tank emptying.
- Rainfall catchment area (fraction of potential) set to zero to simulate a closed tank (default is 100%).
- Evaporation area (fraction of potential) set to zero to simulate a closed tank (default is 100%).
- Leakage (mm/day) set to zero to simulate a closed tank (default setting assumes leakage from ponded storage of 0.1 mm/day).

The range of tank volumes and irrigation areas used in the simulation were 1-5 ML and 5-25 ha respectively.

Stages 1B to 3 inclusive

After discussion with Sam Koci and Nathan Lee Long of Arup, it was decided that the on-site dam can be used for wet weather storage overflow. An in-line balance tank was also discussed, and this option has been included in modelling scenarios (5 ML tank using the simulated parameters above).

The dam is part of the aesthetic appeal of the KUR-World Farm Theme Park, and water levels will need to be managed to maintain visual amenity. This has been considered in the MEDLI inputs for the dam. The following parameters were assumed for MEDLI modelling.

- Volume = 19 ML.
- Dimensions = 114 m x 52 m.
- Depth = 4.5 m and 0.8 m freeboard.
- Internal slopes 1:4.
- Leakage 0.1mm/day.
- Evaporation coefficient 0.7 (pond evaporation relative to Pan A)
- Maximum drawdown to 2.0 m depth (to retain sufficient water for visual amenity) and starting condition empty.

The management and use of water from the on-site dam needs careful consideration as, after storage, it may not meet the A+ quality required for unrestricted use and this may restrict its application to some parts of the development.

2.2.4 Irrigation area

Non-remnant vegetation covers 212 ha (NRA 2017b) and, in Stages 1A and 1B, the existing paddocks will be available for irrigation use. Until the Golf Course has been finished, there may be a need to use paddocks for irrigation during Stage 2. After the Golf Course has been constructed in Stage 2, this area and other areas of amenity planning will be irrigated with treated effluent. These different scenarios have been incorporated into the MEDLI runs.

Stages 1A and 1B

For Stages 1A and 1B, the MEDLI multi run mode was used to estimate optimum land area. For Stage 1A, the land area was set to between 5 ha and 25 ha; for Stage 1B, it was set to between 10 ha and 100 ha.

Stages 2 and 3

After Stage 2, it is estimated that approximately 56 ha will be available for effluent disposal (including open spaces, road verges and the Golf Course) (based on land area figures provided by Sam Koci, Arup, email dated 15 August 2017). This is the area used in modelling, but the results of the land suitability assessment have been used to confirm that available land areas (as provided by Arup) are suitable for effluent irrigation application.

It is envisaged that the maximum available area will be required in the wet season to utilise as much effluent as possible, but that irrigation can be directed to critical areas (such as the Golf Course) in the dry season to maximise its value.

As indicated previously, during Stage 2 development, there may still be a need to utilise surrounding paddocks. Scenarios using Stage 2 waste generation data and the multi run mode with 10-100 ha has been used to simulate this.

2.2.5 Irrigation scheduling

The simulations used fixed sprinklers for irrigation application. Effluent irrigation has been set to simulate a management approach that maximises effluent re-use without compromising proposed land use or causing excess run-off. For example, Golf Course staff are expected to manage irrigation applications to maximise grass cover, but minimise the risks of waterlogging or saturation that may limit playability. Irrigation scheduling can also be used to maximise recycling rates and minimise effluent storage requirements by applying irrigation in frequent small applications rather than infrequent large applications.

To simulate these management requirements, irrigation was triggered to occur when the soil moisture deficit was 5 mm and irrigation was allowed until the soil reached the upper drainage limit (also known as field capacity). This maintains a high water content, but does not cause excessive drainage or saturation. The maximum allowable irrigation in this scenario is 5 mm/day and this also prevents irrigation rates exceeding soil infiltration rates that are estimated to be relatively slow in one of the soil types present.

An examination of the climate data for the site revealed that rainfall occurs on close to 50% of days. The default setting in MEDLI is for no irrigation to occur on rainy days. Further examination of the rainfall data revealed that on over 60% of rainy days, falls were less than 3 mm. There is some short-term water storage capacity in the soils between field capacity and saturation (estimated to be at least 4 mm in these soils) and therefore irrigation has been allowed on days when rainfall is less than or equal to 3 mm. This may result in greater deep drainage and groundwater impacts (but preliminary modelling suggested this impact would not be significant under the scenarios modelled).

2.2.6 Plant selection

Stages 1A and 1B

The existing paddocks under pasture are dominated by the Signal grass (*Brachiaria decumbens*) (NRA 2017b). Signal grass is not included in the pre-set plant types in MEDLI. Kikuyu (*Pennisetum clandestinum*) was selected as a suitable alternative with similar traits. It has a similar growth habit and height, similar dry matter production potential, maintains green cover in dry periods and has similar climatic requirements and temperature tolerance.

Kikuyu was also selected for Stage 2 scenarios that simulate conditions if the Golf Course is not finalised.

Growth was 'kickstarted' to simulate established pasture.

Stages 2 and 3

Bermuda grass or Coastal Couch (*Cynodon dactylon*) was selected for the modelling of amenity planting. This grass maintains good cover when cut, and varieties are used for amenity turf planting in warm climates. To mimic the management regime expected for amenity planting, it was necessary to modify some of the model parameters. It was assumed that 100% green grass cover is maintained throughout the year, and some growth and grass management parameters were accordingly modified to simulate this. Residual biomass (after cutting/harvest) was set to 500 kg/ha to simulate the retention of 100% groundcover. MEDLI V2.0 allows application to an established grass cover and residual green cover was assumed to be maintained at 100% even after mowing (residual green cover set to 1). Growth was 'kickstarted'.

Management of vegetation

Cut and carry systems are preferred for effluent irrigation schemes. This allows the nutrients applied to be periodically exported from the site in cut vegetation rather than accumulating in the plant soil system.

For the simulations using Kikuyu grass, it is assumed that grass will be cut and removed (for use as feed for KUR-Cow cattle).

For simulations using Coastal Couch, cut and carry has been used as a default. As clippings may be returned (particularly to fairways on the Golf Course), simulations were also conducted to mimic the effect of nutrient re-applications through the return of grass clippings. MEDLI's developers suggest adjusting effluent nutrient loads to simulate the return of nutrients removed under similar cut and carry scenarios to determine if it affects nutrient accumulation, saturation of soil sorption capacity for phosphorus and deep drainage/groundwater quality.

The scenario that would result in the maximum rate of application of effluent per unit land area (*ie* the scenario that simulates low infiltration efficiency/stormwater ingress) was modified for this purpose.

Adams and Gibbs (1994) suggest that approximately 75% of the organic matter in grass clippings from sport and amenity turf is mineralised (decomposed to release stored nutrients). To simulate the potential effect of clippings return, 75% of the maximum amount of N and P uptake in cut and carry simulations is returned via increased nutrient content in the effluent[6]. **Table 2** shows the adjustments to effluent quality made to simulate the return of clippings for Stages 2 and 3.

Table 2: Adjustments to effluent quality made to simulate the return of clippings for Stages 2 and 3

	Units	Stage 2				Stage 3			
		Low range ADWF		High range ADWF		Low range ADWF		High range ADWF	
		N	P	N	P	N	P	N	P
Rate of nutrient uptake in vegetation	Kg/ha/yr	251	0.09	286	1.45	258	0.09	287	1.69
Total nutrient mass removed[1]	Kg	14056	5.04	16016	81.2	14459	5.04	16072	94.64
Nutrient mass to be reapplied through irrigation	Kg	10542	3.78	12012	60.9	10844	3.78	12054	70.98
ADWF	ML/yr	270.29	270.29	613.62	613.62	299.51	299.51	661.10	661.10
Adjusted effluent concentration	mg/L	44.00	1.01	24.58	1.10	41.21	1.01	23.23	1.11
Adjusted N ratios in effluent (pond inputs)									
Nitrate N		0.083	-	0.149	-	0.089	-	0.157	-
Ammonium N		0.002	-	0.004	-	0.002	-	0.004	-
Organic N [2]		0.915	-	0.847	-	0.909	-	0.839	-

1. Assuming 56 ha
2. Assumes all “reapplied” N from clippings is in an organic form and concentrations of mineral N are unchanged.

2.2.7 Soil

MEDLI contains a range of default soil profiles that can be used for modelling, but the selection is small. Differences in soil properties have a significant effect on the outcome of the modelling. Given the sensitive receiving environment at KUR-World, as much site-specific field and laboratory data as possible was collected to improve the quality of model outcomes (see NRA 2017c for details of the fieldwork and laboratory testing conducted).

Two soil types (Bicton and Galmara) dominate the project site (NRA 2017c). Site-specific soils data was collected for both soils as part of the field investigations. MEDLI is unable to model the application of effluent to areas that have more than one soil type. Initial modelling using both soil types indicated that their behaviour was similar but that the Bicton soil had the most limiting properties (in terms of drainage characteristics, soil water storage and therefore potential to assimilate high rates of irrigation). Mapping of soil types and infrastructure in the master plan (NRA 2017c) shows that significant areas of Bicton will be utilised for the Golf Course and amenity planting. This soil type has been used for all modelling scenarios to provide a conservative approach to assessing risk and potential impact.

[6] This is a compromise suggested by MEDLI’s developers as it does not mimic the timing of the return of clippings and some of the effluent may not be applied to land.

Model input variables for run-off and evaporation characteristics were estimated using published sources. Run-off curve numbers were estimated using the USDA Natural Resources Conservation Service Technical Release 55 (TR-55, USDA 1986) as recommended by MEDLI developers. Although both soils have moderate infiltration rates, they have fine textured horizons in the upper subsoil consistent with the soil textures in hydrologic group D in TR-55. For open spaces (lawn parks and Golf Courses) with good groundcover (>75%), TR-55 gives a curve number of 80 and this was adopted for both soil types. It simulated average annual run-off of approximately 25% of rainfall, which is considered reasonable.

A summary of the data input for the Bicton soil profile is provided in **Table 3**.

Table 3: Bicton soil profile properties used in MEDLI simulations

	Units	Layer 1	Layer 2	Layer 3	Layer 4
Thickness	mm	100	300	550	250
Soil water characteristics					
Air dry moisture content[4]	%v/v	1.7	-	-	-
Lower storage limit[1]	% v/v	9	13	9	6
Drained upper limit[1]	% v/v	36	40	39	33
Saturated water content[1]	% v/v	42	47	43	37
Bulk density[2]	g/cm^3	1.34	1.33	1.41	1.38
KSat[3]	mm/hr	7.5	5.7	7.2	22.7
P sorption characteristics					
Initial Colwell P[4]	mg/kg	69.61	20.19	28.96	15.14
Adsorption coefficient (A)[4]	coefficient	799.05	533.77	424.83	325.31
Adsorption exponent (B)[4]	exponent	0.2312	0.2930	0.2903	0.3186
Desorption exponent[4]	exponent	0.2197	0.2195	0.2758	0.3027
Other profile characteristics					
Run-off curve number	coefficient	80	-	-	-
Slope of stage II drying – Cona[5]	mm/sqrt day	8.5	-	-	-
Stage I drying maximum – U[5]	mm	3.75	-	-	-
Initial nitrate N (average in profile)[4]	mg/kg	4.5	-	-	-
Initial organic N (average in organic layer)[4]	mg/kg	1900	-	-	-
Thickness of the organic layer	mm	150	-	-	-
Thickness of the labile carbon	mm	150	-	-	-

1. Estimated from the moisture release characteristic curve derived from site-specific measurements of particle size analysis and field bulk density using pedotransfer functions (van Genuchten *et al.* 2000).
2. Measured on intact core samples collected in the field.
3. Values estimated from site-specific measurements of particle size analysis and field bulk density using pedotransfer functions (van Genuchten *et al*. 2000). These values also correspond to the range expected based on observations of soil structure and particle size analysis according to Hazleton and Murphy (2007).
4. Measured on samples collected from site.
5. Estimated from measured clay content and cross reference to tabulated data in DSITI (2015).

2.2.8 Data assessment

Two main aspects of the feasibility and sustainability of effluent irrigation have been examined.

- The capacity of the system to assimilate hydraulic loads and minimise rate of effluent discharge (of salt and nutrients) and downstream or off-site impacts
- The capacity of the system to assimilate nutrient and salt loads and minimise leaching of nutrients to groundwater or minimise salt accumulation and plant stress.

The hydraulic capacity of the system is assessed through the simulated behaviour of the wet weather storage system in MEDLI. This is a function of pond volume, fluid inflows (effluent, stormwater ingress, rainfall on open storage structures) and exports (irrigation demand, evaporation from open storage structures and leakage). Where the difference in inflows and exports exceeds storage capacity, there is overflow from the storage (which is effectively a discharge). In general, such discharges are triggered by single storm events or prolonged wet periods that supress irrigation demand (see **Graph 1** in **Section 4.2.3** for an illustration). If this discharge is directed to a waterbody, the nutrients and salts it contains have the potential to impact on such receiving waters.

Although MEDLI has the capacity to produce daily time step discharge estimates, unless a detailed hydrological model is available for the receiving environment, impacts on nutrient loads caused by discharges cannot be made with this data. In the absence of a detailed hydrological model for the KUR-World catchments, background loads have been estimated from Source Catchments modelling inputs used to calculate loads entering the Great Barrier Reef Lagoon from the Wet Tropics region under different land uses (Hateley *et al.* 2014). It has been assumed that approximately 460 ha is under “nature conservation” (native vegetation) use and 200 ha is under grazing use. This results in a loss of c. 2,348 kg total N/annum and c. 174 kg total P/annum[7].

This method may underestimate background loads entering the creek systems at KUR-World. The peak concentrations of total nitrogen (TN) and total phosphorus (TP) recorded in Owen Creek in the 2016/2017 wet season (NRA 2017a) were more than twice the expected event mean concentrations estimated by Hateley *et al.* (2014) for catchment load modelling under similar land uses. However, the degree of influence of land disturbances upstream of KUR-World on downstream nutrient concentrations is unknown. The approach taken is therefore considered to be conservative. Approximately 35% of the background TN is presented as dissolved inorganic N (DIN), which is largely nitrate and ammonium N. Effluent (at all stages of the development) is likely to have close to 70% DIN, and the assessments presented here using TN may underestimate impacts on DIN loads.

The influence of loads on nutrient/salt concentrations and thus direct impacts on sensitive ecological receptors in the receiving water downstream of the point of discharge could not be estimated with the data available. It is known that effluent discharges will most likely occur when stream flow rates are high. This will allow for high rates of dilution and it will also tend to coincide with periods when water quality is naturally lower (see differences in water quality during high flow and low flow events in NRA 2017a). The relative increase in loads calculated in **Section 3** may not translate to a proportionally equivalent change in nutrient or salt concentration, and this should be considered when viewing the data assessment results.

The capacity of the soil/plant system to assimilate nutrient and salt loads and minimise leaching of nutrients to groundwater has relied on the nutrient leaching and soil phosphorus storage capacity estimates produced by MEDLI. The model also estimates root zone salinity and determines if this is sufficient to limit plant growth. This can be used to assess salinity accumulation risk. For assessing impacts of nutrient loads on soil and groundwater quality, control runs with no effluent irrigation and closed tank wet weather storage were carried out. This provides background contributions of soil drainage to groundwater quality.

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7 Data on salt loads was not included as this is not an important aspect of reef water quality. No assessment of the potential influence of salt load exports was possible. However, based on the relative difference in quality of effluent and receiving waters, it is expected that changes in salt loads would be similar to those for simulated for nutrients.

3. Results and Discussion

3.1 Suitability of land for effluent irrigation

3.1.1 Soil physical and chemical properties

The soils that may be used for effluent irrigation are considered to have no limitations with respect to depth, salinity or sodicity. There are moderate limitations with respect to likely drainage properties, but it is anticipated that these will be managed by irrigation scheduling or modification to surface soil properties during the construction of the Golf Course.

Nutrient retention is considered as part of the MEDLI modelling and, as modelling shows, the soils have a high capacity for phosphate retention. The profile with the lowest retention capacity has been used for modelling.

3.1.2 Topography and buffers

Variation in topography is the greatest potential limitation to irrigation use. The land with non-limiting slope (<20%) and the proposed buffer areas have been mapped with precincts that may be primarily used for effluent irrigation. The results are shown on **Figure 3** and summarised in **Table 4**.

Table 4: Summary of irrigable areas

Project precinct	Potential area available (ha)	Suitable area (ha)*	Proportion of suitable land with 12-20% slopes (%)
Golf Course	47.24	33.96	45
Farm Theme Park and Equestrian Centre	19.03	14.91	34
Produce Garden	2.52	2.23	50
Open Space	1.76	1.20	46
Total [#]	**70.55**	**52.32**	**-**

* Potential area minus buffers and unsuitable land.

[#] This does not include amenity/landscape planting that will surround built structures in other precincts such as the Business and Leisure Hotel and Function Centre, Eco Resort and KUR-World Campus.

Approximately 26% of the potentially irrigable area in the four main precincts is either within creek buffer areas or too steep for irrigation use. The remaining area covers approximately 52.3 ha, most of which is in the Golf Course precinct. Large portions of the irrigable area (*eg* 45% in the Golf Course precinct) are on moderate slopes (12-20%) and will require careful management to prevent run-off and accelerated erosion.

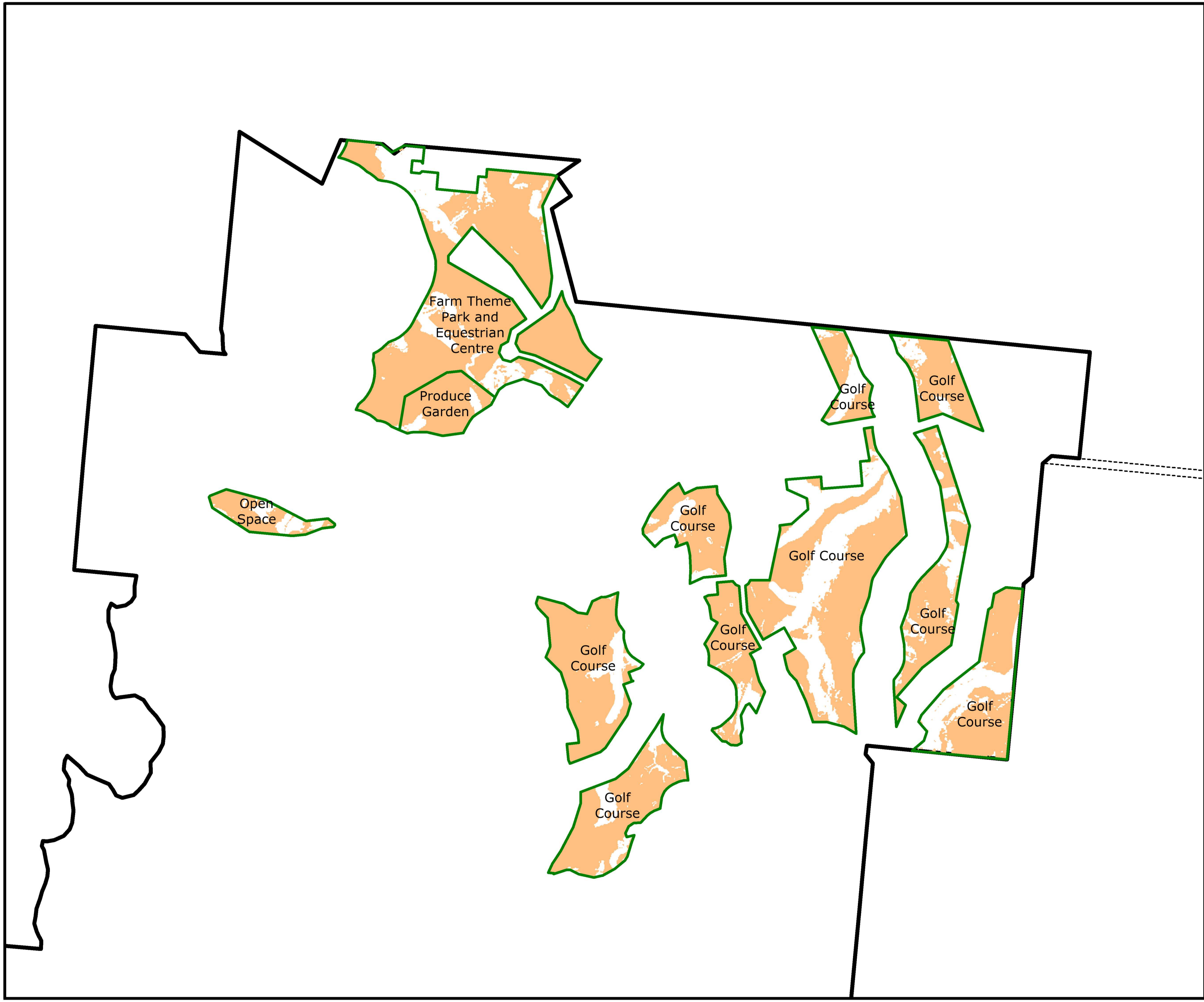
The area mapped as suitable for effluent irrigation is slightly lower than the potentially available area provided by Arup that was used as the basis for the modelling (56 ha). The suitable area in **Table 4**, does not include the landscaped areas and grounds in other precincts such as the Business and Leisure Hotel and Function Centre, Eco Resort and KUR-World Campus, or road verges. A suitable irrigable area of approximately 56 ha is therefore considered a reasonable basis for effluent irrigation modelling.

3.2 Soil plant system capacity

The outcomes of the assessment of the water balance and the capacity of the soil plant system to assimilate water, salt and nutrient loads for each stage of the project are presented in the following sections. Selected MEDLI output data is presented in **Appendix A**.

Figure 3: Slope constraints for effluent irrigation

Project: KUR-World Effluent Irrigation Feasibility Study



KUR-World project area

Proposed access road

Potential effluent irrigation areas (Master Plan Rev G)

Areas suitable for effluent irrigation (slope of less than 20 percent)

N

0 100 300 500

METRES

NRA Ref: 424104.02
Date: November 2017

Source:
Reever & Ocean Pty Ltd, © State of Queensland (Department of Natural Resources and Mines) 2017.

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Recommended print size: A4

3.2.1 Stage 1A

Storage capacity, effluent re-use and potential for discharge

The multi run function in MEDLI can determine what land area and storage capacity combination are required to achieve a desired level of performance. One of the most important measures of performance at KUR-World is the ability to maximise the fraction of effluent that is re-used and minimise the potential for discharge. There is a trade-off between using effluent irrigation as means of disposing of effluent or as a means of raw water substitution.

As land area is increased to maximise the proportion of effluent that can be diverted to irrigation, the proportion of irrigation demand that is satisfied decreases (as irrigation is spread over a wider area). Assessments in this report are focused on potential impacts on water quality (and therefore irrigation as a means of disposal) rather than on impacts on available water resources.

MEDLI has an internal default setting that calculates the probability of achieving 90% re-use, and this is a reasonable target for estimating the possible combinations of storage and land area required to minimise the potential for discharge from storage. The multi run results are summarised in **Table 5**. Shading has been used to allow easy comparison of outcomes under the different scenarios. Light shading shows combinations where re-use is <90%, medium shading shows where re-use is between 90% and 95% and darkest shading shows where re-use is ≥95%.

Table 5: Fraction of effluent re-used using different land and tank size combinations under a range of scenarios – Stage 1A

Scenario Irrigation area (ha)	Tank volume (ML)				
	1	2	3	4	5
Low range ADWF – Average ingress					
5	0.81	0.86	0.89	0.91	0.93
10	0.84	0.90	0.93	0.94	0.96
15	0.85	0.91	0.94	0.96	0.97
20	0.85	0.91	0.94	0.96	0.97
25	0.85	0.91	0.94	0.97	0.98
High range ADWF – Average ingress					
5	0.72	0.77	0.79	0.82	0.83
10	0.78	0.84	0.87	0.89	0.90
15	0.79	0.86	0.89	0.91	0.93
20	0.80	0.86	0.90	0.92	0.94
25	0.80	0.87	0.91	0.93	0.94
High range ADWF – Low ingress					
5	0.77	0.82	0.84	0.87	0.88
10	0.83	0.88	0.91	0.93	0.94
15	0.84	0.89	0.93	0.95	0.96
20	0.84	0.90	0.93	0.95	0.96
25	0.85	0.90	0.94	0.95	0.97

The light shading shows combinations where re-use is <90%, medium shading where re-use is between 90% and 95% and darkest shading where re-use is ≥95%.

Under the low range estimate for ADWF, the lowest irrigation area and storage volumes required to achieve 90% re-use were estimated to be 5 ha land and 4 ML storage or 10 ha land and 2 ML. The lowest irrigation area and storage volumes required to achieve 95% re-use were estimated to be 10 ha land and 5 ML storage or 15 ha land and 4 ML storage.

Under the high range estimate for ADWF, the lowest irrigation area and storage volumes required to achieve 90% re-use were estimated to be 10 ha land and 5 ML storage or 20 ha land and 2 ML. It was not possible to achieve 95% re-use. Under the high range ADWF scenario, it was possible to achieve results similar to the low range ADWF scenario if stormwater ingress could be reduced by 50%, and this is an important management tool for reducing the risk of discharge.

Table 6 shows the number of occasions per annum that overtopping of the simulated storage occurs (equivalent to effluent discharge events[8]) under the same scenarios as in **Table 5**. Light shading shows combinations where the number of overtopping events is >2/annum, medium shading shows where the number of overtopping events/year is between 1 and 2 and darkest shading shows where the number of overtopping events/year is ≤1.

Table 6: Number of occasions per year when overtopping or the wet weather storage* occurs under a range of scenarios – Stage 1A

Scenario Irrigation area (ha)	Tank volume (ML)				
	1	2	3	4	5
Low range ADWF – Average ingress					
5	4.24	2.66	2.14	1.68	1.26
10	3.84	1.80	1.20	0.98	0.86
15	3.60	1.64	1.18	0.74	0.52
20	3.42	1.54	1.04	0.72	0.46
25	3.34	1.56	0.96	0.64	0.40
High range ADWF – Average ingress					
5	8.00	5.86	4.78	4.44	4.06
10	5.96	3.30	2.56	2.08	1.74
15	5.66	2.98	1.98	1.58	1.34
20	5.48	2.80	1.92	1.34	1.04
25	5.46	2.72	1.84	1.40	1.02
High range ADWF – Low ingress					
5	7.24	4.96	4.60	3.82	3.30
10	5.26	2.82	2.26	1.60	1.32
15	5.22	2.34	1.48	1.20	0.92
20	4.90	2.32	1.48	1.02	0.76
25	4.74	2.18	1.36	1.06	0.72

* Overtopping of wet weather storage would result in discharge.

Light shading shows combinations where the number of overtopping events is >2/annum, medium shading shows where the number of overtopping events/year is between 1 and 2 and darkest shading shows where the number of overtopping events/year is ≤1.

The results show a similar trend to **Table 5**. The modelling indicated that with ADWF in the low range it is possible to achieve less than one discharge event per annum at a moderate area and storage volume combination (10 ha and 4 ML).

[8] These events may last for several days depending on the rainfall pattern that resulted in the triggering of discharge.

The potential nutrient loads entering the receiving environment as a result of overtopping/discharge are shown in **Tables 7** and **8**. Shading has been used to show the relative impact of the discharge amounts on nutrient loads leaving the KUR-World project area. No shading represents combinations where a load of more than 10% of the background project annual load (see **Section 2.2.8** for how this was estimated) is discharged, light shading shows where a load of between 5% and 10% of the background project load is discharged, medium shading shows where a load of between 1% and 5% of the background project annual load is discharged and darkest shading shows where a load of ≤1% of the background project annual load is discharged.

Table 7: Mass of total nitrogen* released in overtopping events using different land and tank size combinations under a range of scenarios – Stage 1A

Scenario Irrigation area (ha)	Tank volume (ML)				
	1	2	3	4	5
Low range ADWF – Average ingress					
5	127	91	72	56	43
10	103	62	45	34	26
15	96	58	38	25	15
20	95	55	34	24	16
25	94	55	35	18	10
High range ADWF – Average ingress					
5	307	257	229	206	190
10	232	166	129	108	102
15	217	144	112	88	69
20	207	136	101	83	63
25	200	133	90	72	59
High range ADWF – Low ingress					
5	290	228	195	167	146
10	209	141	107	88	70
15	192	126	86	62	50
20	188	117	79	56	42
25	174	115	71	53	37

* Note: due to the higher proportion of DIN in sewage effluent, the proportional increase in DIN loads will be greater than for TN.

No shading represents combinations where a load of more than 10% of the background project annual load is discharged, light shading shows where a load of between 5% and 10% of the background project load is discharged, medium shading shows where a load of between 1% and 5% of the background project annual load is discharged and darkest shading shows where a load of ≤1% of the background project annual load is discharged.

Under the majority of land area and storage volume combinations with low range ADWF estimates, the contribution of effluent discharge would be between 1-5% of background TN loads. With a combination of at least 15 ha of land and 4 ML storage or 25 ha of land and 5 ML, TN discharge loads could be reduced to less than 1% of background.

Under the land area and storage volume combinations modelled with high range ADWF estimates, the best performance that could be achieved was between 1% and 5% (c 2.5% at best) of background load. Performance was improved by reducing wet weather stormwater ingress, but this measure could not reproduce performance under low range ADWF estimates.

Table 8: Mass of total phosphorus released in overtopping events using different land and tank size combinations under a range of scenarios – Stage 1A

Scenario	Tank volume (ML)				
Irrigation area (ha)	1	2	3	4	5
Low range ADWF – Average ingress					
5	31	22	17	13	10
10	25	15	11	8	6
15	23	14	9	6	4
20	23	13	8	6	4
25	23	13	8	4	2
High range ADWF – Average ingress					
5	74	62	55	49	46
10	56	40	31	26	24
15	52	35	27	21	16
20	50	33	24	20	15
25	48	32	22	17	14
High range ADWF – Low ingress					
5	70	55	47	40	35
10	50	34	26	21	17
15	46	30	21	15	12
20	45	28	19	13	10
25	42	28	17	13	9

No shading represents combinations where a load of more than 10% of the background project annual load is discharged, light shading shows where a load of between 5% and 10% of the background project load is discharged, medium shading shows where a load of between 1% and 5% of the background project annual load is discharged and darkest shading shows where a load of ≤1% of the background project annual load is discharged.

For a given combination of land area and storage volume, performance for total phosphorus (TP) loads was poorer than for TN. The majority of combinations under all scenarios resulted in TP discharge loads >5% of background.

Performance was best under low range ADWF, with 5% of background achievable with moderate land area and storage volume combinations. This is similar to the combinations required to achieve 95% effluent re-use.

The best performance that could be achieved with high range ADWF estimates was between 5% and 10% (c. 8% at most). Performance was improved by reducing wet weather stormwater ingress, but this measure could not reproduce performance under low range ADWF estimates.

Nutrient assimilation, leaching potential and salt accumulation

A conservative approach was taken to assessing the sustainability of effluent application in terms of land and groundwater quality impacts. The following scenarios were examined to cover a range of outcomes.

- Scenario providing the maximum rate of nutrient application per unit area. This is based on the MEDLI multi run scenario with the combination of the maximum storage volume and minimum land area.
- Scenario providing the minimum combination of storage volume and land area required to achieve 90% re-use (optimum rate of application).
- Scenario providing the maximum re-use fraction (multi run with maximum land area and storage volume combination).

Low and high range ADWF scenario (based on 'average' infiltration efficiency multi runs) outputs were compared with a control run (also based on Kikuyu pasture). Outputs were examined for evidence of increased nitrogen leaching out of the profile, exhaustion of phosphorus storage capacity (P saturation) and impacts on plant productivity due to soil salinity increases.

The simulations assume cut and carry management practices and therefore irrigated areas would not be grazed. However, as the irrigation area is set to manage peak effluent production rather than water resource use efficiency, it is envisaged that to maximise the value of the water for pasture productivity, some areas would not be irrigated all year round. These areas could be periodically grazed with little impact on nutrient export.

The MEDLI output data for land water and nutrient balance under the scenarios modelled is shown in **Table 9**.

The data shows the following.

- Under all scenarios, irrigation increased deep drainage (*ie* water that moves below the root zone and potentially to groundwater). The impact is proportional to irrigation rate and was therefore highest under high range ADWF scenarios.
- The nutrients supplied in irrigation increased plant productivity and resulted in higher plant uptake.
- Under all irrigated scenarios, plant uptake of N exceeded the amount of N applied in irrigation (net negative N balance).
- Under all irrigated scenarios plant uptake of P did not exceed the amount of P applied in irrigation (net positive P balance).
- The application of P in excess of crop demand did not result in a noticeable increase in the amount of P leached or the concentration of P in deep drainage compared to the control scenario. This is because the soil has the capacity to adsorb and retain the excess P applied.
- Under the scenarios with maximum possible irrigation rates (which are not considered realistic, but were used to test soil capacity), P storage capacity would not be exhausted for 222 years under low range ADWF or 166 years under high range ADWF.
- Under the optimum scenarios (reasonable storage and land area combinations required to achieve 90% re-use), soil P storage capacity was 378 years under low range ADWF and 444 years under high range ADWF.
- Under all irrigated scenarios, the amount of N leached was higher than the control scenario and highest under the highest rates of irrigation. However, the amount of N leached under all scenarios was small (up to 110 g/ha compared to DIN exports from native vegetation of 1,500 g/ha (Harteley *et al.* 2014)).
- Under all irrigated scenarios, the concentration of nitrate N in deep drainage was not increased compared to the control scenario. The increased N loads in deep drainage were therefore a result of increased deep drainage volumes leaving the soil profile rather than an increase in concentration of nitrogen passing through it. The concentration of nitrate N in deep drainage is less than the concentration of nitrate N measured in local groundwaters (0.033 to 1.7 mg/L of nitrate N) (RLA 2017). An adverse impact on groundwater quality and groundwater environmental values would not be expected.
- Under all irrigated scenarios, soil salinity did not impact on plant productivity and significant salinity accumulation did not occur over the period of the simulation. The irrigation of relatively low strength effluent provides sufficient leaching fraction to prevent salt build up.

Table 9: Summary of MEDLI output data for land water and nutrient balance under range of scenarios – Stage 1A

	Control	Low range ADWF			High range ADWF		
		Maximum irrigation rate	Optimum irrigation rate	Maximum re-use	Maximum irrigation rate	Optimum irrigation rate	Maximum re-use
		5 ML and 5 ha	2 ML and 10 ha	5 ML and 25 ha	5 ML and 5 ha	3 ML and 20 ha	5 ML and 25 ha
Rainfall (mm)	1939	1939	1939	1939	1939	1939	1939
Irrigation (mm)	0	410	197	86	584	158	132
Deep drainage (mm)	381	546	440	391	646	427	417
Soil nutrient balance							
N irrigated (kg/ha/yr)	0	164.82	80.67	34.20	240.95	64.50	53.17
N uptake (kg/ha/yr)	71.4	238.22	153.28	106.09	314.52	136.93	125.38
N leached (kg/ha/yr)	0.06	0.10	0.09	0.09	0.11	0.09	0.09
P irrigated (kg/ha/yr)	0	41.64	20.38	8.64	60.87	16.30	13.43
P uptake (kg/ha/yr)	0.01	23.43	7.23	0.43	36.36	4.28	2.48
P leached (kg/ha/yr)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Deep drainage characteristics							
Deep drainage NO_3 –N concentration (mg/L)	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Deep drainage P concentration (mg/L)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Soil profile P storage life (years)	NA	222	378	697	166	444	509
Salinity impact							
Relative crop yield due to salinity impacts*	1	1	1	1	1	1	1

* A value of '1' indicates no reduction in crop yield (*ie* no impact) and a value of '0' indicates a 100% reduction in crop yield.

Stage 1A Summary

No potential adverse soil or groundwater impacts were identified under any of the scenarios considered.

None of the scenarios modelled achieved 100% re-use of the effluent generated in the simulations. Therefore, discharge was simulated to occur under all scenarios modelled. The frequency of discharges, the volume of discharge and the nutrient (and salt) loads exported all increased with increasing effluent production. Discharge has the potential to impact on water quality in the receiving environment.

Effluent re-use of >95% and infrequent overtopping events could be obtained under ADWF scenarios with relatively modest storage volume and land areas combinations. However, with 90% effluent re-use achievable under the high range ADWF scenarios with similar storage and land area combinations, it was estimated that discharge loads have the potential to increase TP loads leaving the project site by over 10%. The impact on TN export is smaller, but due to the high proportion of DIN in effluent (see **Section 2.2.8**), the impact on DIN loads in the receiving environment may be similar to that of TP.

Potential impacts to the receiving environment can be managed by offsets gained from revegetation works upstream, minimising stormwater infiltration to reduce discharge volumes or by discharging to an alternate location on- or off-site.

3.2.2 Stage 1B

Storage capacity, effluent re-use and potential for discharge

The multi run results using the fixed storage volume (5 ML tank and 19 ML dam) are summarised in **Table 10**. Shading has been used to allow easy comparison of outcomes under the different scenarios. No shading shows combinations where re-use is <75%, light shading shows where re-use is between 75% and 90% and medium shading shows where re-use is ≥90%. No dark shading was used as no scenario achieved >95% effluent re-use.

Table 10: Fraction of effluent re-used as irrigation using different land and tank size combinations under a range of scenarios – Stage 1B

Scenario Irrigation area (ha)	Low range ADWF			High range ADWF		
	10% ADWF reduction & low ingress	Low ingress	Average ingress	10% ADWF reduction & low ingress	Low ingress	Average ingress
10	0.56	0.51	0.46	0.21	0.19	0.18
20	0.81	0.78	0.73	0.43	0.39	0.35
30	0.88	0.86	0.82	0.60	0.56	0.51
40	0.90	0.89	0.85	0.70	0.67	0.62
50	0.91	0.90	0.86	0.76	0.74	0.69
60	0.92	0.91	0.88	0.80	0.77	0.72
70	0.93	0.92	0.88	0.81	0.80	0.75
80	0.93	0.92	0.89	0.83	0.81	0.76
90	0.93	0.92	0.89	0.84	0.82	0.78
100	0.93	0.92	0.89	0.84	0.83	0.79

No shading shows combinations where re-use is <75%, light shading shows where re-use is between 75% and 90% and medium shading shows where re-use is ≥90%. No dark shading was used as no scenario achieved >95% effluent re-use.

With average stormwater ingress, 90% re-use could not be achieved with either the high or low range ADWF estimates even with 100 ha under irrigation. Low stormwater ingress was required to achieve 90% re-use under a reasonable irrigation area (50 ha), but this could only be achieved with low range ADWF. Reducing ADWF by 10% improved performance, but still did not increase re-use to 90% with high range ADWF.

Table 11 shows the number of occasions per annum that overtopping of the simulated storage occurs under the same scenarios as in **Table 10**. No shading shows combinations where the number of overtopping events is >10/annum, light shading shows where the number of overtopping events/year is between 2 and 10 and medium shading shows where the number of overtopping events/year is between 1 and 2. No dark shading is used as no scenarios result in a rate of overtopping events/year of ≤1.

Table 11: Number of occasions per year when overtopping of the wet weather storage occurs using different land and tank size combinations under a range of scenarios – Stage 1B

Scenario Irrigation area (ha)	Low range ADWF			High range ADWF		
	10% ADWF reduction & low ingress	Low ingress	Average ingress	10% ADWF reduction & low ingress	Low ingress	Average ingress
10	26.6	32.84	33.32	5.28#	1.52#	1.22#
20	5.04	6.66	7.14	44.22	46.42	45.54
30	2.54	2.88	3.44	23.24	28.46	30.24
40	1.7	2.16	2.52	11.26	15.4	15.58
50	1.52	1.66	2.06	7.6	9.38	9.92
60	1.34	1.52	1.84	5.26	6.18	7.32
70	1.26	1.5	1.92	4.46	5.42	6.38
80	1.22	1.36	1.78	4.16	4.92	5.64
90	1.22	1.26	1.8	3.8	4.52	5.18
100	1.16	1.24	1.66	3.54	4.24	5.06

In these scenarios, the apparently low number of events is an artefact. With low irrigation area and low rates of re-use of around 20%, discharge events may last for days or weeks rather than being short pulses as in other scenarios. Therefore, these have not been shaded.

No shading shows combinations where the number of overtopping events is >10/annum, light shading shows where the number of overtopping events/year is between 2 and 10 and medium shading shows where the number of overtopping events/year is between 1 and 2. No dark shading is used as no scenarios result in a rate of overtopping events/year of ≤1.

The results show a similar trend to that in **Table 10**. The modelling indicated that, with ADWF in the low range, it is possible to achieve less than two discharge events per annum with a moderate irrigation area (between 50 ha and 60 ha – similar to the areas envisaged for full development). Under high range ADWF scenarios, at least 50 ha of irrigation area was required to achieve less than 10 overtopping events/annum.

The potential nutrient loads entering the receiving environment as a result of overtopping/discharge are shown in **Tables 12** and **13**. Shading has been used to show the relative impact of the discharge amounts on nutrient loads leaving the KUR-World project area (see **Section 3.2.1** for the basis of these estimates and the assumptions made). No shading represents combinations where a load of more than 10% of the background project annual load is discharged, light shading shows where a load of between 5% and 10% of the background project load is discharged and medium shading shows where a load of between 1% and 5% of the background project annual load is discharged. No scenarios resulted in discharge loads of ≤1% of the background project annual load.

Table 12: Mass of total nitrogen* released in overtopping events using different land and tank size combinations under a range of scenarios – Stage 1B

Scenario Irrigation area (ha)	Low range ADWF			High range ADWF		
	10% ADWF reduction & low ingress	Low ingress	Average ingress	10% ADWF reduction & low ingress	Low ingress	Average ingress
10	258	324	343	1316	1505	1522
20	94	125	146	927	1115	1148
30	57	74	90	621	774	825
40	47	57	72	438	563	589
50	41	51	62	346	422	472
60	36	44	55	276	354	404
70	32	42	54	255	317	358
80	31	38	48	233	292	327
90	31	39	51	214	269	303
100	32	37	49	209	250	287

* Note: due to the higher proportion of DIN in sewage effluent, the proportional increase in DIN loads will be greater than for TN.

No shading represents combinations where a load of more than 10% of the background project annual load is discharged, light shading shows where a load of between 5% and 10% of the background project load is discharged and medium shading shows where a load of between 1% and 5% of the background project annual load is discharged. No scenarios resulted in discharge loads of ≤1% of the background project annual load.

Table 13: Mass of total phosphorus released in overtopping events using different land and tank size combinations under a range of scenarios – Stage 1B

Scenario Irrigation area (ha)	Low range ADWF			High range ADWF		
	10% ADWF reduction & low ingress	Low ingress	Average ingress	10% ADWF reduction & low ingress	Low ingress	Average ingress
10	52	65	69	263	301	304
20	19	25	29	185	223	230
30	11	15	18	124	155	165
40	9	11	14	88	113	118
50	8	10	12	69	84	94
60	7	9	11	55	71	81
70	6	8	11	51	63	72
80	6	8	10	47	58	65
90	6	8	10	43	54	61
100	6	7	10	42	50	57

No shading represents combinations where a load of more than 10% of the background project annual load is discharged, light shading shows where a load of between 5% and 10% of the background project load is discharged and medium shading shows where a load of between 1% and 5% of the background project annual load is discharged. No scenarios resulted in discharge loads of ≤1% of the background project annual load.

Under the majority of land area scenarios with low range ADWF estimates, the contribution of effluent discharge would be between 1-5% of project background TN loads. An irrigation area of at least 30 ha was required to achieve a TN discharge load of <5% of background.

Under the land area and storage volume combinations modelled with high range ADWF estimates, the best performance that could be achieved was TN discharge loads of between 5% and 10% (c. 9% at best) of background. This required low stormwater ingress, a reduction in ADWF of 10% and an irrigation area of at least 80 ha, which would likely be impractical. Under realistic scenarios TN discharge loads would be >10% of background.

Under the majority of land area scenarios with low range ADWF estimates, effluent TP discharge equivalent to between 1-5% of background could only be achieved with low stormwater ingress; otherwise, loads of 10% of background could be achieved with 40 ha of irrigation.

None of the scenarios with high range ADWF estimates achieved TP loads of ≤10% of background.

Although the WWTP will be installed in Stage 1B, leading to an improvement in effluent quality, due to the increased ADWF, the potential for discharge impacts is higher than in Stage 1A under the conditions simulated.

Nutrient assimilation, leaching potential and salt accumulation

This was not specifically assessed for this stage of the development. Greater rates of effluent application of the quality achievable in Stage 1B will occur in later stages of the development. Later stage scenarios were used to assess whether adverse soil and groundwater outcomes would be likely in Stage 1B.

No potential adverse soil or groundwater impacts were anticipated under any of the scenarios considered.

3.2.3 Stage 2 prior to Golf Course construction

These scenarios assume that pasture will be available for use during the construction of the Golf Course and are presented to allow effective management of effluent through the scheduling of the development. The modelling was used to illustrate the likely land areas required, and only average infiltration efficiencies scenarios are modelled.

Storage capacity, effluent re-use and potential for discharge

The multi run results are summarised in **Table 14**. Shading has been used to allow easy comparison of outcomes under the different scenarios. No shading shows combinations where re-use is <75%, light shading shows where re-use is between 75% and 90%. No medium or dark shading was used as no scenario achieved >90% effluent re-use.

The results indicate that very large areas would be required to manage effluent under the high range ADWF range, but that impacts to the receiving environment would be likely even with 100 ha under irrigation. Outcomes under the low range ADWF scenarios were better with 60 ha under irrigation required to allow almost 80% re-use and TN loads of less than 10% of background. Under all scenarios, TP loads remained >10% of background.

Nutrient assimilation, leaching potential and salt accumulation

This was not specifically assessed for this stage of the development. The simulations conducted for Stage 2 after Golf Course construction would be suitable for assessing whether adverse outcomes would be likely.

No potential adverse soil or groundwater impacts were anticipated under any of the scenarios considered.

Table 14: Fraction of effluent re-used as irrigation using different land and tank size combinations under a range of scenarios – Stage 2 using pastures only

Scenario Irrigation area (ha)	Low range ADWF and average ingress				High range ADWF and average ingress			
	Re-use fraction	No. of overflow events/ annum	TN load kg/ annum	TP load kg/ annum	Re-use fraction	No. of overflow events/annum	TN load kg/ annum	TP load kg/ annum
10	0.25	21.1	977	**195***	0.11	0.02#	**2686**	**537**
20	0.49	32.76	620	124	0.22	10.48#	2307	**461**
30	0.65	12.88	391	78	0.33	42.42	1929	**386**
40	0.73	7.72	280	56	0.43	40.64	1567	**313**
50	0.76	5.34	236	47	0.52	28.4	1282	**256**
60	0.79	4.42	203	41	0.58	20.2	1078	**216**
70	0.81	3.80	180	36	0.63	14.54	923	**185**
80	0.82	3.54	169	34	0.66	11.54	836	167
90	0.82	3.44	165	33	0.69	9.46	740	148
100	0.83	3.28	158	32	0.71	8.30	681	136

Under these scenarios, the apparently low number of events is an artefact. With low irrigation area and rates of re-use of around 20%, discharge events may last for days or weeks rather than being short pulses as in other scenarios. A rate of 0.02 event/annum indicates almost continuous discharge. Therefore, these values have not been shaded.

* Values in **bold and underlined** indicate loads in excess of 100% of estimated background (see **Section 2.2.8** for details).

No shading shows combinations where re-use is <75%, light shading shows where re-use is between 75% and 90%. No medium or dark shading was used as no scenario achieved >90% effluent re-use.

3.2.4 Stage 2 after Golf Course completion

Storage capacity, effluent re-use and potential for discharge after Golf Course construction

After completion of Stage 2, it is assumed that the storage volume (5 ML tank and 19 ML dam) and the irrigation area (56 ha) are fixed. Modelled scenarios therefore consider potential management measures designed to minimise effluent production only. The water balance and nutrient discharge results are shown in **Table 15**.

The results show that although the high range ADWF allowed more irrigation to occur (meeting more of the irrigation demand of the Golf Course), it also resulted in higher rates of discharge. The difference in discharge between low and high range ADWF scenarios was double that suggested by the difference in ADWF volumes, illustrating the need to control effluent generation to minimise impacts. The pattern of discharge was also different. The frequency of discharge events was higher with high range ADWF, but the average duration of events was shorter than with low range ADWF. The resulting number of days on which discharge occurs was higher under high range ADWF (see **Graph 1** in **Section 4.2.5** as an illustration).

For the low range ADWF scenarios, effluent re-use was >80% and in over 25% of years exceeded 90%. This compared to a maximum of 71% re-use and 90% re-use in 3% of years for the high range ADWF.

Nutrient loads followed the same trend. TN discharge was below 10% of background and TP discharge up to 20% of background in all low range ADWF scenarios. This compared to TN discharge of up to 40% of background and TP in excess of 100% of background for the high range ADWF.

Under low range ADWF conditions, measures to decrease stormwater infiltration into the sewage system and further attempts to divert effluent to other non-potable uses was simulated to have a marked effect on discharge volumes and nutrient loads in the receiving environment. Discharge volumes could be reduced by over 40% by halving stormwater infiltration and by diverting 10% of effluent to other uses. Despite these measures, simulations indicate notable impacts on nutrient loads are still apparent.

Nutrient assimilation, leaching potential and salt accumulation

The MEDLI output data for land water and nutrient balance under the scenarios modelled is shown in **Table 16**.

Outputs were examined for evidence of increased nitrogen leaching out of the profile, exhaustion of phosphorus storage capacity (P saturation) and impacts on plant productivity due to soil salinity increases.

Table 15: MEDLI output data for water balance and nutrient discharge under a range of scenarios – Stage 2 after Golf Course completion

	Low range ADWF			High range ADWF		
	10% ADWF reduction & low ingress	Low ingress	Average ingress	10% ADWF reduction & low ingress	Low ingress	Average ingress
Storage water balance						
Irrigation (ML)	238.55	260.42	269.12	437.76	461.07	465.73
Discharge (ML)	35.56	43.43	61.96	176.38	220.56	277.76
Number of overflow events/annum	3.18	3.64	4.20	12.68	16.94	17.52
Average duration of events (days)	11.89	11.59	11.52	7.62	6.64	6.77
Re-use fraction	0.87	0.86	0.81	0.71	0.68	0.63
Probability >90% re-use*	0.33	0.30	0.25	0.03	0.00	0.00
Discharge nutrient load						
N in discharge kg/annum	119	149	175	684	871	933
P in discharge kg/annum	24	30	35	137	174	187
Estimates background loads						
TN kg/annum	2348	2348	2348	2348	2348	2348
TP kg/annum	174	174	174	174	174	174

* This indicates the proportion of years in the simulated period when 90% re-use was achieved *ie* a value of '0.2' would be equivalent to >90% re-use occurring in 10 years out of the 50 years of simulation.

Table 16: Summary of MEDLI output data for land water and nutrient balance under range of scenarios – Stage 2 after Golf Course construction

	Control	Low range ADWF				High range ADWF			
		10% ADWF reduction & low ingress	Low ingress	Average ingress	Clippings retuned	10% ADWF reduction & low ingress	Low ingress	Average ingress	Clippings retuned
Soil water balance									
Rainfall (mm)	1939	1939	1939	1939	1939	1939	1939	1939	1939
Irrigation (mm)	0	425.98	465.04	480.56	465.04	781.71	823.35	831.65	823.35
Deep drainage (mm)	361.64	489.57	502.23	510.93	502.23	649.89	679.08	686.12	679.08
Soil nutrient balance									
N irrigated (kg/ha/yr)	0	19.48	21.36	20.89	188.66	36.91	39.04	37.94	192.53
N uptake (kg/ha/yr)	69.91	92.00	94.06	93.62	258.35	110.52	112.66	111.56	263.66
N leached (kg/ha/yr)	0.85	1.18	1.19	1.20	1.40	1.23	1.23	1.23	1.28
P irrigated (kg/ha/yr)	0	3.91	4.29	4.19	4.33	7.41	7.84	7.62	7.92
P uptake (kg/ha/yr)	0.13	<0.01	<0.01	<0.01	<0.01	0.10	0.16	0.12	0.18
P leached (kg/ha/yr)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Deep drainage characteristics									
Deep drainage NO_3 –N concentration (mg/L)	0.23	0.24	0.24	0.23	0.28	0.19	0.18	0.18	0.19
Deep drainage P concentration (mg/L)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Soil profile P storage life (years)	NA	>999	>999	>999	>999	696	666	678	661
Salinity Impact									
Relative crop yield due to salinity impacts*	NA	1	1	1	1	1	1	1	1

* A value of '1' indicates no reduction in crop yield (*ie* no impact) and a value of '0' indicates a 100% reduction in crop yield.

The data shows the following.

- Under all scenarios, irrigation increased deep drainage. The impact is proportional to irrigation rate and was therefore highest under high range ADWF scenarios.
- The nutrients supplied in irrigation increased plant productivity and resulted in higher plant uptake[9].
- Under all irrigated scenarios, plant uptake of N exceeded the amount of N applied in irrigation (net negative N balance). The effluent is not a significant source of N, and additional fertiliser would be required to maintain good quality turf under intensive amenity use.
- Under all irrigated scenarios, plant uptake of P did not exceed the amount of P applied in irrigation[9] (net positive P balance).
- The application of P in excess of crop demand did not result in a noticeable increase in the amount of P leached or the concentration of P in deep drainage compared to the control scenario. This is because the soil has the capacity to adsorb and retain the excess P applied.
- Under the scenarios with maximum P application rates (clippings returned), P storage capacity would not be exhausted for >999 years under low range ADWF or 661 years under high range ADWF.
- Under all irrigated scenarios, the amount of N leached was higher than the control scenario and highest under the highest rates of irrigation.
- Under all high range ADWF irrigated scenarios, the concentration of nitrate N in deep drainage was not increased compared to the control scenario. The increased N loads in deep drainage were therefore a result of increased deep drainage volumes leaving the soil profile rather than an increase in concentration of nitrogen passing through it. The concentration of nitrate N in deep drainage is within the range of concentration of nitrate N measured in local groundwaters (0.033-1.7 mg/L of nitrate N) (RLA 2017). An adverse impact on groundwater quality and groundwater environmental values would not be expected.
- Under low range ADWF, deep drainage concentrations were the same as or very similar to the control scenario. The increased N loads in deep drainage were therefore largely a result of increased deep drainage volumes leaving the soil profile rather than an increase in concentration of nitrogen passing through it. The concentration of nitrate N in deep drainage is within the range of concentration of nitrate N measured in local groundwaters (0.033-1.7 mg/L of nitrate N) (RLA 2017). An adverse impact on groundwater quality and groundwater environmental values would not be expected.
- Under all irrigated scenarios, soil salinity did not impact on plant productivity and significant salinity accumulation did not occur over the period of the simulation. The irrigation of relatively low strength effluent provides sufficient leaching fraction to prevent salt accumulation in the profile.
- Similar outcomes would be expected for irrigated pasture using similar land area (c. 60 ha) if this option is required prior to Golf Course completion.

[9] In low range ADWF scenarios for Stages 2 and 3, P uptake was lower than controls. The plant parameters for these runs were checked and found to be the same as the high range ADWF runs. The plant P concentration is not critical for simulating plant growth/performance (driven by other parameters) and the result is that more P is retained in the soil which makes for a more conservative simulation for P impacts. The apparent error is not therefore a limitation in terms of the impact assessment and was not investigated further.

Stage 2 summary

No potential adverse soil or groundwater impacts were identified under any of the scenarios considered.

None of the scenarios modelled achieved 100% re-use of the effluent generated in the simulations. Therefore, discharge was simulated to occur under all scenarios modelled. The frequency of discharges, the volume of discharge and the nutrient (and salt) loads exported all increased with increasing effluent production. Discharge has the potential to impact on water quality in the receiving environment.

Under the base scenario, effluent re-use was 81% with low range ADWF and 63% with high range ADWF. It was estimated that discharge loads would have the potential to increase TP loads leaving the project site by up to 20% or over 100% under low and high range ADWF scenarios respectively. The estimated impact due to TN export was smaller, but the impact due to DIN export may be similar to that for TP.

Potential impacts in the receiving environment can be reduced by improving effluent quality, reducing discharge volumes or directing discharge to an alternative location either on- or off-site.

3.2.5 Stage 3 – full development

Storage capacity, effluent re-use and potential for discharge

The water balance and nutrient discharge results based on irrigation to Golf Course and other amenity areas are shown in **Table 17**.

An additional scenario was included to examine whether the dam provides any benefit in terms of discharge mitigation. The use of the dam may add additional management restrictions on the use, management or location of irrigation applications as water is unlikely to meet A+ quality[10] after storage in the dam. Data from the additional scenario can be used to assist with decision making during the detailed design phase.

The results show that although the high range ADWF allowed more irrigation to occur (meeting more of the irrigation demand of the Golf Course), it also resulted in higher rates of discharge. Observations made on the outcomes of similar modelling in Stage 2 (after Golf Course construction in **Section 3.2.4**) are relevant.

For the low range ADWF scenarios that included the dam, effluent re-use was ≥80% and with additional management to minimise effluent volumes could achieve 90% re-use in up to 31% of years. This compared to a maximum of 69% re-use on average and no years with 90% re-use for the high range ADWF. The no dam scenarios with high or low range ADWF both indicated a net benefit of including the dam as part of the wet weather storage in terms of improving effluent re-use and reducing potential for discharge impacts.

Nutrient loads followed the same trend as discharge volumes. TN discharge was below 10% of background and TP discharge up to 25% of background in all low range ADWF scenarios. This compared to TN discharge of up to 47% of background and TP in excess of 100% of background for the high range ADWF.

[10] A+ effluent quality is required for unrestricted use. If this quality cannot be met, additional buffer distances to sensitive receptors and withholding periods may be required. This would likely hamper the re-use of effluent and may result in rates of discharge above those modelled here.

Under low range ADWF conditions, measures to decrease stormwater infiltration into the sewage system and further attempts to divert effluent to other non-potable uses were simulated to have a marked effect on discharge volumes and nutrient loads in the receiving environment. Discharge volumes could be reduced by over 40% by halving stormwater infiltration and by diverting 10% of effluent to other uses. Despite these measures, simulations indicate notable impacts on nutrient loads are still apparent.

Nutrient assimilation, leaching potential and salt accumulation

The MEDLI output data for land water and nutrient balance under the scenarios modelled is shown in **Table 18**.

Outputs were examined for evidence of increased nitrogen leaching out of the profile, exhaustion of phosphorus storage capacity (P saturation) and impacts on plant productivity due to soil salinity increases.

The data shows the following.

- Under all scenarios, irrigation increased deep drainage. The impact is proportional to irrigation rate and was therefore highest under high range ADWF scenarios.
- The nutrients supplied in irrigation increased plant productivity and resulted in higher plant uptake[11].
- Under all irrigated scenarios, plant uptake of N exceeded the amount of N applied in irrigation (net negative N balance). The effluent is not a significant source of N and additional fertiliser would be required to maintain good quality turf under intensive amenity use.
- Under all irrigated scenarios, plant uptake of P did not exceed the amount of P applied in irrigation[11] (net positive P balance).
- The application of P in excess of crop demand did not result in a noticeable increase in the amount of P leached or the concentration of P in deep drainage compared to the control scenario. This is because the soil has the capacity to adsorb and retain the excess P applied.
- Under the scenarios with maximum P application rates (clippings returned), P storage capacity would not be exhausted for 983 years under low range ADWF or 602 years under high range ADWF.
- Under all irrigated scenarios, the amount of N leached was higher than the control scenario and highest under the highest rates of irrigation.
- Under all high range ADWF irrigated scenarios, the concentration of nitrate N in deep drainage was not increased compared to the control scenario. The concentration of nitrate N in deep drainage is within the range of concentrations of nitrate N measured in local groundwaters (0.033-1.7 mg/L of nitrate N) (RLA 2017). The increased N loads in deep drainage were therefore a result of increased deep drainage volumes leaving the soil profile rather than an increase in concentration of nitrogen passing through it. An adverse impact on groundwater quality and groundwater environmental values would not be expected.

[11] In low range ADWF scenarios for Stages 2 and 3, P uptake was lower than controls. The plant parameters for these runs were checked and found to be the same as the high range ADWF runs. The plant P concentration is not critical for simulating plant growth/performance (driven by other parameters) and the result is that more P is retained in the soil which makes for a more conservative simulation for P impacts. The apparent error is not therefore a limitation in terms of the impact assessment and was not investigated further.

- Under low range ADWF, deep drainage concentrations were the same as or very similar to the control scenario. The increased N loads in deep drainage were therefore largely a result of increased deep drainage volumes leaving the soil profile rather than an increase in concentration of nitrogen passing through it. The concentration of nitrate N in deep drainage is within the range of concentrations of nitrate N measured in local groundwaters (0.033-1.7 mg/L of nitrate N) (RLA 2017). An adverse impact on groundwater quality and groundwater environmental values would not be expected.
- Under all irrigated scenarios, soil salinity did not impact on plant productivity and significant salinity accumulation did not occur over the period of the simulation. The irrigation of relatively low strength effluent provides sufficient leaching fraction to prevent salt accumulation in the profile.

Table 17: MEDLI output data for water balance and nutrient discharge under a range of scenarios – Stage 3

	Low range ADWF				High range ADWF			
	10% ADWF reduction & low ingress	Low ingress	Low Ingress with no dam	Average ingress	10% ADWF reduction & low ingress	Low ingress	Low ingress with no dam	Average ingress
Storage water balance								
Irrigation (ML)	259.75	282.93	249.83	291.84	454.54	476.54	431.03	480.58
Discharge (ML)	43.23	53.06	80.32	74.32	206.58	257.40	297.81	320.02
Number of overflow events	3.64	4.08	10.74	4.88	15.24	20.74	34.84	21.44
Average duration of events (days)	11.57	11.55	7.38	11.05	7.04	6.00	4.42	6.07
Re-use fraction	0.86	0.84	0.76	0.80	0.69	0.65	0.59	0.60
Probability >90% re-use*	0.31	0.29	0.06	0.18	0.00	0.00	0.00	0.00
Discharge nutrient load								
N in discharge kg/annum	148	185	304	214	812	1029	1203	1093
P in discharge kg/annum	30	37	61	43	162	206	241	219
Estimates background loads								
TN kg/annum	2348	2348	2348	2348	2348	2348	2348	2348
TP kg/annum	174	174	174	174	174	174	174	174

* This indicates the proportion of years in the simulated period when 90% re-use was achieved *ie* a value of '0.2' would be equivalent to >90% re-use occurring in 10 years out of the 50 years of simulation.

Table 18: Summary of MEDLI output data for land water and nutrient balance under range of scenarios – Stage 3

	Control	Low range ADWF				High range ADWF			
		10% ADWF reduction + low ingress	Low ingress	Average ingress	Clippings retuned	10% ADWF reduction + low ingress	Low ingress	Average ingress	Clippings retuned
Soil water balance									
Rainfall (mm)	1939	1939	1939	1939	1939	1939	1939	1939	1939
Irrigation (mm)	0	463.84	505.23	521.14	505.23	811.68	850.96	858.17	850.96
Deep drainage (mm)	361.64	501.77	516.18	525.68	516.18	670.42	700.74	706.89	700.74
Soil nutrient balance									
N irrigated (kg/ha/yr)	0	21.30	23.31	22.79	192.80	38.43	40.46	39.32	188.59
N uptake (kg/ha/yr)	69.91	94.00	96.19	95.70	262.70	112.05	114.08	112.94	259.81
N leached (kg/ha/yr)	0.85	1.19	1.20	1.20	1.35	1.23	1.23	1.23	1.27
P irrigated (kg/ha/yr)	0	4.28	4.68	4.58	4.73	7.72	8.12	7.90	9.02
P uptake (kg/ha/yr)	0.13	<0.01	<0.01	<0.01	<0.01	0.15	0.21	0.16	0.41
P leached (kg/ha/yr)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Deep drainage characteristics									
Deep drainage NO_3 concentration (mg/L)	0.23	0.24	0.23	0.23	0.26	0.18	0.18	0.17	0.18
Deep drainage P concentration (mg/L)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Soil profile P storage life (years)	NA	>999	999	>999	983	674	648	660	602
Salinity impact									
Relative crop yield due to salinity impacts*	NA	1	1	1	1	1	1	1	1

* A value of '1' indicates no reduction in crop yield (*ie* no impact) and a value of '0' indicates a 100% reduction in crop yield.

4. Relevant Project Activities and Potential Impacts

4.1 Proposed action and threats

R&O is proposing to develop the project area into a luxury residential, tourism, health and education experience.

As discussed in **Section 1.2**, waste water from the development will be treated on-site (via a purpose built WWTP from Stage 1B onwards) and treated waste water effluent is seen as an important resource for supplementing non-potable water supply.

The feasibility and long-term sustainability of using effluent for land irrigation has required an assessment of:

- the suitability of the land for receiving effluent irrigation
- the capacity of the soil/plant system to assimilate effluent application and in particular:
  - the capacity of the system to assimilate hydraulic loads and minimise rate of effluent discharge (of salt and nutrients) and downstream or off-site impacts
  - the capacity of the system to assimilate nutrient and salt loads and minimise leaching of nutrients to groundwater or minimise salt accumulation and plant stress.

The project has the potential to result in a range of direct and indirect threats to terrestrial, surface water and groundwater environmental or conservation values. The potential project-related impacts are described below.

4.2 Summary of values and existing threats

4.2.1 Values

No areas of State or Regional interest (agriculture) were identified. The project area does not contain land that is recognised at State level as being of high quality or strategic value. Portions of the project site are suitable for grazing, but land quality limitations and existing threats would prevent intensive land use (NRA 2017c). Effluent irrigation will not impact on agricultural land resources.

Pre-existing land disturbances on the project site (for example, at the Helipad and area used by the Paintball operator) will be rehabilitated as part of the project development. This is expected to provide some improvement to water quality that may offset potential impacts if instream disposal of surplus treated effluent is required.

The *KUR-World Water Quality and Aquatic Ecology Technical Report* (NRA 2017a) identified the discharge of treated effluent as a potential threat to water quality and environmental values in the receiving environment. Effluent will be used as much as possible to reduce the need for non-potable water supply demand on the project. However, during periods of wet weather, effluent production may exceed non-potable water demand.

The condition of the waters on the project site (and in the Barron River downstream of the site) is nominated as 'moderately disturbed' in the *Environmental Protection (Water) Policy 2009 - Barron River Basin, Environmental Values and Water Quality Objectives - Basin No 110 and Adjacent Coastal Waters* (EHP 2014). Under the Queensland *Environmental*

Protection (Water) Policy 2009, the management intent for moderately disturbed waters is that physical or chemical indicators are progressively improved to achieve the water quality objectives (WQOs) for high ecological value water. Although water quality data for creeks on the project site is limited, it appears that some of the indicators do not meet the WQOs for moderately disturbed waters. The intent should be for those indicators to be improved to achieve the nominated WQOs.

The creeks on and downstream of the project site provide habitat for, and sustain breeding populations of, the critically endangered Kuranda Tree Frog (*Litoria myola*) (NRA 2017b). Warril Creek (downstream of the project site) contains the second largest and Owen Creek (on-site and downstream of the project site) the third largest known population of this species. There is also a smaller population on Cain Creek (in two areas; one upstream and another downstream of the project site). The Kuranda Tree Frog may be impacted by changes in hydrology (flow regimes) and water quality if waste water management requires excess treated effluent to be discharged to waterways.

According to RLA (2017), the groundwater at KUR-World is, on the whole, considered to be of good chemical quality. The salinity is low, as are concentrations of sulfate and nitrate, and there are few problems with metals exceeding Australian Drinking Water Guidelines (ADWG). The pH of the groundwater is regularly lower than the ADWG guideline value. Iron and manganese sporadically exceed the ADWG guideline values, but not always in the same bore for successive samples. Occasional exceedances of the ADWG guideline values for aluminium and arsenic occur, but not always in the same bore for successive samples.

4.2.2 Potential threats and impacts to land and groundwater

The project area has limitations with respect to suitability for receiving irrigation. The greatest limitation is due to the dissected and steep topography that is not well suited to irrigation use. Large portions of the irrigable area (*eg* 45% in the Golf Course precinct) are on moderate slopes (12-20%) and will require careful management to prevent run-off and accelerated erosion.

No effluent irrigation should occur to native vegetation. The nutrients applied would potentially change soil conditions and nutrient availability that may adversely affect native vegetation dynamics and encourage weed growth.

No potential adverse soil or groundwater impacts were identified under any of the effluent irrigation scenarios modelled for all stages of the project.

Provided that irrigation occurs on land that is suitable for receiving irrigation, the land is used for agriculture or amenity planting and effluent quality and quantity is similar to that modelled, no adverse impacts to land and groundwater values are expected in the long-term.

4.2.3 Potential impacts to surface water and aquatic ecology

Simulations have indicated that not all effluent can be re-used on the project. The proportion that can be re-used decreases with increasing effluent generation rates and decreases as the project progresses.

The greatest threat posed by effluent irrigation is not due to effluent re-use, but due to the impact of the effluent that cannot be re-used and must be disposed of. If effluent that is surplus to demand is disposed of in waterways on the project site, it has the potential to impact on water quality and environmental values contrary to the intent of the Queensland *Environmental Protection (Water) Policy* 2009. The change in water quality may have an impact on stream-dwelling fauna including the critically endangered Kuranda Tree Frog. The potential changes in water quality will be flow dependent and discharge will tend to occur in pulses. Many organisms can tolerate poorer water quality for short periods. The effects of pulse exposures are toxicant and species dependent. If organisms do recover between pulses, then the rate of recovery relative to the frequency of exposures is important. If the organisms do not recover (or have not fully recovered) from an initial pulse, the effects of subsequent pulses are likely to be cumulative (and could be greater than additive). In work on impacts of major ion (magnesium) pulses, Hogan *et al.* (2013) and Prouse *et al.* (2015) found that organisms could recover rapidly between pulses. Therefore, any management measure that can minimise the duration and frequency of pulse events will minimise potential impacts.

There is insufficient information available to quantify the impact, but the potential level of impact is expected to increase as the size of the development increases through the proposed project stages. With the information available, the upper range of ADWF values estimated by Arup and used for modelling purposes on the whole produced estimated nutrient export loads of more than 10% of background under most scenarios from stage 1B onwards.

The following sections summarise the potential threats as they relate to water quality and aquatic ecology.

Stage 1A

None of the scenarios modelled achieved 100% effluent re-use, and discharge will occur under all scenarios modelled. The frequency of discharges, the volume of discharge and the nutrient (and salt) loads exported all increased with increasing effluent production volume. Discharge has the potential to impact on water quality in the receiving environment.

Effluent re-use of >95% and infrequent overtopping events could be obtained under ADWF scenarios with relatively modest storage volume and land areas combinations. However, with 90% effluent re-use achievable under the high range ADWF scenarios with similar storage and land area combinations, it was estimated that discharge loads have the potential to increase TP loads leaving the project site by over 10%. The impact due to TN export is smaller, but the impact due to DIN may be similar to that of TP.

Stage 1B

Under the majority of land area scenarios with low range ADWF estimates, the contribution of effluent discharge would be between 1-5% of TN loads resulting from background land uses on the project site. An irrigation area of at least 30 ha was required to achieve a TN discharge load of <5% of background. Under high range ADWF, TN load contributions of more than 10% of background are possible unless stormwater ingress and ADWF are reduced and a large land area (at least 80 ha) is used.

Under the majority of land area scenarios with low range ADWF estimates, effluent TP discharge equivalent to between 1-5% of background could only be achieved with low stormwater ingress; otherwise, loads of 10% of background could be achieved with 40 ha of irrigation. None of the scenarios with high range ADWF estimates achieved TP loads of 10% of background.

Although the WWTP will be installed in Stage 1B, leading to an improvement in effluent quality, because of the increased ADWF, the potential for discharge impacts is higher than in Stage 1A under the conditions simulated.

Stage 2

Until the Golf Course is completed, there may be a need to use paddocks for irrigation during Stage 2. After the Golf Course has been constructed in Stage 2, this area and other areas of amenity planning will be irrigated with treated effluent.

If paddocks are used, modelling indicates that very large areas would be required to manage effluent under the high range ADWF, but that impacts >10% on nutrient loads in the receiving environment would be likely even with 100 ha of irrigation. Outcomes under the low range ADWF scenarios were better with 60 ha irrigation required to allow almost 80% re-use and TN export loads of less than 10% of background. Under all scenarios, TP export loads remained >10% of background.

With the Golf Course finalised, TN discharge loads were below 10% of background and TP discharge up to 20% of background in all low range ADWF scenarios. This compared to TN discharge of up to 40% of background and TP in excess of 100% of background for the high range ADWF.

Stage 3

TN discharge was below 10% of background and TP discharge up to 25% of background in all low range ADWF scenarios. This compared to TN discharge of up to 47% of background and TP in excess of 100% of background for the high range ADWF.

4.2.4 Recommended mitigation measures – land and groundwater

The following management measures are required to minimise impacts to land and groundwater.

- Only land identified as suitable for irrigation should be used for effluent disposal.
- Appropriate buffer zones/set-backs nominated in the report should be applied around creeks.
- Irrigable land with moderate slopes (12-20%) should be managed and land condition monitored to prevent run-off and accelerated erosion.
- No effluent irrigation should occur to native vegetation. Effluent from the Rainforest Education Centre should be pumped to the on-site WWTP for treatment.

4.2.5 Recommended mitigation measures – surface water and aquatic ecology

There are several ways to reduce or remove potential impacts associated with effluent discharge that need to be explored at the detailed design stage of the WWTP.

- Offset the nutrient loads from WWTP discharge by improving water quality through environmental works in the catchment that receives discharge.
- Increase storage volume and irrigated land area.
- Reduce nutrient content in effluent to the lowest practicable extent.
- Reduce effluent production:
  - use water saving and efficiency measures on-site
  - identify non-potable uses other than irrigation
  - reduce stormwater infiltration into the sewerage system through appropriate design, build specification and maintenance.
- Explore options to discharge other on-site creeks less sensitive to impacts than Owen Creek (such as Cain Creek).

- Explore options for effluent discharge off-site discharge into a less sensitive or already impacted waterway (such as the current location of the Kuranda WWTP outfall or the Barron River).

Any design that includes on-site effluent discharge must be accompanied by more detailed hydrological modelling to determine the potential impact on receiving water quality.

Potential offsets through environmental improvements

There are plans to revegetate two eroding areas (Paintball activities and the Helipad) that may be contributing sediment and associated nutrients to the Owen Creek system. This improvement as part of the development will lead to an anticipated reduction in nutrient loads in this creek.

The Revised Universal Soil Loss Equation (RUSLE) (Rosewell & Loch 2002) and the SOILOSS program (Rosewell 1993) was used to estimate current erosion rates and erosion rates following management intervention. Local soil TN and TP concentrations were used to estimate the nutrient load offset that may be generated. The results are presented in **Table 19**.

Table 19: Predicted suspended solids and nutrient offsets from land management improvements on eroded areas at KUR-World

Area	Soil types (NRA 2017c)	Estimated current soil erosion[#] (t/annum)	Predicted soil erosion after revegetation (t/annum)	Potential suspended solids offset (t/annum)	Average subsoil nutrient content (g/t)*	Potential nutrient load offset (kg/annum)
Paintball	Galmara and Mission	21.0	2.3	18.7	201 TN 363 TP	3.8 TN 6.8 TP
Helipad	Galmara	18.9	1.9	17.0	274 TN 412 TP	4.7 TN 7.0 TP

[#] Based on known exposed subsoil properties (NRA 2017c).

*Based on Murtha *et al*. (1996).

The results indicate that the potential TN offset is insignificant compared to expected increases on nutrient loads from discharge. The TP offset is sufficient to potentially offset most of the TP in discharge from Stage 1A and 1B (under some management scenarios), but not from Stage 2 onwards.

Other planned land management measures such as the management of cattle watering points in creeks would also potentially offset any impacts from effluent discharge.

Improved land management alone is insufficient to mitigate potential long-term impacts from discharge.

Increase land area and storage volume

All irrigable land areas within the project were considered during modelling. Irrigated land area cannot be increased without additional clearing on-site or finding suitable land off-site (neighbouring properties). The irrigation is unlikely to greatly benefit neighbouring users. Modelling has shown that, to achieve high rates of land disposal, the value of irrigation as a means of supplementing non-potable demand is diminished (*ie* the volumes provided to off-site properties would be relatively small and not at times of greatest demand). This option appears to be impractical.

The scenarios already included the 19 ML on-site dam and a 5 ML storage tank. Modelling in **Section 3.2.5** indicated that the storage capacity provided by the dam is beneficial for minimising discharge. However, its use may impact on water microbiological quality and prevent unrestricted irrigation use. Avoiding the use of the dam would make irrigation management less complicated, but would require additional tank storage to compensate. Space is at a premium and this option would need to be considered at the detailed design stage.

Improve effluent quality

Modelling was based on WWTP effluent containing 5 mg/L of TN and 1 mg/L of TP. It is possible to treat waste water to a higher level of nutrient removal through a range of processes including reverse osmosis (RO). The Magnetic Island water recycling plant, which is surrounded by the Great Barrier Reef Marine Park, was designed to achieve 3 mg/L TN and 0.1 mg/L TP (*pers. comm.* Sam Koci, Arup, 18 October 2017). A TN concentration of below 1 mg/L may be possible with RO (Schoeman & Steyn 2003, Merlo *et al*. 2012), although this would require management of RO brine.

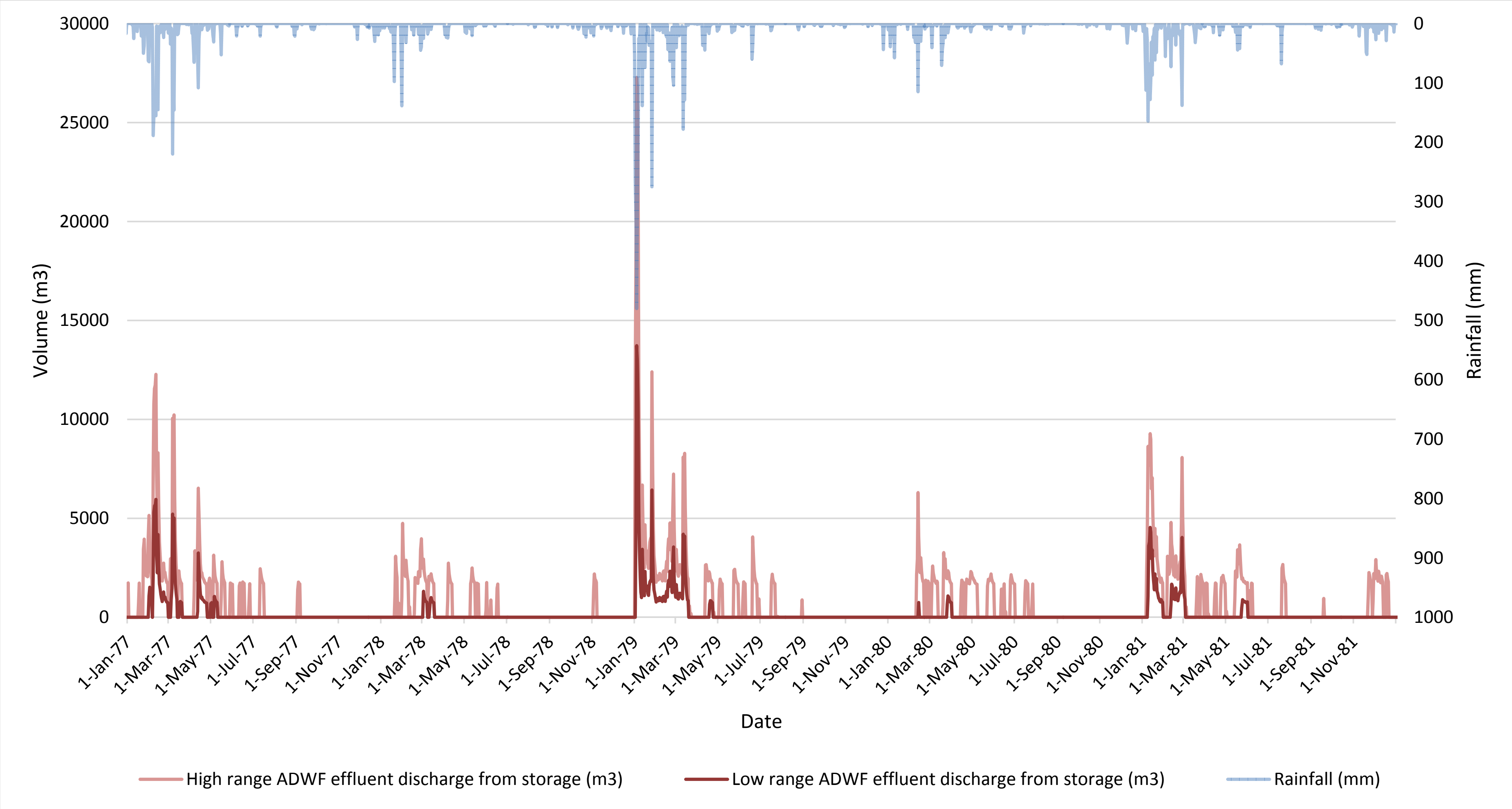
If effluent discharge is to occur on-site and the intent is to not further degrade local water quality, the required WWTP performance criteria could be determined through further MEDLI modelling in daily time-step mode coupled with detailed hydrological modelling of catchment flows and mixing in the receiving waters. This effort would also benefit from more measurements of local water quality under a range of flow conditions.

Reduction in effluent generation

Modelling indicated that the difference in discharge between low and high range ADWF scenarios was double that suggested by the difference in ADWF volumes, illustrating the need to control effluent generation to minimise impacts. **Graph 1** illustrates the effect of reducing different ADWF volumes on the frequency and magnitude of discharge during periods with different rainfall patterns. The higher the ADWF, the larger and more frequent the discharge events. With high ADWF, discharge is triggered by relatively small events or periods of moderate rainfall. Under low range ADWF, discharge pulses are fewer and further apart (important for ecological recovery) and generally occur when rainfall (and therefore creek flows) are high and may potentially mask discharge effects[12].

Modelling showed that discharge volumes could be reduced by over 40% by halving stormwater infiltration and by diverting 10% of effluent to other uses.

[12] Detailed hydrological modelling could elucidate this effect.



Graph 1: Effect of variations in rainfall pattern on effluent discharge from wet weather storage under low and high range ADWF (Stage 2 with Golf Course and low stormwater infiltration)

Alternative discharge locations

The report considered only discharge to the Owen Creek catchment (the catchment that receives overflows from the on-site dam).

If options for waste water treatment and volume reductions are insufficient to prevent further degradation of Owen Creek water quality, discharge to a location that may result in a lower potential impact on sensitive receptors may be a reasonable alternative.

The following two options could be explored.

- Discharge to the location of the outfall of the Kuranda WWTP on Jumrum Creek (or another suitable off-site location).
- Discharge to an alternative creek on-site. Of the creeks on-site, Cain Creek has the smallest known Kuranda Tree Frog population (NRA 2017b). Discharge downstream of the current access road would avoid the known small population upstream of this point. There is a small population at the confluence with Barron River, and further MEDLI and receiving environment hydrological modelling would be required to determine potential impacts on water quality that may affect this population.

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Appendix A:
MEDLI Output

Control Runs

MEDLI REPORT - FULL RUN

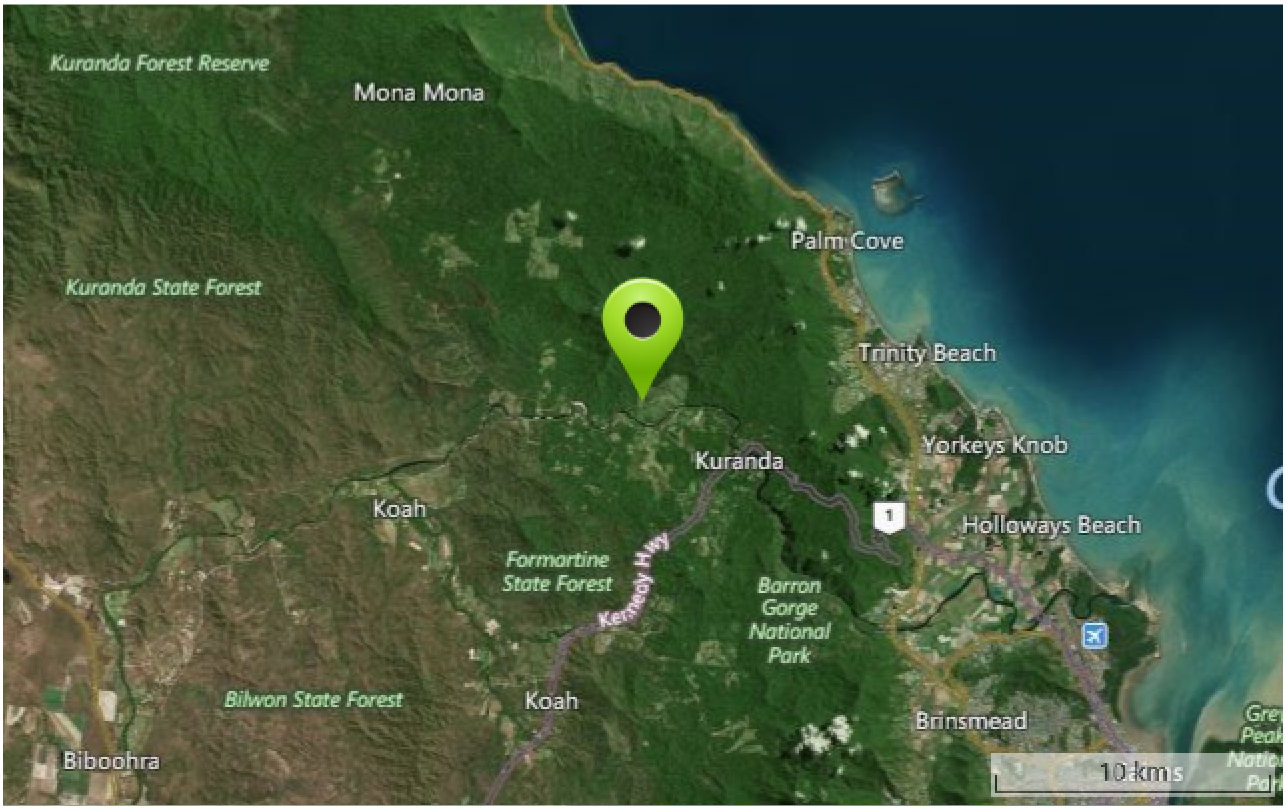
Enterprise: Kur World

Description:
Kur World Control under Kikuyu

Client: Reever and Ocean

MEDLI User: NATRES\andrew

Scenario Details:
Control
Bicton Soil
No effluent and no clippings
Background nutrient loss under rainfall. Kikuyu pasture kickstarted

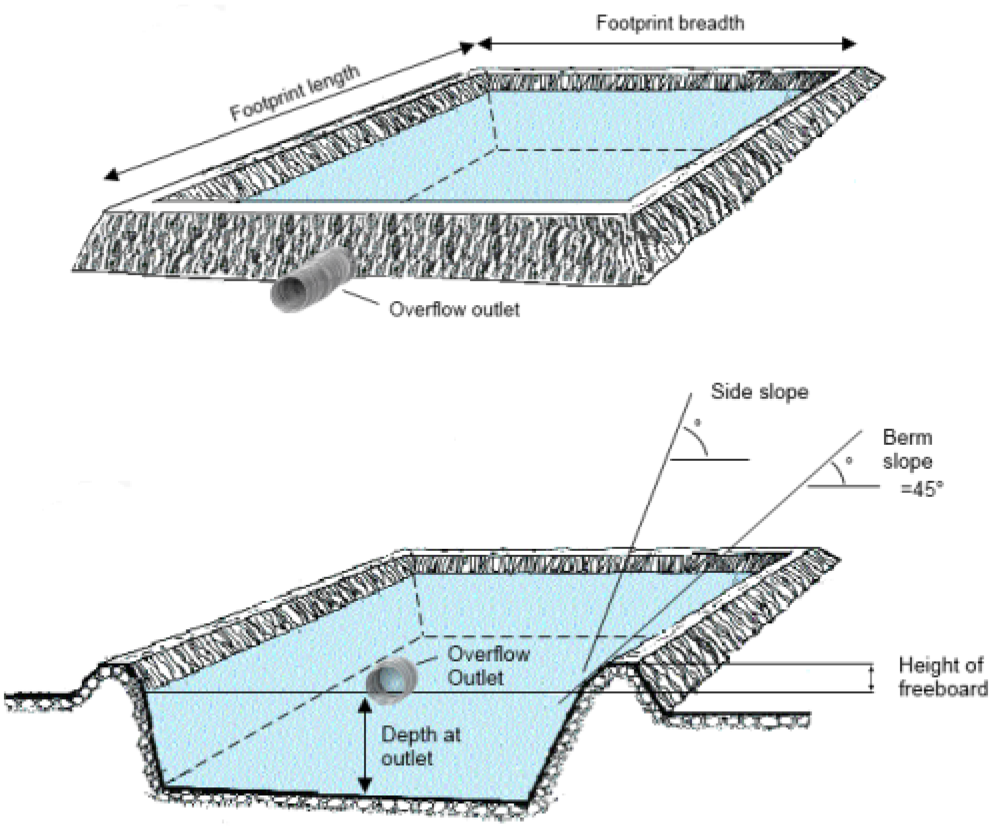


DESCRIPTION

Pond system: 1 closed storage tank

Pond system details:

	Pond 1
Maximum pond volume (ML)	5.00
Minimum allowable pond volume (ML)	0.00
Pond depth at overflow outlet (m)	4.00
Maximum water surface area (m2)	1250.00
Pond footprint length (m)	35.36
Pond footprint width (m)	35.36
Pond catchment area (m2)	1250.00
Average active volume (ML)	0.00



Irrigation pump limits:

Minimum pump rate limit (ML/day)	0.00
Maximum pump rate limit (ML/day)	10.00

Shandying water:

Annual allocation of fresh water available for shandying (ML/year)	0.00
Maximum rate of application of fresh water (ML/day)	0.00
Nitrogen concentration (mg/L)	0.00
Salinity (dS/m)	0.00
Minimum shandy water is used	False

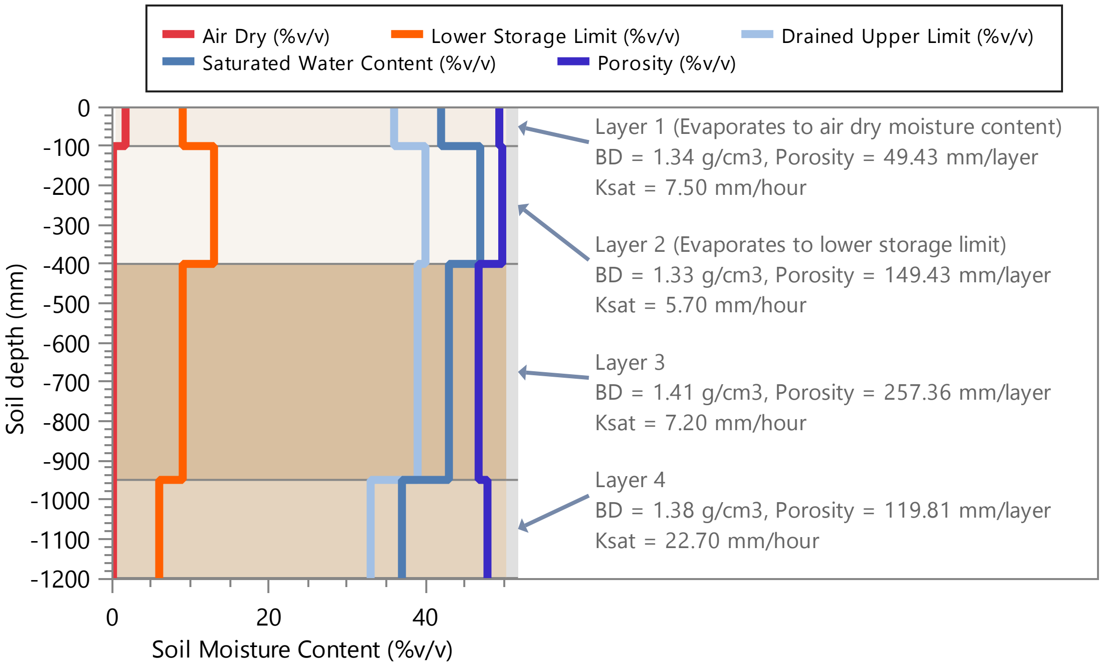
DESCRIPTION

Land: New Paddock

Area (ha): 30.00

Soil Type: Bicton (Kur-World), 1200.00 mm defined profile depth

Profile Porosity (mm)	576.04
Profile saturation water content (mm)	512.00
Profile drained upper limit (or field capacity) (mm)	453.00
Profile lower storage limit (or permanent wilting point) (mm)	112.50
Profile available water capacity (mm)	340.50
Profile limiting saturated hydraulic conductivity (mm/hour)	5.70
Surface saturated hydraulic conductivity (mm/hour)	7.50
Runoff curve number II (coefficient)	80.00
Soil evaporation U (mm)	8.50
Soil evaporation Cona (mm/sqrt day)	3.75



Plant Data: Continuous Kikuyu 1 Pasture - kickstart, kick started

Average monthly cover (fraction) (minimum - maximum)	0.88 (0.82 - 0.92)
Maximum crop factor at 100% cover (mm/mm) (Maximum crop coefficient 0.8 x Pan coefficient 1)	0.80
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Maximum potential root depth in defined soil profile (mm)	1200.00
Salt tolerance	Moderately tolerant
Salinity threshold EC sat. ext. (dS/m)	3.00
Proportion of yield decrease per dS/m increase (fraction/dS/m)	0.03

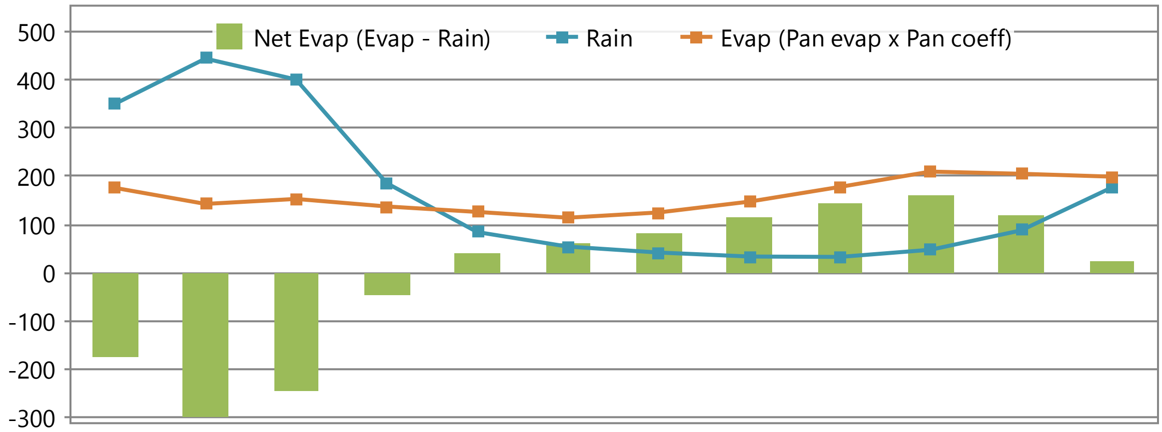
DIAGNOSTICS

Sustainability Diagnostics: Kur World

Averaged Historical Climate Data Used in Simulation (mm)

Location: KurWorlSTP, -16.8°, 145.6°

Run Period: 01/01/1967 to 31/12/2016 50 years, 0 days



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	349.9	444.0	400.6	185.8	84.3	54.1	41.9	33.6	32.8	47.6	87.8	176.5	1938.9
Evap	176.0	142.7	153.0	137.4	126.0	114.1	125.0	147.4	177.9	209.7	205.2	199.2	1913.4
Net Evap	-173.9	-301.3	-247.6	-48.4	41.8	59.9	83.1	113.8	145.1	162.1	117.4	22.7	-25.5
Net Evap/day	-5.6	-10.7	-8.0	-1.6	1.3	2.0	2.7	3.7	4.8	5.2	3.9	0.7	-0.1

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Pond System: 1 closed storage tank

New Sewage Treatment Plant - 0.00 ML/year or 0.00 ML/day generated on average

Effluent entering pond system after any pretreatment and recycling

Average (Minimum-Maximum) influent quality calculated for 0.00 non-zero flow days, after any pretreatment and recycling.

Constituent	Concentration (mg/L)	Load (kg/year)
Total Nitrogen	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Total Phosphorus	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Total Dissolved Salts	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Volatile Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Total Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)

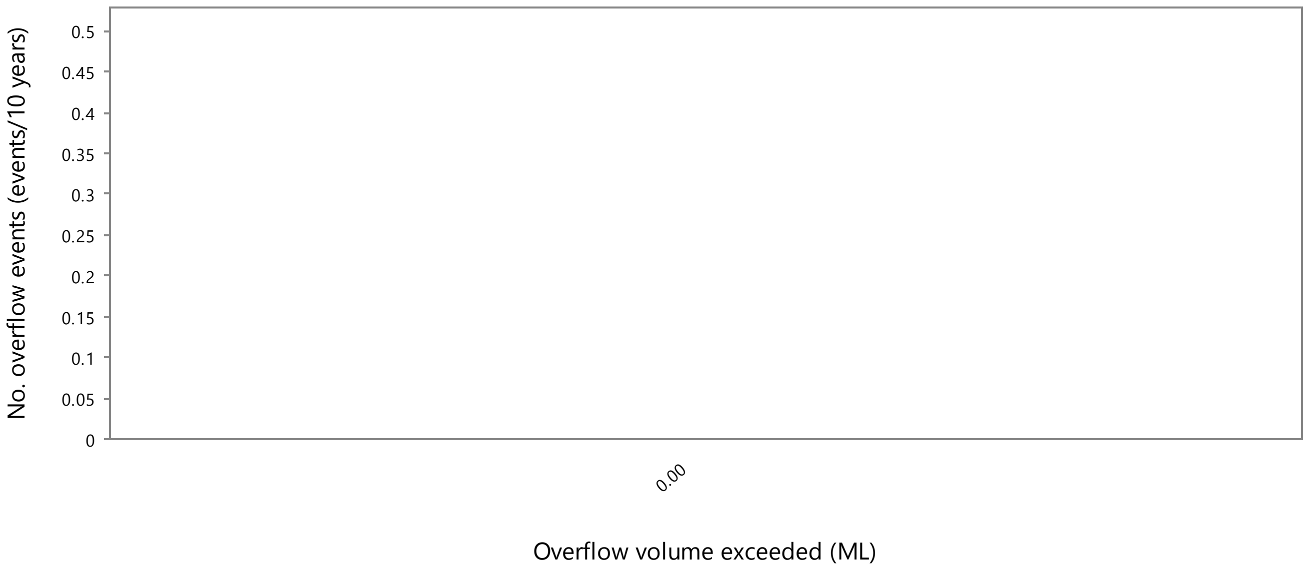
Last pond (Wet weather store): 5.00 ML

Theoretical hydraulic retention time (days)	0.00
Average volume of overflow (ML/year)	0.00
No. overflow events per year exceeding threshold* of 0.00 ML (no./year)	0.00
Average duration of overflow (days)	0.00
Effluent Reuse (Proportion of Inflow + Net Rain Gain that is Irrigated) (fraction)	0.00
Probability of at least 90% effluent reuse (fraction)	0.00
Average salinity of last pond (dS/m)	0.91
Salinity of last pond on final day of simulation (dS/m)	0.91
Ammonia loss from pond system water area (kg/m2/year)	0.00

* The threshold is the volume equivalent to the top 1 mm depth of water of a full pond

Overflow exceedance:

Chart Table



Export plot

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Irrigation Information

Irrigation: 30 ha total area (assumed 100% irrigation efficiency)

	Quantity/year	Quantity/ha/year
Total irrigation applied (ML)	0.00	0.00
Total nitrogen applied (kg)	0.00	0.00
Total phosphorus applied (kg)	0.00	0.00
Total salts applied (kg)	0.00	0.00

Shandying

Annual allocation of fresh water for shandying (ML/year)	0.00
Average Shandy water irrigation (ML/year) (minimum - maximum)	0.00 (0.00 - 0.00)
Average exceedance as a proportion of annual shandy water allocation (% of allocation) (minimum - maximum)	0.00 (0.00 - 0.00)
Proportion of irrigation events requiring shandying (fraction of events)	0.00
Minimum shandy water is used	False

Irrigation Issues

Proportion of Days irrigation is prevented when triggered (fraction)	0.94
Proportion of Days water demand is too small to trigger irrigation (fraction)	0.06

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Land: New Paddock: 30 ha

Irrigation: Fixed Sprinkler with 0.2% ammonium loss during irrigation

Irrigation triggered when soil water deficit reaches 5.00 mm and rainfall is less than or equal to 3.00 mm
Irrigate up to a soil water content of drained upper limit plus 0.00 mm
Irrigation window from 1/1 to 31/12 including the days specified
A minimum of 0 days must be skipped between irrigation events

Soil Water Balance (mm): Bicton (Kur-World), 340.50 mm PAWC at maximum root depth

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	349.9	444.0	400.6	185.8	84.3	54.1	41.9	33.6	32.8	47.6	87.8	176.5	1938.9
Irrigation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Soil Evap	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.0	0.5
Transpn.	103.5	100.4	108.7	100.2	92.6	82.1	88.2	92.7	86.1	72.6	63.8	87.8	1078.7
Runoff	105.5	151.3	148.6	36.5	5.4	1.8	0.5	0.0	1.0	1.7	4.6	27.3	484.1
Drainage	42.3	115.7	133.4	66.0	17.3	5.2	1.0	0.0	0.0	0.0	0.0	0.5	381.4
Delta	98.7	76.6	10.0	-17.0	-31.1	-34.9	-47.8	-59.1	-54.4	-26.8	19.1	60.9	-5.8

Soil Nitrogen Balance

Average annual effluent nitrogen added (kg/ha/year)	0.00
Average annual soil nitrogen removed by plant uptake (kg/ha/year)	71.40
Average annual soil nitrogen removed by denitrification (kg/ha/year)	1.70E-03
Average annual soil nitrogen leached (kg/ha/year)	0.06
Average annual nitrate-N loading to groundwater (kg/ha/year)	0.06
Soil organic-N kg/ha (Initial - Final)	3809.50 - 315.00
	74.41 - 3.31E-03
Average nitrate-N concentration of deep drainage (mg/L)	0.02
Max. annual nitrate-N concentration of deep drainage (mg/L)	0.59

Soil Phosphorus Balance

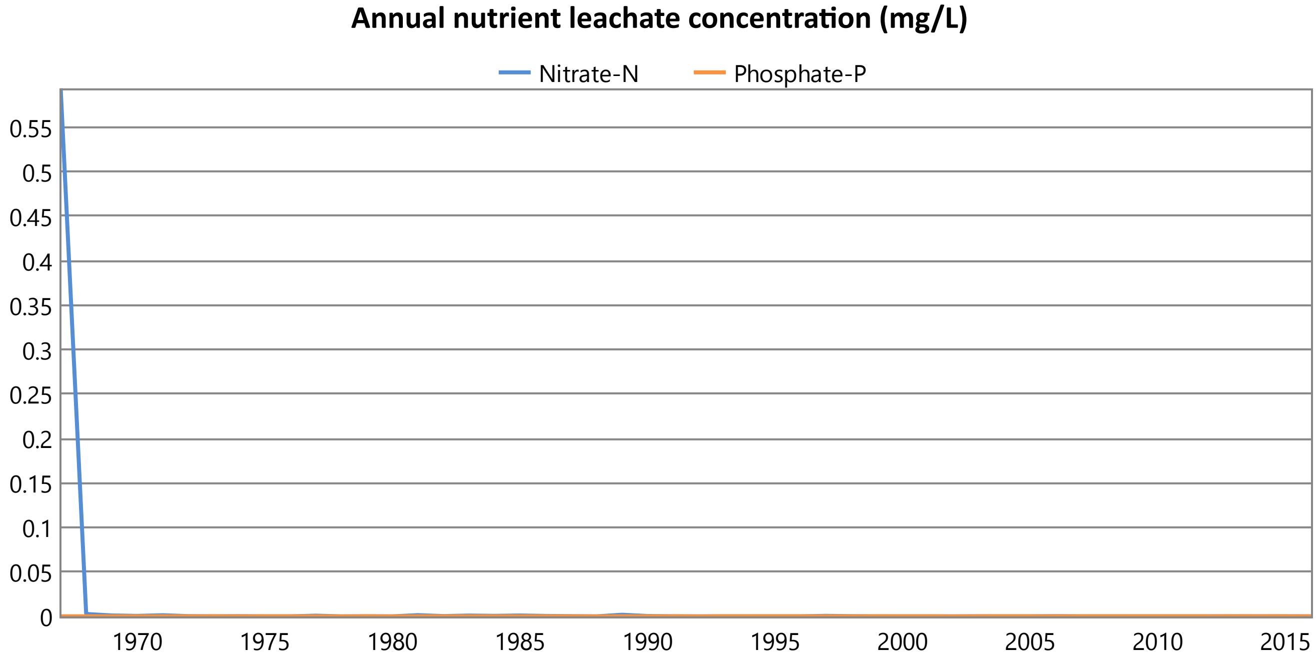
Average annual effluent phosphorus added (kg/ha/year)	0.00
Average annual soil phosphorus removed by plant uptake (kg/ha/year)	0.01
Average annual soil phosphorus leached (kg/ha/year)	2.71E-04
Dissolved phosphorus (kg/ha) (Initial - Final)	2.86E-04 - 3.10E-04
Adsorbed phosphorus (kg/ha) (Initial - Final)	450.65 - 453.97
Average phosphate-P concentration in rootzone (mg/L)	8.25E-05
Average phosphate-P concentration of deep drainage (mg/L)	7.10E-05
Max. annual phosphate-P concentration of deep drainage (mg/L)	7.81E-05
Design soil profile storage life based on average infiltrated water phosphorus concn. of 0.00 mg/L (years)	0.00

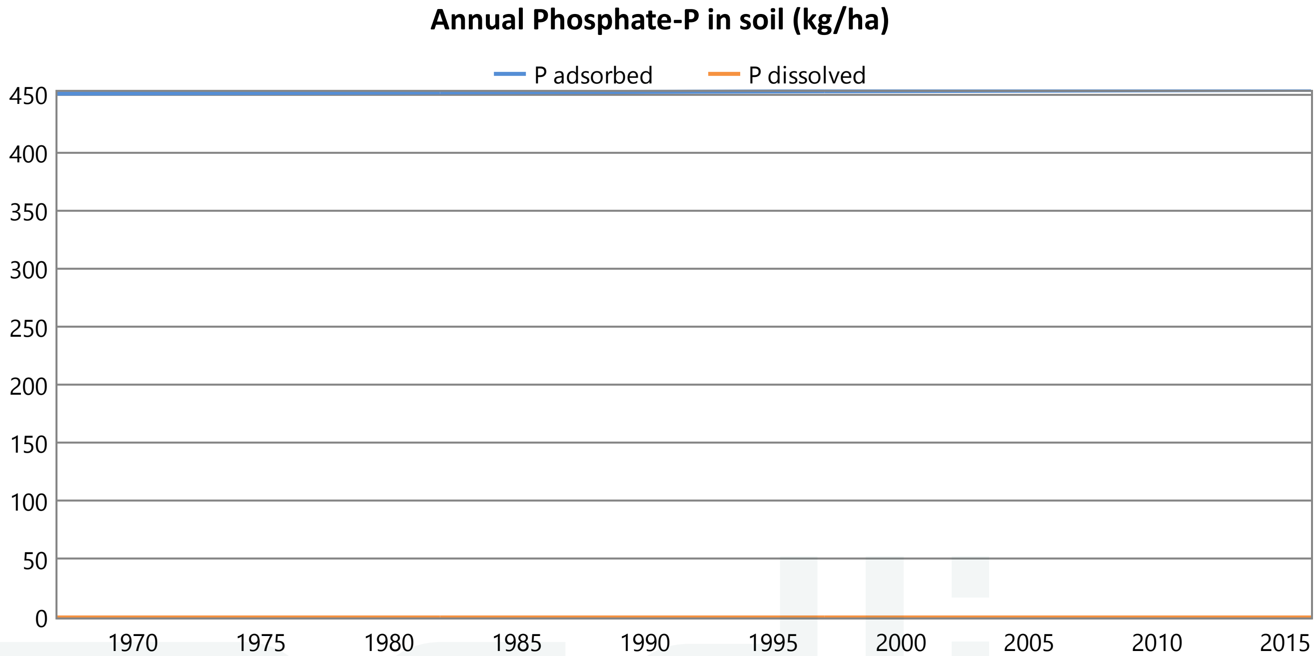
DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Land: New Paddock: 30 ha

Irrigation: Fixed Sprinkler with 0.2% ammonium loss during irrigation





DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Plant Performance: New Paddock: 30 ha

Average Plant Performance (Minimum - Maximum): Continuous Kikuyu 1 Pasture - kickstart, kick started

Average annual shoot dry matter yield (kg/ha/year)	6219.11 (1823.96 - 16029.87)
Average monthly plant (green) cover (fraction)	0.88 (0.82 - 0.92)
Average monthly crop factor (fraction)	0.70 (0.66 - 0.73)
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Average monthly root depth (mm)	1186.41 (1143.60 - 1200.00)
Average number of normal harvests per year (no./year)	1.10 (0.00 - 2.00)
Average number of normal harvests for last five years only (no./year)	0.40
Average number of crop deaths per year (no./year)	0.06 (0.00 - 1.00)
Average number of crop deaths for last five years only (no./year)	0.20
Average annual nitrogen deficiency index (0 = no stress, 1 = full stress) (coefficient)	0.85 (0.60 - 0.96)
Average January temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.01 (0.00 - 0.07)
Average July temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.11 (0.00 - 0.22)
Average monthly water stress index (0 = no stress, 1 = full stress) (coefficient)	0.15 (0.00 - 0.48)
Average monthly waterlogging index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.00)
No. days without crop/year (days)	1.70

Soil Salinity - Plant salinity tolerance: Moderately tolerant

Assumes 1.0 dS/m Electrical Conductivity = 640 mg/L Total Dissolved Salts
All values based on 10 year running averages

Insufficient deep drainage to run steady state salinity calculations.

DIAGNOSTICS

Run Messages

Messages generated when the scenario was run:

This is a Dryland scenario
No effluent irrigation has occurred!
WARNING: Pasture yield and soil nutrient balances may be INVALID due to the frequent kickstarting of pasture establishment. Try to reduce the number of forced harvests.
Full run chosen

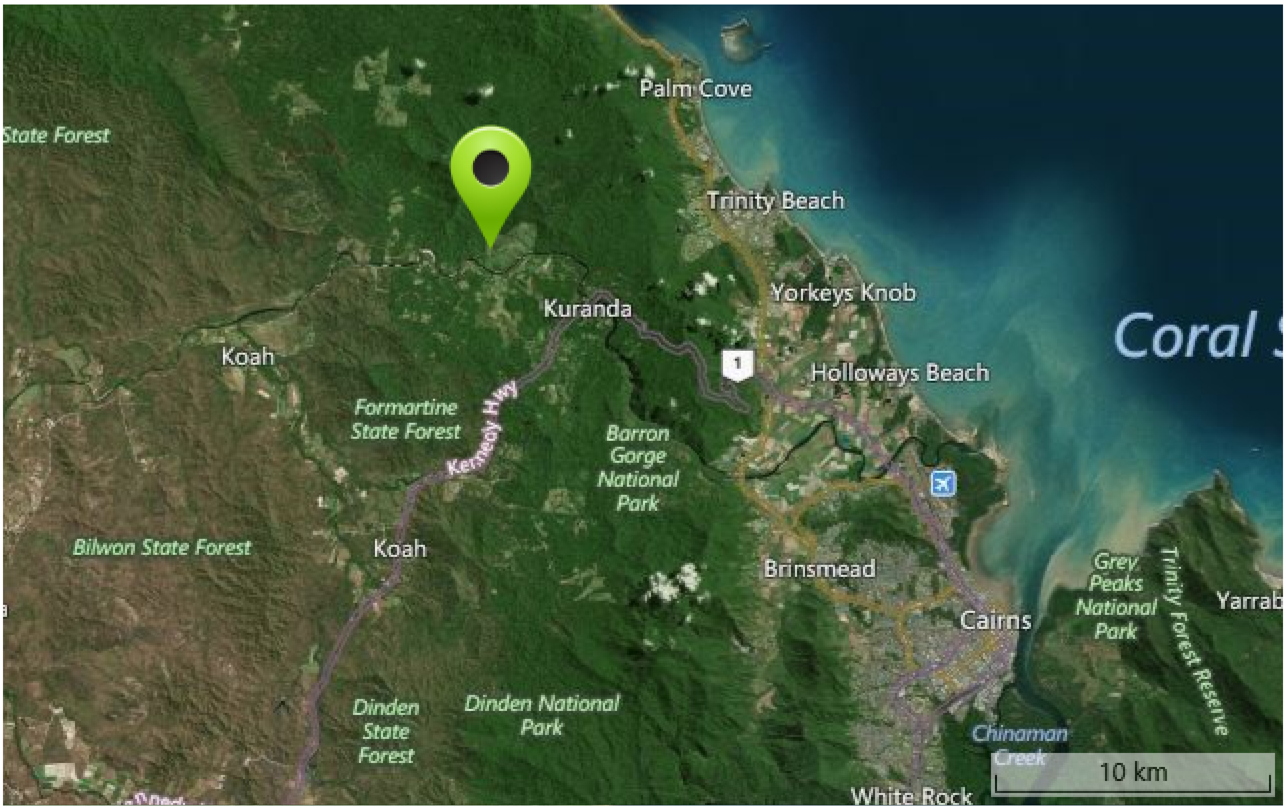
Enterprise: Kur World

Description:
Kur World Control

Client: Reever and Ocean

MEDLI User: NATRES\andrew

Scenario Details:
Control
Bicton Soil
No effluent and no clippings
Background nutrient loss under rainfall. Coastal couch longer grass cut at 40mm to 10 mm (@300 kg/ha/cm DM)

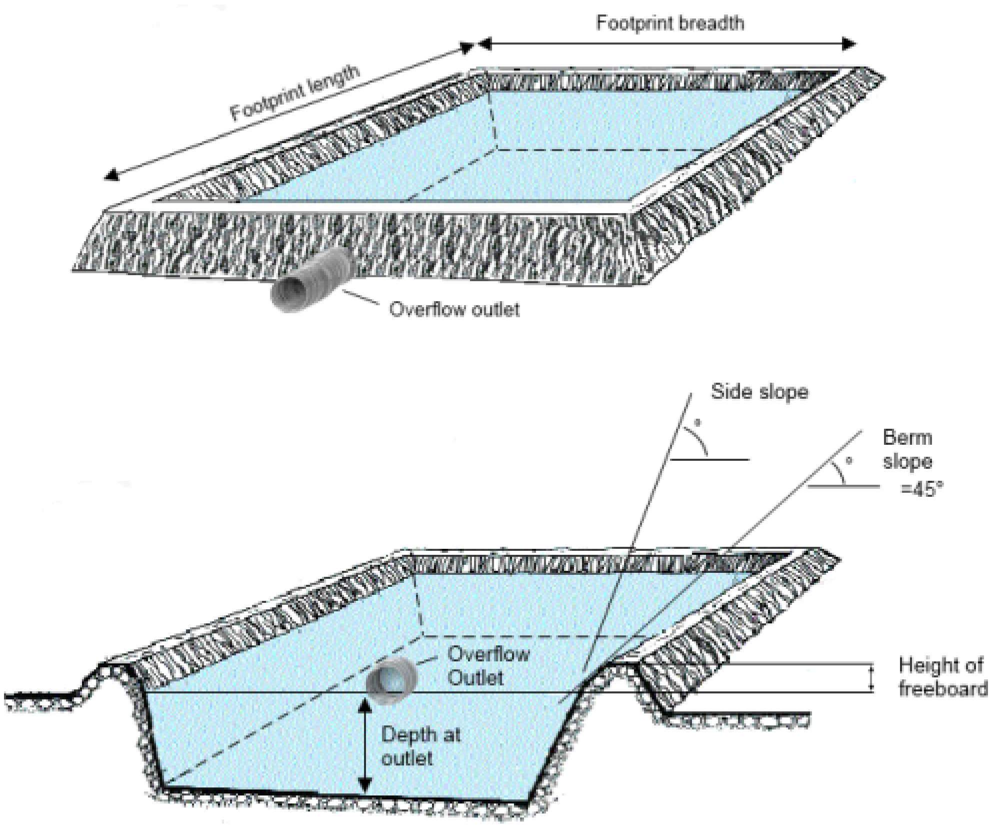


DESCRIPTION

Pond system: 1 closed storage tank

Pond system details:

	Pond 1
Maximum pond volume (ML)	3.00
Minimum allowable pond volume (ML)	0.00
Pond depth at overflow outlet (m)	4.00
Maximum water surface area (m2)	750.00
Pond footprint length (m)	27.39
Pond footprint width (m)	27.39
Pond catchment area (m2)	750.00
Average active volume (ML)	0.00



Irrigation pump limits:

Minimum pump rate limit (ML/day)	0.00
Maximum pump rate limit (ML/day)	10.00

Shandying water:

Annual allocation of fresh water available for shandying (ML/year)	0.00
Maximum rate of application of fresh water (ML/day)	0.00
Nitrogen concentration (mg/L)	0.00
Salinity (dS/m)	0.00
Minimum shandy water is used	False

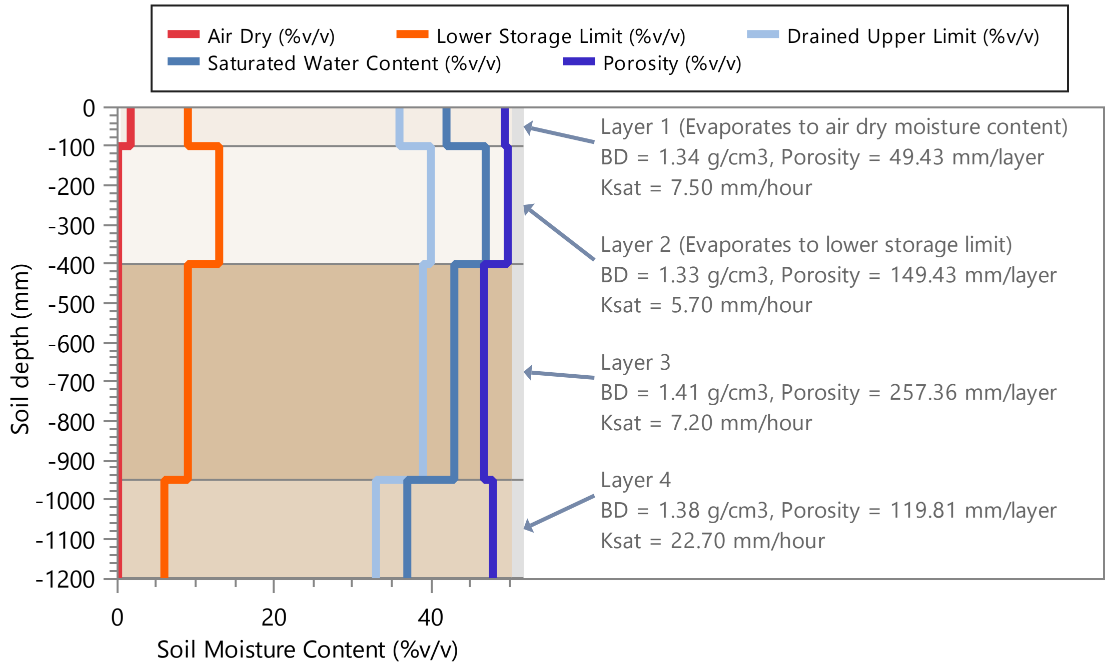
DESCRIPTION

Land: New Paddock

Area (ha): 30.00

Soil Type: Bicton (Kur-World), 1200.00 mm defined profile depth

Profile Porosity (mm)	576.04
Profile saturation water content (mm)	512.00
Profile drained upper limit (or field capacity) (mm)	453.00
Profile lower storage limit (or permanent wilting point) (mm)	112.50
Profile available water capacity (mm)	340.50
Profile limiting saturated hydraulic conductivity (mm/hour)	5.70
Surface saturated hydraulic conductivity (mm/hour)	7.50
Runoff curve number II (coefficient)	80.00
Soil evaporation U (mm)	8.50
Soil evaporation Cona (mm/sqrt day)	3.75



Plant Data: Continuous Coastal Couch Grass (Cynodon dactylon) Pasture_mod golf

Average monthly cover (fraction) (minimum - maximum)	0.85 (0.45 - 1.00)
Maximum crop factor at 100% cover (mm/mm) (Maximum crop coefficient 0.8 x Pan coefficient 1)	0.80
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Maximum potential root depth in defined soil profile (mm)	800.00
Salt tolerance	Tolerant
Salinity threshold EC sat. ext. (dS/m)	6.90
Proportion of yield decrease per dS/m increase (fraction/dS/m)	0.06

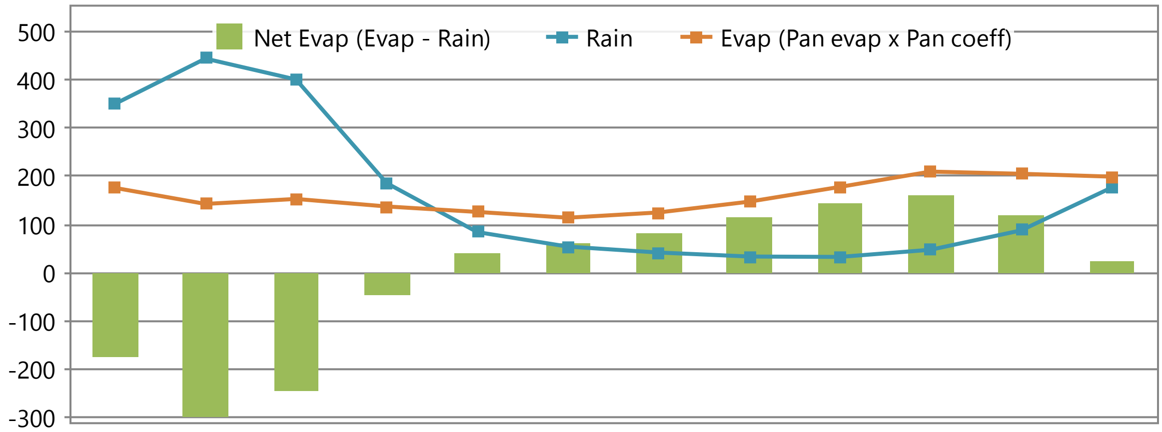
DIAGNOSTICS

Sustainability Diagnostics: Kur World

Averaged Historical Climate Data Used in Simulation (mm)

Location: KurWorlSTP, -16.8°, 145.6°

Run Period: 01/01/1967 to 31/12/2016 50 years, 0 days



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	349.9	444.0	400.6	185.8	84.3	54.1	41.9	33.6	32.8	47.6	87.8	176.5	1938.9
Evap	176.0	142.7	153.0	137.4	126.0	114.1	125.0	147.4	177.9	209.7	205.2	199.2	1913.4
Net Evap	-173.9	-301.3	-247.6	-48.4	41.8	59.9	83.1	113.8	145.1	162.1	117.4	22.7	-25.5
Net Evap/day	-5.6	-10.7	-8.0	-1.6	1.3	2.0	2.7	3.7	4.8	5.2	3.9	0.7	-0.1

Sustainability Diagnostics: Kur World

Pond System: 1 closed storage tank

New Sewage Treatment Plant - 0.00 ML/year or 0.00 ML/day generated on average

Effluent entering pond system after any pretreatment and recycling

Average (Minimum-Maximum) influent quality calculated for 0.00 non-zero flow days, after any pretreatment and recycling.

Constituent	Concentration (mg/L)	Load (kg/year)
Total Nitrogen	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Total Phosphorus	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Total Dissolved Salts	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Volatile Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Total Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)

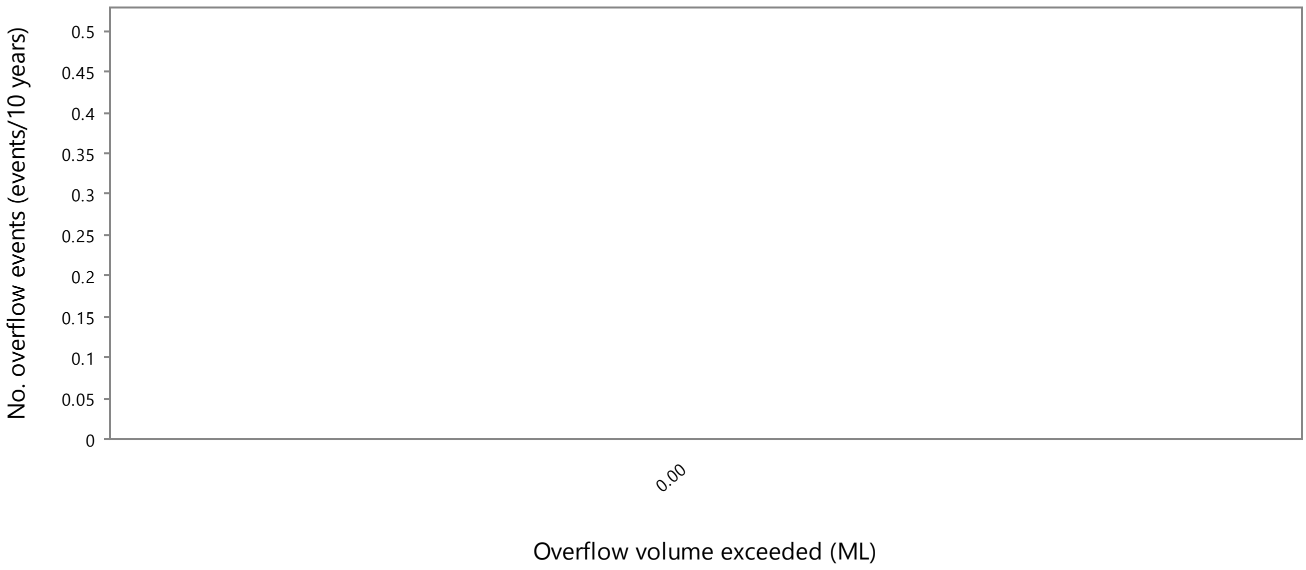
Last pond (Wet weather store): 3.00 ML

Theoretical hydraulic retention time (days)	0.00
Average volume of overflow (ML/year)	0.00
No. overflow events per year exceeding threshold* of 0.00 ML (no./year)	0.00
Average duration of overflow (days)	0.00
Effluent Reuse (Proportion of Inflow + Net Rain Gain that is Irrigated) (fraction)	0.00
Probability of at least 90% effluent reuse (fraction)	0.00
Average salinity of last pond (dS/m)	0.91
Salinity of last pond on final day of simulation (dS/m)	0.91
Ammonia loss from pond system water area (kg/m2/year)	0.00

* The threshold is the volume equivalent to the top 1 mm depth of water of a full pond

Overflow exceedance:

■ Chart ☐ Table



Export plot

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Irrigation Information

Irrigation: 30 ha total area (assumed 100% irrigation efficiency)

	Quantity/year	Quantity/ha/year
Total irrigation applied (ML)	0.00	0.00
Total nitrogen applied (kg)	0.00	0.00
Total phosphorus applied (kg)	0.00	0.00
Total salts applied (kg)	0.00	0.00

Shandying

Annual allocation of fresh water for shandying (ML/year)	0.00
Average Shandy water irrigation (ML/year) (minimum - maximum)	0.00 (0.00 - 0.00)
Average exceedance as a proportion of annual shandy water allocation (% of allocation) (minimum - maximum)	0.00 (0.00 - 0.00)
Proportion of irrigation events requiring shandying (fraction of events)	0.00
Minimum shandy water is used	False

Irrigation Issues

Proportion of Days irrigation is prevented when triggered (fraction)	0.95
Proportion of Days water demand is too small to trigger irrigation (fraction)	0.05

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Land: New Paddock: 30 ha

Irrigation: Fixed Sprinkler with 0.2% ammonium loss during irrigation

Irrigation triggered when soil water deficit reaches 5.00 mm and rainfall is less than or equal to 3.00 mm
Irrigate up to a soil water content of drained upper limit plus 0.00 mm
Irrigation window from 1/1 to 31/12 including the days specified
A minimum of 0 days must be skipped between irrigation events

Soil Water Balance (mm): Bicton (Kur-World), 228.00 mm PAWC at maximum root depth

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	349.9	444.0	400.6	185.8	84.3	54.1	41.9	33.6	32.8	47.6	87.8	176.5	1938.9
Irrigation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Soil Evap	10.6	1.5	0.9	0.0	0.0	0.0	0.1	1.9	4.5	14.7	26.5	24.6	85.3
Transpn.	104.3	106.6	121.1	109.7	100.4	88.7	91.5	87.9	62.2	34.3	34.5	65.5	1006.6
Runoff	107.3	151.7	149.1	35.5	4.7	1.5	0.3	0.1	0.6	2.5	7.1	30.1	490.7
Drainage	41.7	115.3	126.6	60.0	11.9	3.1	0.5	0.0	0.0	0.0	0.0	2.6	361.6
Delta	86.0	68.9	2.9	-19.4	-32.8	-39.2	-50.5	-56.4	-34.6	-3.9	19.7	53.7	-5.4

Soil Nitrogen Balance

Average annual effluent nitrogen added (kg/ha/year)	0.00
Average annual soil nitrogen removed by plant uptake (kg/ha/year)	69.91
Average annual soil nitrogen removed by denitrification (kg/ha/year)	0.01
Average annual soil nitrogen leached (kg/ha/year)	0.85
Average annual nitrate-N loading to groundwater (kg/ha/year)	0.85
Soil organic-N kg/ha (Initial - Final)	3809.50 - 389.20
	74.41 - 0.06
Average nitrate-N concentration of deep drainage (mg/L)	0.23
Max. annual nitrate-N concentration of deep drainage (mg/L)	8.63

Soil Phosphorus Balance

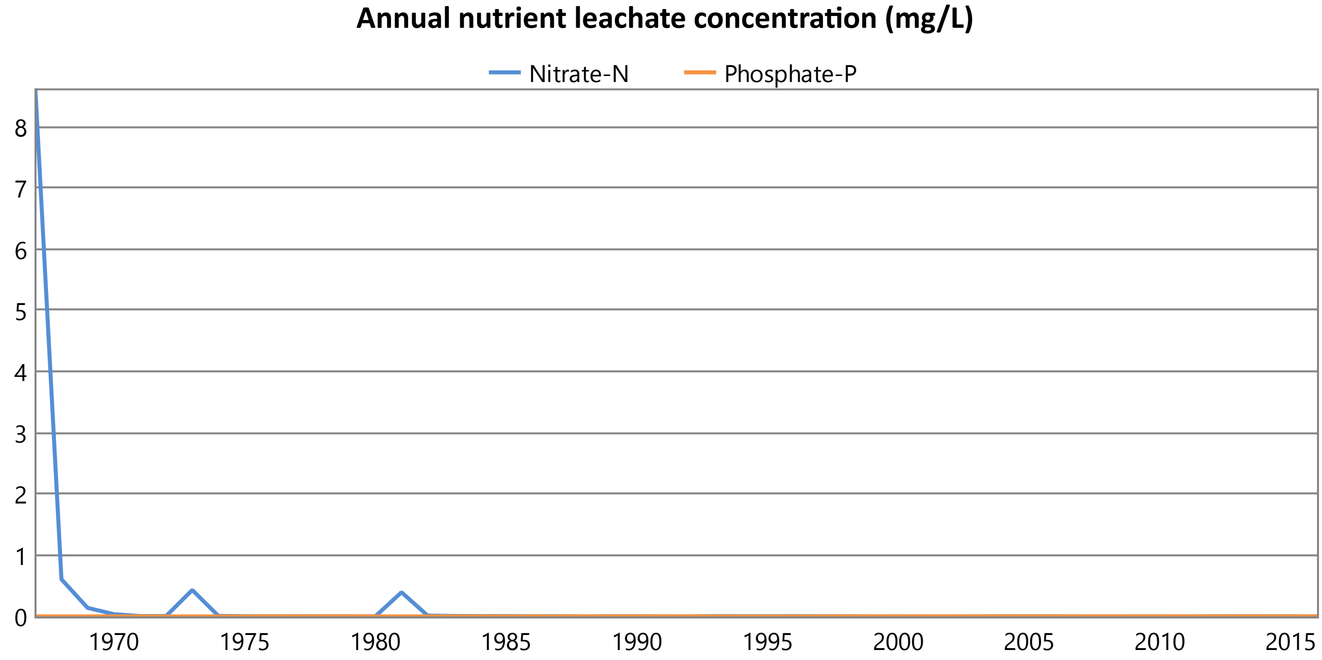
Average annual effluent phosphorus added (kg/ha/year)	0.00
Average annual soil phosphorus removed by plant uptake (kg/ha/year)	0.13
Average annual soil phosphorus leached (kg/ha/year)	2.50E-04
Dissolved phosphorus (kg/ha) (Initial - Final)	2.86E-04 - 3.26E-04
Adsorbed phosphorus (kg/ha) (Initial - Final)	450.65 - 454.02
Average phosphate-P concentration in rootzone (mg/L)	7.60E-05
Average phosphate-P concentration of deep drainage (mg/L)	6.91E-05
Max. annual phosphate-P concentration of deep drainage (mg/L)	9.80E-05
Design soil profile storage life based on average infiltrated water phosphorus concn. of 0.00 mg/L (years)	0.00

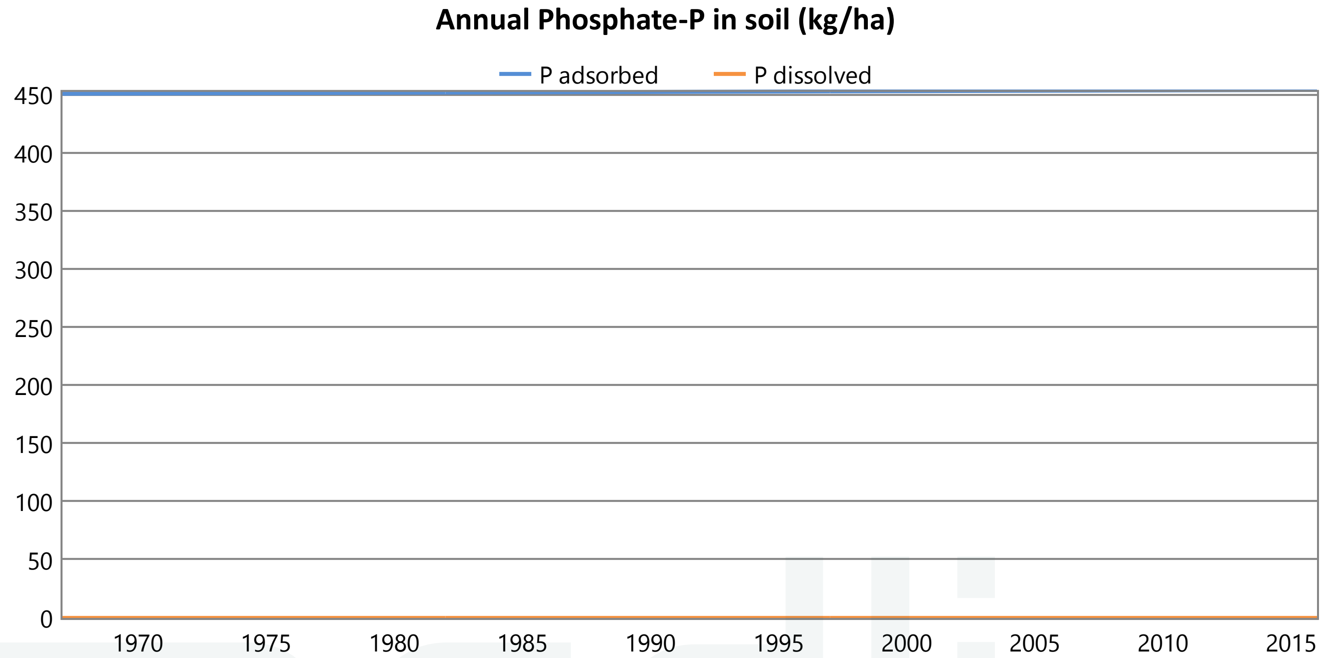
DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Land: New Paddock: 30 ha

Irrigation: Fixed Sprinkler with 0.2% ammonium loss during irrigation





DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Plant Performance: New Paddock: 30 ha

Average Plant Performance (Minimum - Maximum): Continuous Coastal Couch Grass (Cynodon dactylon) Pasture_mod golf

Average annual shoot dry matter yield (kg/ha/year)	6814.46 (2760.14 - 13260.92)
Average monthly plant (green) cover (fraction)	0.85 (0.45 - 1.00)
Average monthly crop factor (fraction)	0.68 (0.36 - 0.80)
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Average monthly root depth (mm)	689.41 (380.55 - 800.00)
Average number of normal harvests per year (no./year)	6.70 (3.00 - 13.00)
Average number of normal harvests for last five years only (no./year)	3.20
Average number of crop deaths per year (no./year)	1.44 (0.00 - 4.00)
Average number of crop deaths for last five years only (no./year)	1.80
Average annual nitrogen deficiency index (0 = no stress, 1 = full stress) (coefficient)	0.54 (0.26 - 0.80)
Average January temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.02 (0.00 - 0.07)
Average July temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.20 (0.00 - 0.41)
Average monthly water stress index (0 = no stress, 1 = full stress) (coefficient)	0.15 (0.00 - 0.39)
Average monthly waterlogging index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.00)
No. days without crop/year (days)	32.36

Soil Salinity - Plant salinity tolerance: Tolerant

Assumes 1.0 dS/m Electrical Conductivity = 640 mg/L Total Dissolved Salts
All values based on 10 year running averages

Insufficient deep drainage to run steady state salinity calculations.

DIAGNOSTICS

Run Messages

Messages generated when the scenario was run:

This is a Dryland scenario
No effluent irrigation has occurred!
Full run chosen

Stage 1A

Kur-World Effluent. Stage 1A Low ADWF Multi run output

Irrigation Area (ha)	Pond Volume (ML)	Overflows (Overtops/year)	Overflows >1mm (Overtops/year)	Overflow volume (ML/year)	Effluent reuse (fraction)	Irrigation supplied (mm/year)	Irrigation demand supplied (fraction)	Yield (kg/ha/year)	Phosphate P leached (kg/ha/year)	Nitrate N leached (kg/ha/year)	Max yield reduction from salinity (fraction)	Relative cost (K$)	Av Phosphate P leachate conc (mg/L)	Av Nitrate N leachate conc (mg/L)	Mass N overflowed (kg/year)	Mass P overflowed (kg/year)	Mass salt overflowed (kg/year)	Av deep drainage (mm/year)
5	1	4.24	4.24	4.270756466	0.805401791	353.5155762	0.418447971	14814.18682	0.000671115	0.096543835	0	460	0.000133682	0.019230925	127.1397073	30.51352976	1322.252956	502.02388
10	1	3.84	3.84	3.576655591	0.837028691	183.6987969	0.217439893	11252.8915	0.000329738	0.090531714	0	810	7.68E-05	0.021088224	103.0935301	24.74244723	1072.172713	429.2998562
15	1	3.6	3.6	3.394216424	0.845341582	123.6821257	0.146399588	9775.249859	0.000310227	0.086086085	0	1160	7.51E-05	0.020852454	96.35980654	23.12635357	1002.141988	412.834316
20	1	3.42	3.42	3.375890191	0.846176622	92.85322544	0.109908152	8973.674002	0.000301615	0.08346007	0	1510	7.49E-05	0.020736976	95.08319587	22.81996701	988.8652371	402.4698147
25	1	3.34	3.34	3.35489224	0.8471334	74.36657216	0.088025941	8494.31048	0.000299356	0.082141844	0	1860	7.45E-05	0.020445964	93.97660714	22.55438571	977.3567142	401.7509054
5	2	2.66	2.66	3.079938568	0.859613765	377.1819342	0.446461276	15046.36104	0.000833575	0.09870595	0	470	0.000158877	0.018813008	90.64341375	21.7544193	942.691503	524.668629
10	2	1.8	1.8	2.230105252	0.898349894	197.0893003	0.233289913	11443.12831	0.00033979	0.091659634	0	820	7.72E-05	0.020823551	62.40389969	14.97693592	649.0005567	440.1729346
15	2	1.64	1.64	2.063639179	0.905937561	132.5026407	0.156840221	9902.164516	0.000321001	0.089048107	0	1170	7.64E-05	0.021197446	57.71109377	13.8506625	600.1953752	420.0888502
20	2	1.54	1.54	1.991712626	0.909216034	99.73661326	0.118055855	9105.48575	0.000307763	0.086357887	0	1520	7.59E-05	0.021284776	55.00965941	13.20231826	572.1004579	405.7260848
25	2	1.56	1.56	1.980383982	0.909732404	79.83460519	0.094498322	8519.895214	0.000292992	0.08407905	0	1870	7.43E-05	0.021333903	54.60907613	13.10617827	567.9343918	394.1100158
5	3	2.14	2.14	2.405184247	0.890332153	390.5270206	0.462257537	15252.08149	0.000729673	0.100201348	0	480	0.00013744	0.018873694	71.77235957	17.2253663	746.4325396	530.9048079
10	3	1.2	1.2	1.599643478	0.927061947	203.318918	0.240663763	11524.14299	0.000352181	0.092344409	0	830	7.83E-05	0.020541389	44.92403435	10.78176824	467.2099572	449.5528984
15	3	1.18	1.18	1.362605989	0.937870014	137.1261953	0.162313013	10010.26482	0.000317778	0.089405025	0	1180	7.55E-05	0.021254391	37.80991687	9.074380048	393.2231354	420.6426035
20	3	1.04	1.04	1.250262957	0.942992456	103.4063616	0.122399648	9181.38294	0.000309258	0.086847401	0	1530	7.64E-05	0.021462064	34.44555371	8.266932891	358.2337586	404.6554054
25	3	0.96	0.96	1.260047572	0.942546313	82.68595083	0.097873391	8632.49582	0.000297926	0.085379822	0	1880	7.45E-05	0.021338067	34.62224654	8.309339169	360.071364	400.1291212
5	4	1.68	1.68	1.867913913	0.914800634	401.1224273	0.474799068	15322.95588	0.000735689	0.101587561	0	490	0.000135883	0.018763391	56.00307826	13.44073878	582.4320139	541.413665
10	4	0.98	0.98	1.207965543	0.944902226	207.1606974	0.245211186	11551.71205	0.000346894	0.092355583	0	840	7.72E-05	0.020556353	34.45686291	8.269647098	358.3513743	449.2800041
15	4	0.74	0.74	0.899985221	0.958949837	140.1603337	0.16590445	10059.74566	0.000320606	0.089478552	0	1190	7.61E-05	0.021226191	25.05323575	6.01277658	260.5536518	421.5478535
20	4	0.72	0.72	0.867679722	0.960423357	105.2817778	0.124619534	9210.110806	0.000308519	0.086744474	0	1540	7.59E-05	0.021337578	23.96794141	5.752305938	249.2665907	406.533844
25	4	0.64	0.64	0.676958064	0.969122561	84.98830886	0.100598638	8632.559258	0.000293116	0.08563243	0	1890	7.46E-05	0.021798424	18.3784006	4.410816143	191.1353662	392.837705
5	5	1.26	1.26	1.428089913	0.934839613	409.7689073	0.4850337	15447.85532	0.000807492	0.101493855	0	500	0.000147824	0.01858006	43.00858739	10.32206097	447.2893089	546.2514859
10	5	0.86	0.86	0.889367324	0.959420259	210.2716795	0.248893581	11560.73378	0.000348363	0.092746444	0	850	7.72E-05	0.020563714	25.60334379	6.14480251	266.2747755	451.0199067
15	5	0.52	0.52	0.556241802	0.974619994	142.4019565	0.168557806	10064.49883	0.000324493	0.089612807	0	1200	7.67E-05	0.021168178	15.30421913	3.673012592	159.163879	423.3373716
20	5	0.46	0.46	0.560018979	0.97444765	106.7825815	0.126396	9212.256665	0.000307854	0.086663214	0	1550	7.60E-05	0.021382784	15.53495025	3.728388061	161.5634827	405.2943316
25	5	0.4	0.4	0.387836811	0.982303918	86.11479387	0.101932031	8638.873025	0.000291041	0.08513154	0	1900	7.44E-05	0.021773938	10.40004522	2.496010854	108.1604703	390.9790696

Kur-World Effluent. Stage 1 A High ADWF Multi run output

Irrigation Area (ha)	Pond Volume (ML)	Overflows (Overtops/year)	Overflows >1mm (Overtops/year)	Overflow volume (ML/year)	Effluent reuse (fraction)	Irrigation supplied (mm/year)	Irrigation demand supplied (fraction)	Yield (kg/ha/year)	Phosphate P leached (kg/ha/year)	Nitrate N leached (kg/ha/year)	Max yield reduction from salinity (fraction)	Relative cost (K$)	Av Phosphate P leachate conc (mg/L)	Av Nitrate N leachate conc (mg/L)	Mass N overflowed (kg/year)	Mass P overflowed (kg/year)	Mass salt overflowed (kg/year)	Av deep drainage (mm/year)
5	1	8	8	9.750384792	0.722361204	507.3714328	0.600563486	17660.55624	0.00163685	0.103293579	0	460	0.000279373	0.017629867	307.0424109	73.69017862	3193.241074	585.9010826
10	1	5.96	5.96	7.811311526	0.777575637	273.0764491	0.323234092	13319.76494	0.000400073	0.09267776	0	810	8.66E-05	0.020061776	232.2833046	55.7479931	2415.746368	461.9618974
15	1	5.66	5.66	7.398866031	0.789319878	184.8006027	0.218744074	11376.64469	0.000325088	0.088154325	0	1160	7.64E-05	0.020722785	217.1787116	52.12289079	2258.658601	425.39806
20	1	5.48	5.48	7.155366147	0.796253452	139.8179514	0.16549918	10225.247	0.000316629	0.085114863	0	1510	7.68E-05	0.020637717	206.8800991	49.65122378	2151.553031	412.4238408
25	1	5.46	5.46	6.972350131	0.801464769	112.5864252	0.133265871	9500.043807	0.000304512	0.083760742	0	1860	7.53E-05	0.020708636	200.0753671	48.01808811	2080.783818	404.472525
5	2	5.86	5.86	8.116472563	0.768836916	539.8996774	0.639066395	18043.89769	0.00172599	0.10729122	0	470	0.000280572	0.017440966	257.3519633	61.76447118	2676.460418	615.1678879
10	2	3.3	3.3	5.681867667	0.838176247	294.2958877	0.348351036	13660.08811	0.000431972	0.094913411	0	820	9.07E-05	0.019924006	166.3914965	39.93395916	1730.471564	476.3771449
15	2	2.98	2.98	5.073476612	0.85550367	200.2531988	0.237034944	11561.75523	0.000346336	0.091100857	0	1170	7.85E-05	0.020658803	144.2725845	34.62542028	1500.434879	440.9783936
20	2	2.8	2.8	4.809227965	0.863029665	151.5111423	0.179340132	10409.89804	0.000321193	0.089005415	0	1520	7.62E-05	0.021110228	136.1940323	32.68656775	1416.417936	421.6222314
25	2	2.72	2.72	4.705753509	0.865976693	121.6228117	0.143962027	9723.205204	0.000310315	0.087258957	0	1870	7.54E-05	0.021209594	132.5658526	31.81580461	1378.684867	411.4126611
5	3	4.78	4.78	7.199014755	0.794922981	558.0988336	0.660608303	18130.26177	0.00180507	0.108306693	0	480	0.000287654	0.017259634	228.9904766	54.95771438	2381.500956	627.5144362
10	3	2.56	2.56	4.436121831	0.873629007	306.678346	0.363007857	13792.9805	0.000447075	0.095913003	0	830	9.19E-05	0.019708847	128.5509693	30.85223263	1336.930081	486.6494968
15	3	1.98	1.98	3.949488776	0.887491634	207.6964511	0.245845344	11686.66751	0.00034362	0.092390125	0	1180	7.68E-05	0.020650465	112.1824467	26.9237872	1166.697445	447.3997219
20	3	1.92	1.92	3.581824782	0.897965211	157.6106583	0.186559984	10534.07283	0.000326134	0.090301098	0	1530	7.63E-05	0.02113985	100.565647	24.13575528	1045.882729	427.1605346
25	3	1.84	1.84	3.277169547	0.906643869	127.3071475	0.15069044	9792.654418	0.000315009	0.088558	0	1880	7.58E-05	0.021311738	90.06920979	21.61661035	936.7197818	415.5362604
5	4	4.44	4.44	6.431706858	0.816741987	573.2949915	0.678595633	18288.22102	0.001928204	0.109697951	0	490	0.000301939	0.017177716	205.6129683	49.3471124	2138.374871	638.6061593
10	4	2.08	2.08	3.709317667	0.894310764	313.8713877	0.371522089	13911.40449	0.000438394	0.096893051	0	840	8.90E-05	0.019670754	107.8503576	25.88408583	1121.643719	492.574164
15	4	1.58	1.58	3.119042431	0.91112942	213.18276	0.252339358	11778.93198	0.0003544	0.092538722	0	1190	7.87E-05	0.020557272	88.04413035	21.13059128	915.6589557	450.1507927
20	4	1.34	1.34	2.974218292	0.915255881	160.6111907	0.190111643	10610.21082	0.000323842	0.090015765	0	1540	7.59E-05	0.021100856	83.3228341	19.99748018	866.5574746	426.5976913
25	4	1.4	1.4	2.595732651	0.926040036	130.0028951	0.153881332	9835.853908	0.000315917	0.088752256	0	1890	7.57E-05	0.021270509	71.79025993	17.22966238	746.6187032	417.2549622
5	5	4.06	4.06	5.881770775	0.832375443	584.1437132	0.691437007	18372.90766	0.001965797	0.11028268	0	500	0.000304141	0.017062513	189.6682548	45.52038114	1972.549849	646.3448956
10	5	1.74	1.74	3.446678675	0.901773121	316.4227776	0.374542109	13908.04876	0.000532743	0.096338361	0	850	0.000107281	0.01940012	101.8363632	24.44072716	1059.098177	496.5864222
15	5	1.34	1.34	2.435543522	0.930589457	217.6894194	0.257673783	11871.03645	0.000350306	0.09304025	0	1200	7.78E-05	0.020652874	68.66162927	16.47879102	714.0809444	450.4954073
20	5	1.04	1.04	2.246326625	0.935981948	164.213149	0.194375195	10657.35124	0.000331018	0.090818769	0	1550	7.69E-05	0.021105722	62.58127009	15.01950482	650.8452089	430.304014
25	5	1.02	1.02	2.124901459	0.939442444	131.8562199	0.156075068	9845.095928	0.000316108	0.088425258	0	1900	7.57E-05	0.02118067	58.60899193	14.06615806	609.533516	417.4809222

Kur-World Effluent. Stage 1 A High ADWF & Low Stormwater infiltration Multi run output

Irrigation Area (ha)	Pond Volume (ML)	Overflows (Overtops/year)	Overflows >1mm (Overtops/year)	Overflow volume (ML/year)	Effluent reuse (fraction)	Irrigation supplied (mm/year)	Irrigation demand supplied (fraction)	Yield (kg/ha/year)	Phosphate P leached (kg/ha/year)	Nitrate N leached (kg/ha/year)	Max yield reduction from salinity (fraction)	Relative cost (K$)	Av Phosphate P leachate conc (mg/L)	Av Nitrate N leachate conc (mg/L)	Mass N overflowed (kg/year)	Mass P overflowed (kg/year)	Mass salt overflowed (kg/year)	Av deep drainage (mm/year)
5	1	7.24	7.24	7.491845279	0.767151488	493.6583199	0.58390543	17811.6149	0.001598383	0.102453735	0	460	0.00027654	0.017725744	289.9030688	69.5767365	3014.991915	577.9940049
10	1	5.26	5.26	5.62478216	0.825180299	265.4997911	0.314036578	13425.8424	0.000439673	0.092738039	0	810	9.58E-05	0.020207225	209.197317	50.20735608	2175.652097	458.9350559
15	1	5.22	5.22	5.224035578	0.837635607	179.6715046	0.212517774	11432.75305	0.000324067	0.087821735	0	1160	7.62E-05	0.020645423	192.3233665	46.15760797	2000.163012	425.3811298
20	1	4.9	4.9	5.147538704	0.84001315	135.1361128	0.159840738	10252.91135	0.000311213	0.084493754	0	1510	7.56E-05	0.020530803	188.4534712	45.2288331	1959.916101	411.5462619
25	1	4.74	4.74	4.814485374	0.850364535	109.4411036	0.129448349	9621.348267	0.000304538	0.083396462	0	1860	7.64E-05	0.020914782	174.285114	41.82842736	1812.565185	398.7441213
5	2	4.96	4.96	5.910229093	0.816265704	525.1406436	0.621143128	18219.59594	0.001803769	0.105935376	0	470	0.000300135	0.017626919	228.0469999	54.73127997	2371.688799	600.9863543
10	2	2.82	2.82	3.850981622	0.880282577	283.1627965	0.334928609	13679.54469	0.000461078	0.09392524	0	820	9.78E-05	0.019932001	141.4110495	33.93865189	1470.674915	471.2283449
15	2	2.34	2.34	3.463531419	0.892327438	191.358199	0.226340947	11579.79337	0.00033424	0.090427583	0	1170	7.70E-05	0.020832705	126.467319	30.35215655	1315.260117	434.0654858
20	2	2.32	2.32	3.219691002	0.899907829	144.7378514	0.171197798	10454.7132	0.000319336	0.088356798	0	1520	7.61E-05	0.021066199	116.6995008	28.00788019	1213.674808	419.4244822
25	2	2.18	2.18	3.161439572	0.901718721	116.0232868	0.137233841	9732.336469	0.00031101	0.086352743	0	1870	7.61E-05	0.021125995	114.6133859	27.50721262	1191.979213	408.7511263
5	3	4.6	4.58	5.032032402	0.843530169	542.5545774	0.641740554	18405.25853	0.002016033	0.107821989	0	480	0.000327457	0.017513113	195.2634028	46.86321667	2030.739389	615.6643355
10	3	2.26	2.26	2.894292461	0.910002676	292.6546881	0.346155741	13910.89727	0.000454606	0.095435355	0	830	9.52E-05	0.019992173	106.6603356	25.59848054	1109.26749	477.363588
15	3	1.48	1.48	2.397011577	0.925465505	198.4183313	0.234691762	11781.53442	0.000354673	0.09155121	0	1180	8.05E-05	0.020786888	86.48620972	20.75669033	899.4565811	440.4276932
20	3	1.48	1.48	2.221064089	0.930936549	149.6934859	0.177059386	10619.55918	0.00032275	0.089012588	0	1530	7.69E-05	0.02119979	79.4665848	19.07198035	826.4524819	419.8748616
25	3	1.36	1.36	1.991394364	0.938078074	120.6734676	0.142734134	9817.747821	0.000314448	0.087640177	0	1880	7.62E-05	0.021234014	71.04161125	17.0499867	738.832757	412.7348497
5	4	3.82	3.82	4.295142145	0.86641244	557.1423826	0.658995198	18537.14399	0.002099268	0.108571483	0	490	0.000333954	0.01727166	166.6114116	39.98673879	1732.758681	628.6105688
10	4	1.6	1.6	2.405466226	0.925185162	297.4679505	0.35184893	13911.59227	0.000606188	0.095757706	0	840	0.000124844	0.019721258	88.39247218	21.21419332	919.2817106	485.5557636
15	4	1.2	1.2	1.728179681	0.946250136	202.8272106	0.239906642	11888.85942	0.000344472	0.091513333	0	1190	7.81E-05	0.020758242	62.23675112	14.93682027	647.2622116	440.8529912
20	4	1.02	1.02	1.560876021	0.951453616	152.9569263	0.180919426	10670.84847	0.000321317	0.089314131	0	1540	7.61E-05	0.021160813	55.88461121	13.41230669	581.1999566	422.0732534
25	4	1.06	1.06	1.484819274	0.953819134	122.669768	0.145095384	9855.446047	0.000316566	0.087266824	0	1890	7.67E-05	0.021138309	52.80066728	12.67216015	549.1269397	412.8372993
5	5	3.3	3.3	3.755275307	0.883176133	567.7897193	0.671589006	18694.383	0.002133912	0.108895628	0	500	0.000335463	0.017118993	146.4979974	35.15951938	1523.579173	636.1100024
10	5	1.32	1.32	1.904964856	0.940737937	302.3979642	0.357680213	14027.29266	0.000538171	0.095904366	0	850	0.000110226	0.019642702	70.49977958	16.9199471	733.1977076	488.2442612
15	5	0.92	0.92	1.385997792	0.956882623	205.0584232	0.242545749	11902.56639	0.000370924	0.091284444	0	1200	8.37E-05	0.020587654	50.03267862	12.00784287	520.3398577	443.3941062
20	5	0.76	0.76	1.155756064	0.964045275	154.945026	0.183270976	10694.4768	0.000322872	0.089398942	0	1550	7.61E-05	0.021073073	41.69238575	10.00617258	433.6008119	424.2330623
25	5	0.72	0.72	1.033675456	0.967843113	124.4443433	0.147194375	9892.558696	0.000319925	0.087809524	0	1900	7.67E-05	0.021060129	36.96121879	8.870692509	384.3966754	416.9467451

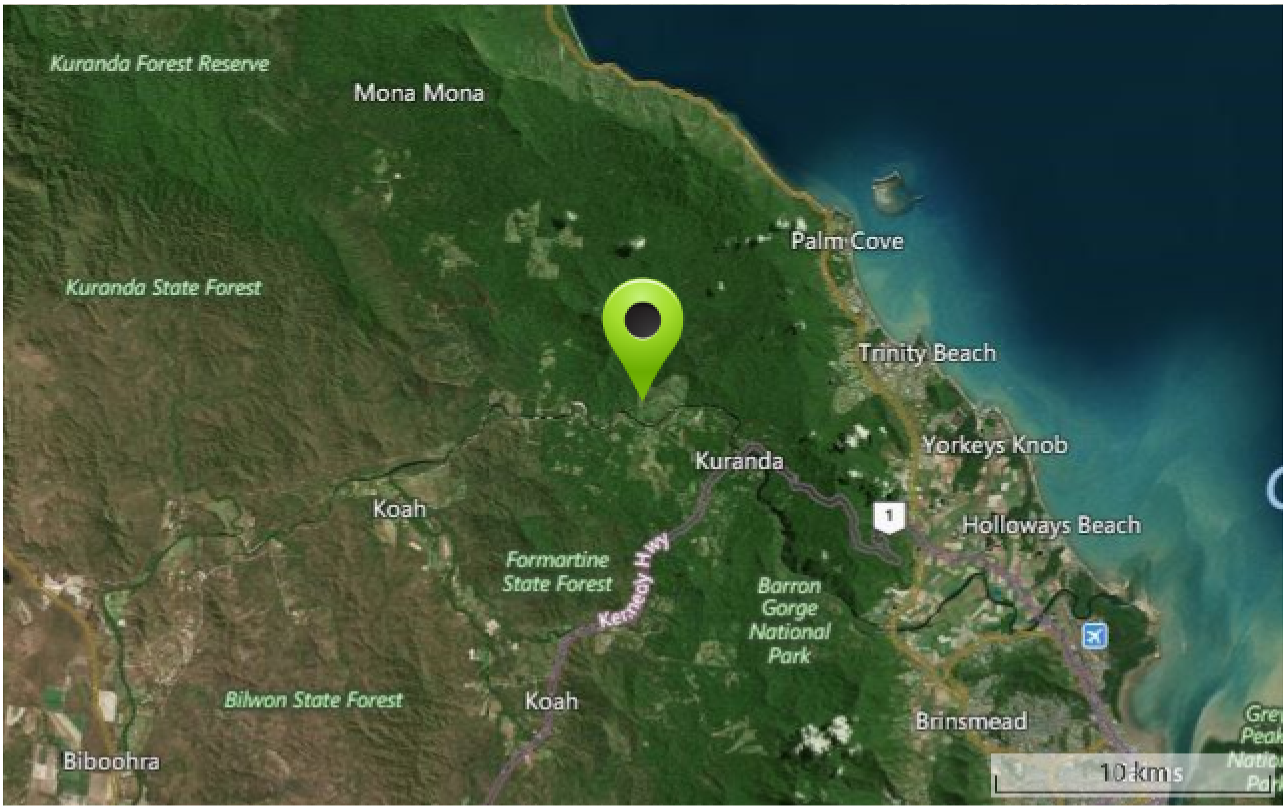
Enterprise: **Kur World with 5000.00 m3 storage pond volume and 5.00 ha irrigation area**

Description:
Stage 1A Low Multi Run

Client: **Reever and Ocean**

MEDLI User: NATRES\andrew

Scenario Details:
Low range ADWF, average infiltration efficiency
N 50 mg/L, P 12 mg/L, TDS 520 mg 45% TON, 25% NH4-N, 30% Org N
1-5 ML tank and 5 - 25 ha
5mm SMD to UDL. Irrigation allowed on days with up to 3 mm rainfall.
Kikuyu 1 (kickarted) selected to match similar salt tolerance and temperature range profile of Sinal grass
No additional nutrient addition to account for return of clippings

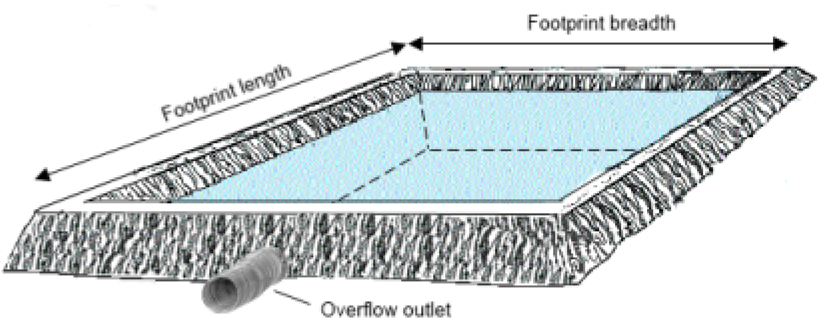


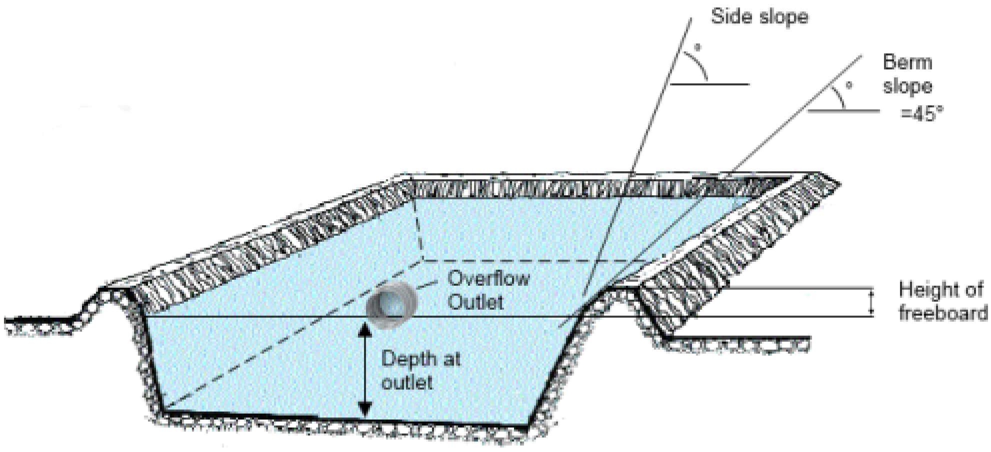
DESCRIPTION

Pond system: 1 closed storage tank

Pond system details:

	Pond 1
Maximum pond volume (ML)	5.00
Minimum allowable pond volume (ML)	1.88
Pond depth at overflow outlet (m)	4.00
Maximum water surface area (m2)	1250.00
Pond footprint length (m)	35.36
Pond footprint width (m)	35.36
Pond catchment area (m2)	1250.00
Average active volume (ML)	2.51





Irrigation pump limits:

Minimum pump rate limit (ML/day)	0.00
Maximum pump rate limit (ML/day)	100.00

Shandying water:

Annual allocation of fresh water available for shandying (ML/year)	0.00
Maximum rate of application of fresh water (ML/day)	0.00
Nitrogen concentration (mg/L)	0.00
Salinity (dS/m)	0.00
Minimum shandy water is used	False

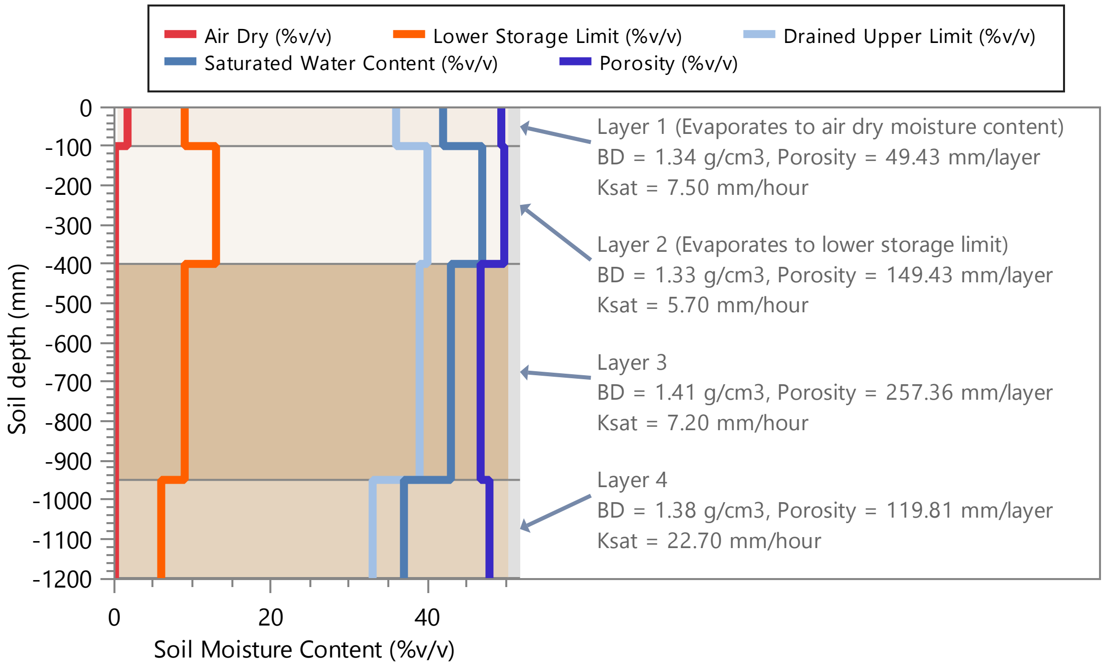
DESCRIPTION

Land: New Paddock

Area (ha): 5.00

Soil Type: Bicton (Kur-World), 1200.00 mm defined profile depth

Profile Porosity (mm)	576.04
Profile saturation water content (mm)	512.00
Profile drained upper limit (or field capacity) (mm)	453.00
Profile lower storage limit (or permanent wilting point) (mm)	112.50
Profile available water capacity (mm)	340.50
Profile limiting saturated hydraulic conductivity (mm/hour)	5.70
Surface saturated hydraulic conductivity (mm/hour)	7.50
Runoff curve number II (coefficient)	80.00
Soil evaporation U (mm)	8.50
Soil evaporation Cona (mm/sqrt day)	3.75



Plant Data: Continuous Kikuyu 1 Pasture - kickstart, kick started

Average monthly cover (fraction) (minimum - maximum)	0.88 (0.84 - 0.91)
Maximum crop factor at 100% cover (mm/mm) (Maximum crop coefficient 0.8 x Pan coefficient 1)	0.80
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Maximum potential root depth in defined soil profile (mm)	1200.00
Salt tolerance	Moderately tolerant
Salinity threshold EC sat. ext. (dS/m)	3.00
Proportion of yield decrease per dS/m increase (fraction/dS/m)	0.03

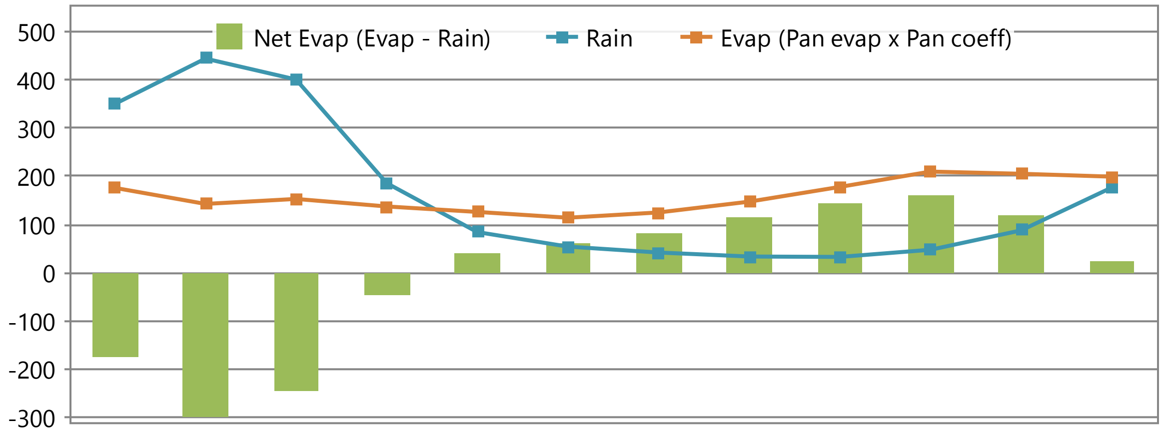
DIAGNOSTICS

Sustainability Diagnostics: Kur World

Averaged Historical Climate Data Used in Simulation (mm)

Location: KurWorlSTP, -16.8°, 145.6°

Run Period: 01/01/1967 to 31/12/2016 50 years, 0 days



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	349.9	444.0	400.6	185.8	84.3	54.1	41.9	33.6	32.8	47.6	87.8	176.5	1938.9
Evap	176.0	142.7	153.0	137.4	126.0	114.1	125.0	147.4	177.9	209.7	205.2	199.2	1913.4
Net Evap	-173.9	-301.3	-247.6	-48.4	41.8	59.9	83.1	113.8	145.1	162.1	117.4	22.7	-25.5
Net Evap/day	-5.6	-10.7	-8.0	-1.6	1.3	2.0	2.7	3.7	4.8	5.2	3.9	0.7	-0.1

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Pond System: 1 closed storage tank

Kur-world 1A Low range September 2017 ADWF - 21.95 ML/year or 0.06 ML/day generated on average

Effluent entering pond system after any pretreatment and recycling

Average (Minimum-Maximum) influent quality calculated for 365.26 non-zero flow days, after any pretreatment and recycling.

Constituent	Concentration (mg/L)	Load (kg/year)
Total Nitrogen	41.55 (3.41 - 50.00)	912.24 (911.59 - 914.08)
Total Phosphorus	9.97 (0.82 - 12.00)	218.94 (218.78 - 219.38)
Total Dissolved Salts	432.14 (35.46 - 520.00)	9487.26 (9480.51 - 9506.48)
Volatile Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Total Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)

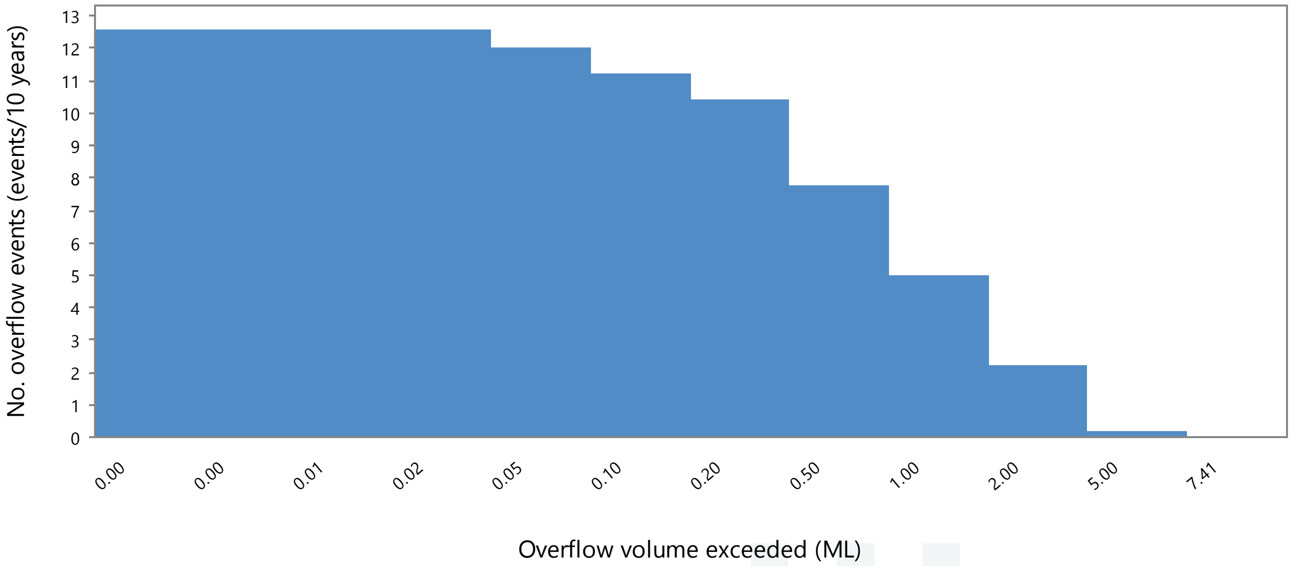
Last pond (Wet weather store): 5.00 ML

Theoretical hydraulic retention time (days)	83.19
Average volume of overflow (ML/year)	1.43
No. overflow events per year exceeding threshold* of 0.00 ML (no./year)	1.26
Average duration of overflow (days)	14.25
Effluent Reuse (Proportion of Inflow + Net Rain Gain that is Irrigated) (fraction)	0.93
Probability of at least 90% effluent reuse (fraction)	0.73
Average salinity of last pond (dS/m)	0.66
Salinity of last pond on final day of simulation (dS/m)	0.76
Ammonia loss from pond system water area (kg/m2/year)	0.00

* The threshold is the volume equivalent to the top 1 mm depth of water of a full pond

Overflow exceedance:

Chart Table



Export plot

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Irrigation Information

Irrigation: 5 ha total area (assumed 100% irrigation efficiency)

	Quantity/year	Quantity/ha/year
Total irrigation applied (ML)	20.49	4.10
Total nitrogen applied (kg)	824.09	164.82
Total phosphorus applied (kg)	208.19	41.64
Total salts applied (kg)	9021.66	1804.33

Shandying

Annual allocation of fresh water for shandying (ML/year)	0.00
Average Shandy water irrigation (ML/year) (minimum - maximum)	0.00 (0.00 - 0.00)
Average exceedance as a proportion of annual shandy water allocation (% of allocation) (minimum - maximum)	0.00 (0.00 - 0.00)
Proportion of irrigation events requiring shandying (fraction of events)	0.00
Minimum shandy water is used	False

Irrigation Issues

Proportion of Days irrigation is prevented when triggered (fraction)	0.25
Proportion of Days water demand is too small to trigger irrigation (fraction)	0.19
Proportion of Days irrigation occurs (fraction)	0.56

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Land: New Paddock: 5 ha

Irrigation: Fixed Sprinkler with 0.2% ammonium loss during irrigation

Irrigation triggered when soil water deficit reaches 5.00 mm and rainfall is less than or equal to 3.00 mm
Irrigate up to a soil water content of drained upper limit plus 0.00 mm
Irrigation window from 1/1 to 31/12 including the days specified
A minimum of 0 days must be skipped between irrigation events

Soil Water Balance (mm): Bicton (Kur-World), 340.50 mm PAWC at maximum root depth

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	349.9	444.0	400.6	185.8	84.3	54.1	41.9	33.6	32.8	47.6	87.8	176.5	1938.9
Irrigation	32.2	21.3	31.8	35.8	42.9	40.1	39.6	35.4	31.8	32.7	32.7	33.4	409.8
Soil Evap	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Transpn.	112.9	98.1	106.4	98.8	89.9	78.0	85.9	105.3	125.4	134.8	126.6	121.1	1283.1
Rain Runoff	113.2	159.6	155.3	40.1	7.0	3.2	1.9	0.7	2.1	2.7	6.8	32.8	525.4
Irr. Runoff	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Drainage	57.5	149.6	163.7	87.9	36.1	19.3	10.9	2.8	1.1	2.4	0.9	14.0	546.3
Delta	98.6	58.0	7.0	-5.3	-5.8	-6.2	-17.2	-39.8	-63.9	-59.7	-13.8	42.1	-6.0

Soil Nitrogen Balance

Average annual effluent nitrogen added (kg/ha/year)	164.82
Average annual soil nitrogen removed by plant uptake (kg/ha/year)	238.22
Average annual soil nitrogen removed by denitrification (kg/ha/year)	0.01
Average annual soil nitrogen leached (kg/ha/year)	0.10
Average annual nitrate-N loading to groundwater (kg/ha/year)	0.10
Soil organic-N kg/ha (Initial - Final)	3809.50 - 209.43
	74.41 - 0.02
Average nitrate-N concentration of deep drainage (mg/L)	0.02
Max. annual nitrate-N concentration of deep drainage (mg/L)	0.50

Soil Phosphorus Balance

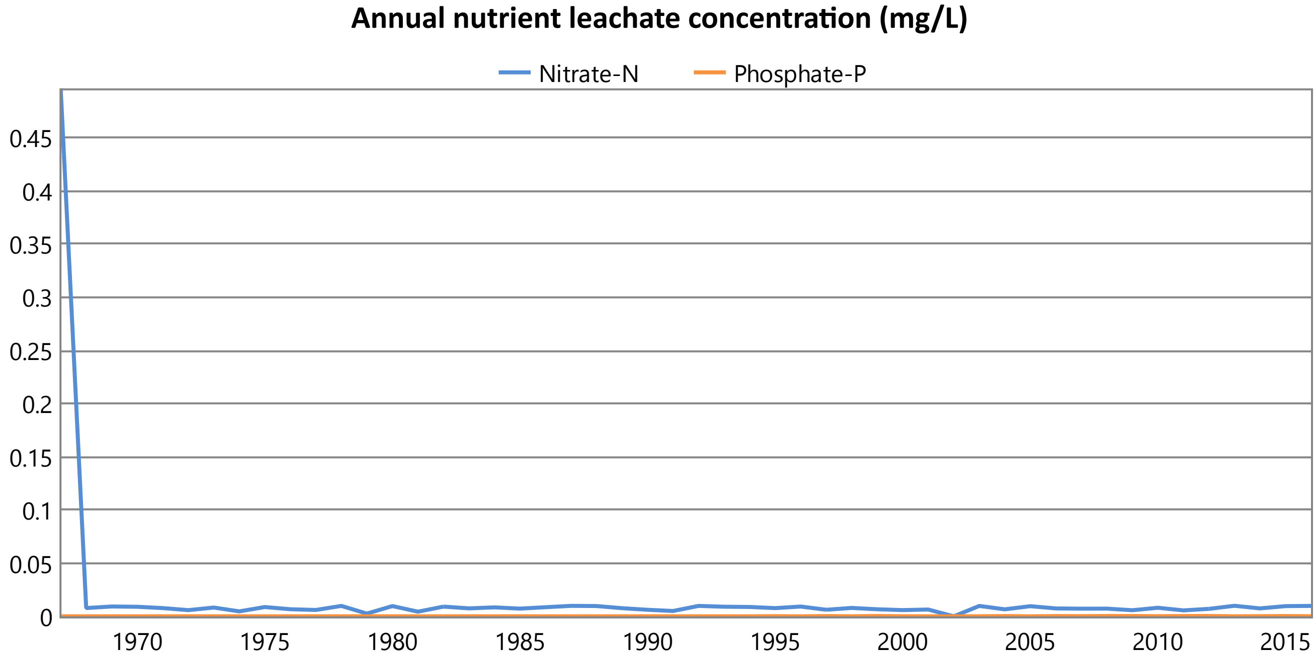
Average annual effluent phosphorus added (kg/ha/year)	41.64
Average annual soil phosphorus removed by plant uptake (kg/ha/year)	23.43
Average annual soil phosphorus leached (kg/ha/year)	8.07E-04
Dissolved phosphorus (kg/ha) (Initial - Final)	2.86E-04 - 1.90E-03
Adsorbed phosphorus (kg/ha) (Initial - Final)	450.65 - 1362.06
Average phosphate-P concentration in rootzone (mg/L)	2.42E-03
Average phosphate-P concentration of deep drainage (mg/L)	1.48E-04
Max. annual phosphate-P concentration of deep drainage (mg/L)	3.87E-04
Design soil profile storage life based on average infiltrated water phosphorus concn. of 2.28 mg/L (years)	222.05

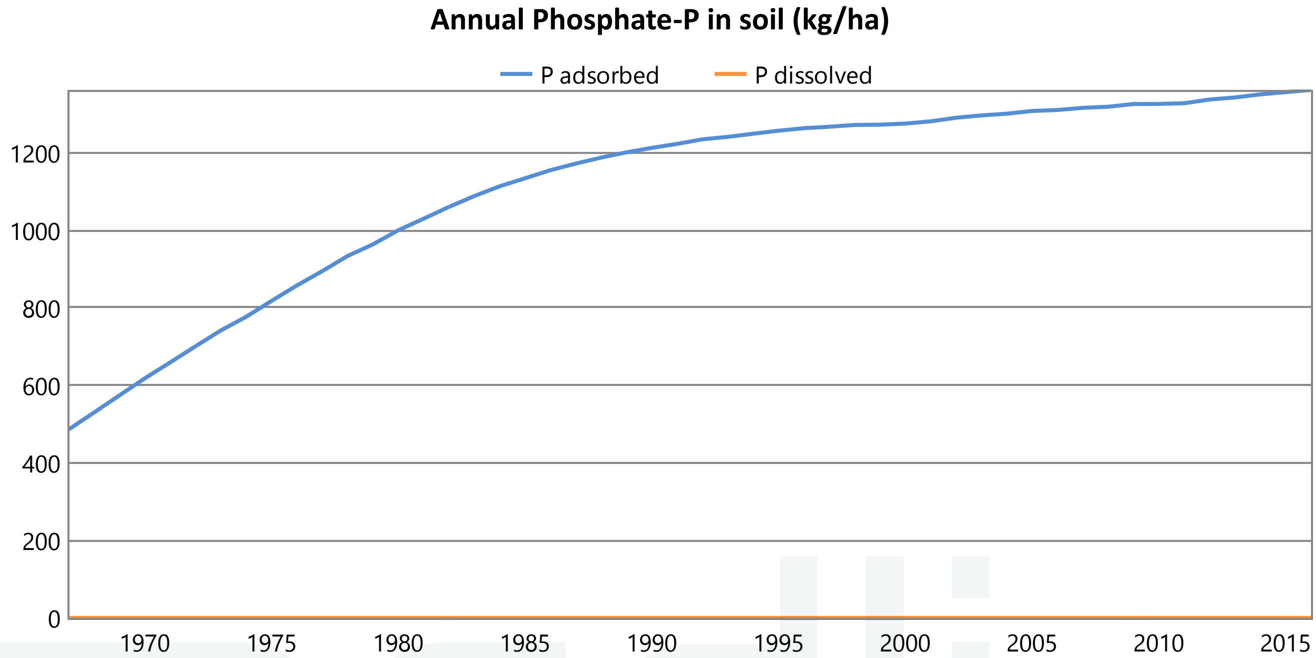
DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Land: New Paddock: 5 ha

Irrigation: Fixed Sprinkler with 0.2% ammonium loss during irrigation





DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Plant Performance: New Paddock: 5 ha

Average Plant Performance (Minimum - Maximum): Continuous Kikuyu 1 Pasture - kickstart, kick started

Average annual shoot dry matter yield (kg/ha/year)	15448.46 (12122.63 - 22310.69)
Average monthly plant (green) cover (fraction)	0.88 (0.84 - 0.91)
Average monthly crop factor (fraction)	0.70 (0.68 - 0.73)
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Average monthly root depth (mm)	1199.25 (1190.96 - 1200.00)
Average number of normal harvests per year (no./year)	2.78 (2.00 - 4.00)
Average number of normal harvests for last five years only (no./year)	2.40
Average number of crop deaths per year (no./year)	0.00 (0.00 - 0.00)
Average number of crop deaths for last five years only (no./year)	0.00
Average annual nitrogen deficiency index (0 = no stress, 1 = full stress) (coefficient)	0.67 (0.48 - 0.74)
Average January temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.01 (0.00 - 0.07)
Average July temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.11 (0.00 - 0.22)
Average monthly water stress index (0 = no stress, 1 = full stress) (coefficient)	0.03 (0.00 - 0.15)
Average monthly waterlogging index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.00)
No. days without crop/year (days)	0.00

Soil Salinity - Plant salinity tolerance: Moderately tolerant

Assumes 1.0 dS/m Electrical Conductivity = 640 mg/L Total Dissolved Salts
All values based on 10 year running averages

Salinity of infiltrated water (Average salinity of rainwater = 0.03 dS/m) (dS/m)	0.18
Salt added by rainfall (kg/ha/year)	271.40
Average annual effluent salt added & leached at steady state (kg/ha/year)	2075.74
Average leaching fraction based on 10 year running averages (fraction)	0.52
Average water-uptake-weighted rootzone salinity sat. ext. (dS/m)	0.16
Salinity of the soil solution (at drained upper limit) at base of rootzone (dS/m)	0.59
Relative crop yield expected due to salinity (fraction)	1.00
Proportion of years that crop yields would be expected to fall below 90% of potential due to salinity (fraction)	0.00

DIAGNOSTICS

Run Messages

Messages generated when the scenario was run:

Full run chosen

MEDLI REPORT - FULL RUN

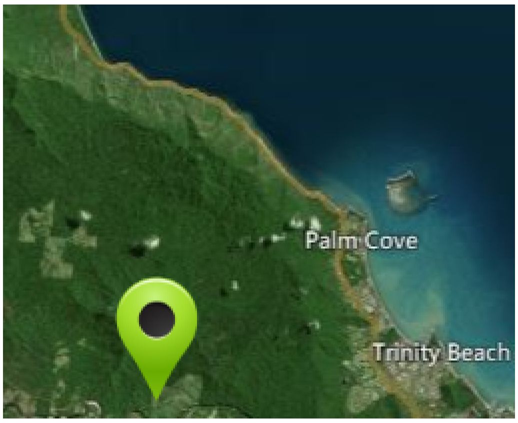
Enterprise: **Kur World with 2000.00 m3 storage pond volume and 10.00 ha irrigation area**

Description:
Stage 1A Low Multi Run

Client: **Reever and Ocean**

MEDLI User: NATRES\andrew

Scenario Details:
Low range ADWF, average infiltration efficiency
N 50 mg/L, P 12 mg/L, TDS 520 mg 45% TON, 25% NH4-N, 30% Org N
1-5 ML tank and 5 - 25 ha
5mm SMD to UDL. Irrigation allowed on days with up to 3 mm rainfall.
Kikuyu 1 (kickarted) selected to match similar salt tolerance and temperature range profile of Sinal grass
No additional nutrient addition to account for return of clippings



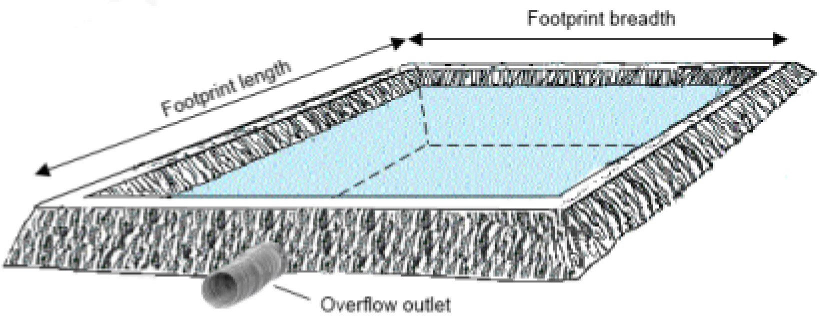
10 km

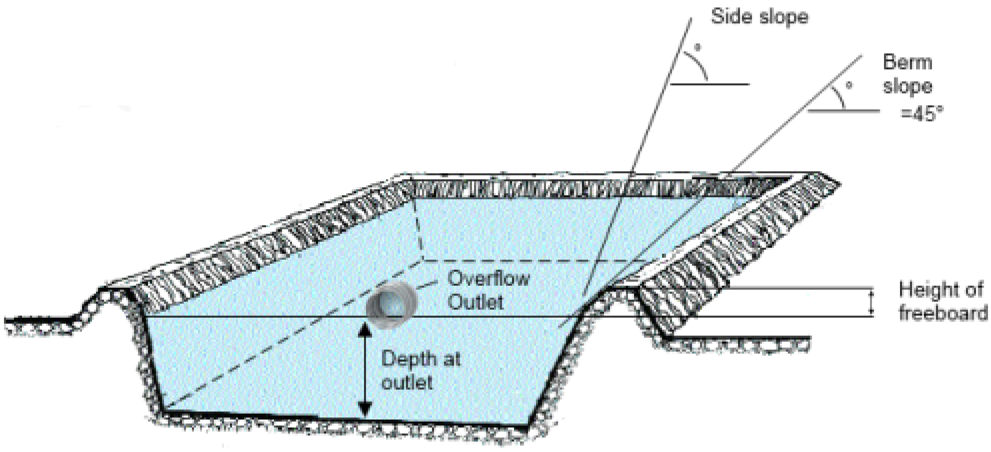
DESCRIPTION

Pond system: 1 closed storage tank

Pond system details:

	Pond 1
Maximum pond volume (ML)	2.00
Minimum allowable pond volume (ML)	0.75
Pond depth at overflow outlet (m)	4.00
Maximum water surface area (m2)	500.00
Pond footprint length (m)	22.36
Pond footprint width (m)	22.36
Pond catchment area (m2)	500.00
Average active volume (ML)	0.93





Irrigation pump limits:

Minimum pump rate limit (ML/day)	0.00
Maximum pump rate limit (ML/day)	100.00

Shandying water:

Annual allocation of fresh water available for shandying (ML/year)	0.00
Maximum rate of application of fresh water (ML/day)	0.00
Nitrogen concentration (mg/L)	0.00
Salinity (dS/m)	0.00
Minimum shandy water is used	False

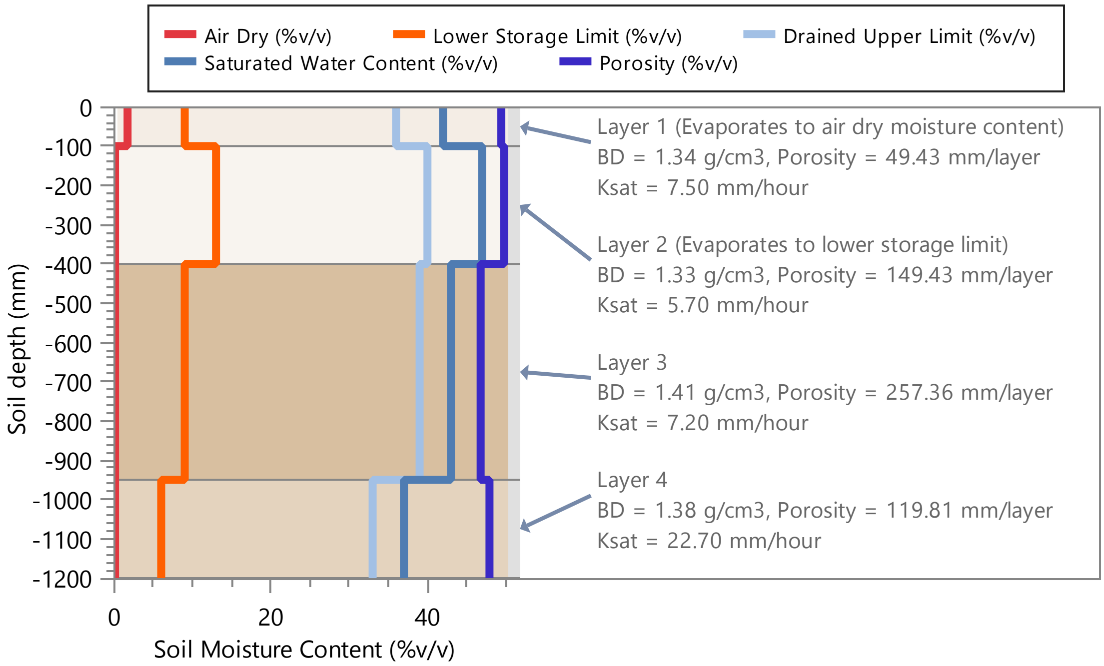
DESCRIPTION

Land: New Paddock

Area (ha): 10.00

Soil Type: Bicton (Kur-World), 1200.00 mm defined profile depth

Profile Porosity (mm)	576.04
Profile saturation water content (mm)	512.00
Profile drained upper limit (or field capacity) (mm)	453.00
Profile lower storage limit (or permanent wilting point) (mm)	112.50
Profile available water capacity (mm)	340.50
Profile limiting saturated hydraulic conductivity (mm/hour)	5.70
Surface saturated hydraulic conductivity (mm/hour)	7.50
Runoff curve number II (coefficient)	80.00
Soil evaporation U (mm)	8.50
Soil evaporation Cona (mm/sqrt day)	3.75



Plant Data: Continuous Kikuyu 1 Pasture - kickstart, kick started

Average monthly cover (fraction) (minimum - maximum)	0.88 (0.86 - 0.90)
Maximum crop factor at 100% cover (mm/mm) (Maximum crop coefficient 0.8 x Pan coefficient 1)	0.80
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Maximum potential root depth in defined soil profile (mm)	1200.00
Salt tolerance	Moderately tolerant
Salinity threshold EC sat. ext. (dS/m)	3.00
Proportion of yield decrease per dS/m increase (fraction/dS/m)	0.03

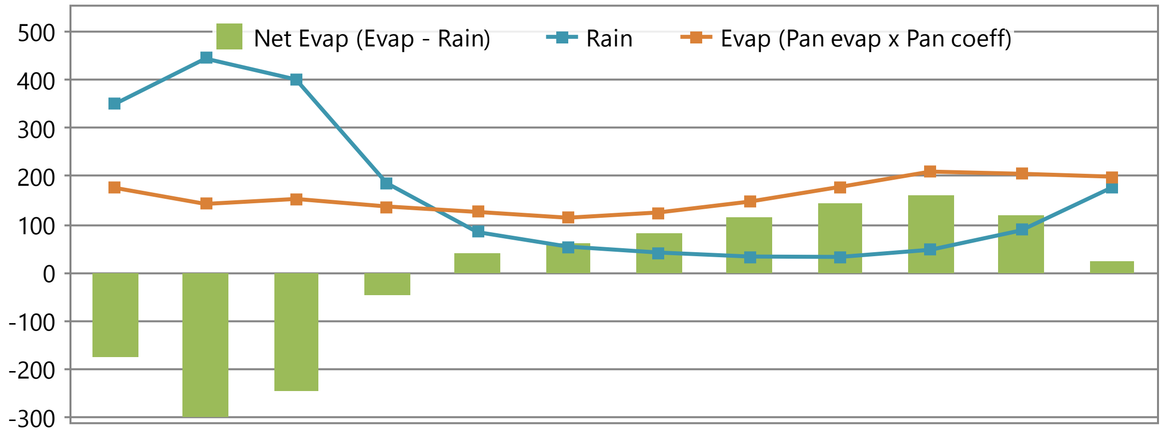
DIAGNOSTICS

Sustainability Diagnostics: Kur World

Averaged Historical Climate Data Used in Simulation (mm)

Location: KurWorlSTP, -16.8°, 145.6°

Run Period: 01/01/1967 to 31/12/2016 50 years, 0 days



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	349.9	444.0	400.6	185.8	84.3	54.1	41.9	33.6	32.8	47.6	87.8	176.5	1938.9
Evap	176.0	142.7	153.0	137.4	126.0	114.1	125.0	147.4	177.9	209.7	205.2	199.2	1913.4
Net Evap	-173.9	-301.3	-247.6	-48.4	41.8	59.9	83.1	113.8	145.1	162.1	117.4	22.7	-25.5
Net Evap/day	-5.6	-10.7	-8.0	-1.6	1.3	2.0	2.7	3.7	4.8	5.2	3.9	0.7	-0.1

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Pond System: 1 closed storage tank

Kur-world 1A Low range September 2017 ADWF - 21.95 ML/year or 0.06 ML/day generated on average

Effluent entering pond system after any pretreatment and recycling

Average (Minimum-Maximum) influent quality calculated for 365.26 non-zero flow days, after any pretreatment and recycling.

Constituent	Concentration (mg/L)	Load (kg/year)
Total Nitrogen	41.55 (3.41 - 50.00)	912.24 (911.59 - 914.08)
Total Phosphorus	9.97 (0.82 - 12.00)	218.94 (218.78 - 219.38)
Total Dissolved Salts	432.14 (35.46 - 520.00)	9487.26 (9480.51 - 9506.48)
Volatile Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Total Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)

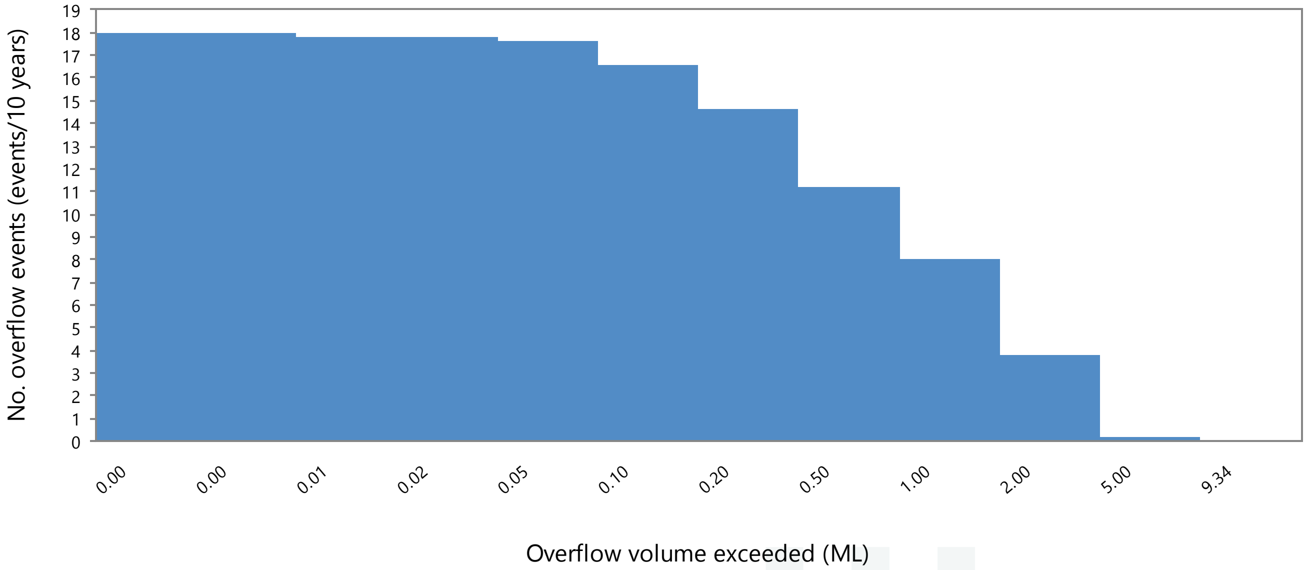
Last pond (Wet weather store): 2.00 ML

Theoretical hydraulic retention time (days)	33.27
Average volume of overflow (ML/year)	2.23
No. overflow events per year exceeding threshold* of 0.00 ML (no./year)	1.80
Average duration of overflow (days)	15.04
Effluent Reuse (Proportion of Inflow + Net Rain Gain that is Irrigated) (fraction)	0.90
Probability of at least 90% effluent reuse (fraction)	0.53
Average salinity of last pond (dS/m)	0.67
Salinity of last pond on final day of simulation (dS/m)	0.76
Ammonia loss from pond system water area (kg/m2/year)	0.00

* The threshold is the volume equivalent to the top 1 mm depth of water of a full pond

Overflow exceedance:

Chart Table



Export plot

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Irrigation Information

Irrigation: 10 ha total area (assumed 100% irrigation efficiency)

	Quantity/year	Quantity/ha/year
Total irrigation applied (ML)	19.71	1.97
Total nitrogen applied (kg)	806.67	80.67
Total phosphorus applied (kg)	203.79	20.38
Total salts applied (kg)	8830.94	883.09

Shandying

Annual allocation of fresh water for shandying (ML/year)	0.00
Average Shandy water irrigation (ML/year) (minimum - maximum)	0.00 (0.00 - 0.00)
Average exceedance as a proportion of annual shandy water allocation (% of allocation) (minimum - maximum)	0.00 (0.00 - 0.00)
Proportion of irrigation events requiring shandying (fraction of events)	0.00
Minimum shandy water is used	False

Irrigation Issues

Proportion of Days irrigation is prevented when triggered (fraction)	0.25
Proportion of Days water demand is too small to trigger irrigation (fraction)	0.10
Proportion of Days irrigation occurs (fraction)	0.66

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Land: New Paddock: 10 ha

Irrigation: Fixed Sprinkler with 0.2% ammonium loss during irrigation

Irrigation triggered when soil water deficit reaches 5.00 mm and rainfall is less than or equal to 3.00 mm
Irrigate up to a soil water content of drained upper limit plus 0.00 mm
Irrigation window from 1/1 to 31/12 including the days specified
A minimum of 0 days must be skipped between irrigation events

Soil Water Balance (mm): Bicton (Kur-World), 340.50 mm PAWC at maximum root depth

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	349.9	444.0	400.6	185.8	84.3	54.1	41.9	33.6	32.8	47.6	87.8	176.5	1938.9
Irrigation	17.3	12.8	17.0	16.4	18.3	16.9	16.3	16.1	15.8	16.4	16.4	17.4	197.1
Soil Evap	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Transpn.	113.2	101.0	107.9	97.5	89.2	79.3	86.4	102.2	120.6	113.6	87.7	100.6	1199.3
Rain Runoff	108.2	156.4	152.0	38.5	6.5	2.6	1.2	0.2	1.4	1.8	5.1	29.0	502.9
Irr. Runoff	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Drainage	45.0	126.4	147.9	74.9	25.0	9.0	4.7	0.2	0.0	0.0	0.0	7.2	440.2
Delta	100.9	73.0	10.0	-8.7	-18.1	-19.8	-34.2	-52.9	-73.6	-51.4	11.3	57.1	-6.4

Soil Nitrogen Balance

Average annual effluent nitrogen added (kg/ha/year)	80.67
Average annual soil nitrogen removed by plant uptake (kg/ha/year)	153.28
Average annual soil nitrogen removed by denitrification (kg/ha/year)	2.99E-03
Average annual soil nitrogen leached (kg/ha/year)	0.09
Average annual nitrate-N loading to groundwater (kg/ha/year)	0.09
Soil organic-N kg/ha (Initial - Final)	3809.50 - 249.65
	74.41 - 0.01
Average nitrate-N concentration of deep drainage (mg/L)	0.02
Max. annual nitrate-N concentration of deep drainage (mg/L)	0.55

Soil Phosphorus Balance

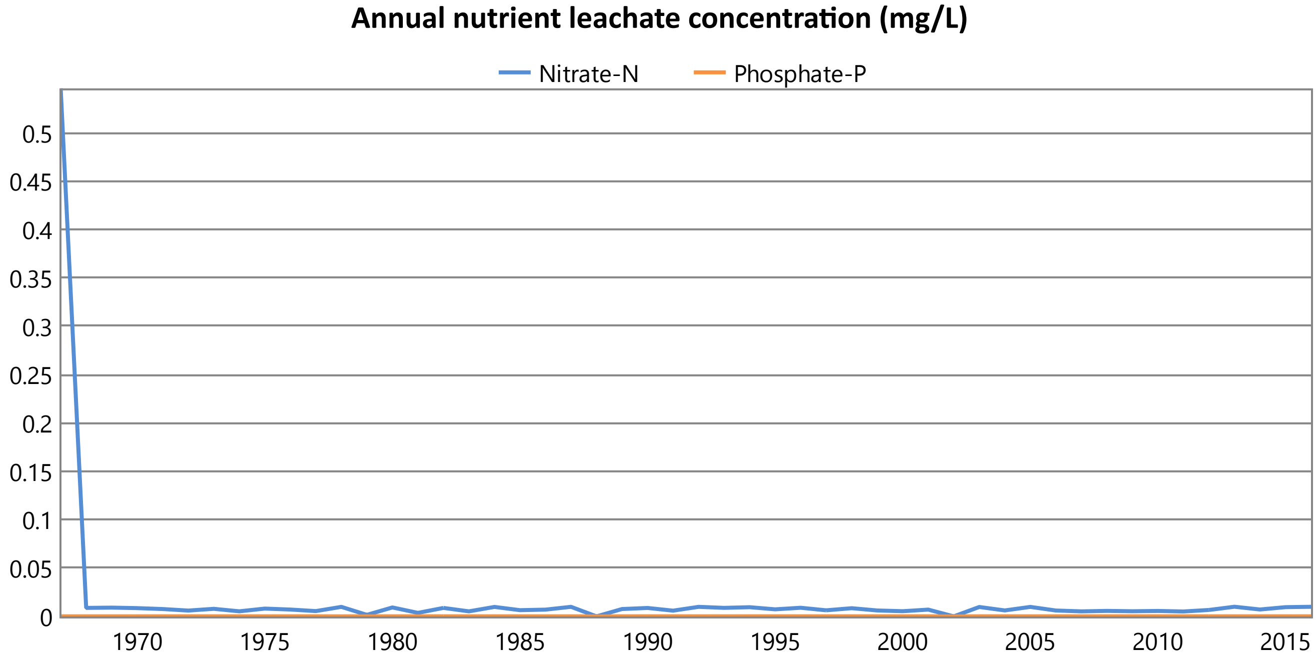
Average annual effluent phosphorus added (kg/ha/year)	20.38
Average annual soil phosphorus removed by plant uptake (kg/ha/year)	7.23
Average annual soil phosphorus leached (kg/ha/year)	3.40E-04
Dissolved phosphorus (kg/ha) (Initial - Final)	2.86E-04 - 1.38E-03
Adsorbed phosphorus (kg/ha) (Initial - Final)	450.65 - 1109.98
Average phosphate-P concentration in rootzone (mg/L)	7.81E-04
Average phosphate-P concentration of deep drainage (mg/L)	7.72E-05
Max. annual phosphate-P concentration of deep drainage (mg/L)	8.99E-05
Design soil profile storage life based on average infiltrated water phosphorus concn. of 1.25 mg/L (years)	378.42

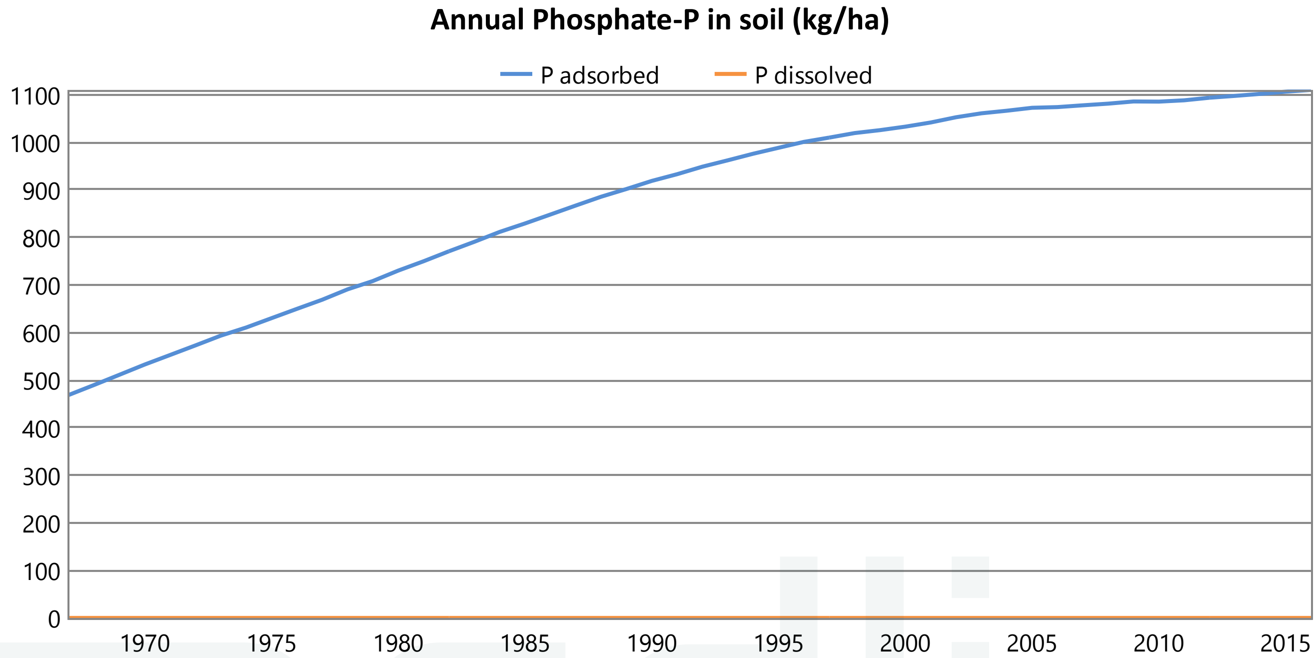
DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Land: New Paddock: 10 ha

Irrigation: Fixed Sprinkler with 0.2% ammonium loss during irrigation





DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Plant Performance: New Paddock: 10 ha

Average Plant Performance (Minimum - Maximum): Continuous Kikuyu 1 Pasture - kickstart, kick started

Average annual shoot dry matter yield (kg/ha/year)	11443.73 (8017.18 - 19894.00)
Average monthly plant (green) cover (fraction)	0.88 (0.86 - 0.90)
Average monthly crop factor (fraction)	0.71 (0.69 - 0.72)
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Average monthly root depth (mm)	1199.25 (1190.97 - 1200.00)
Average number of normal harvests per year (no./year)	2.06 (1.00 - 3.00)
Average number of normal harvests for last five years only (no./year)	1.60
Average number of crop deaths per year (no./year)	0.00 (0.00 - 0.00)
Average number of crop deaths for last five years only (no./year)	0.00
Average annual nitrogen deficiency index (0 = no stress, 1 = full stress) (coefficient)	0.75 (0.52 - 0.84)
Average January temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.01 (0.00 - 0.07)
Average July temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.11 (0.00 - 0.22)
Average monthly water stress index (0 = no stress, 1 = full stress) (coefficient)	0.08 (0.00 - 0.36)
Average monthly waterlogging index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.00)
No. days without crop/year (days)	0.00

Soil Salinity - Plant salinity tolerance: Moderately tolerant

Assumes 1.0 dS/m Electrical Conductivity = 640 mg/L Total Dissolved Salts
All values based on 10 year running averages

Salinity of infiltrated water (Average salinity of rainwater = 0.03 dS/m) (dS/m)	0.11
Salt added by rainfall (kg/ha/year)	275.71
Average annual effluent salt added & leached at steady state (kg/ha/year)	1158.81
Average leaching fraction based on 10 year running averages (fraction)	0.49
Average water-uptake-weighted rootzone salinity sat. ext. (dS/m)	0.10
Salinity of the soil solution (at drained upper limit) at base of rootzone (dS/m)	0.41
Relative crop yield expected due to salinity (fraction)	1.00
Proportion of years that crop yields would be expected to fall below 90% of potential due to salinity (fraction)	0.00

DIAGNOSTICS

Run Messages

Messages generated when the scenario was run:

Full run chosen

MEDLI REPORT - FULL RUN

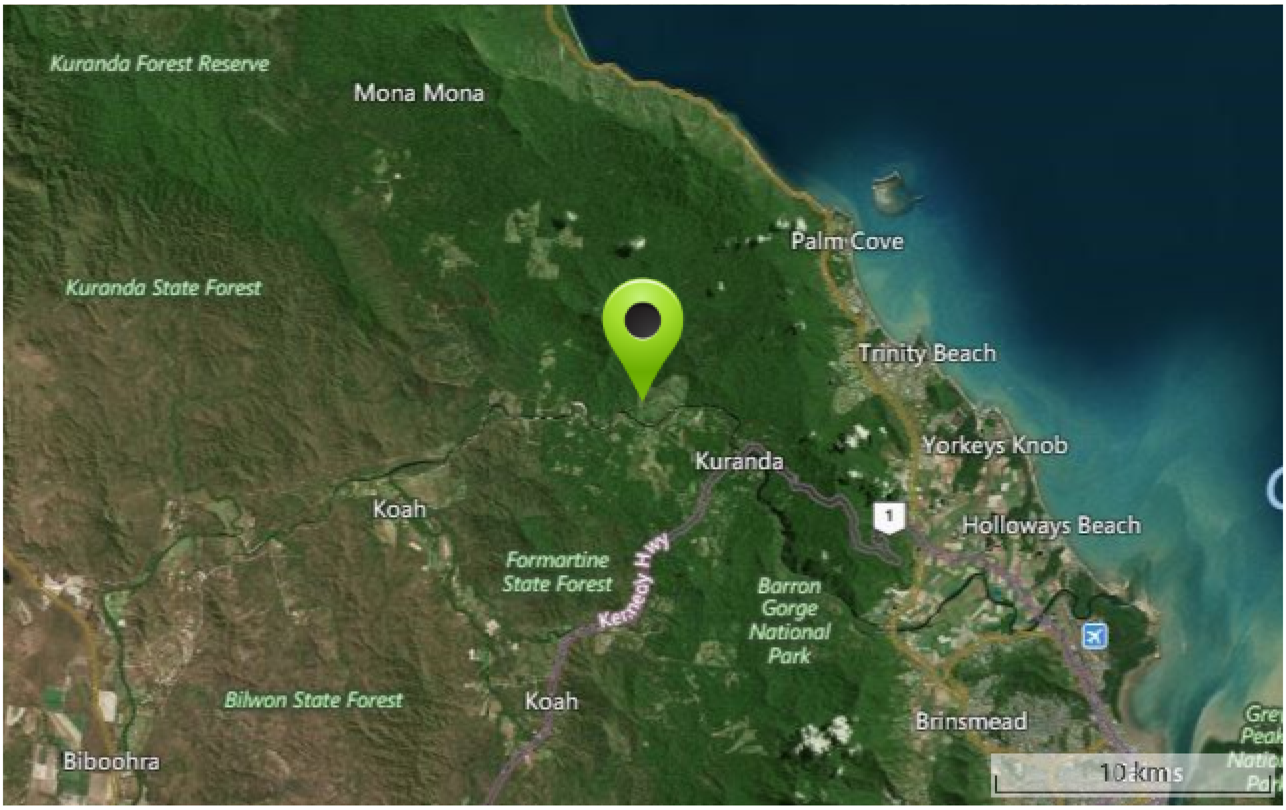
Enterprise: **Kur World with 5000.00 m3 storage pond volume and 25.00 ha irrigation area**

Description:
Stage 1A Low Multi Run

Client: **Reever and Ocean**

MEDLI User: NATRES\andrew

Scenario Details:
Low range ADWF, average infiltration efficiency
N 50 mg/L, P 12 mg/L, TDS 520 mg 45% TON, 25% NH4-N, 30% Org N
1-5 ML tank and 5 - 25 ha
5mm SMD to UDL. Irrigation allowed on days with up to 3 mm rainfall.
Kikuyu 1 (kickarted) selected to match similar salt tolerance and temperature range profile of Sinal grass
No additional nutrient addition to account for return of clippings

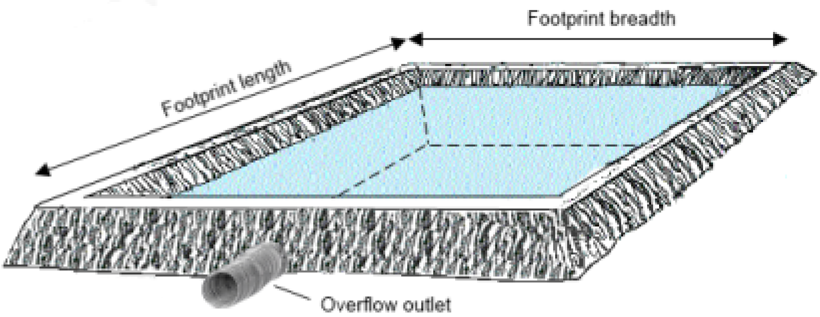


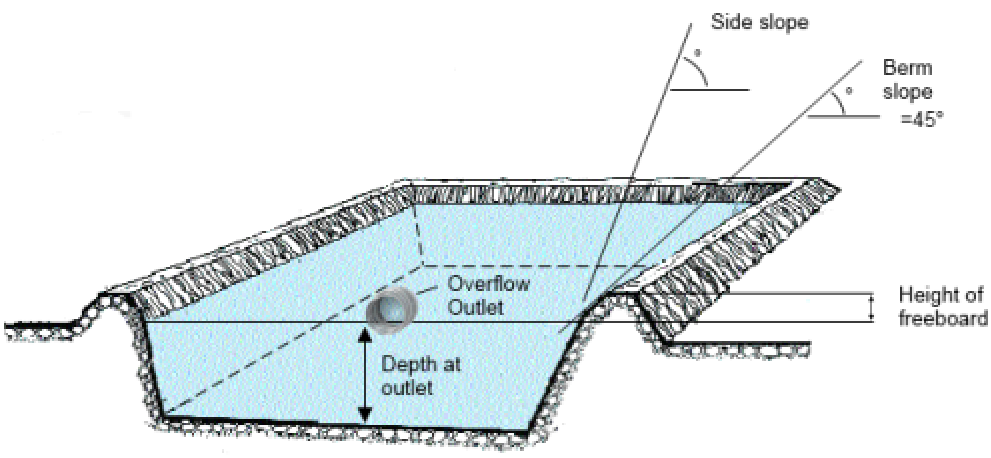
DESCRIPTION

Pond system: 1 closed storage tank

Pond system details:

	Pond 1
Maximum pond volume (ML)	5.00
Minimum allowable pond volume (ML)	1.88
Pond depth at overflow outlet (m)	4.00
Maximum water surface area (m2)	1250.00
Pond footprint length (m)	35.36
Pond footprint width (m)	35.36
Pond catchment area (m2)	1250.00
Average active volume (ML)	2.10





Irrigation pump limits:

Minimum pump rate limit (ML/day)	0.00
Maximum pump rate limit (ML/day)	100.00

Shandying water:

Annual allocation of fresh water available for shandying (ML/year)	0.00
Maximum rate of application of fresh water (ML/day)	0.00
Nitrogen concentration (mg/L)	0.00
Salinity (dS/m)	0.00
Minimum shandy water is used	False

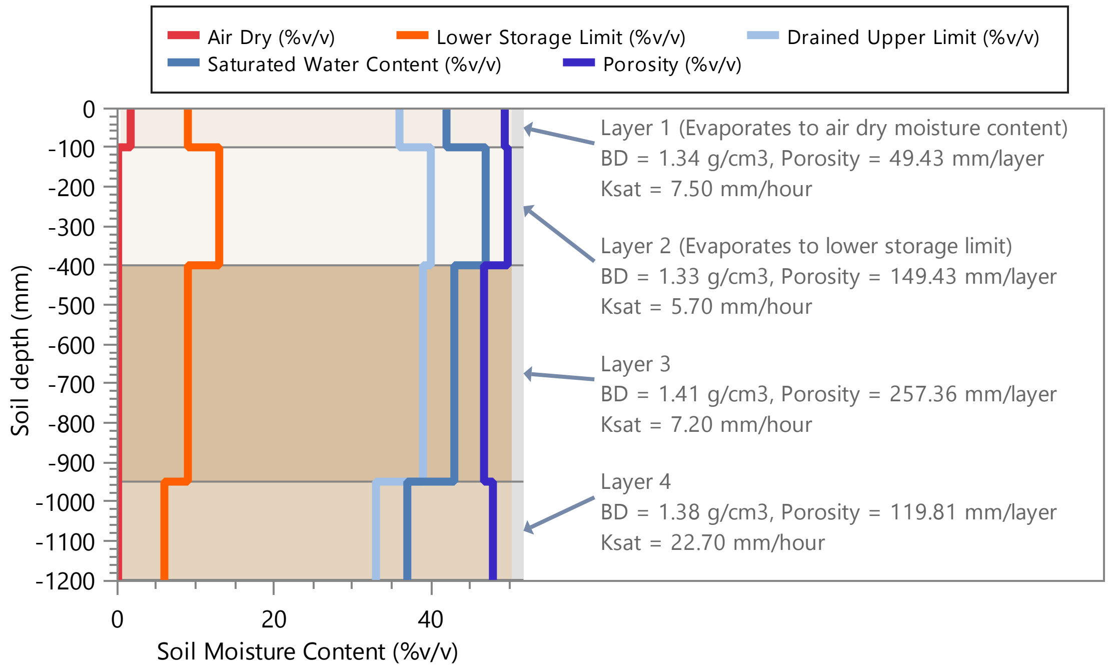
DESCRIPTION

Land: New Paddock

Area (ha): 25.00

Soil Type: Bicton (Kur-World), 1200.00 mm defined profile depth

Profile Porosity (mm)	576.04
Profile saturation water content (mm)	512.00
Profile drained upper limit (or field capacity) (mm)	453.00
Profile lower storage limit (or permanent wilting point) (mm)	112.50
Profile available water capacity (mm)	340.50
Profile limiting saturated hydraulic conductivity (mm/hour)	5.70
Surface saturated hydraulic conductivity (mm/hour)	7.50
Runoff curve number II (coefficient)	80.00
Soil evaporation U (mm)	8.50
Soil evaporation Cona (mm/sqrt day)	3.75



Plant Data: Continuous Kikuyu 1 Pasture - kickstart, kick started

Average monthly cover (fraction) (minimum - maximum)	0.89 (0.85 - 0.93)
Maximum crop factor at 100% cover (mm/mm) (Maximum crop coefficient 0.8 x Pan coefficient 1)	0.80
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Maximum potential root depth in defined soil profile (mm)	1200.00
Salt tolerance	Moderately tolerant
Salinity threshold EC sat. ext. (dS/m)	3.00
Proportion of yield decrease per dS/m increase (fraction/dS/m)	0.03

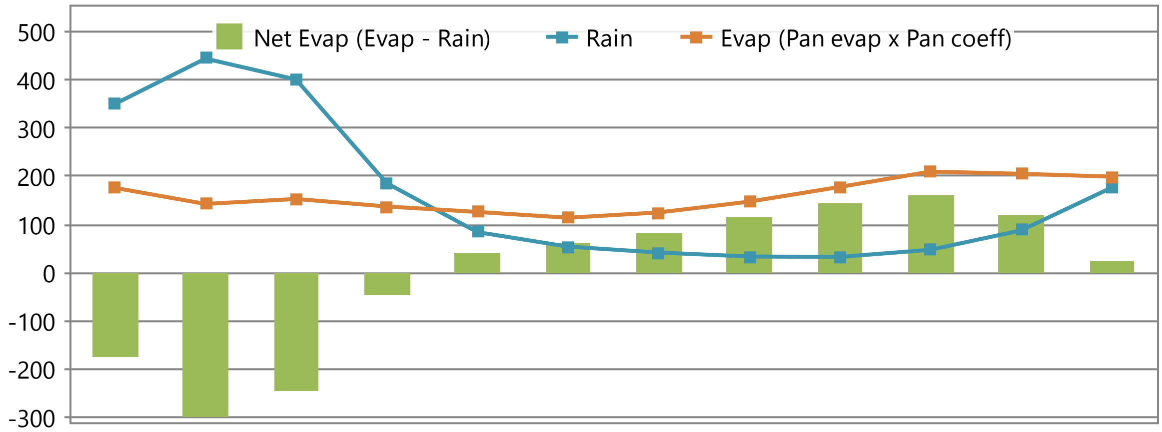
DIAGNOSTICS

Sustainability Diagnostics: Kur World

Averaged Historical Climate Data Used in Simulation (mm)

Location: KurWorlSTP, -16.8°, 145.6°

Run Period: 01/01/1967 to 31/12/2016 50 years, 0 days



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	349.9	444.0	400.6	185.8	84.3	54.1	41.9	33.6	32.8	47.6	87.8	176.5	1938.9
Evap	176.0	142.7	153.0	137.4	126.0	114.1	125.0	147.4	177.9	209.7	205.2	199.2	1913.4
Net Evap	-173.9	-301.3	-247.6	-48.4	41.8	59.9	83.1	113.8	145.1	162.1	117.4	22.7	-25.5
Net Evap/day	-5.6	-10.7	-8.0	-1.6	1.3	2.0	2.7	3.7	4.8	5.2	3.9	0.7	-0.1

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Pond System: 1 closed storage tank

Kur-world 1A Low range September 2017 ADWF - 21.95 ML/year or 0.06 ML/day generated on average

Effluent entering pond system after any pretreatment and recycling

Average (Minimum-Maximum) influent quality calculated for 365.26 non-zero flow days, after any pretreatment and recycling.

Constituent	Concentration (mg/L)	Load (kg/year)
Total Nitrogen	41.55 (3.41 - 50.00)	912.24 (911.59 - 914.08)
Total Phosphorus	9.97 (0.82 - 12.00)	218.94 (218.78 - 219.38)
Total Dissolved Salts	432.14 (35.46 - 520.00)	9487.26 (9480.51 - 9506.48)
Volatile Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Total Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)

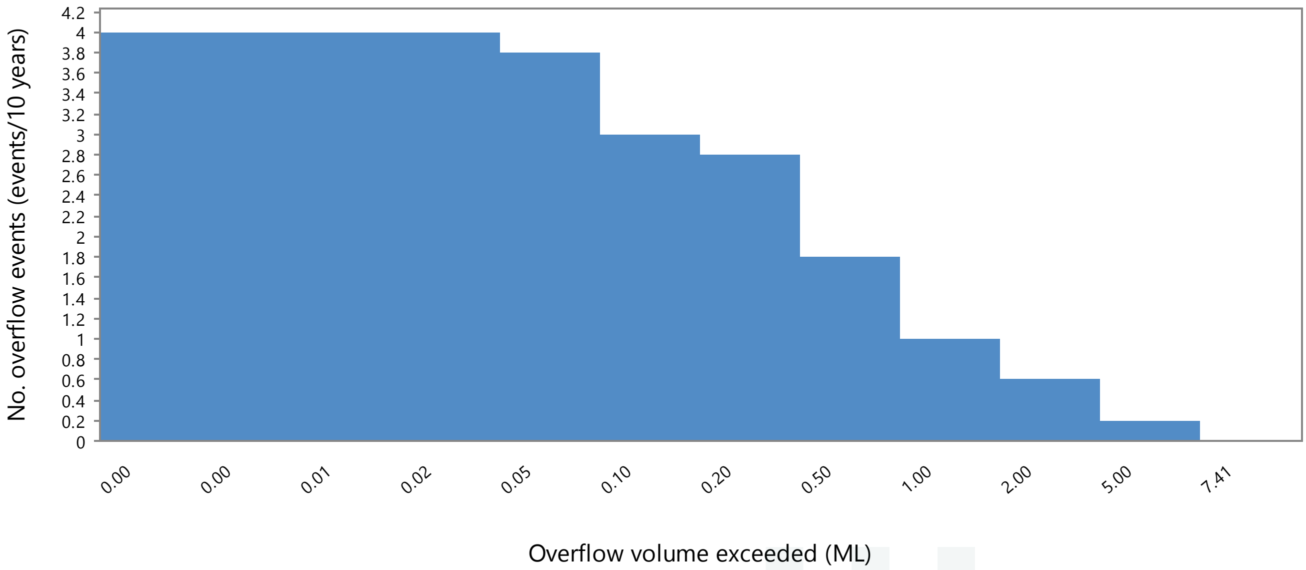
Last pond (Wet weather store): 5.00 ML

Theoretical hydraulic retention time (days)	83.19
Average volume of overflow (ML/year)	0.39
No. overflow events per year exceeding threshold* of 0.00 ML (no./year)	0.40
Average duration of overflow (days)	11.60
Effluent Reuse (Proportion of Inflow + Net Rain Gain that is Irrigated) (fraction)	0.98
Probability of at least 90% effluent reuse (fraction)	0.94
Average salinity of last pond (dS/m)	0.68
Salinity of last pond on final day of simulation (dS/m)	0.76
Ammonia loss from pond system water area (kg/m2/year)	0.00

* The threshold is the volume equivalent to the top 1 mm depth of water of a full pond

Overflow exceedance:

Chart Table



Export plot

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Irrigation Information

Irrigation: 25 ha total area (assumed 100% irrigation efficiency)

	Quantity/year	Quantity/ha/year
Total irrigation applied (ML)	21.53	0.86
Total nitrogen applied (kg)	855.07	34.20
Total phosphorus applied (kg)	216.02	8.64
Total salts applied (kg)	9360.79	374.43

Shandying

Annual allocation of fresh water for shandying (ML/year)	0.00
Average Shandy water irrigation (ML/year) (minimum - maximum)	0.00 (0.00 - 0.00)
Average exceedance as a proportion of annual shandy water allocation (% of allocation) (minimum - maximum)	0.00 (0.00 - 0.00)
Proportion of irrigation events requiring shandying (fraction of events)	0.00
Minimum shandy water is used	False

Irrigation Issues

Proportion of Days irrigation is prevented when triggered (fraction)	0.25
Proportion of Days water demand is too small to trigger irrigation (fraction)	0.07
Proportion of Days irrigation occurs (fraction)	0.68

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Land: New Paddock: 25 ha

Irrigation: Fixed Sprinkler with 0.2% ammonium loss during irrigation

Irrigation triggered when soil water deficit reaches 5.00 mm and rainfall is less than or equal to 3.00 mm
Irrigate up to a soil water content of drained upper limit plus 0.00 mm
Irrigation window from 1/1 to 31/12 including the days specified
A minimum of 0 days must be skipped between irrigation events

Soil Water Balance (mm): Bicton (Kur-World), 340.50 mm PAWC at maximum root depth

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	349.9	444.0	400.6	185.8	84.3	54.1	41.9	33.6	32.8	47.6	87.8	176.5	1938.9
Irrigation	7.3	6.5	10.1	8.2	8.0	6.6	6.6	6.4	6.3	6.6	6.6	7.1	86.1
Soil Evap	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Transpn.	110.9	104.4	113.4	100.3	89.9	77.7	85.4	97.1	102.1	92.8	78.3	96.4	1148.6
Rain Runoff	105.7	153.7	150.1	37.2	5.9	2.1	0.9	0.0	1.5	1.8	4.8	27.8	491.5
Irr. Runoff	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Drainage	39.7	116.9	133.2	69.5	18.6	6.3	2.2	0.3	0.1	0.0	0.0	4.1	391.0
Delta	100.9	75.5	14.0	-13.0	-22.1	-25.4	-40.1	-57.5	-64.7	-40.4	11.3	55.3	-6.1

Soil Nitrogen Balance

Average annual effluent nitrogen added (kg/ha/year)	34.20
Average annual soil nitrogen removed by plant uptake (kg/ha/year)	106.09
Average annual soil nitrogen removed by denitrification (kg/ha/year)	2.30E-03
Average annual soil nitrogen leached (kg/ha/year)	0.09
Average annual nitrate-N loading to groundwater (kg/ha/year)	0.09
Soil organic-N kg/ha (Initial - Final)	3809.50 - 286.26
	74.41 - 0.01
Average nitrate-N concentration of deep drainage (mg/L)	0.02
Max. annual nitrate-N concentration of deep drainage (mg/L)	0.57

Soil Phosphorus Balance

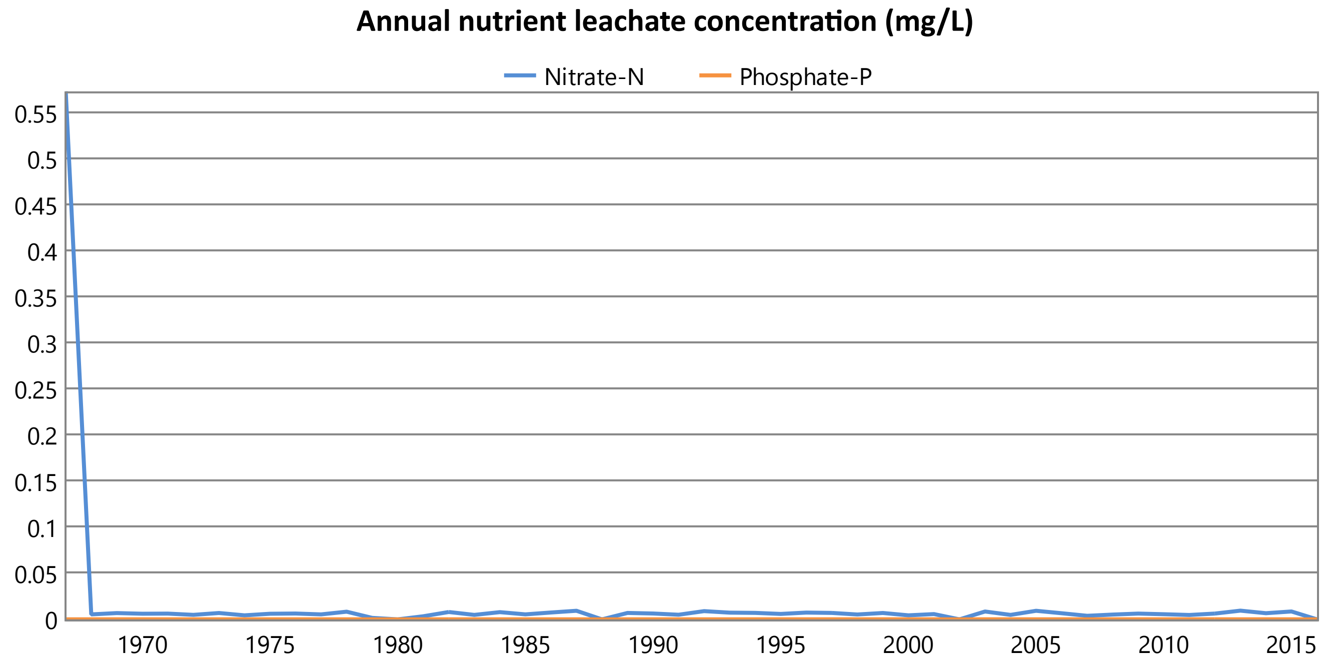
Average annual effluent phosphorus added (kg/ha/year)	8.64
Average annual soil phosphorus removed by plant uptake (kg/ha/year)	0.43
Average annual soil phosphorus leached (kg/ha/year)	2.91E-04
Dissolved phosphorus (kg/ha) (Initial - Final)	2.86E-04 - 1.87E-03
Adsorbed phosphorus (kg/ha) (Initial - Final)	450.65 - 863.13
Average phosphate-P concentration in rootzone (mg/L)	5.23E-04
Average phosphate-P concentration of deep drainage (mg/L)	7.44E-05
Max. annual phosphate-P concentration of deep drainage (mg/L)	8.50E-05
Design soil profile storage life based on average infiltrated water phosphorus concn. of 0.56 mg/L (years)	696.50

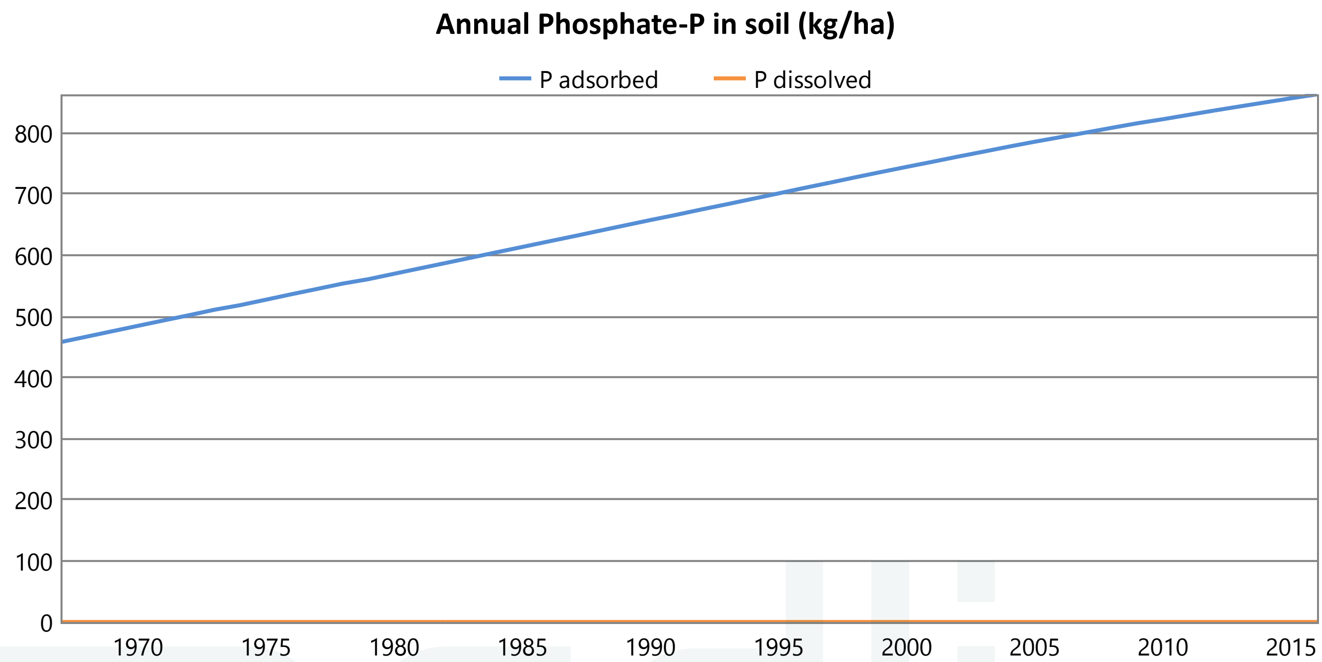
DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Land: New Paddock: 25 ha

Irrigation: Fixed Sprinkler with 0.2% ammonium loss during irrigation





DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Plant Performance: New Paddock: 25 ha

Average Plant Performance (Minimum - Maximum): Continuous Kikuyu 1 Pasture - kickstart, kick started

Average annual shoot dry matter yield (kg/ha/year)	8639.47 (4910.51 - 17629.21)
Average monthly plant (green) cover (fraction)	0.89 (0.85 - 0.93)
Average monthly crop factor (fraction)	0.71 (0.68 - 0.75)
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Average monthly root depth (mm)	1199.25 (1190.96 - 1200.00)
Average number of normal harvests per year (no./year)	1.56 (1.00 - 3.00)
Average number of normal harvests for last five years only (no./year)	1.00
Average number of crop deaths per year (no./year)	0.00 (0.00 - 0.00)
Average number of crop deaths for last five years only (no./year)	0.00
Average annual nitrogen deficiency index (0 = no stress, 1 = full stress) (coefficient)	0.81 (0.57 - 0.89)
Average January temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.01 (0.00 - 0.07)
Average July temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.11 (0.00 - 0.22)
Average monthly water stress index (0 = no stress, 1 = full stress) (coefficient)	0.12 (0.00 - 0.45)
Average monthly waterlogging index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.00)
No. days without crop/year (days)	0.00

Soil Salinity - Plant salinity tolerance: Moderately tolerant

Assumes 1.0 dS/m Electrical Conductivity = 640 mg/L Total Dissolved Salts
All values based on 10 year running averages

Salinity of infiltrated water (Average salinity of rainwater = 0.03 dS/m) (dS/m)	0.07
Salt added by rainfall (kg/ha/year)	277.90
Average annual effluent salt added & leached at steady state (kg/ha/year)	652.33
Average leaching fraction based on 10 year running averages (fraction)	0.48
Average water-uptake-weighted rootzone salinity sat. ext. (dS/m)	0.06
Salinity of the soil solution (at drained upper limit) at base of rootzone (dS/m)	0.26
Relative crop yield expected due to salinity (fraction)	1.00
Proportion of years that crop yields would be expected to fall below 90% of potential due to salinity (fraction)	0.00

DIAGNOSTICS

Run Messages

Messages generated when the scenario was run:

Full run chosen

MEDLI REPORT - FULL RUN

Enterprise: **Kur World with 5000.00 m3 storage pond volume and 5.00 ha irrigation area**

Description:
Stage 1A Low Multi Run

Client: **Reever and Ocean**

MEDLI User: NATRES\andrew

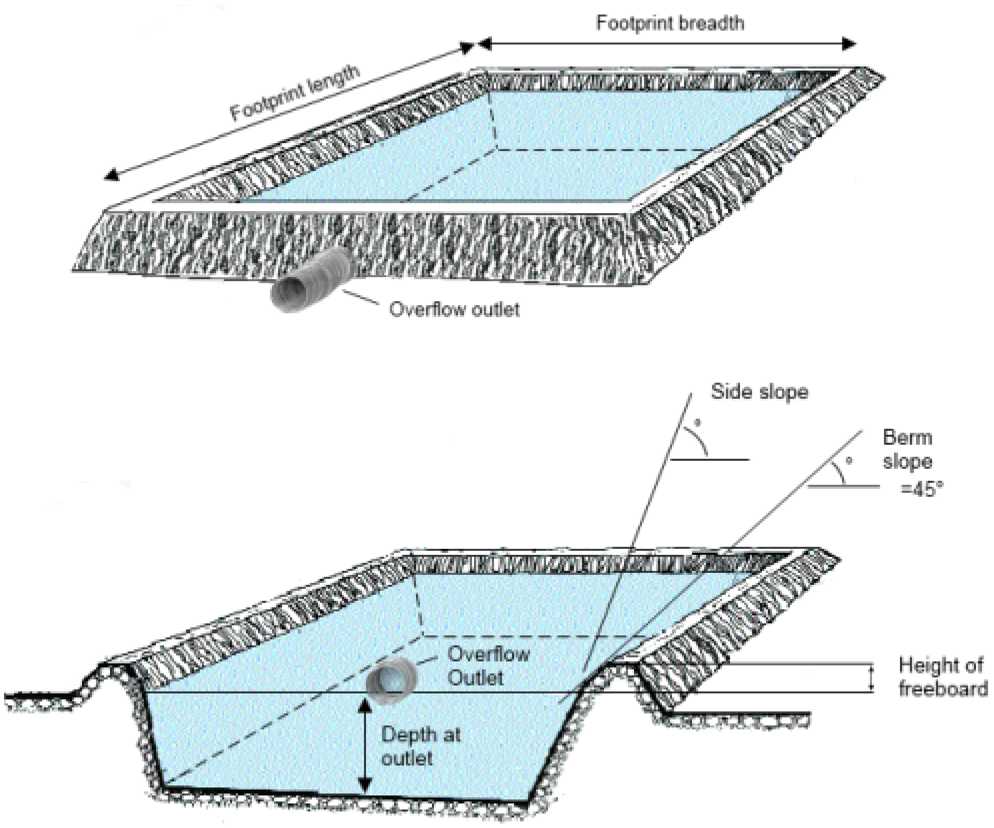
Scenario Details:
High range ADWF, average infiltration efficiency
N 50 mg/L, P 12 mg/L, TDS 520 mg 45% TON, 25% NH4-N, 30% Org N
1-5 ML tank and 5 - 25 ha
5mm SMD to UDL. Irrigation allowed on days with up to 3 mm rainfall.
Kikuyu 1 (kickarted) selected to match similar salt tolerance and temperature range profile of Sinal grass
No additional nutrient addition to account for return of clippings

DESCRIPTION

Pond system: 1 closed storage tank

Pond system details:

	Pond 1
Maximum pond volume (ML)	5.00
Minimum allowable pond volume (ML)	1.88
Pond depth at overflow outlet (m)	4.00
Maximum water surface area (m2)	1250.00
Pond footprint length (m)	35.36
Pond footprint width (m)	35.36
Pond catchment area (m2)	1250.00
Average active volume (ML)	3.09



Irrigation pump limits:

Minimum pump rate limit (ML/day)	0.00
Maximum pump rate limit (ML/day)	100.00

Shandying water:

Annual allocation of fresh water available for shandying (ML/year)	0.00
Maximum rate of application of fresh water (ML/day)	0.00
Nitrogen concentration (mg/L)	0.00
Salinity (dS/m)	0.00
Minimum shandy water is used	False

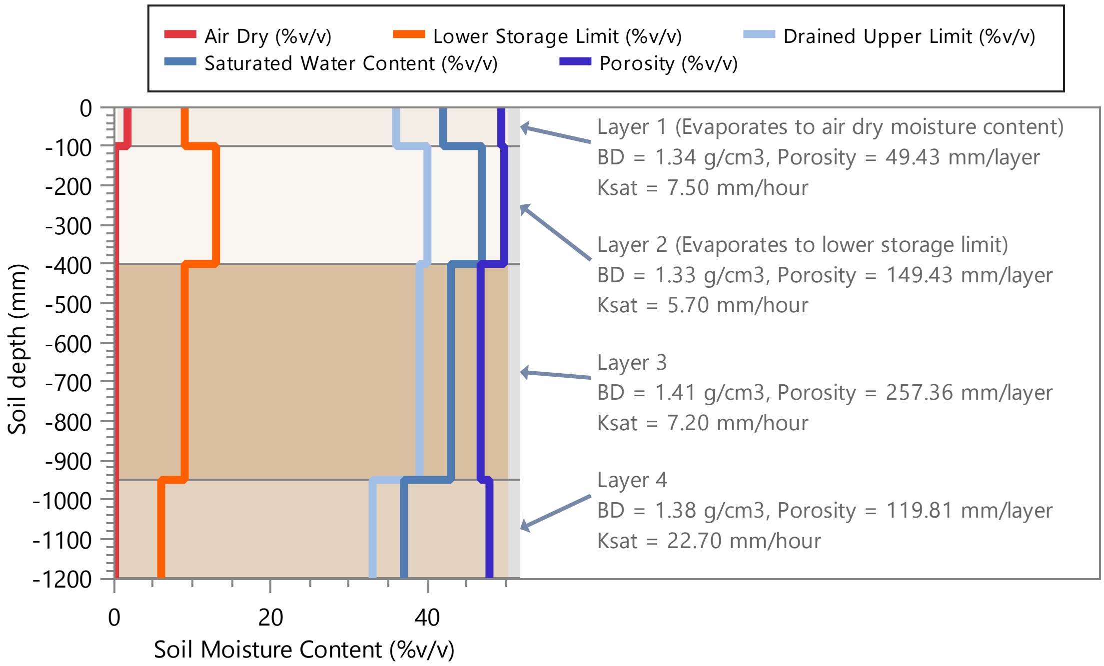
DESCRIPTION

Land: New Paddock

Area (ha): 5.00

Soil Type: Bicton (Kur-World), 1200.00 mm defined profile depth

Profile Porosity (mm)	576.04
Profile saturation water content (mm)	512.00
Profile drained upper limit (or field capacity) (mm)	453.00
Profile lower storage limit (or permanent wilting point) (mm)	112.50
Profile available water capacity (mm)	340.50
Profile limiting saturated hydraulic conductivity (mm/hour)	5.70
Surface saturated hydraulic conductivity (mm/hour)	7.50
Runoff curve number II (coefficient)	80.00
Soil evaporation U (mm)	8.50
Soil evaporation Cona (mm/sqrt day)	3.75



Plant Data: Continuous Kikuyu 1 Pasture - kickstart, kick started

Average monthly cover (fraction) (minimum - maximum)	0.88 (0.84 - 0.91)
Maximum crop factor at 100% cover (mm/mm) (Maximum crop coefficient 0.8 x Pan coefficient 1)	0.80
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Maximum potential root depth in defined soil profile (mm)	1200.00
Salt tolerance	Moderately tolerant
Salinity threshold EC sat. ext. (dS/m)	3.00
Proportion of yield decrease per dS/m increase (fraction/dS/m)	0.03

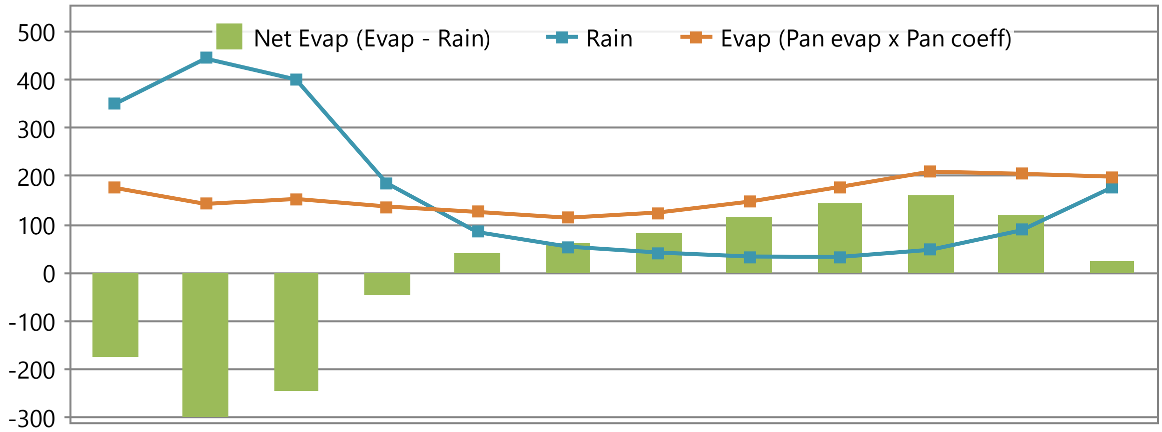
DIAGNOSTICS

Sustainability Diagnostics: Kur World

Averaged Historical Climate Data Used in Simulation (mm)

Location: KurWorlSTP, -16.8°, 145.6°

Run Period: 01/01/1967 to 31/12/2016 50 years, 0 days



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	349.9	444.0	400.6	185.8	84.3	54.1	41.9	33.6	32.8	47.6	87.8	176.5	1938.9
Evap	176.0	142.7	153.0	137.4	126.0	114.1	125.0	147.4	177.9	209.7	205.2	199.2	1913.4
Net Evap	-173.9	-301.3	-247.6	-48.4	41.8	59.9	83.1	113.8	145.1	162.1	117.4	22.7	-25.5
Net Evap/day	-5.6	-10.7	-8.0	-1.6	1.3	2.0	2.7	3.7	4.8	5.2	3.9	0.7	-0.1

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Pond System: 1 closed storage tank

Kur-world 1A High range September 2017 ADWF - 35.13 ML/year or 0.10 ML/day generated on average

Effluent entering pond system after any pretreatment and recycling

Average (Minimum-Maximum) influent quality calculated for 365.26 non-zero flow days, after any pretreatment and recycling.

Constituent	Concentration (mg/L)	Load (kg/year)
Total Nitrogen	41.55 (3.41 - 50.00)	1459.58 (1458.54 - 1462.54)
Total Phosphorus	9.97 (0.82 - 12.00)	350.30 (350.05 - 351.01)
Total Dissolved Salts	432.14 (35.46 - 520.00)	15179.62 (15168.82 - 15210.37)
Volatile Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Total Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)

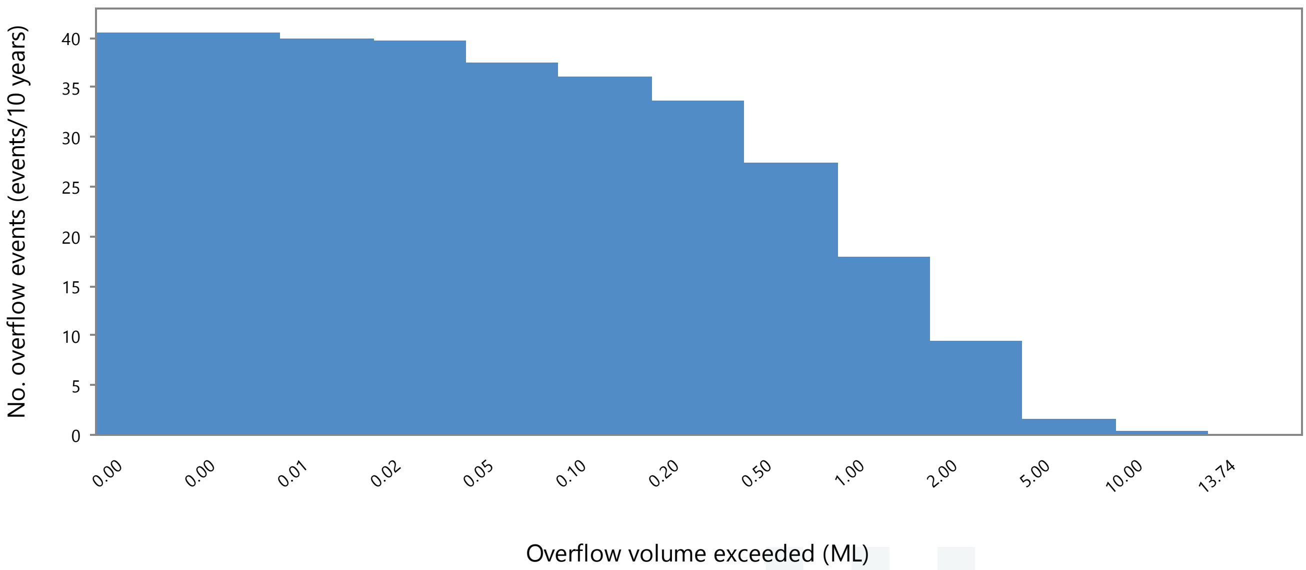
Last pond (Wet weather store): 5.00 ML

Theoretical hydraulic retention time (days)	51.99
Average volume of overflow (ML/year)	5.88
No. overflow events per year exceeding threshold* of 0.00 ML (no./year)	4.06
Average duration of overflow (days)	12.22
Effluent Reuse (Proportion of Inflow + Net Rain Gain that is Irrigated) (fraction)	0.83
Probability of at least 90% effluent reuse (fraction)	0.30
Average salinity of last pond (dS/m)	0.66
Salinity of last pond on final day of simulation (dS/m)	0.76
Ammonia loss from pond system water area (kg/m2/year)	0.00

* The threshold is the volume equivalent to the top 1 mm depth of water of a full pond

Overflow exceedance:

Chart Table



Export plot

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Irrigation Information

Irrigation: 5 ha total area (assumed 100% irrigation efficiency)

	Quantity/year	Quantity/ha/year
Total irrigation applied (ML)	29.21	5.84
Total nitrogen applied (kg)	1204.75	240.95
Total phosphorus applied (kg)	304.36	60.87
Total salts applied (kg)	13188.80	2637.76

Shandying

Annual allocation of fresh water for shandying (ML/year)	0.00
Average Shandy water irrigation (ML/year) (minimum - maximum)	0.00 (0.00 - 0.00)
Average exceedance as a proportion of annual shandy water allocation (% of allocation) (minimum - maximum)	0.00 (0.00 - 0.00)
Proportion of irrigation events requiring shandying (fraction of events)	0.00
Minimum shandy water is used	False

Irrigation Issues

Proportion of Days irrigation is prevented when triggered (fraction)	0.25
Proportion of Days water demand is too small to trigger irrigation (fraction)	0.28
Proportion of Days irrigation occurs (fraction)	0.47

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Land: New Paddock: 5 ha

Irrigation: Fixed Sprinkler with 0.2% ammonium loss during irrigation

Irrigation triggered when soil water deficit reaches 5.00 mm and rainfall is less than or equal to 3.00 mm
Irrigate up to a soil water content of drained upper limit plus 0.00 mm
Irrigation window from 1/1 to 31/12 including the days specified
A minimum of 0 days must be skipped between irrigation events

Soil Water Balance (mm): Bicton (Kur-World), 340.50 mm PAWC at maximum root depth

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	349.9	444.0	400.6	185.8	84.3	54.1	41.9	33.6	32.8	47.6	87.8	176.5	1938.9
Irrigation	42.0	25.5	35.1	42.7	49.8	48.1	59.4	68.0	56.4	52.8	52.6	51.7	584.1
Soil Evap	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Transpn.	118.1	99.0	107.2	99.5	89.8	76.9	85.4	104.6	125.6	141.3	144.4	140.9	1333.0
Rain Runoff	121.3	163.1	157.2	40.5	7.1	3.4	2.2	1.1	2.4	3.7	9.8	37.7	549.5
Irr. Runoff	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Drainage	81.6	171.0	173.4	91.8	41.8	22.9	19.3	7.3	5.3	4.0	3.8	24.2	646.3
Delta	71.0	36.3	-2.1	-3.3	-4.6	-0.9	-5.5	-11.4	-44.1	-48.7	-17.6	25.3	-5.7

Soil Nitrogen Balance

Average annual effluent nitrogen added (kg/ha/year)	240.95
Average annual soil nitrogen removed by plant uptake (kg/ha/year)	314.52
Average annual soil nitrogen removed by denitrification (kg/ha/year)	0.01
Average annual soil nitrogen leached (kg/ha/year)	0.11
Average annual nitrate-N loading to groundwater (kg/ha/year)	0.11
Soil organic-N kg/ha (Initial - Final)	3809.50 - 200.18
	74.41 - 0.02
Average nitrate-N concentration of deep drainage (mg/L)	0.02
Max. annual nitrate-N concentration of deep drainage (mg/L)	0.48

Soil Phosphorus Balance

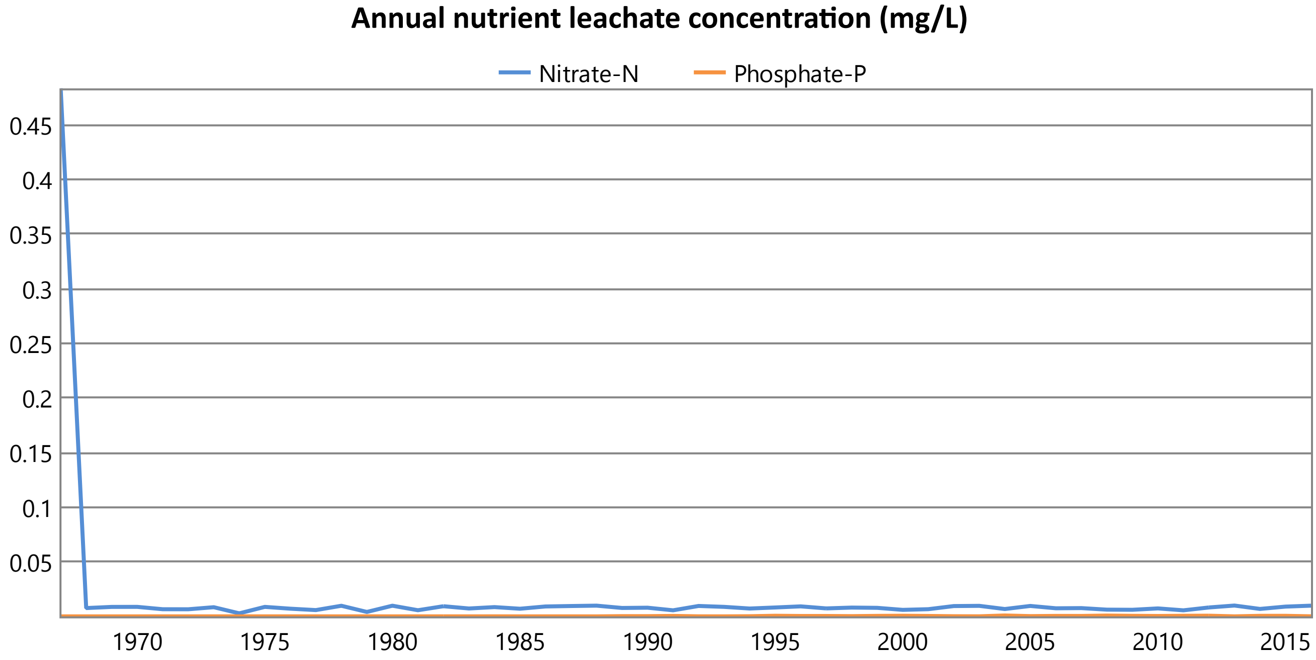
Average annual effluent phosphorus added (kg/ha/year)	60.87
Average annual soil phosphorus removed by plant uptake (kg/ha/year)	36.36
Average annual soil phosphorus leached (kg/ha/year)	1.97E-03
Dissolved phosphorus (kg/ha) (Initial - Final)	2.86E-04 - 0.05
Adsorbed phosphorus (kg/ha) (Initial - Final)	450.65 - 1676.79
Average phosphate-P concentration in rootzone (mg/L)	0.01
Average phosphate-P concentration of deep drainage (mg/L)	3.04E-04
Max. annual phosphate-P concentration of deep drainage (mg/L)	8.67E-04
Design soil profile storage life based on average infiltrated water phosphorus concn. of 3.08 mg/L (years)	166.48

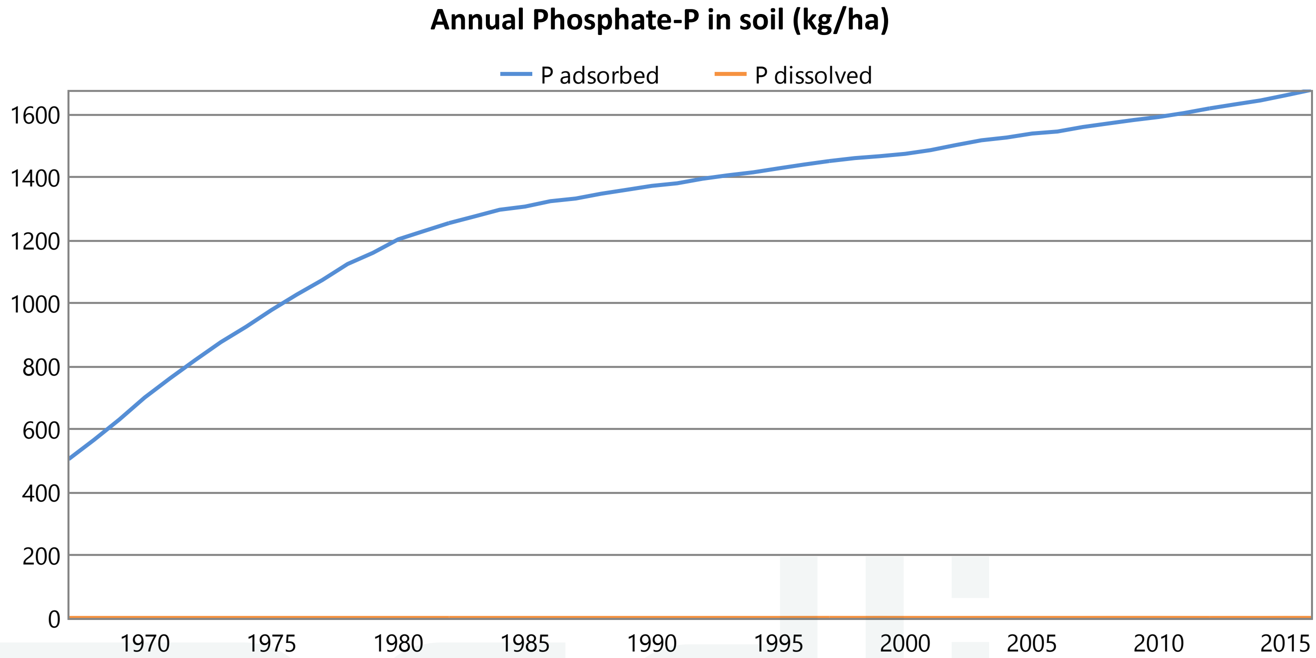
DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Land: New Paddock: 5 ha

Irrigation: Fixed Sprinkler with 0.2% ammonium loss during irrigation





DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Plant Performance: New Paddock: 5 ha

Average Plant Performance (Minimum - Maximum): Continuous Kikuyu 1 Pasture - kickstart, kick started

Average annual shoot dry matter yield (kg/ha/year)	18373.51 (13944.10 - 24309.25)
Average monthly plant (green) cover (fraction)	0.88 (0.84 - 0.91)
Average monthly crop factor (fraction)	0.70 (0.67 - 0.72)
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Average monthly root depth (mm)	1199.25 (1190.96 - 1200.00)
Average number of normal harvests per year (no./year)	3.30 (2.00 - 4.00)
Average number of normal harvests for last five years only (no./year)	3.00
Average number of crop deaths per year (no./year)	0.00 (0.00 - 0.00)
Average number of crop deaths for last five years only (no./year)	0.00
Average annual nitrogen deficiency index (0 = no stress, 1 = full stress) (coefficient)	0.62 (0.44 - 0.70)
Average January temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.01 (0.00 - 0.07)
Average July temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.11 (0.00 - 0.22)
Average monthly water stress index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.02)
Average monthly waterlogging index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.00)
No. days without crop/year (days)	0.00

Soil Salinity - Plant salinity tolerance: Moderately tolerant

Assumes 1.0 dS/m Electrical Conductivity = 640 mg/L Total Dissolved Salts
All values based on 10 year running averages

Salinity of infiltrated water (Average salinity of rainwater = 0.03 dS/m) (dS/m)	0.23
Salt added by rainfall (kg/ha/year)	266.77
Average annual effluent salt added & leached at steady state (kg/ha/year)	2904.53
Average leaching fraction based on 10 year running averages (fraction)	0.54
Average water-uptake-weighted rootzone salinity sat. ext. (dS/m)	0.19
Salinity of the soil solution (at drained upper limit) at base of rootzone (dS/m)	0.69
Relative crop yield expected due to salinity (fraction)	1.00
Proportion of years that crop yields would be expected to fall below 90% of potential due to salinity (fraction)	0.00

DIAGNOSTICS

Run Messages

Messages generated when the scenario was run:

Full run chosen

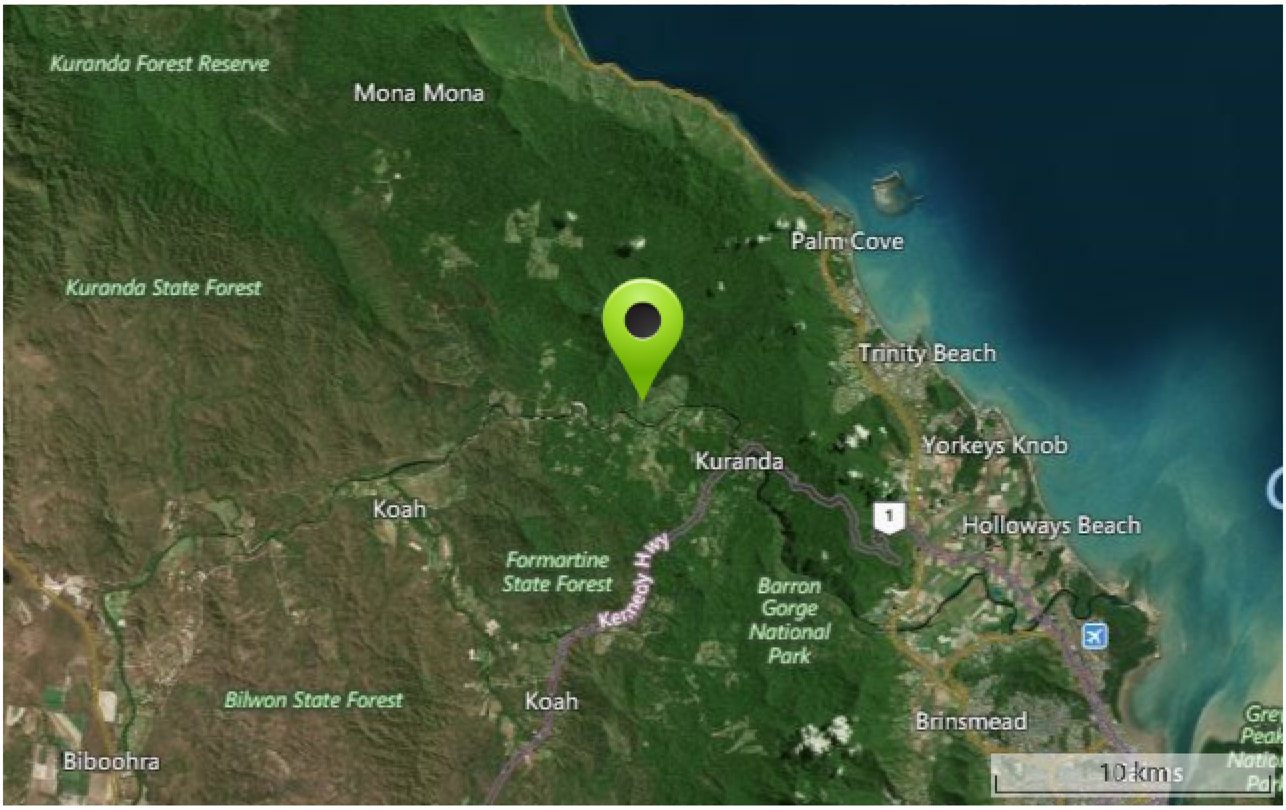
Enterprise: **Kur World with 3000.00 m3 storage pond volume and 20.00 ha irrigation area**

Description:
Stage 1A Low Multi Run

Client: **Reever and Ocean**

MEDLI User: NATRES\andrew

Scenario Details:
High range ADWF, average infiltration efficiency
N 50 mg/L, P 12 mg/L, TDS 520 mg 45% TON, 25% NH4-N, 30% Org N
1-5 ML tank and 5 - 25 ha
5mm SMD to UDL. Irrigation allowed on days with up to 3 mm rainfall.
Kikuyu 1 (kickarted) selected to match similar salt tolerance and temperature range profile of Sinal grass
No additional nutrient addition to account for return of clippings

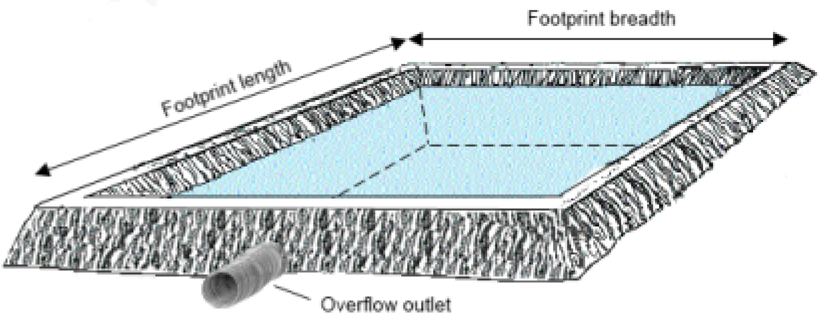


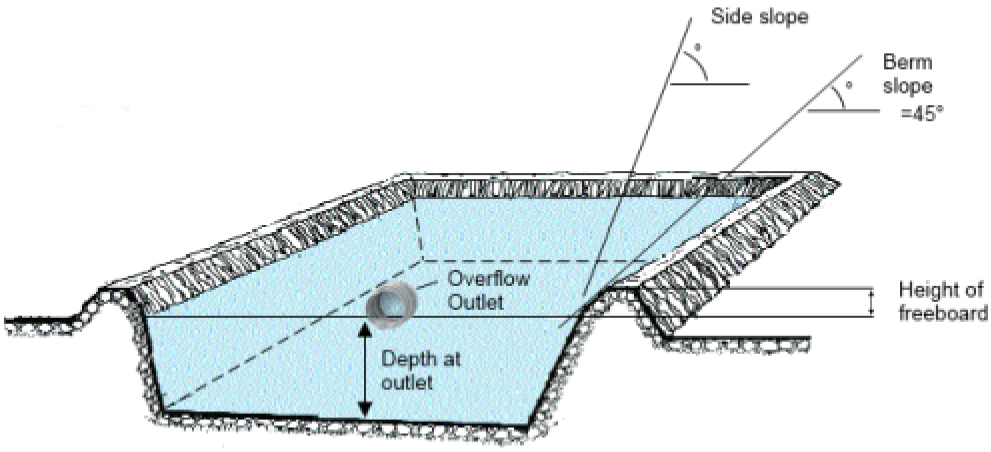
DESCRIPTION

Pond system: 1 closed storage tank

Pond system details:

	Pond 1
Maximum pond volume (ML)	3.00
Minimum allowable pond volume (ML)	1.13
Pond depth at overflow outlet (m)	4.00
Maximum water surface area (m2)	750.00
Pond footprint length (m)	27.39
Pond footprint width (m)	27.39
Pond catchment area (m2)	750.00
Average active volume (ML)	1.39





Irrigation pump limits:

Minimum pump rate limit (ML/day)	0.00
Maximum pump rate limit (ML/day)	100.00

Shandying water:

Annual allocation of fresh water available for shandying (ML/year)	0.00
Maximum rate of application of fresh water (ML/day)	0.00
Nitrogen concentration (mg/L)	0.00
Salinity (dS/m)	0.00
Minimum shandy water is used	False

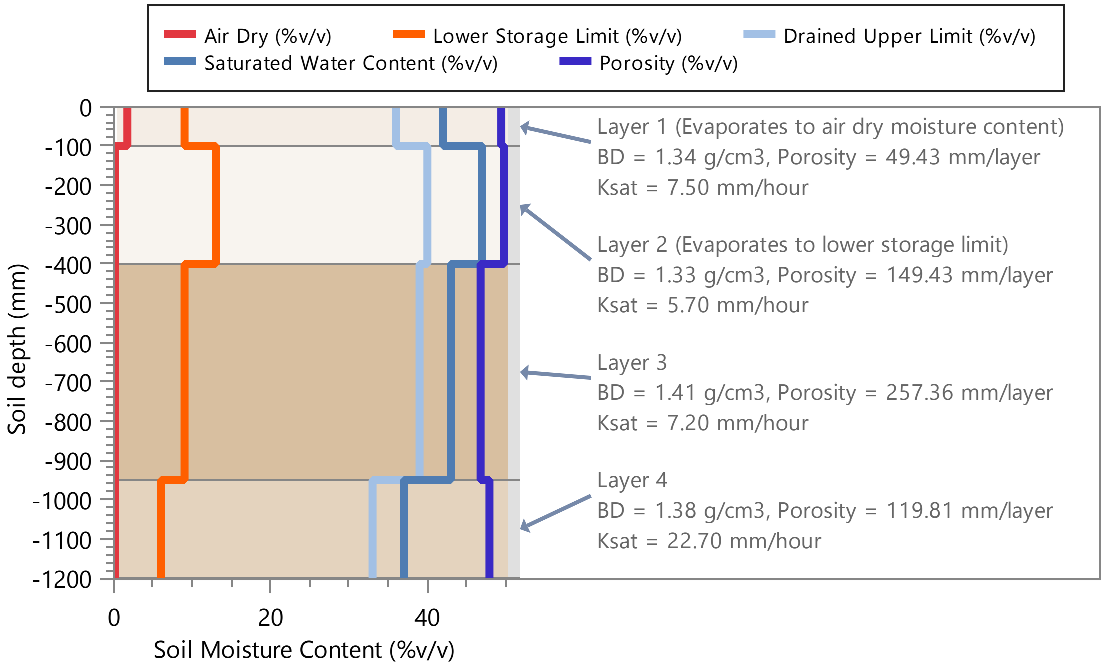
DESCRIPTION

Land: New Paddock

Area (ha): 20.00

Soil Type: Bicton (Kur-World), 1200.00 mm defined profile depth

Profile Porosity (mm)	576.04
Profile saturation water content (mm)	512.00
Profile drained upper limit (or field capacity) (mm)	453.00
Profile lower storage limit (or permanent wilting point) (mm)	112.50
Profile available water capacity (mm)	340.50
Profile limiting saturated hydraulic conductivity (mm/hour)	5.70
Surface saturated hydraulic conductivity (mm/hour)	7.50
Runoff curve number II (coefficient)	80.00
Soil evaporation U (mm)	8.50
Soil evaporation Cona (mm/sqrt day)	3.75



Plant Data: Continuous Kikuyu 1 Pasture - kickstart, kick started

Average monthly cover (fraction) (minimum - maximum)	0.88 (0.85 - 0.91)
Maximum crop factor at 100% cover (mm/mm) (Maximum crop coefficient 0.8 x Pan coefficient 1)	0.80
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Maximum potential root depth in defined soil profile (mm)	1200.00
Salt tolerance	Moderately tolerant
Salinity threshold EC sat. ext. (dS/m)	3.00
Proportion of yield decrease per dS/m increase (fraction/dS/m)	0.03

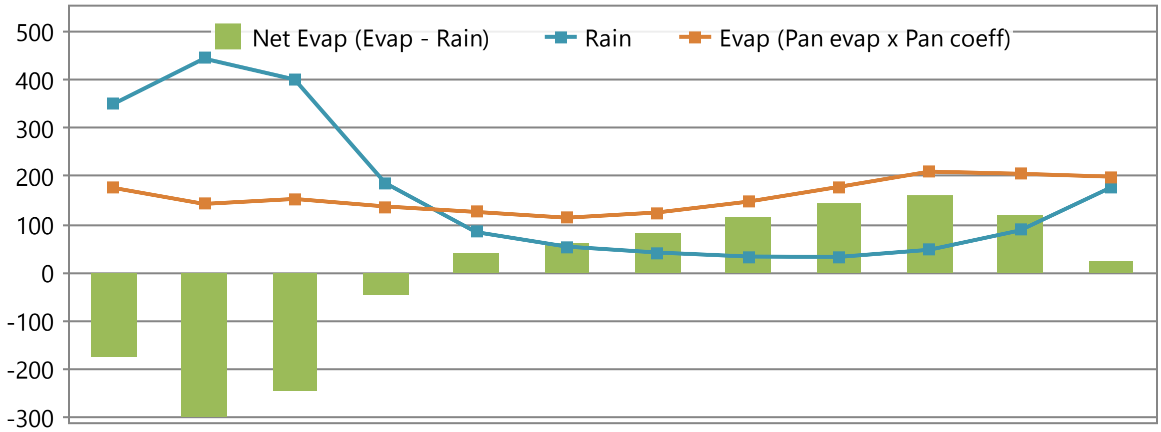
DIAGNOSTICS

Sustainability Diagnostics: Kur World

Averaged Historical Climate Data Used in Simulation (mm)

Location: KurWorlSTP, -16.8°, 145.6°

Run Period: 01/01/1967 to 31/12/2016 50 years, 0 days



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	349.9	444.0	400.6	185.8	84.3	54.1	41.9	33.6	32.8	47.6	87.8	176.5	1938.9
Evap	176.0	142.7	153.0	137.4	126.0	114.1	125.0	147.4	177.9	209.7	205.2	199.2	1913.4
Net Evap	-173.9	-301.3	-247.6	-48.4	41.8	59.9	83.1	113.8	145.1	162.1	117.4	22.7	-25.5
Net Evap/day	-5.6	-10.7	-8.0	-1.6	1.3	2.0	2.7	3.7	4.8	5.2	3.9	0.7	-0.1

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Pond System: 1 closed storage tank

Kur-world 1A High range September 2017 ADWF - 35.13 ML/year or 0.10 ML/day generated on average

Effluent entering pond system after any pretreatment and recycling

Average (Minimum-Maximum) influent quality calculated for 365.26 non-zero flow days, after any pretreatment and recycling.

Constituent	Concentration (mg/L)	Load (kg/year)
Total Nitrogen	41.55 (3.41 - 50.00)	1459.58 (1458.54 - 1462.54)
Total Phosphorus	9.97 (0.82 - 12.00)	350.30 (350.05 - 351.01)
Total Dissolved Salts	432.14 (35.46 - 520.00)	15179.62 (15168.82 - 15210.37)
Volatile Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Total Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)

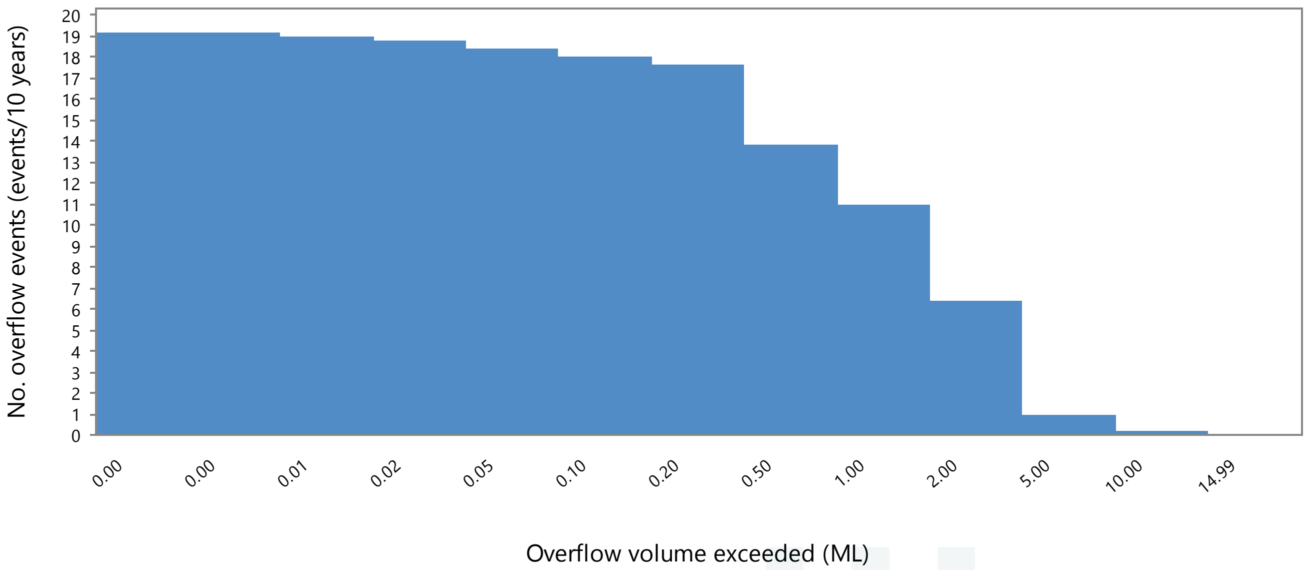
Last pond (Wet weather store): 3.00 ML

Theoretical hydraulic retention time (days)	31.20
Average volume of overflow (ML/year)	3.58
No. overflow events per year exceeding threshold* of 0.00 ML (no./year)	1.92
Average duration of overflow (days)	14.30
Effluent Reuse (Proportion of Inflow + Net Rain Gain that is Irrigated) (fraction)	0.90
Probability of at least 90% effluent reuse (fraction)	0.54
Average salinity of last pond (dS/m)	0.67
Salinity of last pond on final day of simulation (dS/m)	0.76
Ammonia loss from pond system water area (kg/m2/year)	0.00

* The threshold is the volume equivalent to the top 1 mm depth of water of a full pond

Overflow exceedance:

Chart Table



Export plot

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Irrigation Information

Irrigation: 20 ha total area (assumed 100% irrigation efficiency)

	Quantity/year	Quantity/ha/year
Total irrigation applied (ML)	31.52	1.58
Total nitrogen applied (kg)	1290.06	64.50
Total phosphorus applied (kg)	325.91	16.30
Total salts applied (kg)	14122.75	706.14

Shandying

Annual allocation of fresh water for shandying (ML/year)	0.00
Average Shandy water irrigation (ML/year) (minimum - maximum)	0.00 (0.00 - 0.00)
Average exceedance as a proportion of annual shandy water allocation (% of allocation) (minimum - maximum)	0.00 (0.00 - 0.00)
Proportion of irrigation events requiring shandying (fraction of events)	0.00
Minimum shandy water is used	False

Irrigation Issues

Proportion of Days irrigation is prevented when triggered (fraction)	0.25
Proportion of Days water demand is too small to trigger irrigation (fraction)	0.09
Proportion of Days irrigation occurs (fraction)	0.67

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Land: New Paddock: 20 ha

Irrigation: Fixed Sprinkler with 0.2% ammonium loss during irrigation

Irrigation triggered when soil water deficit reaches 5.00 mm and rainfall is less than or equal to 3.00 mm
Irrigate up to a soil water content of drained upper limit plus 0.00 mm
Irrigation window from 1/1 to 31/12 including the days specified
A minimum of 0 days must be skipped between irrigation events

Soil Water Balance (mm): Bicton (Kur-World), 340.50 mm PAWC at maximum root depth

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	349.9	444.0	400.6	185.8	84.3	54.1	41.9	33.6	32.8	47.6	87.8	176.5	1938.9
Irrigation	13.7	10.6	14.1	12.6	14.4	13.3	13.3	12.8	12.5	13.2	13.1	14.1	157.6
Soil Evap	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Transpn.	108.1	99.5	108.0	97.4	89.1	82.9	86.6	99.2	111.6	107.4	85.6	99.9	1175.3
Rain Runoff	107.3	156.1	151.6	38.0	6.3	2.4	1.2	0.1	1.6	1.9	5.0	28.9	500.3
Irr. Runoff	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Drainage	44.2	126.1	143.1	74.2	23.1	7.6	3.5	0.0	0.2	0.0	0.0	5.1	427.2
Delta	104.1	72.9	12.0	-11.3	-19.9	-25.4	-36.1	-52.8	-68.1	-48.5	10.3	56.7	-6.2

Soil Nitrogen Balance

Average annual effluent nitrogen added (kg/ha/year)	64.50
Average annual soil nitrogen removed by plant uptake (kg/ha/year)	136.93
Average annual soil nitrogen removed by denitrification (kg/ha/year)	2.64E-03
Average annual soil nitrogen leached (kg/ha/year)	0.09
Average annual nitrate-N loading to groundwater (kg/ha/year)	0.09
Soil organic-N kg/ha (Initial - Final)	3809.50 - 258.94
	74.41 - 0.01
Average nitrate-N concentration of deep drainage (mg/L)	0.02
Max. annual nitrate-N concentration of deep drainage (mg/L)	0.56

Soil Phosphorus Balance

Average annual effluent phosphorus added (kg/ha/year)	16.30
Average annual soil phosphorus removed by plant uptake (kg/ha/year)	4.28
Average annual soil phosphorus leached (kg/ha/year)	3.26E-04
Dissolved phosphorus (kg/ha) (Initial - Final)	2.86E-04 - 1.68E-03
Adsorbed phosphorus (kg/ha) (Initial - Final)	450.65 - 1053.26
Average phosphate-P concentration in rootzone (mg/L)	7.30E-04
Average phosphate-P concentration of deep drainage (mg/L)	7.63E-05
Max. annual phosphate-P concentration of deep drainage (mg/L)	9.41E-05
Design soil profile storage life based on average infiltrated water phosphorus concn. of 1.02 mg/L (years)	444.24

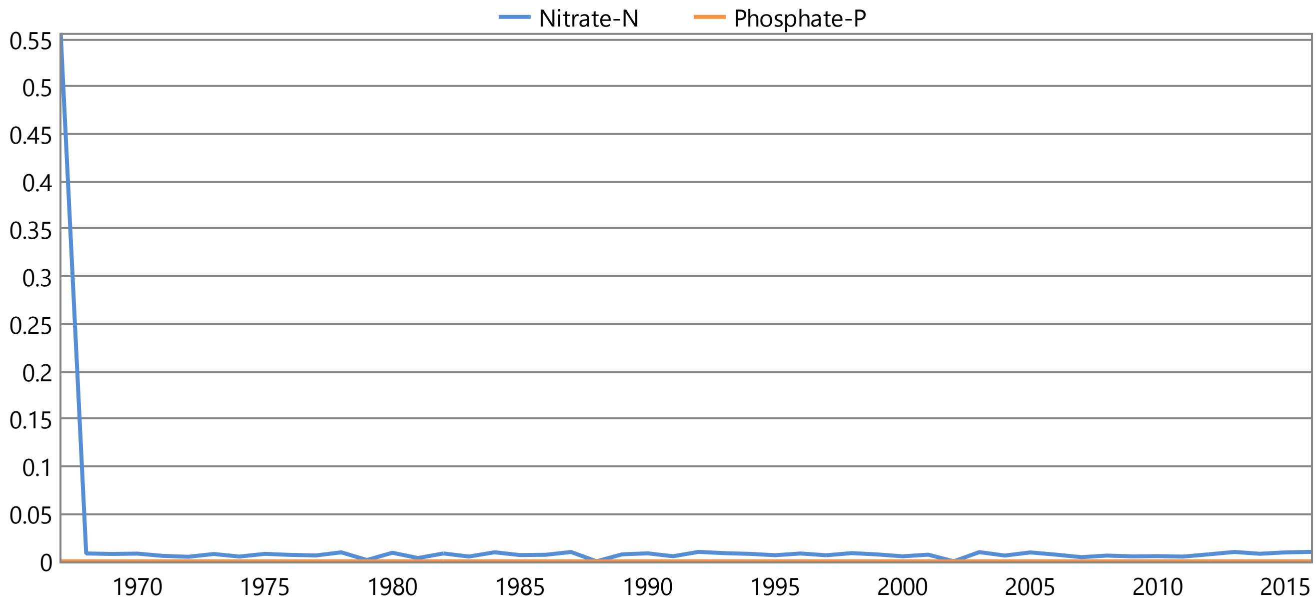
DIAGNOSTICS

Sustainability Diagnostics: Kur World

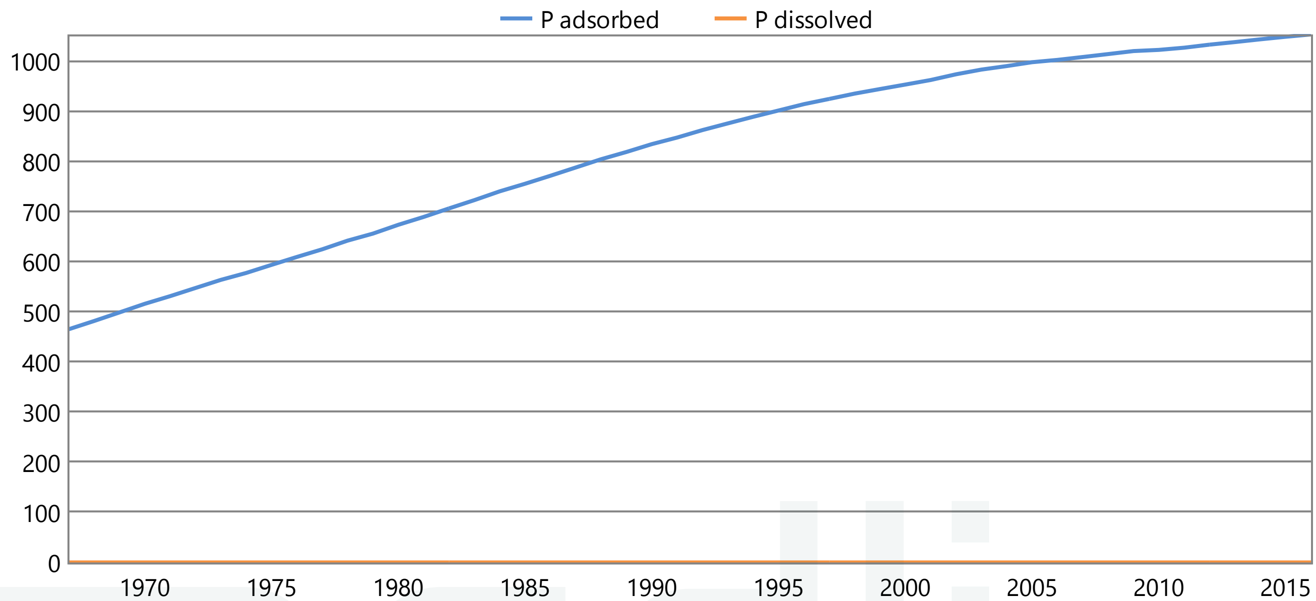
Paddock Land: New Paddock: 20 ha

Irrigation: Fixed Sprinkler with 0.2% ammonium loss during irrigation

Annual nutrient leachate concentration (mg/L)



Annual Phosphate-P in soil (kg/ha)



DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Plant Performance: New Paddock: 20 ha

Average Plant Performance (Minimum - Maximum): Continuous Kikuyu 1 Pasture - kickstart, kick started

Average annual shoot dry matter yield (kg/ha/year)	10534.67 (7127.42 - 19030.09)
Average monthly plant (green) cover (fraction)	0.88 (0.85 - 0.91)
Average monthly crop factor (fraction)	0.71 (0.68 - 0.73)
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Average monthly root depth (mm)	1199.25 (1190.96 - 1200.00)
Average number of normal harvests per year (no./year)	1.90 (1.00 - 3.00)
Average number of normal harvests for last five years only (no./year)	1.40
Average number of crop deaths per year (no./year)	0.00 (0.00 - 0.00)
Average number of crop deaths for last five years only (no./year)	0.00
Average annual nitrogen deficiency index (0 = no stress, 1 = full stress) (coefficient)	0.77 (0.54 - 0.85)
Average January temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.01 (0.00 - 0.07)
Average July temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.11 (0.00 - 0.22)
Average monthly water stress index (0 = no stress, 1 = full stress) (coefficient)	0.10 (0.00 - 0.40)
Average monthly waterlogging index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.00)
No. days without crop/year (days)	0.00

Soil Salinity - Plant salinity tolerance: Moderately tolerant

Assumes 1.0 dS/m Electrical Conductivity = 640 mg/L Total Dissolved Salts
All values based on 10 year running averages

Salinity of infiltrated water (Average salinity of rainwater = 0.03 dS/m) (dS/m)	0.10
Salt added by rainfall (kg/ha/year)	276.22
Average annual effluent salt added & leached at steady state (kg/ha/year)	982.35
Average leaching fraction based on 10 year running averages (fraction)	0.49
Average water-uptake-weighted rootzone salinity sat. ext. (dS/m)	0.09
Salinity of the soil solution (at drained upper limit) at base of rootzone (dS/m)	0.36
Relative crop yield expected due to salinity (fraction)	1.00
Proportion of years that crop yields would be expected to fall below 90% of potential due to salinity (fraction)	0.00

DIAGNOSTICS

Run Messages

Messages generated when the scenario was run:

Full run chosen

MEDLI REPORT - FULL RUN

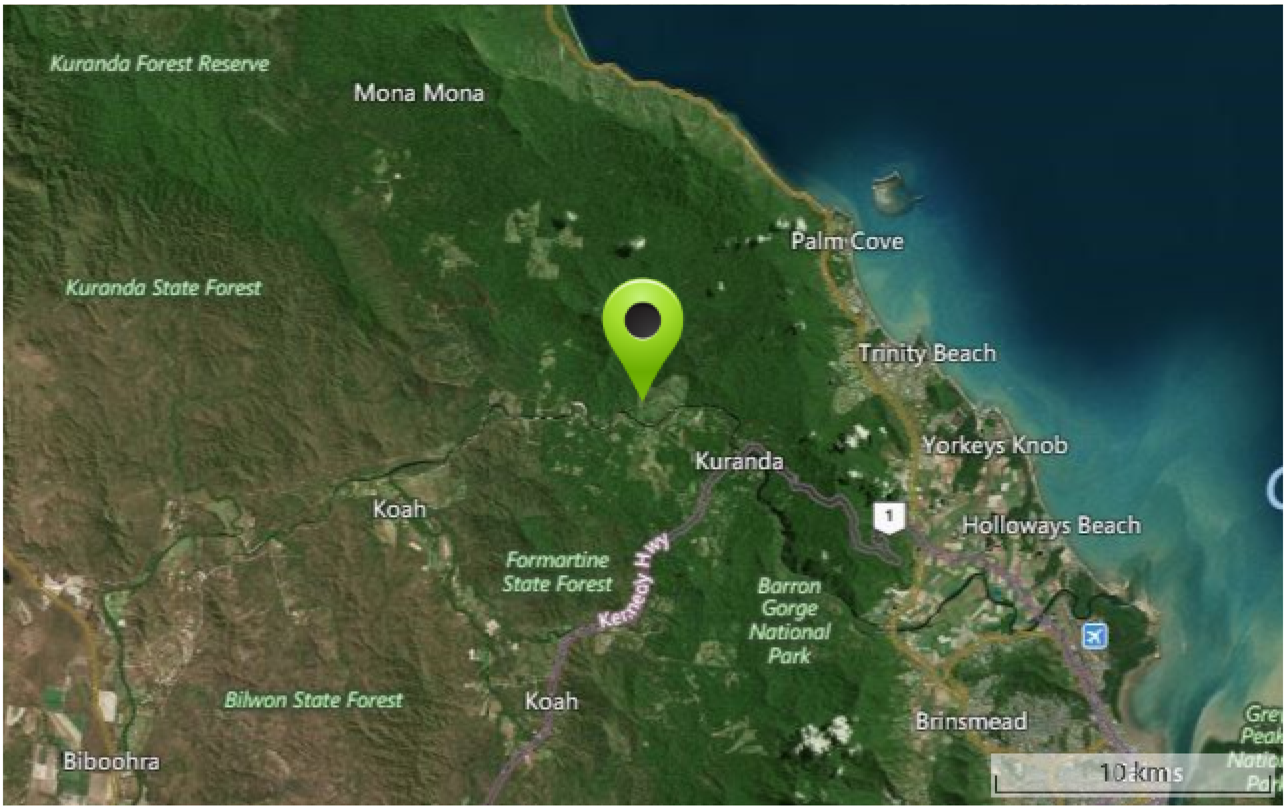
Enterprise: **Kur World with 5000.00 m3 storage pond volume and 25.00 ha irrigation area**

Description:
Stage 1A Low Multi Run

Client: **Reever and Ocean**

MEDLI User: NATRES\andrew

Scenario Details:
High range ADWF, average infiltration efficiency
N 50 mg/L, P 12 mg/L, TDS 520 mg 45% TON, 25% NH4-N, 30% Org N
1-5 ML tank and 5 - 25 ha
5mm SMD to UDL. Irrigation allowed on days with up to 3 mm rainfall.
Kikuyu 1 (kickarted) selected to match similar salt tolerance and temperature range profile of Sinal grass
No additional nutrient addition to account for return of clippings

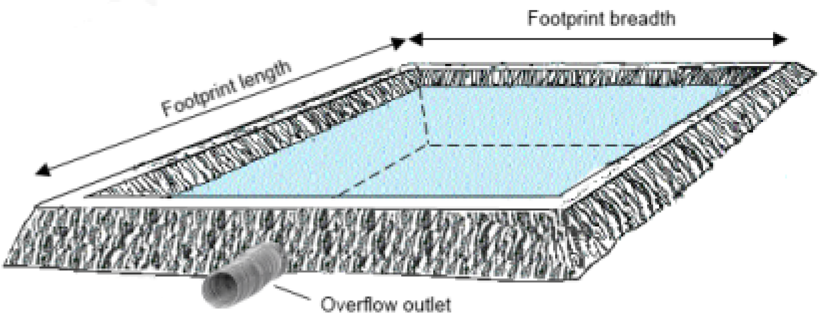


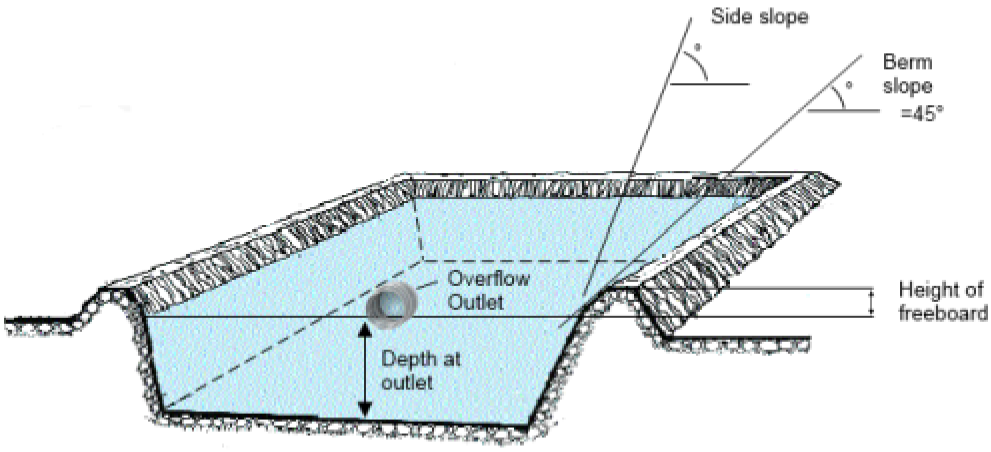
DESCRIPTION

Pond system: 1 closed storage tank

Pond system details:

	Pond 1
Maximum pond volume (ML)	5.00
Minimum allowable pond volume (ML)	1.88
Pond depth at overflow outlet (m)	4.00
Maximum water surface area (m2)	1250.00
Pond footprint length (m)	35.36
Pond footprint width (m)	35.36
Pond catchment area (m2)	1250.00
Average active volume (ML)	2.22





Irrigation pump limits:

Minimum pump rate limit (ML/day)	0.00
Maximum pump rate limit (ML/day)	100.00

Shandying water:

Annual allocation of fresh water available for shandying (ML/year)	0.00
Maximum rate of application of fresh water (ML/day)	0.00
Nitrogen concentration (mg/L)	0.00
Salinity (dS/m)	0.00
Minimum shandy water is used	False

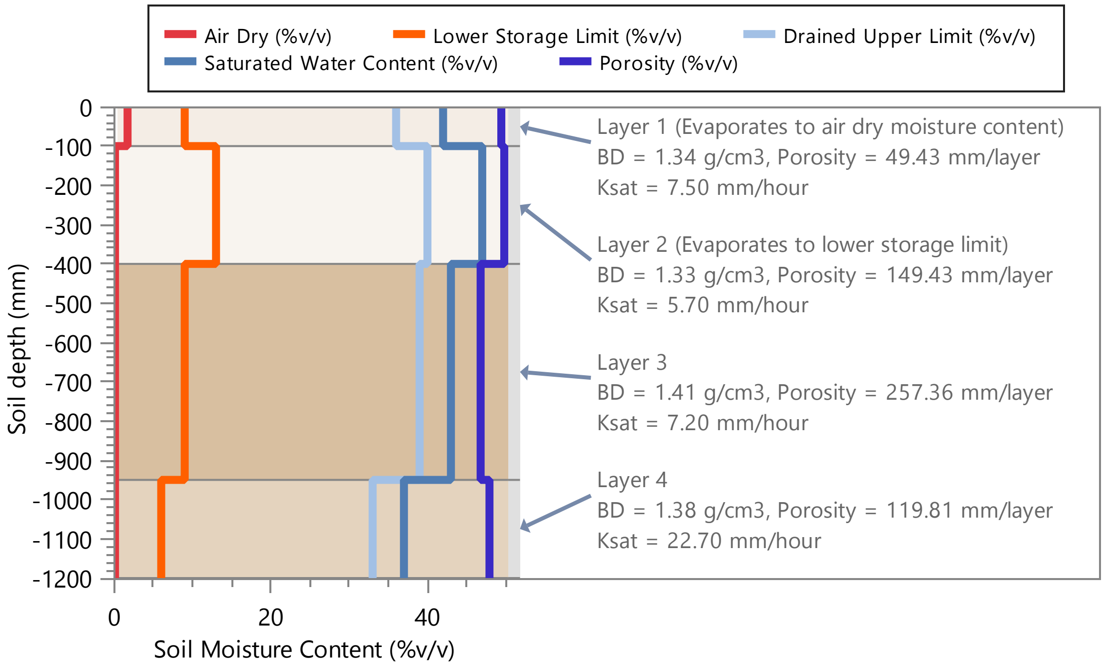
DESCRIPTION

Land: New Paddock

Area (ha): 25.00

Soil Type: Bicton (Kur-World), 1200.00 mm defined profile depth

Profile Porosity (mm)	576.04
Profile saturation water content (mm)	512.00
Profile drained upper limit (or field capacity) (mm)	453.00
Profile lower storage limit (or permanent wilting point) (mm)	112.50
Profile available water capacity (mm)	340.50
Profile limiting saturated hydraulic conductivity (mm/hour)	5.70
Surface saturated hydraulic conductivity (mm/hour)	7.50
Runoff curve number II (coefficient)	80.00
Soil evaporation U (mm)	8.50
Soil evaporation Cona (mm/sqrt day)	3.75



Plant Data: Continuous Kikuyu 1 Pasture - kickstart, kick started

Average monthly cover (fraction) (minimum - maximum)	0.88 (0.83 - 0.92)
Maximum crop factor at 100% cover (mm/mm) (Maximum crop coefficient 0.8 x Pan coefficient 1)	0.80
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Maximum potential root depth in defined soil profile (mm)	1200.00
Salt tolerance	Moderately tolerant
Salinity threshold EC sat. ext. (dS/m)	3.00
Proportion of yield decrease per dS/m increase (fraction/dS/m)	0.03

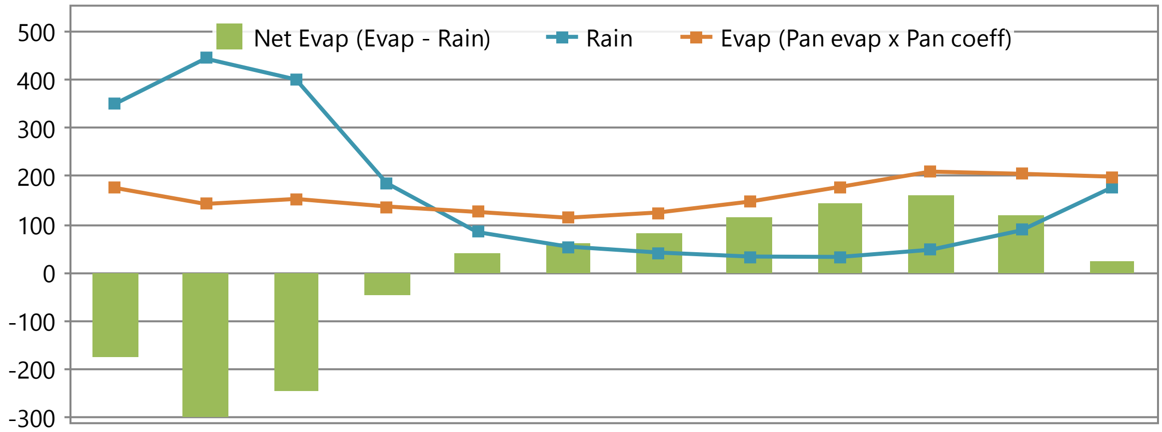
DIAGNOSTICS

Sustainability Diagnostics: Kur World

Averaged Historical Climate Data Used in Simulation (mm)

Location: KurWorlSTP, -16.8°, 145.6°

Run Period: 01/01/1967 to 31/12/2016 50 years, 0 days



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	349.9	444.0	400.6	185.8	84.3	54.1	41.9	33.6	32.8	47.6	87.8	176.5	1938.9
Evap	176.0	142.7	153.0	137.4	126.0	114.1	125.0	147.4	177.9	209.7	205.2	199.2	1913.4
Net Evap	-173.9	-301.3	-247.6	-48.4	41.8	59.9	83.1	113.8	145.1	162.1	117.4	22.7	-25.5
Net Evap/day	-5.6	-10.7	-8.0	-1.6	1.3	2.0	2.7	3.7	4.8	5.2	3.9	0.7	-0.1

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Pond System: 1 closed storage tank

Kur-world 1A High range September 2017 ADWF - 35.13 ML/year or 0.10 ML/day generated on average

Effluent entering pond system after any pretreatment and recycling

Average (Minimum-Maximum) influent quality calculated for 365.26 non-zero flow days, after any pretreatment and recycling.

Constituent	Concentration (mg/L)	Load (kg/year)
Total Nitrogen	41.55 (3.41 - 50.00)	1459.58 (1458.54 - 1462.54)
Total Phosphorus	9.97 (0.82 - 12.00)	350.30 (350.05 - 351.01)
Total Dissolved Salts	432.14 (35.46 - 520.00)	15179.62 (15168.82 - 15210.37)
Volatile Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Total Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)

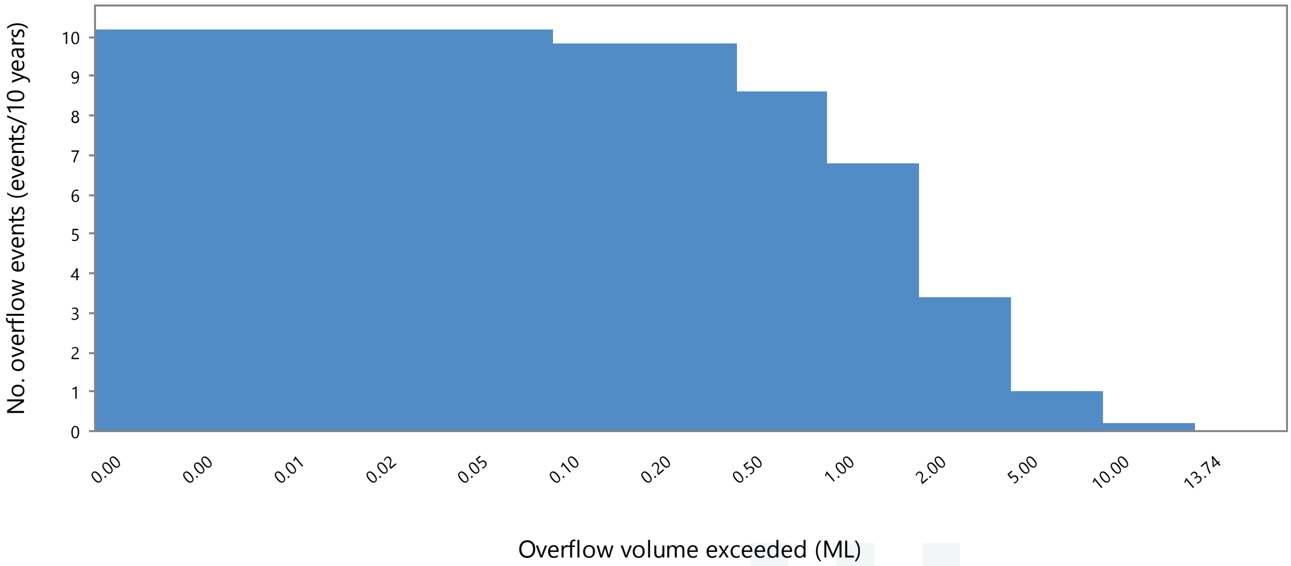
Last pond (Wet weather store): 5.00 ML

Theoretical hydraulic retention time (days)	51.99
Average volume of overflow (ML/year)	2.12
No. overflow events per year exceeding threshold* of 0.00 ML (no./year)	1.02
Average duration of overflow (days)	15.86
Effluent Reuse (Proportion of Inflow + Net Rain Gain that is Irrigated) (fraction)	0.94
Probability of at least 90% effluent reuse (fraction)	0.77
Average salinity of last pond (dS/m)	0.67
Salinity of last pond on final day of simulation (dS/m)	0.76
Ammonia loss from pond system water area (kg/m2/year)	0.00

* The threshold is the volume equivalent to the top 1 mm depth of water of a full pond

Overflow exceedance:

Chart Table



Export plot

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Irrigation Information

Irrigation: 25 ha total area (assumed 100% irrigation efficiency)

	Quantity/year	Quantity/ha/year
Total irrigation applied (ML)	32.96	1.32
Total nitrogen applied (kg)	1329.25	53.17
Total phosphorus applied (kg)	335.81	13.43
Total salts applied (kg)	14551.81	582.07

Shandying

Annual allocation of fresh water for shandying (ML/year)	0.00
Average Shandy water irrigation (ML/year) (minimum - maximum)	0.00 (0.00 - 0.00)
Average exceedance as a proportion of annual shandy water allocation (% of allocation) (minimum - maximum)	0.00 (0.00 - 0.00)
Proportion of irrigation events requiring shandying (fraction of events)	0.00
Minimum shandy water is used	False

Irrigation Issues

Proportion of Days irrigation is prevented when triggered (fraction)	0.25
Proportion of Days water demand is too small to trigger irrigation (fraction)	0.08
Proportion of Days irrigation occurs (fraction)	0.67

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Land: New Paddock: 25 ha

Irrigation: Fixed Sprinkler with 0.2% ammonium loss during irrigation

Irrigation triggered when soil water deficit reaches 5.00 mm and rainfall is less than or equal to 3.00 mm
Irrigate up to a soil water content of drained upper limit plus 0.00 mm
Irrigation window from 1/1 to 31/12 including the days specified
A minimum of 0 days must be skipped between irrigation events

Soil Water Balance (mm): Bicton (Kur-World), 340.50 mm PAWC at maximum root depth

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	349.9	444.0	400.6	185.8	84.3	54.1	41.9	33.6	32.8	47.6	87.8	176.5	1938.9
Irrigation	11.1	9.2	13.7	11.8	12.2	10.8	10.5	10.3	10.0	10.5	10.5	11.3	131.9
Soil Evap	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Transpn.	109.6	97.7	107.0	96.9	91.0	81.1	85.1	96.6	110.9	103.5	84.4	98.4	1162.3
Rain Runoff	106.2	154.9	151.4	37.7	6.2	2.5	0.8	0.2	1.5	1.8	4.9	28.9	497.0
Irr. Runoff	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Drainage	41.8	124.1	143.8	72.9	19.8	7.1	3.3	0.0	0.0	0.0	0.0	4.7	417.5
Delta	103.4	76.6	12.1	-9.9	-20.5	-25.8	-36.8	-53.0	-69.6	-47.2	9.0	55.9	-5.9

Soil Nitrogen Balance

Average annual effluent nitrogen added (kg/ha/year)	53.17
Average annual soil nitrogen removed by plant uptake (kg/ha/year)	125.38
Average annual soil nitrogen removed by denitrification (kg/ha/year)	2.54E-03
Average annual soil nitrogen leached (kg/ha/year)	0.09
Average annual nitrate-N loading to groundwater (kg/ha/year)	0.09
Soil organic-N kg/ha (Initial - Final)	3809.50 - 270.14
	74.41 - 0.02
Average nitrate-N concentration of deep drainage (mg/L)	0.02
Max. annual nitrate-N concentration of deep drainage (mg/L)	0.56

Soil Phosphorus Balance

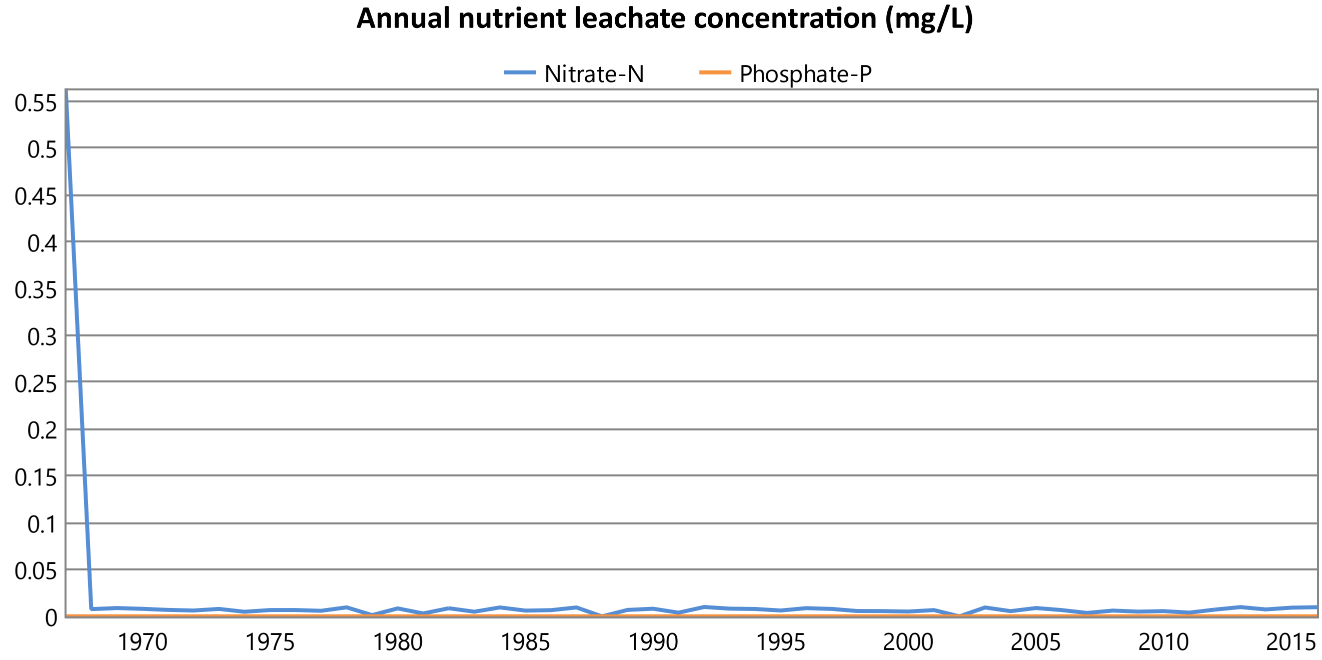
Average annual effluent phosphorus added (kg/ha/year)	13.43
Average annual soil phosphorus removed by plant uptake (kg/ha/year)	2.48
Average annual soil phosphorus leached (kg/ha/year)	3.16E-04
Dissolved phosphorus (kg/ha) (Initial - Final)	2.86E-04 - 2.16E-03
Adsorbed phosphorus (kg/ha) (Initial - Final)	450.65 - 1000.10
Average phosphate-P concentration in rootzone (mg/L)	6.78E-04
Average phosphate-P concentration of deep drainage (mg/L)	7.57E-05
Max. annual phosphate-P concentration of deep drainage (mg/L)	8.76E-05
Design soil profile storage life based on average infiltrated water phosphorus concn. of 0.85 mg/L (years)	509.32

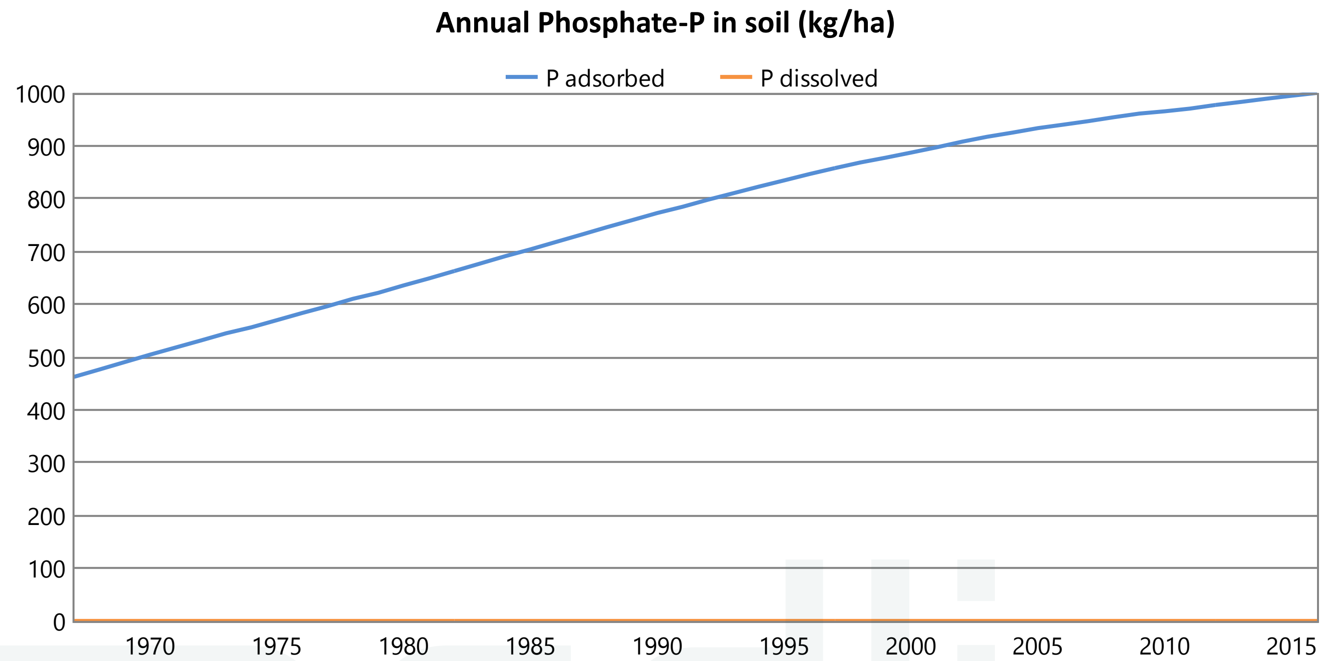
DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Land: New Paddock: 25 ha

Irrigation: Fixed Sprinkler with 0.2% ammonium loss during irrigation





DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Plant Performance: New Paddock: 25 ha

Average Plant Performance (Minimum - Maximum): Continuous Kikuyu 1 Pasture - kickstart, kick started

Average annual shoot dry matter yield (kg/ha/year)	9845.70 (6346.49 - 18418.70)
Average monthly plant (green) cover (fraction)	0.88 (0.83 - 0.92)
Average monthly crop factor (fraction)	0.71 (0.67 - 0.73)
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Average monthly root depth (mm)	1199.25 (1190.96 - 1200.00)
Average number of normal harvests per year (no./year)	1.78 (1.00 - 3.00)
Average number of normal harvests for last five years only (no./year)	1.20
Average number of crop deaths per year (no./year)	0.00 (0.00 - 0.00)
Average number of crop deaths for last five years only (no./year)	0.00
Average annual nitrogen deficiency index (0 = no stress, 1 = full stress) (coefficient)	0.79 (0.55 - 0.87)
Average January temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.01 (0.00 - 0.07)
Average July temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.11 (0.00 - 0.22)
Average monthly water stress index (0 = no stress, 1 = full stress) (coefficient)	0.11 (0.00 - 0.42)
Average monthly waterlogging index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.00)
No. days without crop/year (days)	0.00

Soil Salinity - Plant salinity tolerance: Moderately tolerant

Assumes 1.0 dS/m Electrical Conductivity = 640 mg/L Total Dissolved Salts
All values based on 10 year running averages

Salinity of infiltrated water (Average salinity of rainwater = 0.03 dS/m) (dS/m)	0.09
Salt added by rainfall (kg/ha/year)	276.86
Average annual effluent salt added & leached at steady state (kg/ha/year)	858.93
Average leaching fraction based on 10 year running averages (fraction)	0.48
Average water-uptake-weighted rootzone salinity sat. ext. (dS/m)	0.08
Salinity of the soil solution (at drained upper limit) at base of rootzone (dS/m)	0.32
Relative crop yield expected due to salinity (fraction)	1.00
Proportion of years that crop yields would be expected to fall below 90% of potential due to salinity (fraction)	0.00

DIAGNOSTICS

Run Messages

Messages generated when the scenario was run:

Full run chosen

Stage 1B

Kur-World Effluent. Stage 1 B Low ADWF with low stormwater infiltration and 10% reduction in ADWF Multi run output

Irrigation Area (ha)	Pond Volume (ML)	Overflows (Overtops/year)	Overflows >1mm (Overtops/year)	Overflow volume (ML/year)	Effluent reuse (fraction)	Irrigation supplied (mm/year)	Irrigation demand supplied (fraction)	Yield (kg/ha/year)	Phosphate P leached (kg/ha/year)	Nitrate N leached (kg/ha/year)	Max yield reduction from salinity (fraction)	Relative cost (K$)	Av Phosphate P leachate conc (mg/L)	Av Nitrate N leachate conc (mg/L)	Mass N overflowed (kg/year)	Mass P overflowed (kg/year)	Mass salt overflowed (kg/year)	Av deep drainage (mm/year)
10	19	26.6	26.56	64.77157895	0.56	810.5476703	0.948806815	8933.492172	0.000613609	0.124360824	0	990	7.42E-05	0.015043242	258	52	29944.20541	826.6889615
20	19	5.04	5.04	27.03385274	0.81	599.2201608	0.701432122	8324.727848	0.000462503	0.108763772	0	1690	7.13E-05	0.016771308	94	19	10850.53421	648.5109791
30	19	2.54	2.54	17.80925844	0.88	431.3389302	0.504914555	7786.668743	0.00039192	0.100089657	0	2390	7.09E-05	0.01809784	57	11	6642.730799	553.0475332
40	19	1.7	1.7	14.85839411	0.9	331.1745089	0.387664591	7451.691749	0.000351786	0.096163431	0	3090	7.03E-05	0.019223635	47	9	5397.227722	500.2354175
50	19	1.52	1.52	13.18874685	0.91	268.4007663	0.314183219	7273.565786	0.000331065	0.092800683	0	3790	7.07E-05	0.019820636	41	8	4717.999722	468.2023583
60	19	1.34	1.34	11.79510449	0.92	226.0388898	0.264595467	7098.307326	0.000315047	0.090598739	0	4490	7.02E-05	0.020182801	36	7	4172.968685	448.8908071
70	19	1.26	1.26	10.76754788	0.93	195.2440996	0.228547856	6972.151665	0.000306706	0.088822273	0	5190	7.05E-05	0.020415038	32	6	3755.733472	435.0825661
80	19	1.22	1.22	10.47898276	0.93	171.2048151	0.200408071	6926.180522	0.000303894	0.088426531	0	5890	7.02E-05	0.020433812	31	6	3649.159539	432.7461278
90	19	1.22	1.22	10.33861045	0.93	152.3520971	0.178339551	6813.292905	0.000300099	0.087185539	0	6590	7.08E-05	0.020582141	31	6	3604.424821	423.5980116
100	19	1.16	1.16	10.60986725	0.93	136.8450499	0.16018739	6780.834133	0.000295631	0.086231828	0	7290	7.02E-05	0.020476055	32	6	3719.765072	421.1349632

Kur-World Effluent. Stage 1 B Low ADWF with low stormwater infiltration Multi run output

Irrigation Area (ha)	Pond Volume (ML)	Overflows (Overtops/year)	Overflows >1mm (Overtops/year)	Overflow volume (ML/year)	Effluent reuse (fraction)	Irrigation supplied (mm/year)	Irrigation demand supplied (fraction)	Yield (kg/ha/year)	Phosphate P leached (kg/ha/year)	Nitrate N leached (kg/ha/year)	Max yield reduction from salinity (fraction)	Relative cost (K$)	Av Phosphate P leachate conc (mg/L)	Av Nitrate N leachate conc (mg/L)	Mass N overflowed (kg/year)	Mass P overflowed (kg/year)	Mass salt overflowed (kg/year)	Av deep drainage (mm/year)
10	19	32.84	32.76	79.64905629	0.51	817.2636779	0.956668405	8945.179264	0.000607183	0.125108366	0	990	7.30E-05	0.015044192	324	65	37587.43976	831.6057367
20	19	6.66	6.66	34.86132638	0.78	637.7941948	0.746585921	8432.395131	0.00049372	0.111539754	0	1690	7.31E-05	0.016519625	125	25	14477.44619	675.1954276
30	19	2.88	2.88	22.45481243	0.86	467.8730982	0.547680538	7943.048047	0.00040517	0.100910433	0	2390	7.15E-05	0.017810982	74	15	8617.737114	566.5630021
40	19	2.16	2.16	18.02402484	0.89	362.3229436	0.424126169	7605.489637	0.000363448	0.097435369	0	3090	7.06E-05	0.018937141	57	11	6666.783356	514.5199635
50	19	1.66	1.66	16.11293301	0.9	293.7841469	0.343896369	7387.540741	0.000342499	0.093761017	0	3790	7.09E-05	0.01942137	51	10	5885.653985	482.7724125
60	19	1.52	1.52	14.27403278	0.91	247.950206	0.290244305	7150.055077	0.000323048	0.091638096	0	4490	7.04E-05	0.019967603	44	9	5122.343151	458.9338751
70	19	1.5	1.5	13.52560239	0.92	213.6150496	0.25005243	7084.450693	0.000316072	0.090441581	0	5190	7.05E-05	0.020175501	42	8	4846.869385	448.2742721
80	19	1.36	1.36	12.48255753	0.92	188.2484599	0.220358935	6968.506427	0.000305418	0.088307112	0	5890	7.08E-05	0.020480121	38	8	4406.294505	431.1845197
90	19	1.26	1.26	12.78507462	0.92	166.9983475	0.195484086	6922.392323	0.000303787	0.087939091	0	6590	7.03E-05	0.020362659	39	8	4526.869568	431.8644806
100	19	1.24	1.24	12.22803789	0.92	150.8685925	0.176602998	6811.861098	0.000299356	0.087030559	0	7290	7.08E-05	0.020594156	37	7	4326.782675	422.5983386

Kur-World Effluent. Stage 1 B Low ADWF with average stormwater infiltration Multi run output

Irrigation Area (ha)	Pond Volume (ML)	Overflows (Overtops/year)	Overflows >1mm (Overtops/year)	Overflow volume (ML/year)	Effluent reuse (fraction)	Irrigation supplied (mm/year)	Irrigation demand supplied (fraction)	Yield (kg/ha/year)	Phosphate P leached (kg/ha/year)	Nitrate N leached (kg/ha/year)	Max yield reduction from salinity (fraction)	Relative cost (K$)	Av Phosphate P leachate conc (mg/L)	Av Nitrate N leachate conc (mg/L)	Mass N overflowed (kg/year)	Mass P overflowed (kg/year)	Mass salt overflowed (kg/year)	Av deep drainage (mm/year)
10	19	33.32	33.24	94.2594693	0.46	814.8574838	0.95	8840.632504	0.0006023	0.124440598	0	990	7.28E-05	0.015051263	343	69	39843.28764	826.778421
20	19	7.14	7.14	47.2351392	0.73	647.5580614	0.76	8396.350323	0.000494649	0.111001302	0	1690	7.22E-05	0.016195598	146	29	16959.96865	685.379459
30	19	3.44	3.44	32.13114104	0.82	483.3076735	0.57	7903.951908	0.000414526	0.102610312	0	2390	7.08E-05	0.017536037	90	18	10495.36548	585.1396881
40	19	2.52	2.52	26.86491287	0.85	376.0095699	0.44	7591.201968	0.000370096	0.09769247	0	3090	7.05E-05	0.018615394	72	14	8384.242329	524.7939911
50	19	2.06	2.06	23.79929243	0.86	307.0589865	0.36	7342.905485	0.00034036	0.094867132	0	3790	6.99E-05	0.019473037	62	12	7242.801245	487.1717356
60	19	1.84	1.84	21.52846699	0.88	259.7445245	0.3	7138.936867	0.00032467	0.092793568	0	4490	6.95E-05	0.019877038	55	11	6424.46653	466.8380098
70	19	1.92	1.92	20.89924004	0.88	223.5522999	0.26	7078.281485	0.000320904	0.09168563	0	5190	7.05E-05	0.020145913	54	11	6275.305384	455.1078408
80	19	1.78	1.78	19.09918935	0.89	197.8899734	0.23	6963.198031	0.000305267	0.089770811	0	5890	6.97E-05	0.020499522	48	10	5611.699145	437.9166004
90	19	1.8	1.8	19.82220946	0.89	175.103905	0.21	6917.098538	0.000308843	0.08866688	0	6590	7.05E-05	0.020236199	51	10	5871.074016	438.1597574
100	19	1.66	1.66	19.38738394	0.89	158.0410242	0.19	6806.997296	0.000303697	0.087777371	0	7290	7.07E-05	0.020438273	49	10	5730.457257	429.4754797

Kur-World Effluent. Stage 1 B High ADWF with low stormwater infiltration and 10% reduction in ADWF Multi run output

Irrigation Area (ha)	Pond Volume (ML)	Overflows (Overtops/year)	Overflows >1mm (Overtops/year)	Overflow volume (ML/year)	Effluent reuse (fraction)	Irrigation supplied (mm/year)	Irrigation demand supplied (fraction)	Yield (kg/ha/year)	Phosphate P leached (kg/ha/year)	Nitrate N leached (kg/ha/year)	Max yield reduction from salinity (fraction)	Relative cost (K$)	Av Phosphate P leachate conc (mg/L)	Av Nitrate N leachate conc (mg/L)	Mass N overflowed (kg/year)	Mass P overflowed (kg/year)	Mass salt overflowed (kg/year)	Av deep drainage (mm/year)
10	19	5.28	5.28	299.2477464	0.21	816.0878051	0.955291958	8965.910184	0.000605328	0.125164745	0	990	7.30E-05	0.015094163	1316	263	152637.9421	829.2261412
20	19	44.22	44.22	218.1192451	0.43	814.5906656	0.953539444	8970.645656	0.000605094	0.124864552	0	1690	7.31E-05	0.015091296	927	185	107551.5975	827.3945128
30	19	23.24	23.16	152.976511	0.6	762.8204487	0.892938524	8850.898601	0.000570217	0.120342896	0	2390	7.34E-05	0.015498469	621	124	72053.16805	776.4824969
40	19	11.26	11.24	113.1418468	0.7	672.6822281	0.787424979	8572.855099	0.000510247	0.112876896	0	3090	7.24E-05	0.016009761	438	88	50797.67917	705.0504665
50	19	7.6	7.6	91.73874351	0.76	581.3855677	0.680555394	8322.643944	0.000449079	0.107014052	0	3790	7.15E-05	0.017047773	346	69	40088.56288	627.7303956
60	19	5.26	5.26	76.00686532	0.8	510.9947095	0.598157617	8093.810026	0.000412304	0.102193814	0	4490	7.13E-05	0.017670361	276	55	32065.96167	578.3346156
70	19	4.46	4.46	71.07000369	0.81	445.1262542	0.521053652	7909.931596	0.000390135	0.099687504	0	5190	7.06E-05	0.01804083	255	51	29609.60354	552.5660512
80	19	4.16	4.16	65.7183931	0.83	396.2422636	0.463831276	7738.048702	0.000368658	0.097127284	0	5890	7.07E-05	0.01861471	233	47	26987.21152	521.7770553
90	19	3.8	3.8	61.08476699	0.84	357.4003534	0.418363908	7615.219125	0.000354126	0.095963777	0	6590	7.04E-05	0.019089677	214	43	24843.32933	502.6998311
100	19	3.54	3.54	59.78234019	0.84	322.9831015	0.378075934	7468.858426	0.000344211	0.093929954	0	7290	7.07E-05	0.01929178	209	42	24220.43348	486.8910801

Kur-World Effluent. Stage 1 B High ADWF with low stormwater infiltration Multi run output

Irrigation Area (ha)	Pond Volume (ML)	Overflows (Overtops/year)	Overflows >1mm (Overtops/year)	Overflow volume (ML/year)	Effluent reuse (fraction)	Irrigation supplied (mm/year)	Irrigation demand supplied (fraction)	Yield (kg/ha/year)	Phosphate P leached (kg/ha/year)	Nitrate N leached (kg/ha/year)	Max yield reduction from salinity (fraction)	Relative cost (K$)	Av Phosphate P leachate conc (mg/L)	Av Nitrate N leachate conc (mg/L)	Mass N overflowed (kg/year)	Mass P overflowed (kg/year)	Mass salt overflowed (kg/year)	Av deep drainage (mm/year)
10	19	1.52	1.52	341.1317822	0.19	815.8270524	0.955019502	8966.585024	0.000608173	0.125163975	0	990	7.34E-05	0.015098614	1505	301	174637.8821	828.976569
20	19	46.42	46.4	259.6512633	0.39	815.8709709	0.955070914	8968.883129	0.000607793	0.125166968	0	1690	7.33E-05	0.015099814	1115	223	129298.4285	828.930506
30	19	28.46	28.42	187.7438685	0.56	785.9062715	0.919993783	8916.838707	0.000587906	0.122598304	0	2390	7.32E-05	0.015260246	774	155	89756.74889	803.383525
40	19	15.4	15.36	141.600133	0.67	705.8066237	0.826227922	8666.525516	0.000529207	0.116036424	0	3090	7.28E-05	0.015963349	563	113	65262.3181	726.892739
50	19	9.38	9.38	110.8275009	0.74	626.7506132	0.733683759	8443.64848	0.000483459	0.110243953	0	3790	7.29E-05	0.016621307	422	84	49009.72193	663.268859
60	19	6.18	6.18	95.43580492	0.77	548.238908	0.641776768	8233.941957	0.000439201	0.104481673	0	4490	7.18E-05	0.017076853	354	71	41043.84096	611.832135
70	19	5.42	5.4	86.67441896	0.8	482.5535483	0.564884491	8052.16149	0.000409256	0.101138398	0	5190	7.17E-05	0.017722222	317	63	36734.57301	570.686881
80	19	4.92	4.92	80.5793339	0.81	429.9100162	0.503259175	7871.422277	0.000384196	0.098628748	0	5890	7.07E-05	0.018151307	292	58	33834.46512	543.369944
90	19	4.52	4.52	75.44699704	0.82	387.8986396	0.454080022	7725.70447	0.000367761	0.096882414	0	6590	7.11E-05	0.018739188	269	54	31210.68132	517.004331
100	19	4.24	4.24	70.56615539	0.83	354.0117136	0.414411473	7610.147681	0.00035119	0.095630448	0	7290	7.03E-05	0.019136995	250	50	28945.36077	499.715085

Kur-World Effluent. Stage 1 B High ADWF with average stormwater infiltration Multi run output

Irrigation Area (ha)	Pond Volume (ML)	Overflows (Overtops/year)	Overflows >1mm (Overtops/year)	Overflow volume (ML/year)	Effluent reuse (fraction)	Irrigation supplied (mm/year)	Irrigation demand supplied (fraction)	Yield (kg/ha/year)	Phosphate P leached (kg/ha/year)	Nitrate N leached (kg/ha/year)	Max yield reduction from salinity (fraction)	Relative cost (K$)	Av Phosphate P leachate conc (mg/L)	Av Nitrate N leachate conc (mg/L)	Mass N overflowed (kg/year)	Mass P overflowed (kg/year)	Mass salt overflowed (kg/year)	Av deep drainage (mm/year)
10	19	1.22	1.22	379.6554321	0.18	813.8021372	0.952019472	8906.454501	0.000603485	0.124672654	0	990	7.28E-05	0.015041773	1522	304	176551.5656	828.8427975
20	19	45.54	45.5	298.4979252	0.35	813.3136495	0.951448019	8906.296245	0.000608417	0.12465719	0	1690	7.34E-05	0.015046808	1148	230	133124.579	828.462709
30	19	30.24	30.2	227.1468187	0.51	782.2172504	0.915070162	8800.817779	0.000575482	0.12236148	0	2390	7.23E-05	0.015362889	825	165	95676.86527	796.474393
40	19	15.58	15.56	173.7549525	0.62	721.1212069	0.843597478	8627.448202	0.000537728	0.116615068	0	3090	7.25E-05	0.01572767	589	118	68379.91416	741.4643575
50	19	9.92	9.92	145.2844736	0.69	634.4330804	0.742186114	8405.318457	0.00048492	0.109954084	0	3790	7.23E-05	0.016403022	472	94	54721.93343	670.3281992
60	19	7.32	7.32	128.4192063	0.72	557.0305731	0.651637453	8167.684133	0.000439793	0.105002937	0	4490	7.14E-05	0.017050377	404	81	46822.24523	615.8393774
70	19	6.38	6.38	117.1877671	0.75	493.6403291	0.577480918	7988.299279	0.000411082	0.101231368	0	5190	7.12E-05	0.017531502	358	72	41572.60375	577.425532
80	19	5.64	5.64	109.1389934	0.76	442.0713071	0.517153339	7846.926628	0.000387548	0.098406799	0	5890	7.09E-05	0.018002758	327	65	37874.98519	546.6206797
90	19	5.18	5.18	103.2926872	0.78	399.4952425	0.467346094	7716.653021	0.000370451	0.096906314	0	6590	7.05E-05	0.018431152	303	61	35095.3923	525.7745924
100	19	5.06	5.06	98.66777015	0.79	364.192039	0.426046943	7592.900809	0.000357642	0.095947387	0	7290	7.06E-05	0.018929599	287	57	33259.46723	506.8643458

Stage 2
(before golf course)

Kur-World Effluent. Stage 2 Pre Golf course, Low ADWF with average stormwater infiltration Multi run output

Irrigation Area (ha)	Pond Volume (ML)	Overflows (Overtops/year)	Overflows >1mm (Overtops/year)	Overflow volume (ML/year)	Effluent reuse (fraction)	Irrigation supplied (mm/year)	Irrigation demand supplied (fraction)	Yield (kg/ha/year)	Phosphate P leached (kg/ha/year)	Nitrate N leached (kg/ha/year)	Max yield reduction from salinity (fraction)	Relative cost (K$)	Av Phosphate P leachate conc (mg/L)	Av Nitrate N leachate conc (mg/L)	Mass N overflowed (kg/year)	Mass P overflowed (kg/year)	Mass salt overflowed (kg/year)	Av deep drainage (mm/year)
10	19	21.1	21.1	247.7916837	0.247118915	814.0231597	0.953112835	8892.008834	0.000605428	0.12492409	0	990	7.31E-05	0.015086406	976.5449233	195.3089847	113279.2111	828.0573422
20	19	32.76	32.7	169.5120057	0.485791654	801.6785219	0.938658906	8829.83665	0.000600632	0.123746515	0	1690	7.37E-05	0.015176425	619.5719825	123.9143965	71870.34997	815.3864397
30	19	12.88	12.88	117.0515951	0.645353215	711.1470581	0.832658605	8576.177301	0.000532459	0.115690442	0	2390	7.22E-05	0.015677609	390.8150719	78.16301437	45334.54834	737.9342095
40	19	7.72	7.72	89.33313297	0.729502384	603.5166343	0.706637696	8287.344764	0.000467581	0.108860431	0	3090	7.23E-05	0.016840397	280.4635386	56.09270772	32533.77048	646.4243533
50	19	5.34	5.34	78.23053294	0.763198014	505.3872992	0.591741298	8028.804841	0.000416209	0.102852281	0	3790	7.00E-05	0.017296937	235.6497192	47.12994384	27335.36743	594.6271429
60	19	4.42	4.42	69.38192996	0.78999683	436.0777933	0.510589087	7756.182239	0.000387104	0.099086444	0	4490	7.06E-05	0.018083366	202.7814658	40.55629315	23522.65003	547.9424735
70	19	3.8	3.8	63.10449869	0.808984066	382.8228518	0.448234634	7622.763223	0.000363287	0.097079512	0	5190	7.00E-05	0.018711307	180.0029293	36.00058586	20880.3398	518.8280734
80	19	3.54	3.54	60.07683477	0.818146181	338.7983828	0.396687838	7449.368028	0.000347104	0.095762234	0	5890	6.96E-05	0.019200215	168.9947996	33.79895993	19603.39676	498.7560609
90	19	3.44	3.44	59.05367691	0.82124695	302.3129869	0.353968292	7369.35961	0.000339967	0.093384446	0	6590	7.02E-05	0.019294284	165.1522589	33.03045178	19157.66203	484.0005653
100	19	3.28	3.28	56.7313063	0.828269185	274.4251258	0.321315317	7264.702304	0.000326085	0.092253428	0	7290	7.01E-05	0.019843798	157.634158	31.52683161	18285.56233	464.8980351

Kur-World Effluent. Stage 2 Pre Golf course, High ADWF with average stormwater infiltration Multi run output

Irrigation Area (ha)	Pond Volume (ML)	Overflows (Overtops/year)	Overflows >1mm (Overtops/year)	Overflow volume (ML/year)	Effluent reuse (fraction)	Irrigation supplied (mm/year)	Irrigation demand supplied (fraction)	Yield (kg/ha/year)	Phosphate P leached (kg/ha/year)	Nitrate N leached (kg/ha/year)	Max yield reduction from salinity (fraction)	Relative cost (K$)	Av Phosphate P leachate conc (mg/L)	Av Nitrate N leachate conc (mg/L)	Mass N overflowed (kg/year)	Mass P overflowed (kg/year)	Mass salt overflowed (kg/year)	Av deep drainage (mm/year)
10	19	0.02	0.02	660.6954569	0.11	815.8778396	0.950333583	8929.907197	0.000612856	0.124687929	0	990	7.37E-05	0.01499308	2686	537	311541.5094	831.6365141
20	19	10.48	10.48	579.291942	0.22	815.0684532	0.94939081	8927.532094	0.000613331	0.124669793	0	1690	7.38E-05	0.015000018	2307	461	267589.5012	831.130974
30	19	42.42	42.4	498.2745425	0.33	813.8775459	0.948003643	8924.659415	0.000610901	0.124545418	0	2390	7.36E-05	0.015002682	1929	386	223718.8397	830.1543589
40	19	40.64	40.6	420.214706	0.43	806.6435088	0.939577445	8917.214396	0.000605243	0.12417132	0	3090	7.37E-05	0.015110582	1567	313	181738.3478	821.7507203
50	19	28.4	28.38	356.9005139	0.52	772.5360808	0.899849151	8784.670899	0.000573803	0.121475656	0	3790	7.29E-05	0.015431906	1282	256	148655.7249	787.1720899
60	19	20.2	20.18	310.5865718	0.58	721.351263	0.840229133	8660.750964	0.000542808	0.116790702	0	4490	7.35E-05	0.015805638	1078	216	125104.2012	738.917988
70	19	14.54	14.54	275.4436446	0.63	668.7596234	0.778970451	8511.323467	0.000502775	0.112355483	0	5190	7.24E-05	0.016174523	923	185	107013.4784	694.6447777
80	19	11.54	11.54	255.1887314	0.66	610.6259502	0.711256415	8364.397769	0.000466935	0.108474436	0	5890	7.16E-05	0.016627114	836	167	97025.18037	652.3948681
90	19	9.46	9.46	232.8993815	0.69	567.6488665	0.661196756	8237.78318	0.000447438	0.104928702	0	6590	7.22E-05	0.016943131	740	148	85877.30771	619.299376
100	19	8.3	8.3	218.3637548	0.71	525.4762638	0.612074156	8092.376126	0.0004191	0.101817518	0	7290	7.18E-05	0.017438142	681	136	78977.50973	583.8782448

Stage 2
(with golf course)

MEDLI REPORT - FULL RUN

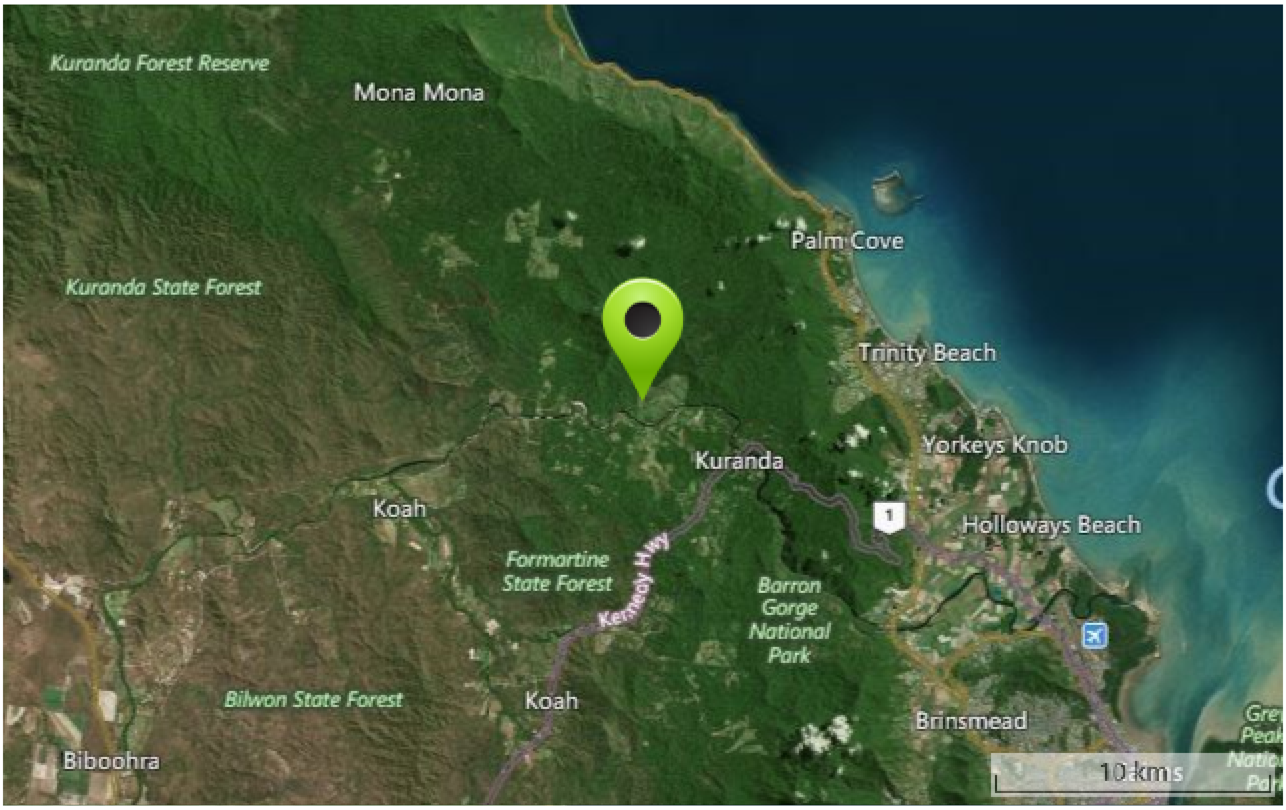
Enterprise: **Kur World**

Description:
Stage 2 low range, low ingress, 10% recycled 56ha Golf and amenity full run

Client: **Reever and Ocean**

MEDLI User: NATRES\andrew

Scenario Details:
low range ADWF, low infiltration efficiency, 10% ADWF recycled (removed from ADWF input), Full run
N 5mg/L, P 1 mg/L, TDS 580 mg 73% TON, 2% NH4-N, 25% Org N
5 ML tank and 19 ML dam
5mm SMD to UDL. Irrigation allowed on days with up to 3 mm rainfall. Coastal couch as amenity grass (kickstarted) assumed for golf course and amenity planting - 56ha
No additional nutrient addition to account for return of clippings

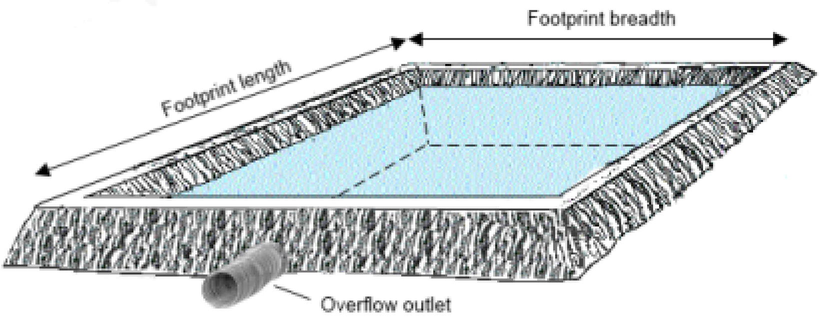


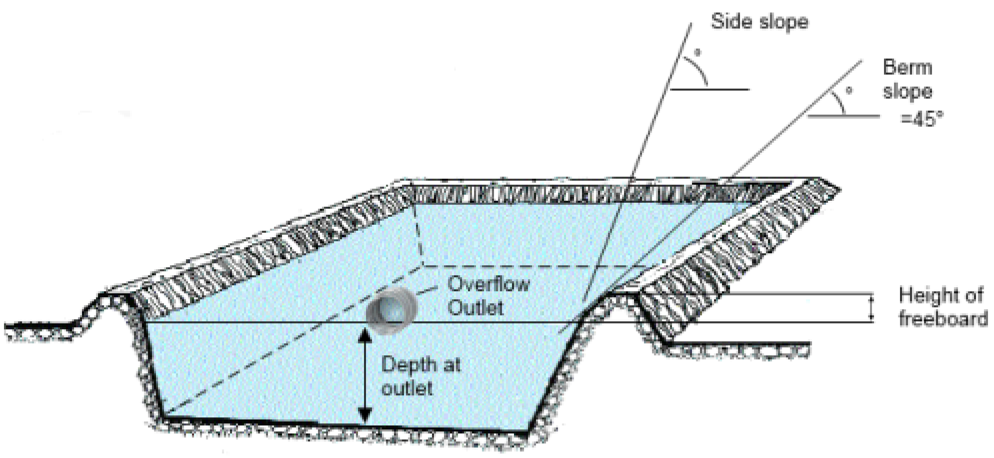
DESCRIPTION

Pond system: 2 facultative, aerobic or storage ponds

Pond system details:

	Pond 1	Pond 2
Maximum pond volume (ML)	5.00	19.00
Minimum allowable pond volume (ML)	0.00	6.77
Pond depth at overflow outlet (m)	4.00	4.50
Maximum water surface area (m2)	1250.00	5794.53
Pond footprint length (m)	35.36	135.05
Pond footprint width (m)	35.36	47.15
Pond catchment area (m2)	1250.00	6367.31
Average active volume (ML)	5.00	9.23





Irrigation pump limits:

Minimum pump rate limit (ML/day)	0.00
Maximum pump rate limit (ML/day)	100.00

Shandying water:

Annual allocation of fresh water available for shandying (ML/year)	0.00
Maximum rate of application of fresh water (ML/day)	0.00
Nitrogen concentration (mg/L)	0.00
Salinity (dS/m)	0.00
Minimum shandy water is used	False

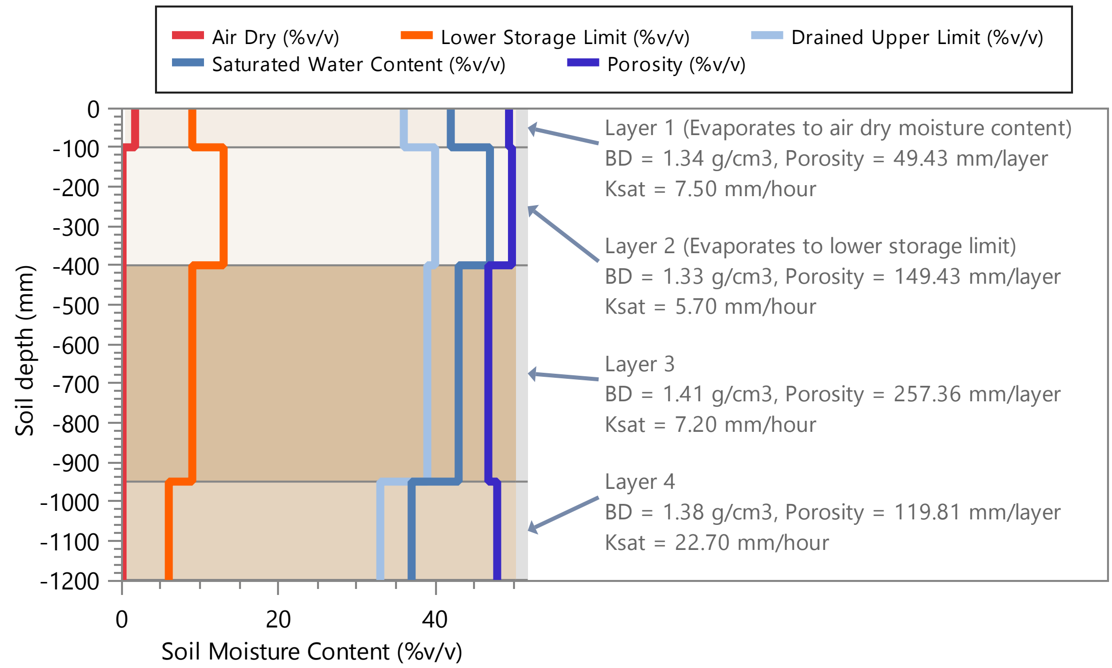
DESCRIPTION

Land: New Paddock

Area (ha): 56.00

Soil Type: Bicton (Kur-World), 1200.00 mm defined profile depth

Profile Porosity (mm)	576.04
Profile saturation water content (mm)	512.00
Profile drained upper limit (or field capacity) (mm)	453.00
Profile lower storage limit (or permanent wilting point) (mm)	112.50
Profile available water capacity (mm)	340.50
Profile limiting saturated hydraulic conductivity (mm/hour)	5.70
Surface saturated hydraulic conductivity (mm/hour)	7.50
Runoff curve number II (coefficient)	80.00
Soil evaporation U (mm)	8.50
Soil evaporation Cona (mm/sqrt day)	3.75



Plant Data: Continuous Coastal Couch Grass (Cynodon dactylon) Pasture_mod golf, kick started

Average monthly cover (fraction) (minimum - maximum)	1.00 (0.99 - 1.00)
Maximum crop factor at 100% cover (mm/mm) (Maximum crop coefficient 0.8 x Pan coefficient 1)	0.80
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Maximum potential root depth in defined soil profile (mm)	800.00
Salt tolerance	Tolerant
Salinity threshold EC sat. ext. (dS/m)	6.90
Proportion of yield decrease per dS/m increase (fraction/dS/m)	0.06

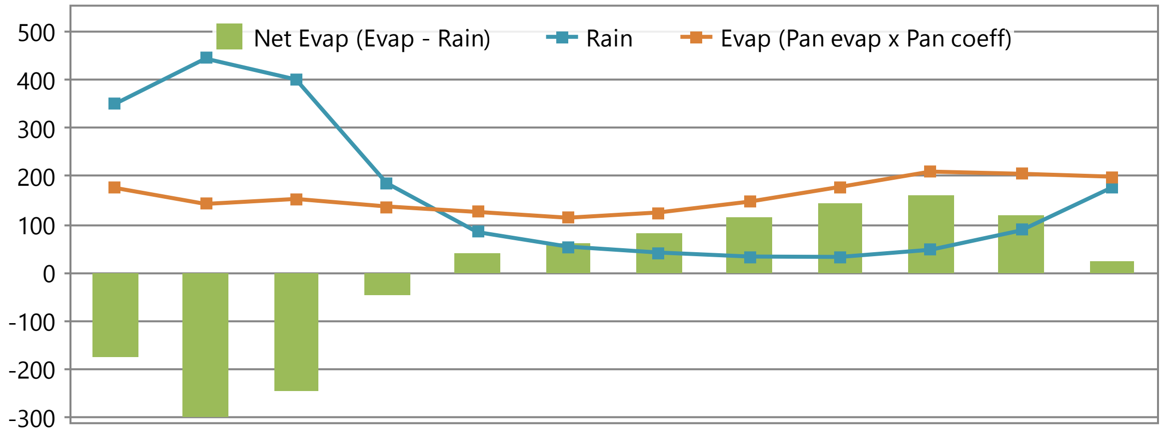
DIAGNOSTICS

Sustainability Diagnostics: Kur World

Averaged Historical Climate Data Used in Simulation (mm)

Location: KurWorlSTP, -16.8°, 145.6°

Run Period: 01/01/1967 to 31/12/2016 50 years, 0 days



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	349.9	444.0	400.6	185.8	84.3	54.1	41.9	33.6	32.8	47.6	87.8	176.5	1938.9
Evap	176.0	142.7	153.0	137.4	126.0	114.1	125.0	147.4	177.9	209.7	205.2	199.2	1913.4
Net Evap	-173.9	-301.3	-247.6	-48.4	41.8	59.9	83.1	113.8	145.1	162.1	117.4	22.7	-25.5
Net Evap/day	-5.6	-10.7	-8.0	-1.6	1.3	2.0	2.7	3.7	4.8	5.2	3.9	0.7	-0.1

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Pond System: 2 facultative, aerobic or storage ponds

Kur-world Stage 2 Low range, low ingress, 10% recycled - Sept 2017 - 268.22 ML/year or 0.73 ML/day generated on average

Effluent entering pond system after any pretreatment and recycling

Average (Minimum-Maximum) influent quality calculated for 365.26 non-zero flow days, after any pretreatment and recycling.

Constituent	Concentration (mg/L)	Load (kg/year)
Total Nitrogen	4.54 (0.64 - 5.00)	1216.48 (1215.61 - 1218.94)
Total Phosphorus	0.91 (0.13 - 1.00)	243.30 (243.12 - 243.79)
Total Dissolved Salts	526.10 (73.77 - 580.00)	141111.70 (141011.25 - 141397.59)
Volatile Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Total Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)

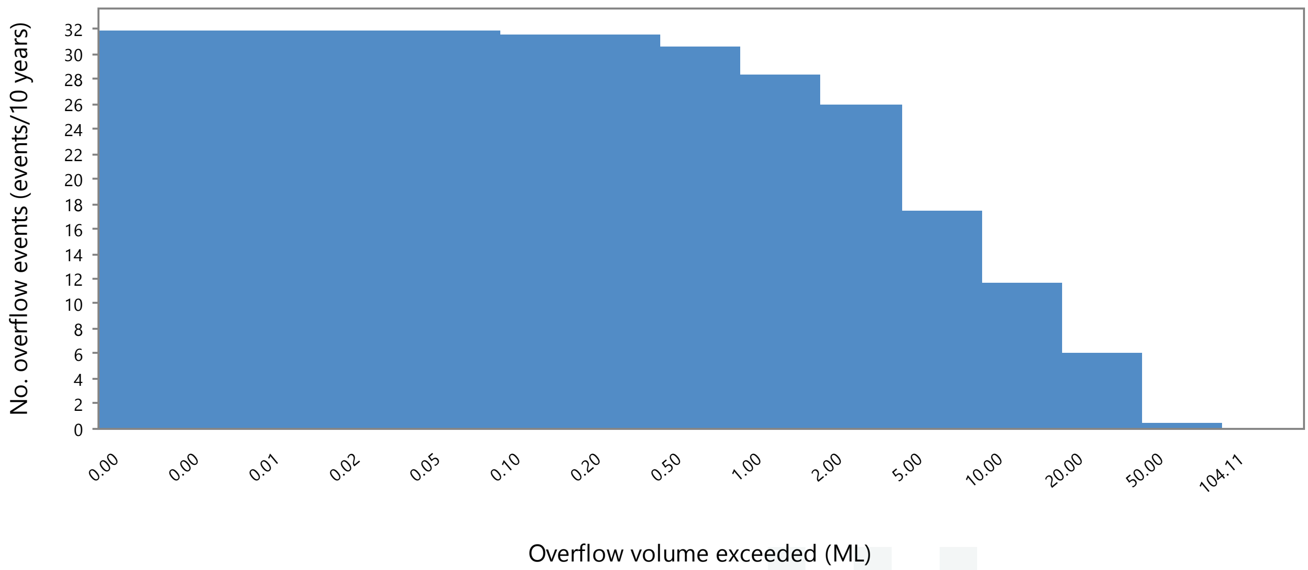
Last pond (Wet weather store): 19.00 ML

Theoretical hydraulic retention time (days)	25.87
Average volume of overflow (ML/year)	35.56
No. overflow events per year exceeding threshold* of 0.00 ML (no./year)	3.18
Average duration of overflow (days)	11.89
Effluent Reuse (Proportion of Inflow + Net Rain Gain that is Irrigated) (fraction)	0.87
Probability of at least 90% effluent reuse (fraction)	0.33
Average salinity of last pond (dS/m)	0.79
Salinity of last pond on final day of simulation (dS/m)	0.88
Ammonia loss from pond system water area (kg/m2/year)	0.00

* The threshold is the volume equivalent to the top 1 mm depth of water of a full pond

Overflow exceedance:

Chart Table



Export plot

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Irrigation Information

Irrigation: 56 ha total area (assumed 100% irrigation efficiency)

	Quantity/year	Quantity/ha/year
Total irrigation applied (ML)	238.55	4.26
Total nitrogen applied (kg)	1090.82	19.48
Total phosphorus applied (kg)	219.04	3.91
Total salts applied (kg)	127042.78	2268.62

Shandying

Annual allocation of fresh water for shandying (ML/year)	0.00
Average Shandy water irrigation (ML/year) (minimum - maximum)	0.00 (0.00 - 0.00)
Average exceedance as a proportion of annual shandy water allocation (% of allocation) (minimum - maximum)	0.00 (0.00 - 0.00)
Proportion of irrigation events requiring shandying (fraction of events)	0.00
Minimum shandy water is used	False

Irrigation Issues

Proportion of Days irrigation is prevented when triggered (fraction)	0.25
Proportion of Days water demand is too small to trigger irrigation (fraction)	0.12
Proportion of Days irrigation occurs (fraction)	0.63

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Land: New Paddock: 56 ha

Irrigation: Fixed Sprinkler with 0.2% ammonium loss during irrigation

Irrigation triggered when soil water deficit reaches 5.00 mm and rainfall is less than or equal to 3.00 mm
Irrigate up to a soil water content of drained upper limit plus 0.00 mm
Irrigation window from 1/1 to 31/12 including the days specified
A minimum of 0 days must be skipped between irrigation events

Soil Water Balance (mm): Bicton (Kur-World), 228.00 mm PAWC at maximum root depth

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	349.9	444.0	400.6	185.8	84.3	54.1	41.9	33.6	32.8	47.6	87.8	176.5	1938.9
Irrigation	34.9	22.8	32.2	34.4	39.2	38.9	37.9	37.0	36.3	37.5	36.8	38.0	426.0
Soil Evap	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Transpn.	126.2	112.0	120.9	109.7	100.8	91.2	100.0	117.8	135.6	129.4	101.5	118.0	1363.2
Rain Runoff	112.7	159.4	153.8	39.3	6.7	2.9	1.6	0.5	1.7	2.1	5.5	30.9	517.2
Irr. Runoff	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Drainage	55.8	143.2	155.9	77.6	27.9	12.0	5.6	1.4	0.1	0.3	0.0	9.8	489.6
Delta	90.1	52.2	2.2	-6.4	-12.0	-13.1	-27.4	-49.1	-68.4	-46.7	17.6	55.8	-5.1

Soil Nitrogen Balance

Average annual effluent nitrogen added (kg/ha/year)	19.48
Average annual soil nitrogen removed by plant uptake (kg/ha/year)	92.00
Average annual soil nitrogen removed by denitrification (kg/ha/year)	0.01
Average annual soil nitrogen leached (kg/ha/year)	1.18
Average annual nitrate-N loading to groundwater (kg/ha/year)	1.18
Soil organic-N kg/ha (Initial - Final)	3809.50 - 198.59
	74.41 - 0.02
Average nitrate-N concentration of deep drainage (mg/L)	0.24
Max. annual nitrate-N concentration of deep drainage (mg/L)	8.58

Soil Phosphorus Balance

Average annual effluent phosphorus added (kg/ha/year)	3.91
Average annual soil phosphorus removed by plant uptake (kg/ha/year)	1.80E-03
Average annual soil phosphorus leached (kg/ha/year)	3.44E-04
Dissolved phosphorus (kg/ha) (Initial - Final)	2.86E-04 - 1.09E-03
Adsorbed phosphorus (kg/ha) (Initial - Final)	450.65 - 648.07
Average phosphate-P concentration in rootzone (mg/L)	1.81E-04
Average phosphate-P concentration of deep drainage (mg/L)	7.02E-05
Max. annual phosphate-P concentration of deep drainage (mg/L)	7.97E-05
Design soil profile storage life based on average infiltrated water phosphorus concn. of 0.21 mg/L (years)	999.90

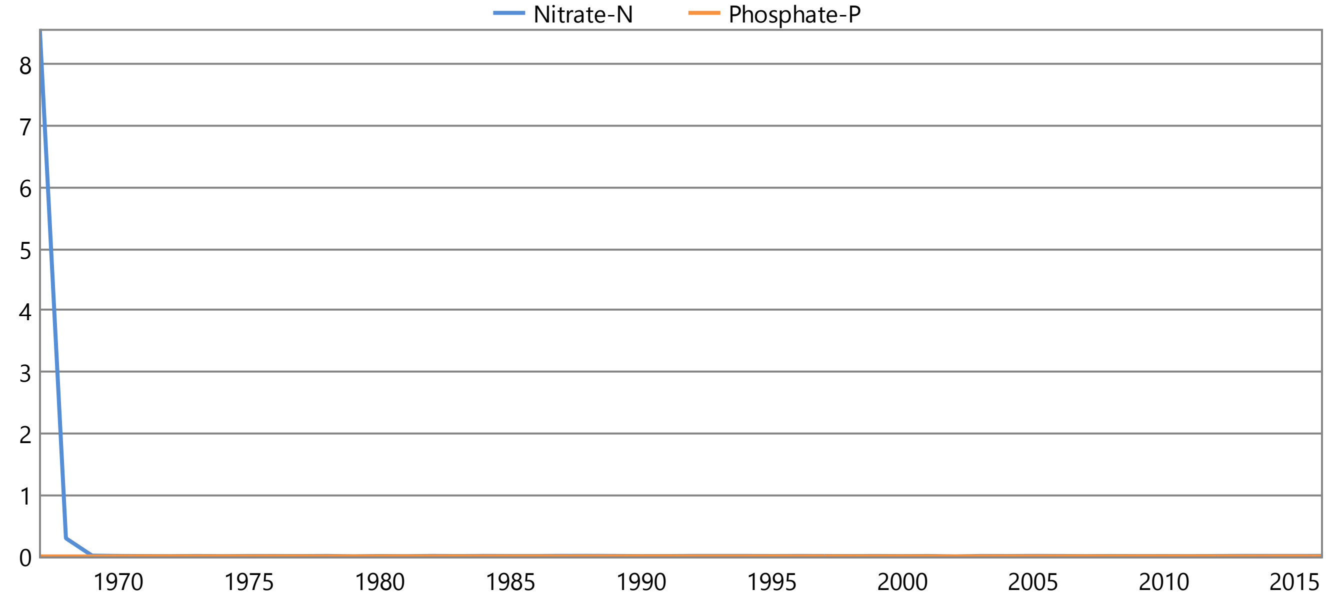
DIAGNOSTICS

Sustainability Diagnostics: Kur World

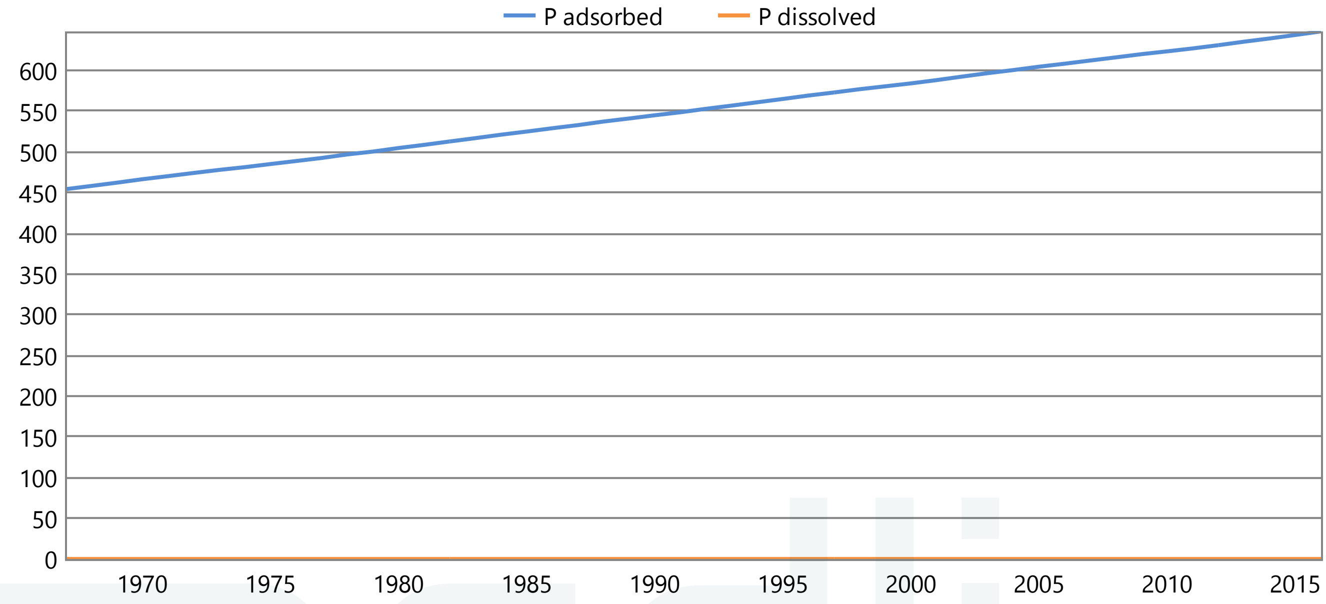
Paddock Land: New Paddock: 56 ha

Irrigation: Fixed Sprinkler with 0.2% ammonium loss during irrigation

Annual nutrient leachate concentration (mg/L)



Annual Phosphate-P in soil (kg/ha)



DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Plant Performance: New Paddock: 56 ha

Average Plant Performance (Minimum - Maximum): Continuous Coastal Couch Grass (Cynodon dactylon) Pasture_mod golf, kick started

Average annual shoot dry matter yield (kg/ha/year)	8858.08 (4900.91 - 15477.29)
Average monthly plant (green) cover (fraction)	1.00 (0.99 - 1.00)
Average monthly crop factor (fraction)	0.80 (0.79 - 0.80)
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Average monthly root depth (mm)	799.36 (792.32 - 800.00)
Average number of normal harvests per year (no./year)	6.22 (3.00 - 10.00)
Average number of normal harvests for last five years only (no./year)	3.60
Average number of crop deaths per year (no./year)	0.00 (0.00 - 0.00)
Average number of crop deaths for last five years only (no./year)	0.00
Average annual nitrogen deficiency index (0 = no stress, 1 = full stress) (coefficient)	0.61 (0.19 - 0.79)
Average January temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.02 (0.00 - 0.07)
Average July temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.20 (0.00 - 0.41)
Average monthly water stress index (0 = no stress, 1 = full stress) (coefficient)	0.08 (0.00 - 0.36)
Average monthly waterlogging index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.00)
No. days without crop/year (days)	0.00

Soil Salinity - Plant salinity tolerance: Tolerant

Assumes 1.0 dS/m Electrical Conductivity = 640 mg/L Total Dissolved Salts
All values based on 10 year running averages

Salinity of infiltrated water (Average salinity of rainwater = 0.03 dS/m) (dS/m)	0.21
Salt added by rainfall (kg/ha/year)	272.96
Average annual effluent salt added & leached at steady state (kg/ha/year)	2541.59
Average leaching fraction based on 10 year running averages (fraction)	0.46
Average water-uptake-weighted rootzone salinity sat. ext. (dS/m)	0.21
Salinity of the soil solution (at drained upper limit) at base of rootzone (dS/m)	0.81
Relative crop yield expected due to salinity (fraction)	1.00
Proportion of years that crop yields would be expected to fall below 90% of potential due to salinity (fraction)	0.00

DIAGNOSTICS

Run Messages

Messages generated when the scenario was run:

Full run chosen

MEDLI REPORT - FULL RUN

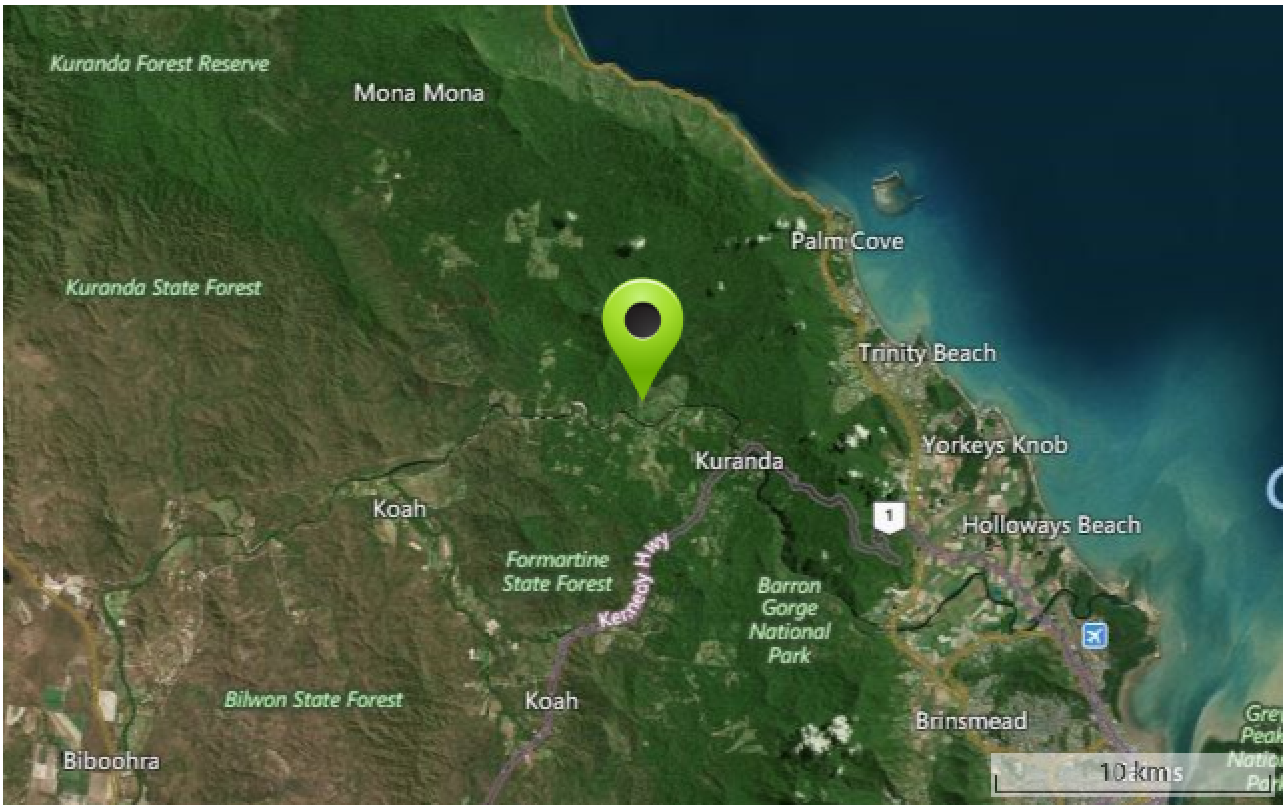
Enterprise: Kur World

Description:
Stage 2 low range, low ingress 56ha Golf and amenity full run

Client: Reever and Ocean

MEDLI User: NATRES\andrew

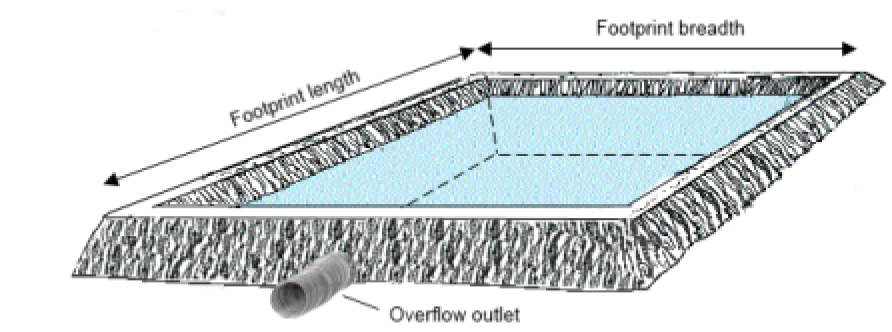
Scenario Details:
low range ADWF, low infiltration efficiency, Full run
N 5mg/L, P 1 mg/L, TDS 580 mg 73% TON, 2% NH4-N, 25% Org N
5 ML tank and 19 ML dam
5mm SMD to UDL. Irrigation allowed on days with up to 3 mm rainfall. Coastal couch as amenity grass (kickstarted) assumed for golf course and amenity planting - 56ha
No additional nutrient addition to account for return of clippings

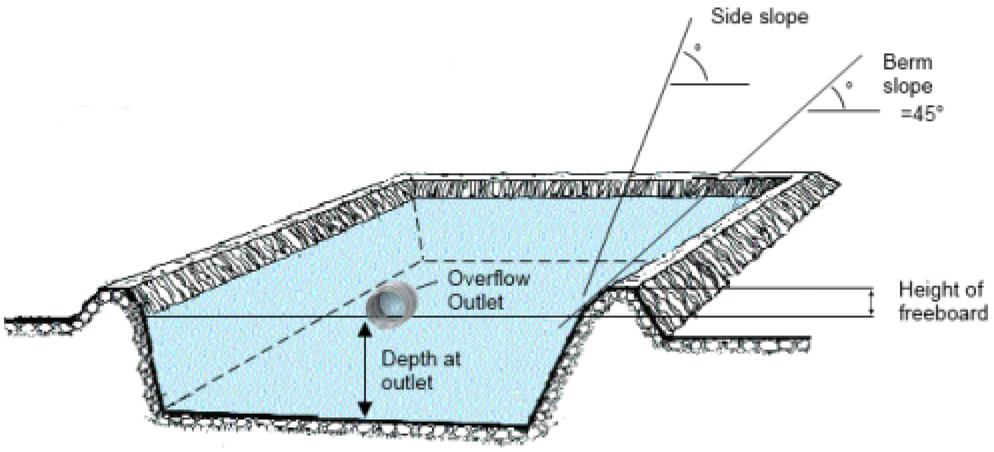


Pond system: 2 facultative, aerobic or storage ponds

Pond system details:

	Pond 1	Pond 2
Maximum pond volume (ML)	5.00	19.00
Minimum allowable pond volume (ML)	0.00	6.77
Pond depth at overflow outlet (m)	4.00	4.50
Maximum water surface area (m2)	1250.00	5794.53
Pond footprint length (m)	35.36	135.05
Pond footprint width (m)	35.36	47.15
Pond catchment area (m2)	1250.00	6367.31
Average active volume (ML)	5.00	9.44





Irrigation pump limits:

Minimum pump rate limit (ML/day)	0.00
Maximum pump rate limit (ML/day)	100.00

Shandying water:

Annual allocation of fresh water available for shandying (ML/year)	0.00
Maximum rate of application of fresh water (ML/day)	0.00
Nitrogen concentration (mg/L)	0.00
Salinity (dS/m)	0.00
Minimum shandy water is used	False

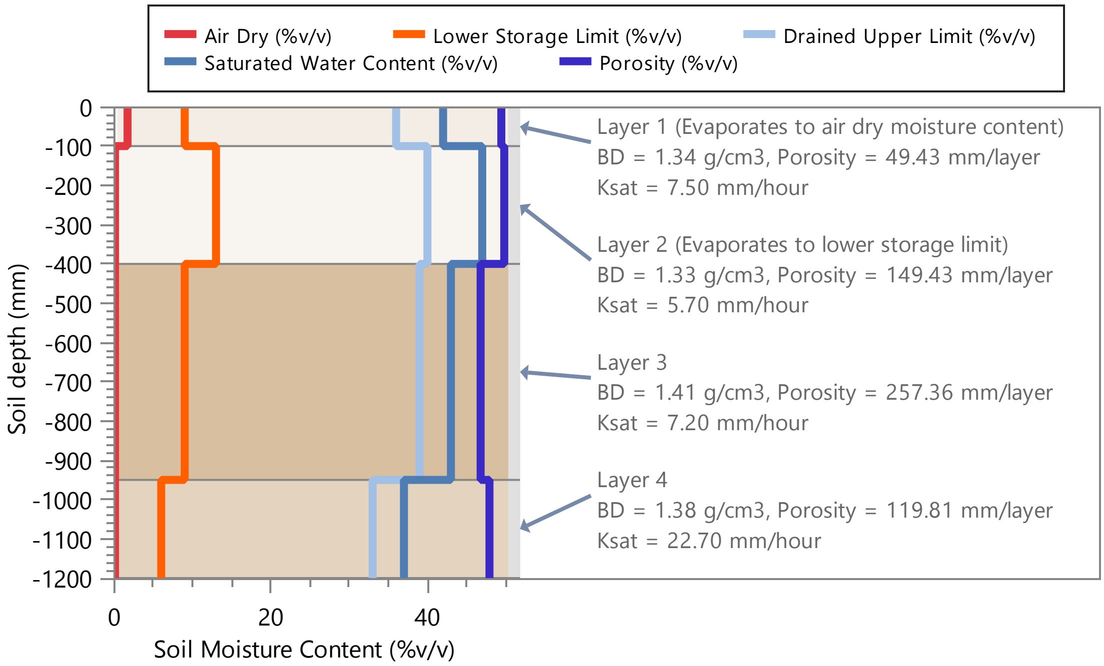
DESCRIPTION

Land: New Paddock

Area (ha): 56.00

Soil Type: Bicton (Kur-World), 1200.00 mm defined profile depth

Profile Porosity (mm)	576.04
Profile saturation water content (mm)	512.00
Profile drained upper limit (or field capacity) (mm)	453.00
Profile lower storage limit (or permanent wilting point) (mm)	112.50
Profile available water capacity (mm)	340.50
Profile limiting saturated hydraulic conductivity (mm/hour)	5.70
Surface saturated hydraulic conductivity (mm/hour)	7.50
Runoff curve number II (coefficient)	80.00
Soil evaporation U (mm)	8.50
Soil evaporation Cona (mm/sqrt day)	3.75



Plant Data: Continuous Coastal Couch Grass (Cynodon dactylon) Pasture_mod golf, kick started

Average monthly cover (fraction) (minimum - maximum)	1.00 (0.99 - 1.00)
Maximum crop factor at 100% cover (mm/mm) (Maximum crop coefficient 0.8 x Pan coefficient 1)	0.80
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Maximum potential root depth in defined soil profile (mm)	800.00
Salt tolerance	Tolerant
Salinity threshold EC sat. ext. (dS/m)	6.90
Proportion of yield decrease per dS/m increase (fraction/dS/m)	0.06

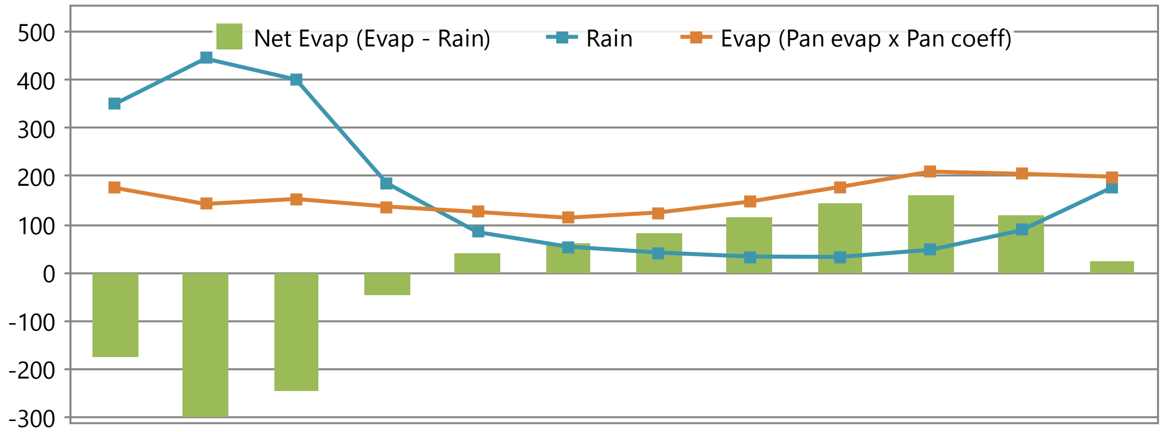
DIAGNOSTICS

Sustainability Diagnostics: Kur World

Averaged Historical Climate Data Used in Simulation (mm)

Location: KurWorlSTP, -16.8°, 145.6°

Run Period: 01/01/1967 to 31/12/2016 50 years, 0 days



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	349.9	444.0	400.6	185.8	84.3	54.1	41.9	33.6	32.8	47.6	87.8	176.5	1938.9
Evap	176.0	142.7	153.0	137.4	126.0	114.1	125.0	147.4	177.9	209.7	205.2	199.2	1913.4
Net Evap	-173.9	-301.3	-247.6	-48.4	41.8	59.9	83.1	113.8	145.1	162.1	117.4	22.7	-25.5
Net Evap/day	-5.6	-10.7	-8.0	-1.6	1.3	2.0	2.7	3.7	4.8	5.2	3.9	0.7	-0.1

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Pond System: 2 facultative, aerobic or storage ponds

Kur-world Stage 2 Low range, low ingress - Sept 2017 - 298.01 ML/year or 0.82 ML/day generated on average

Effluent entering pond system after any pretreatment and recycling

Average (Minimum-Maximum) influent quality calculated for 365.26 non-zero flow days, after any pretreatment and recycling.

Constituent	Concentration (mg/L)	Load (kg/year)
Total Nitrogen	4.54 (0.64 - 5.00)	1351.59 (1350.63 - 1354.33)
Total Phosphorus	0.91 (0.13 - 1.00)	270.32 (270.13 - 270.87)
Total Dissolved Salts	526.10 (73.77 - 580.00)	156784.42 (156672.82 - 157102.06)
Volatile Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Total Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)

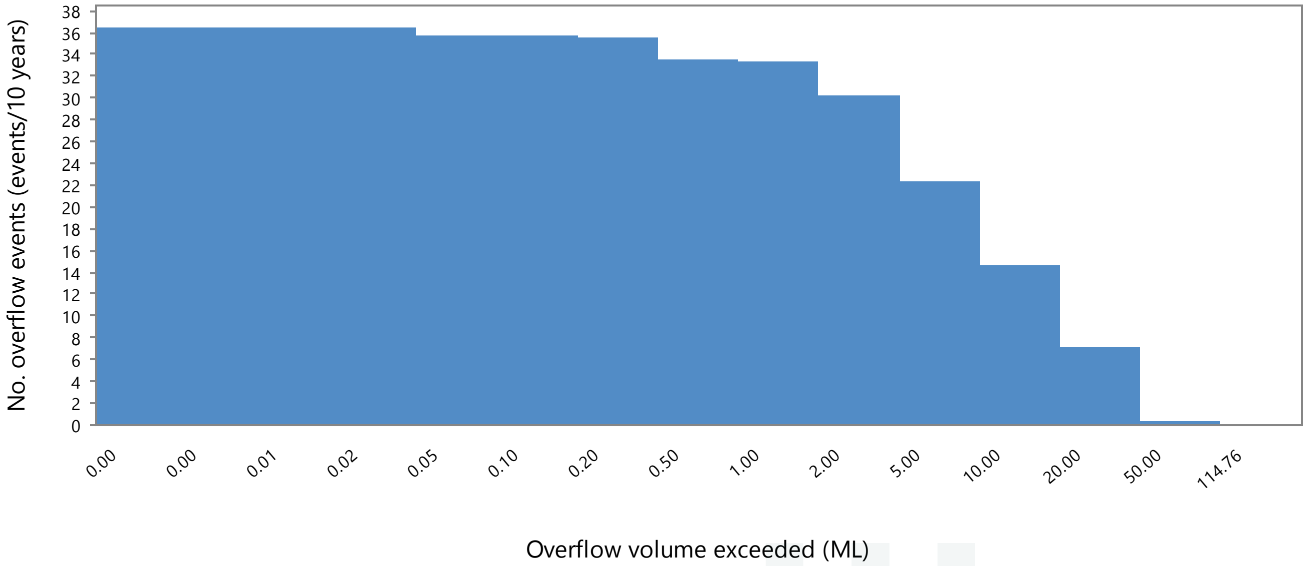
Last pond (Wet weather store): 19.00 ML

Theoretical hydraulic retention time (days)	23.29
Average volume of overflow (ML/year)	43.43
No. overflow events per year exceeding threshold* of 0.00 ML (no./year)	3.64
Average duration of overflow (days)	11.59
Effluent Reuse (Proportion of Inflow + Net Rain Gain that is Irrigated) (fraction)	0.86
Probability of at least 90% effluent reuse (fraction)	0.30
Average salinity of last pond (dS/m)	0.79
Salinity of last pond on final day of simulation (dS/m)	0.88
Ammonia loss from pond system water area (kg/m2/year)	0.00

* The threshold is the volume equivalent to the top 1 mm depth of water of a full pond

Overflow exceedance:

Chart Table



Export plot

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Irrigation Information

Irrigation: 56 ha total area (assumed 100% irrigation efficiency)

	Quantity/year	Quantity/ha/year
Total irrigation applied (ML)	260.42	4.65
Total nitrogen applied (kg)	1196.25	21.36
Total phosphorus applied (kg)	240.21	4.29
Total salts applied (kg)	139322.21	2487.90

Shandying

Annual allocation of fresh water for shandying (ML/year)	0.00
Average Shandy water irrigation (ML/year) (minimum - maximum)	0.00 (0.00 - 0.00)
Average exceedance as a proportion of annual shandy water allocation (% of allocation) (minimum - maximum)	0.00 (0.00 - 0.00)
Proportion of irrigation events requiring shandying (fraction of events)	0.00
Minimum shandy water is used	False

Irrigation Issues

Proportion of Days irrigation is prevented when triggered (fraction)	0.25
Proportion of Days water demand is too small to trigger irrigation (fraction)	0.13
Proportion of Days irrigation occurs (fraction)	0.62

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Land: New Paddock: 56 ha

Irrigation: Fixed Sprinkler with 0.2% ammonium loss during irrigation

Irrigation triggered when soil water deficit reaches 5.00 mm and rainfall is less than or equal to 3.00 mm
Irrigate up to a soil water content of drained upper limit plus 0.00 mm
Irrigation window from 1/1 to 31/12 including the days specified
A minimum of 0 days must be skipped between irrigation events

Soil Water Balance (mm): Bicton (Kur-World), 228.00 mm PAWC at maximum root depth

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	349.9	444.0	400.6	185.8	84.3	54.1	41.9	33.6	32.8	47.6	87.8	176.5	1938.9
Irrigation	37.7	24.1	33.5	36.4	42.1	42.8	42.4	41.1	40.3	41.7	41.0	41.9	465.0
Soil Evap	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Transpn.	127.1	112.1	120.9	109.7	100.8	91.2	100.0	117.9	138.3	138.4	108.7	121.0	1386.2
Rain Runoff	113.6	160.0	154.2	39.5	6.7	3.0	1.7	0.6	1.8	2.2	5.7	31.5	520.5
Irr. Runoff	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Drainage	57.9	145.9	157.7	78.8	29.5	13.2	6.5	1.6	0.1	0.6	0.2	10.3	502.2
Delta	89.1	50.1	1.3	-5.7	-10.6	-10.6	-24.0	-45.3	-67.1	-52.0	14.1	55.6	-5.0

Soil Nitrogen Balance

Average annual effluent nitrogen added (kg/ha/year)	21.36
Average annual soil nitrogen removed by plant uptake (kg/ha/year)	94.06
Average annual soil nitrogen removed by denitrification (kg/ha/year)	0.01
Average annual soil nitrogen leached (kg/ha/year)	1.19
Average annual nitrate-N loading to groundwater (kg/ha/year)	1.19
Soil organic-N kg/ha (Initial - Final)	3809.50 - 189.23
	74.41 - 0.02
Average nitrate-N concentration of deep drainage (mg/L)	0.24
Max. annual nitrate-N concentration of deep drainage (mg/L)	8.49

Soil Phosphorus Balance

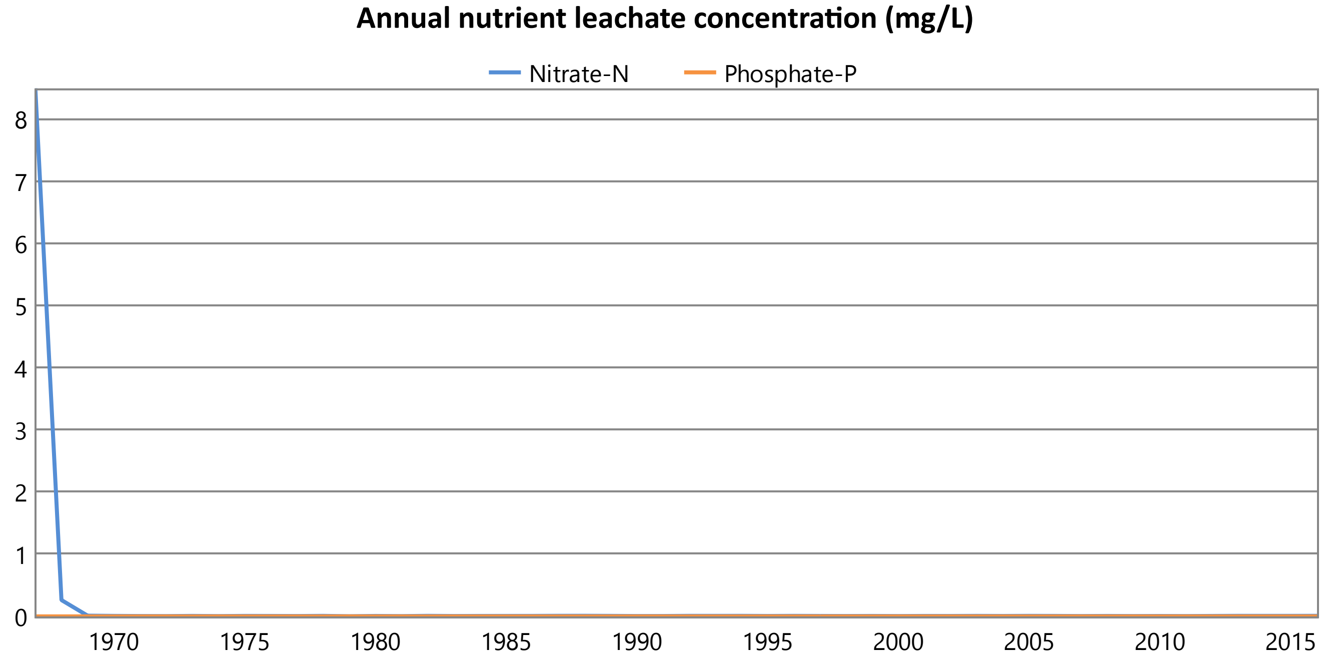
Average annual effluent phosphorus added (kg/ha/year)	4.29
Average annual soil phosphorus removed by plant uptake (kg/ha/year)	1.80E-03
Average annual soil phosphorus leached (kg/ha/year)	3.56E-04
Dissolved phosphorus (kg/ha) (Initial - Final)	2.86E-04 - 1.18E-03
Adsorbed phosphorus (kg/ha) (Initial - Final)	450.65 - 666.90
Average phosphate-P concentration in rootzone (mg/L)	2.08E-04
Average phosphate-P concentration of deep drainage (mg/L)	7.09E-05
Max. annual phosphate-P concentration of deep drainage (mg/L)	1.20E-04
Design soil profile storage life based on average infiltrated water phosphorus concn. of 0.23 mg/L (years)	999.90

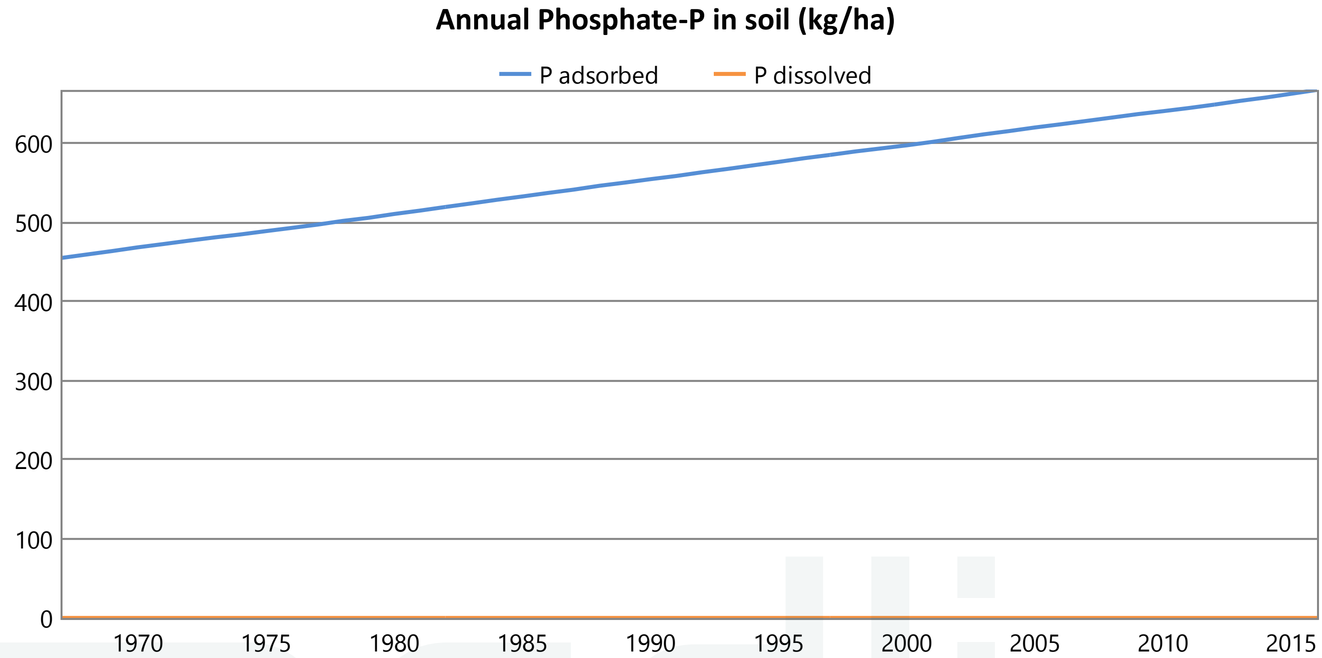
DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Land: New Paddock: 56 ha

Irrigation: Fixed Sprinkler with 0.2% ammonium loss during irrigation





DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Plant Performance: New Paddock: 56 ha

Average Plant Performance (Minimum - Maximum): Continuous Coastal Couch Grass (Cynodon dactylon) Pasture_mod golf, kick started

Average annual shoot dry matter yield (kg/ha/year)	9014.36 (5047.24 - 15723.07)
Average monthly plant (green) cover (fraction)	1.00 (0.99 - 1.00)
Average monthly crop factor (fraction)	0.80 (0.79 - 0.80)
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Average monthly root depth (mm)	799.36 (792.32 - 800.00)
Average number of normal harvests per year (no./year)	6.32 (3.00 - 11.00)
Average number of normal harvests for last five years only (no./year)	3.60
Average number of crop deaths per year (no./year)	0.00 (0.00 - 0.00)
Average number of crop deaths for last five years only (no./year)	0.00
Average annual nitrogen deficiency index (0 = no stress, 1 = full stress) (coefficient)	0.61 (0.18 - 0.79)
Average January temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.02 (0.00 - 0.07)
Average July temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.20 (0.00 - 0.41)
Average monthly water stress index (0 = no stress, 1 = full stress) (coefficient)	0.07 (0.00 - 0.32)
Average monthly waterlogging index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.00)
No. days without crop/year (days)	0.00

Soil Salinity - Plant salinity tolerance: Tolerant

Assumes 1.0 dS/m Electrical Conductivity = 640 mg/L Total Dissolved Salts
All values based on 10 year running averages

Salinity of infiltrated water (Average salinity of rainwater = 0.03 dS/m) (dS/m)	0.23
Salt added by rainfall (kg/ha/year)	272.33
Average annual effluent salt added & leached at steady state (kg/ha/year)	2760.23
Average leaching fraction based on 10 year running averages (fraction)	0.46
Average water-uptake-weighted rootzone salinity sat. ext. (dS/m)	0.22
Salinity of the soil solution (at drained upper limit) at base of rootzone (dS/m)	0.86
Relative crop yield expected due to salinity (fraction)	1.00
Proportion of years that crop yields would be expected to fall below 90% of potential due to salinity (fraction)	0.00

DIAGNOSTICS

Run Messages

Messages generated when the scenario was run:

Full run chosen

MEDLI REPORT - FULL RUN

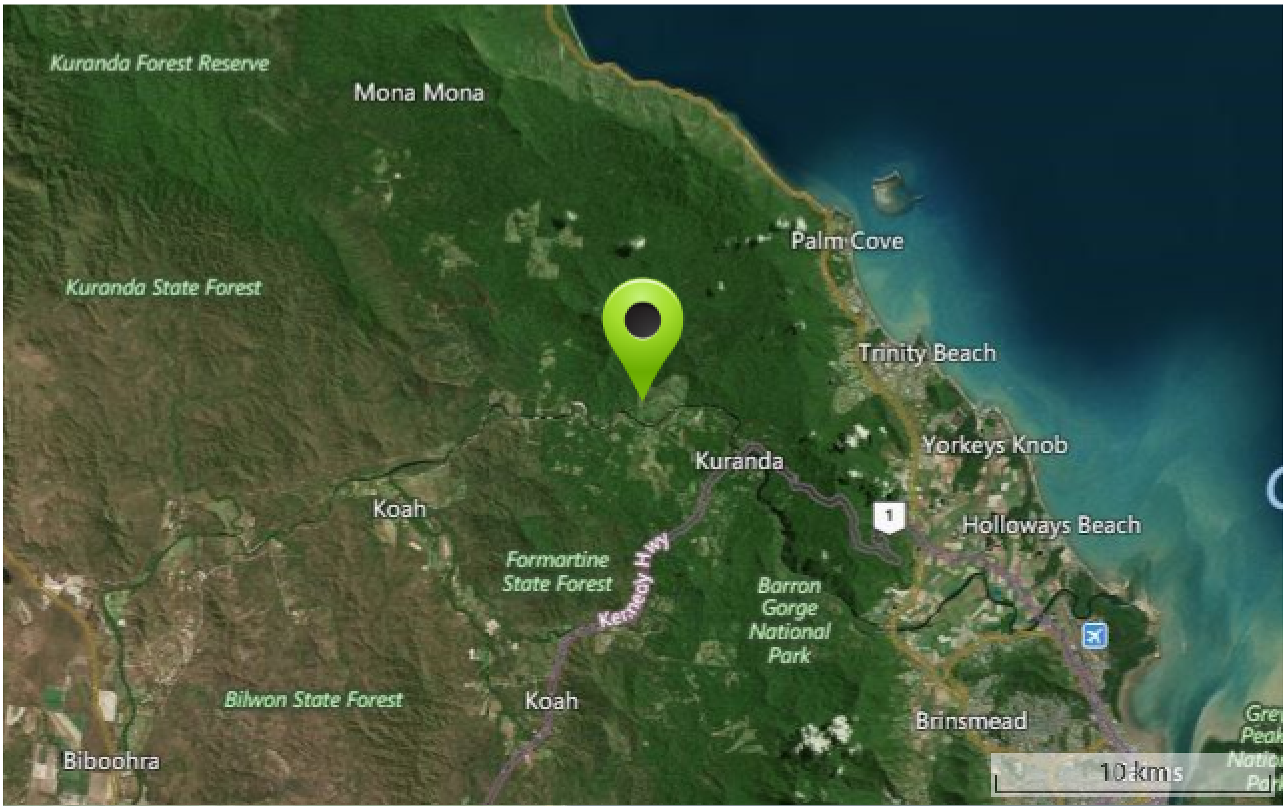
Enterprise: **Kur World**

Description:
Stage 2 High range 56ha Golf and amenity full run

Client: **Reever and Ocean**

MEDLI User: NATRES\andrew

Scenario Details:
low range ADWF, average infiltration efficiency, Full run
N 5mg/L, P 1 mg/L, TDS 580 mg 73% TON, 2% NH4-N, 25% Org N
5 ML tank and 19 ML dam
5mm SMD to UDL. Irrigation allowed on days with up to 3 mm rainfall. Coastal couch as amenity grass (kickstarted) assumed for golf course and amenity planting - 56ha
No additional nutrient addition to account for return of clippings

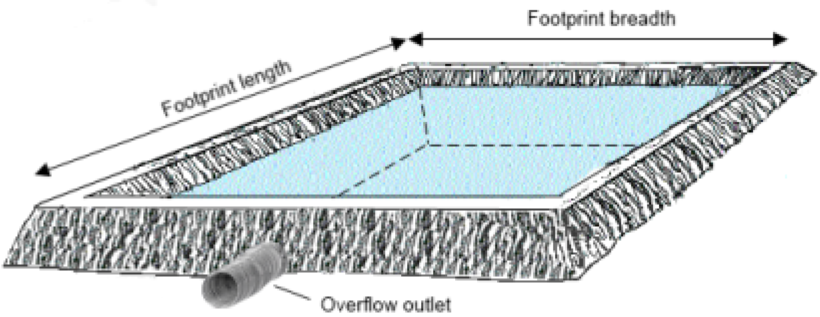


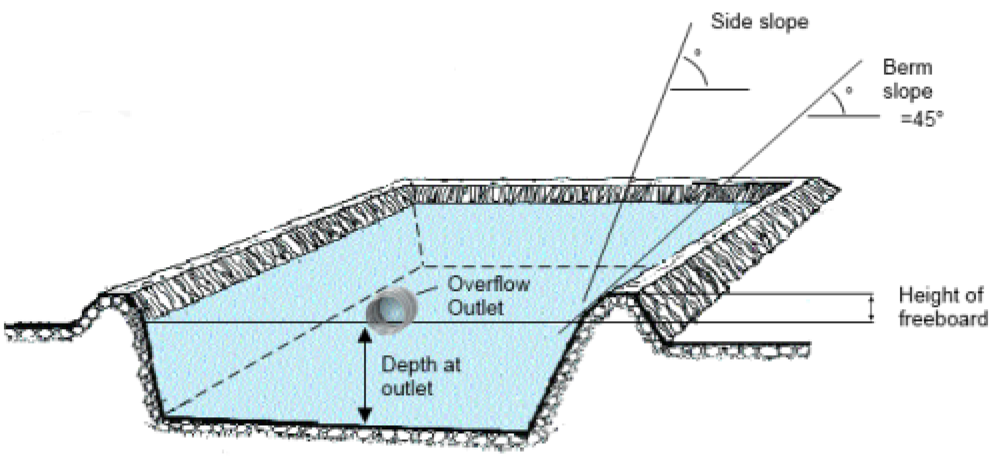
DESCRIPTION

Pond system: 2 facultative, aerobic or storage ponds

Pond system details:

	Pond 1	Pond 2
Maximum pond volume (ML)	5.00	19.00
Minimum allowable pond volume (ML)	0.00	6.77
Pond depth at overflow outlet (m)	4.00	4.50
Maximum water surface area (m2)	1250.00	5794.53
Pond footprint length (m)	35.36	135.05
Pond footprint width (m)	35.36	47.15
Pond catchment area (m2)	1250.00	6367.31
Average active volume (ML)	5.00	9.63





Irrigation pump limits:

Minimum pump rate limit (ML/day)	0.00
Maximum pump rate limit (ML/day)	100.00

Shandying water:

Annual allocation of fresh water available for shandying (ML/year)	0.00
Maximum rate of application of fresh water (ML/day)	0.00
Nitrogen concentration (mg/L)	0.00
Salinity (dS/m)	0.00
Minimum shandy water is used	False

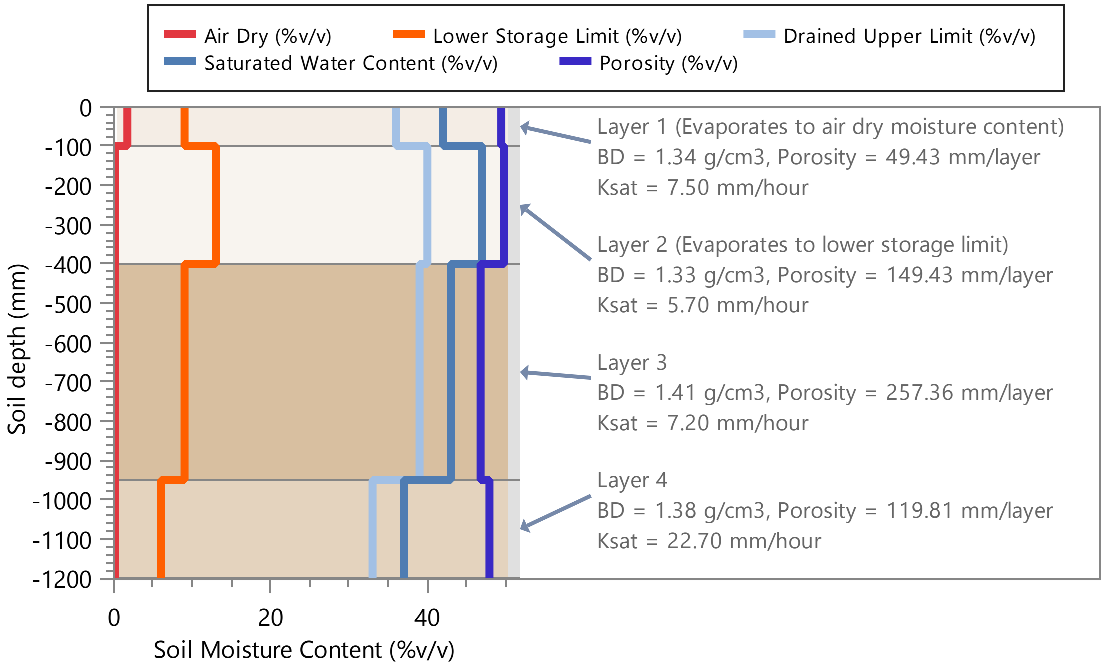
DESCRIPTION

Land: New Paddock

Area (ha): 56.00

Soil Type: Bicton (Kur-World), 1200.00 mm defined profile depth

Profile Porosity (mm)	576.04
Profile saturation water content (mm)	512.00
Profile drained upper limit (or field capacity) (mm)	453.00
Profile lower storage limit (or permanent wilting point) (mm)	112.50
Profile available water capacity (mm)	340.50
Profile limiting saturated hydraulic conductivity (mm/hour)	5.70
Surface saturated hydraulic conductivity (mm/hour)	7.50
Runoff curve number II (coefficient)	80.00
Soil evaporation U (mm)	8.50
Soil evaporation Cona (mm/sqrt day)	3.75



Plant Data: Continuous Coastal Couch Grass (Cynodon dactylon) Pasture_mod golf, kick started

Average monthly cover (fraction) (minimum - maximum)	1.00 (0.99 - 1.00)
Maximum crop factor at 100% cover (mm/mm) (Maximum crop coefficient 0.8 x Pan coefficient 1)	0.80
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Maximum potential root depth in defined soil profile (mm)	800.00
Salt tolerance	Tolerant
Salinity threshold EC sat. ext. (dS/m)	6.90
Proportion of yield decrease per dS/m increase (fraction/dS/m)	0.06

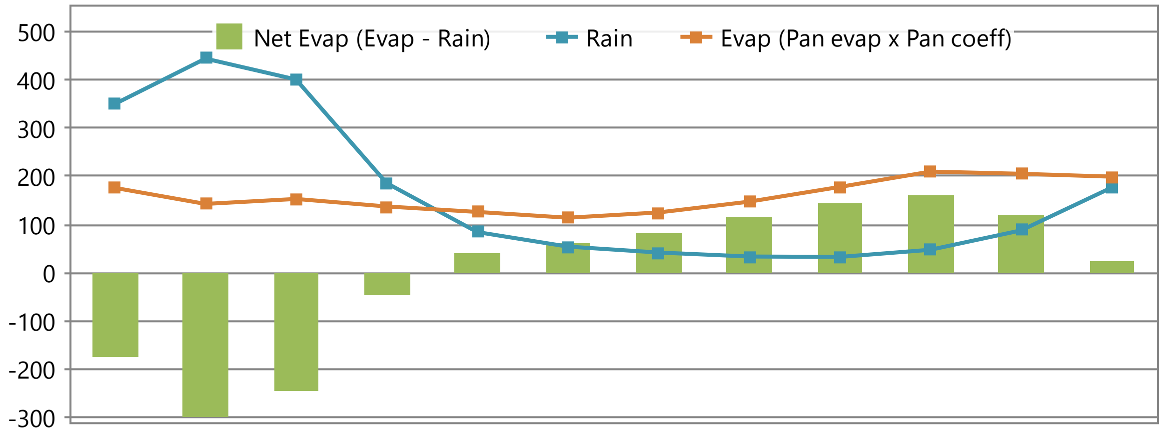
DIAGNOSTICS

Sustainability Diagnostics: Kur World

Averaged Historical Climate Data Used in Simulation (mm)

Location: KurWorlSTP, -16.8°, 145.6°

Run Period: 01/01/1967 to 31/12/2016 50 years, 0 days



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	349.9	444.0	400.6	185.8	84.3	54.1	41.9	33.6	32.8	47.6	87.8	176.5	1938.9
Evap	176.0	142.7	153.0	137.4	126.0	114.1	125.0	147.4	177.9	209.7	205.2	199.2	1913.4
Net Evap	-173.9	-301.3	-247.6	-48.4	41.8	59.9	83.1	113.8	145.1	162.1	117.4	22.7	-25.5
Net Evap/day	-5.6	-10.7	-8.0	-1.6	1.3	2.0	2.7	3.7	4.8	5.2	3.9	0.7	-0.1

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Pond System: 2 facultative, aerobic or storage ponds

Kur-world Stage 2 Low range - Sept 2017 - 325.28 ML/year or 0.89 ML/day generated on average

Effluent entering pond system after any pretreatment and recycling

Average (Minimum-Maximum) influent quality calculated for 365.26 non-zero flow days, after any pretreatment and recycling.

Constituent	Concentration (mg/L)	Load (kg/year)
Total Nitrogen	4.16 (0.34 - 5.00)	1351.59 (1350.63 - 1354.33)
Total Phosphorus	0.83 (0.07 - 1.00)	270.32 (270.13 - 270.87)
Total Dissolved Salts	482.00 (39.55 - 580.00)	156784.42 (156672.82 - 157102.06)
Volatile Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Total Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)

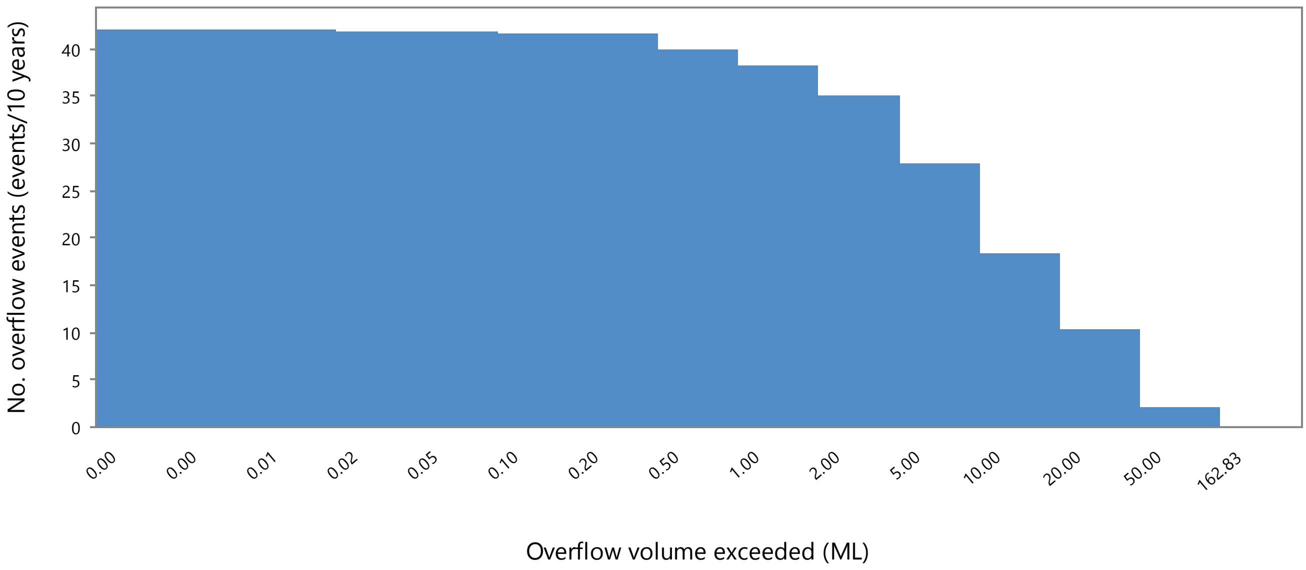
Last pond (Wet weather store): 19.00 ML

Theoretical hydraulic retention time (days)	21.34
Average volume of overflow (ML/year)	61.96
No. overflow events per year exceeding threshold* of 0.00 ML (no./year)	4.20
Average duration of overflow (days)	11.52
Effluent Reuse (Proportion of Inflow + Net Rain Gain that is Irrigated) (fraction)	0.81
Probability of at least 90% effluent reuse (fraction)	0.25
Average salinity of last pond (dS/m)	0.73
Salinity of last pond on final day of simulation (dS/m)	0.85
Ammonia loss from pond system water area (kg/m2/year)	0.00

* The threshold is the volume equivalent to the top 1 mm depth of water of a full pond

Overflow exceedance:

■ Chart ☐ Table



Export plot

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Irrigation Information

Irrigation: 56 ha total area (assumed 100% irrigation efficiency)

	Quantity/year	Quantity/ha/year
Total irrigation applied (ML)	269.12	4.81
Total nitrogen applied (kg)	1169.88	20.89
Total phosphorus applied (kg)	234.92	4.19
Total salts applied (kg)	136251.36	2433.06

Shandying

Annual allocation of fresh water for shandying (ML/year)	0.00
Average Shandy water irrigation (ML/year) (minimum - maximum)	0.00 (0.00 - 0.00)
Average exceedance as a proportion of annual shandy water allocation (% of allocation) (minimum - maximum)	0.00 (0.00 - 0.00)
Proportion of irrigation events requiring shandying (fraction of events)	0.00
Minimum shandy water is used	False

Irrigation Issues

Proportion of Days irrigation is prevented when triggered (fraction)	0.25
Proportion of Days water demand is too small to trigger irrigation (fraction)	0.14
Proportion of Days irrigation occurs (fraction)	0.62

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Land: New Paddock: 56 ha

Irrigation: Fixed Sprinkler with 0.2% ammonium loss during irrigation

Irrigation triggered when soil water deficit reaches 5.00 mm and rainfall is less than or equal to 3.00 mm
Irrigate up to a soil water content of drained upper limit plus 0.00 mm
Irrigation window from 1/1 to 31/12 including the days specified
A minimum of 0 days must be skipped between irrigation events

Soil Water Balance (mm): Bicton (Kur-World), 228.00 mm PAWC at maximum root depth

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	349.9	444.0	400.6	185.8	84.3	54.1	41.9	33.6	32.8	47.6	87.8	176.5	1938.9
Irrigation	40.8	25.3	34.1	37.1	43.2	43.9	43.4	41.8	41.2	42.9	42.9	44.0	480.6
Soil Evap	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Transpn.	127.5	112.4	120.9	109.7	100.8	91.2	100.0	117.9	138.6	139.8	110.4	121.8	1391.1
Rain Runoff	114.2	160.4	154.4	39.5	6.8	3.0	1.7	0.6	1.8	2.3	5.8	31.8	522.4
Irr. Runoff	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Drainage	59.6	148.6	159.1	79.1	30.2	13.9	6.9	1.7	0.1	0.6	0.3	10.8	510.9
Delta	89.5	47.9	0.2	-5.5	-10.4	-10.1	-23.3	-44.7	-66.6	-52.3	14.2	56.0	-5.0

Soil Nitrogen Balance

Average annual effluent nitrogen added (kg/ha/year)	20.89
Average annual soil nitrogen removed by plant uptake (kg/ha/year)	93.62
Average annual soil nitrogen removed by denitrification (kg/ha/year)	0.01
Average annual soil nitrogen leached (kg/ha/year)	1.20
Average annual nitrate-N loading to groundwater (kg/ha/year)	1.20
Soil organic-N kg/ha (Initial - Final)	3809.50 - 187.42
	74.41 - 0.02
Average nitrate-N concentration of deep drainage (mg/L)	0.23
Max. annual nitrate-N concentration of deep drainage (mg/L)	8.47

Soil Phosphorus Balance

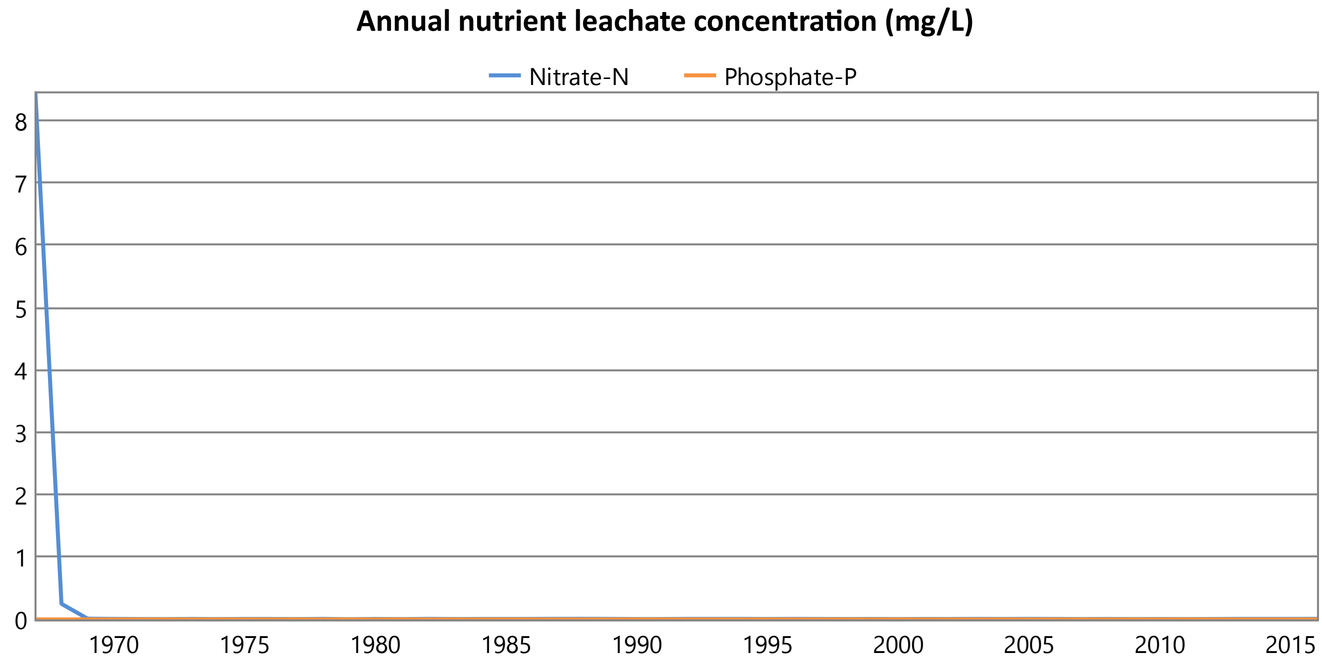
Average annual effluent phosphorus added (kg/ha/year)	4.19
Average annual soil phosphorus removed by plant uptake (kg/ha/year)	1.80E-03
Average annual soil phosphorus leached (kg/ha/year)	3.63E-04
Dissolved phosphorus (kg/ha) (Initial - Final)	2.86E-04 - 1.04E-03
Adsorbed phosphorus (kg/ha) (Initial - Final)	450.65 - 662.15
Average phosphate-P concentration in rootzone (mg/L)	1.99E-04
Average phosphate-P concentration of deep drainage (mg/L)	7.10E-05
Max. annual phosphate-P concentration of deep drainage (mg/L)	7.96E-05
Design soil profile storage life based on average infiltrated water phosphorus concn. of 0.22 mg/L (years)	999.90

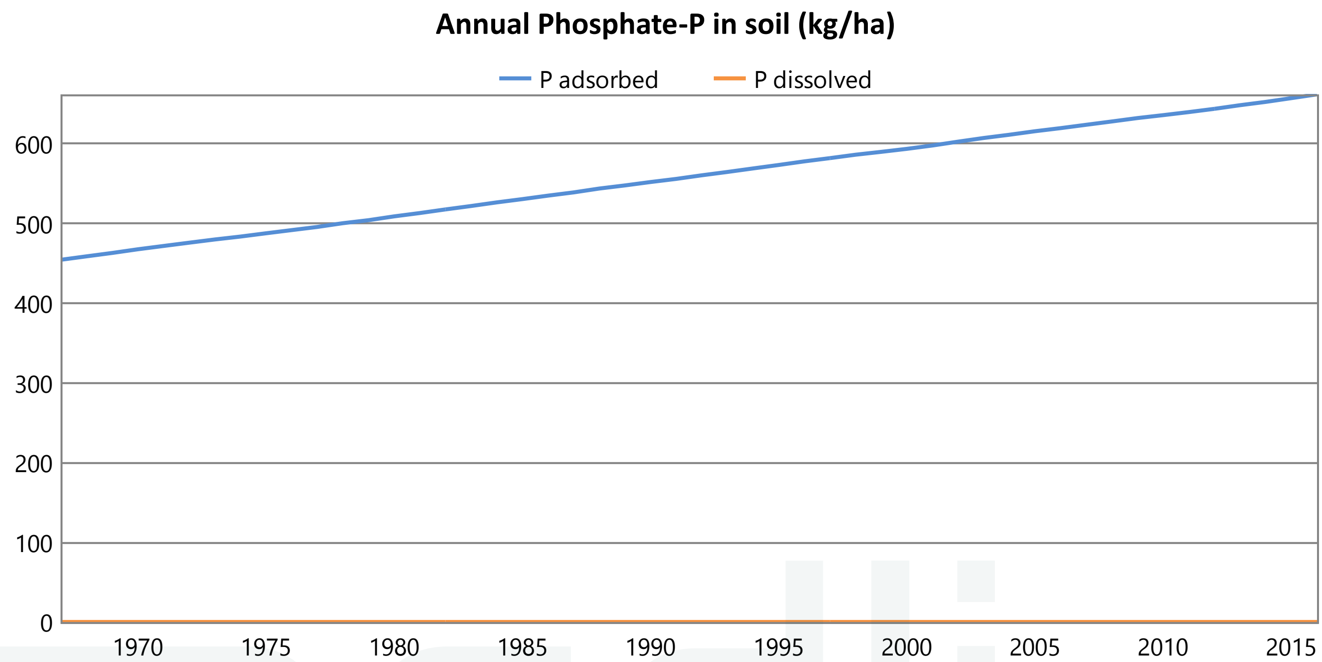
DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Land: New Paddock: 56 ha

Irrigation: Fixed Sprinkler with 0.2% ammonium loss during irrigation





DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Plant Performance: New Paddock: 56 ha

Average Plant Performance (Minimum - Maximum): Continuous Coastal Couch Grass (Cynodon dactylon) Pasture_mod golf, kick started

Average annual shoot dry matter yield (kg/ha/year)	8979.41 (4955.02 - 15752.08)
Average monthly plant (green) cover (fraction)	1.00 (0.99 - 1.00)
Average monthly crop factor (fraction)	0.80 (0.79 - 0.80)
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Average monthly root depth (mm)	799.36 (792.32 - 800.00)
Average number of normal harvests per year (no./year)	6.30 (3.00 - 11.00)
Average number of normal harvests for last five years only (no./year)	3.60
Average number of crop deaths per year (no./year)	0.00 (0.00 - 0.00)
Average number of crop deaths for last five years only (no./year)	0.00
Average annual nitrogen deficiency index (0 = no stress, 1 = full stress) (coefficient)	0.61 (0.18 - 0.79)
Average January temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.02 (0.00 - 0.07)
Average July temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.20 (0.00 - 0.41)
Average monthly water stress index (0 = no stress, 1 = full stress) (coefficient)	0.07 (0.00 - 0.31)
Average monthly waterlogging index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.00)
No. days without crop/year (days)	0.00

Soil Salinity - Plant salinity tolerance: Tolerant

Assumes 1.0 dS/m Electrical Conductivity = 640 mg/L Total Dissolved Salts
All values based on 10 year running averages

Salinity of infiltrated water (Average salinity of rainwater = 0.03 dS/m) (dS/m)	0.22
Salt added by rainfall (kg/ha/year)	271.97
Average annual effluent salt added & leached at steady state (kg/ha/year)	2705.03
Average leaching fraction based on 10 year running averages (fraction)	0.47
Average water-uptake-weighted rootzone salinity sat. ext. (dS/m)	0.22
Salinity of the soil solution (at drained upper limit) at base of rootzone (dS/m)	0.83
Relative crop yield expected due to salinity (fraction)	1.00
Proportion of years that crop yields would be expected to fall below 90% of potential due to salinity (fraction)	0.00

DIAGNOSTICS

Run Messages

Messages generated when the scenario was run:

Full run chosen

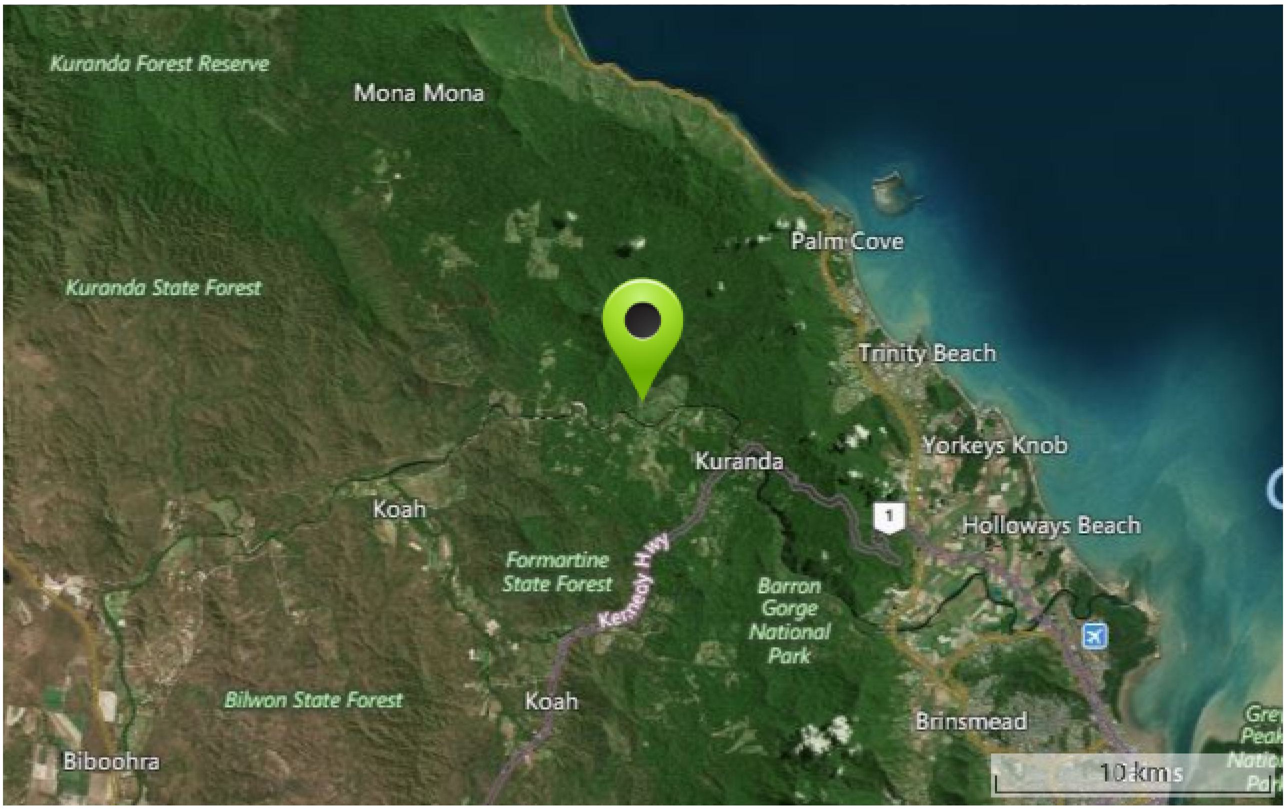
Enterprise: Kur World

Description:
Stage 2 low range, low ingress 56ha Golf and amenity clippings returned simulation full run

Client: Reever and Ocean

MEDLI User: NATRES\andrew

Scenario Details:
low range ADWF, low infiltration efficiency, Full run
WWTP design specs:N 5mg/L, P 1 mg/L, TDS 580 mg 73% TON, 2% NH4-N, 25% Org N.
Adjusted to include clipping from maximum N and P offtake in full run scenario. Assumes 75% clippings N will be mineralised on retunr rate and all clippings returnd as organic N,resulting in:
TN 44.00 mg/L, TP 1.01 mg/L, TDS 580mg/L, 8.3% TON, 0.2% NH4-N, 91.5 Org N
5 ML tank and 19 ML dam
5mm SMD to UDL. Irrigation allowed on days with up to 3 mm rainfall. Coastal couch as amenity grass (kickstarted) assumed for golf course and amenity planting - 56ha

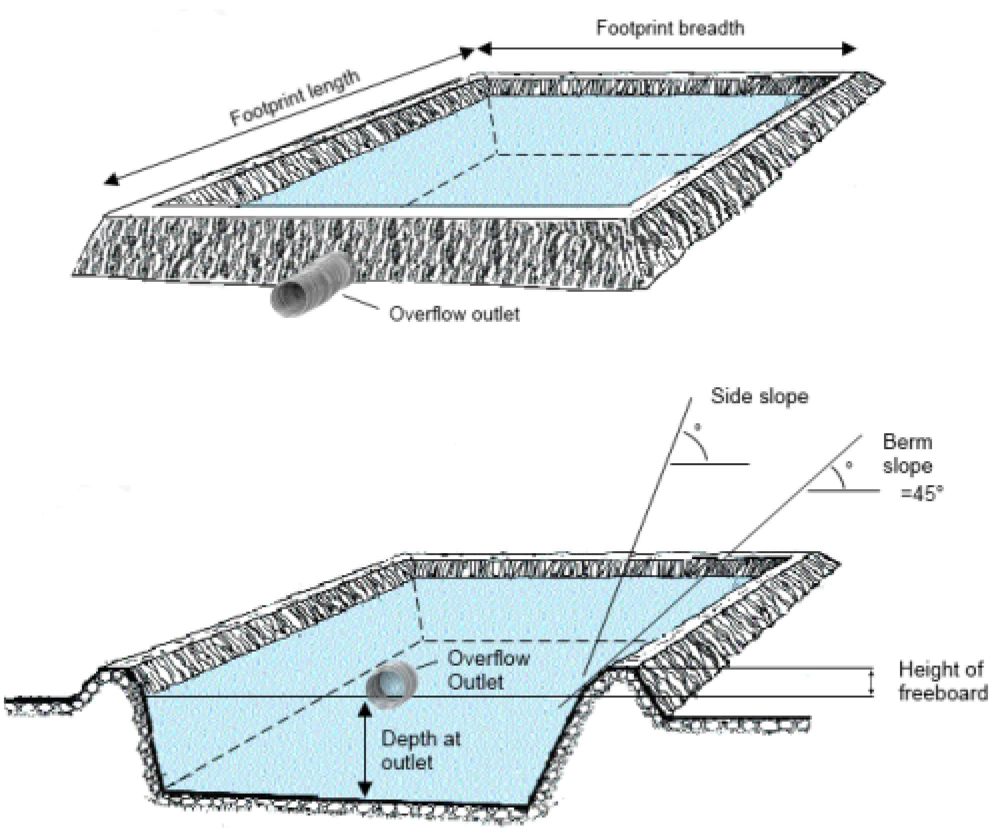


DESCRIPTION

Pond system: 2 facultative, aerobic or storage ponds

Pond system details:

	Pond 1	Pond 2
Maximum pond volume (ML)	5.00	19.00
Minimum allowable pond volume (ML)	0.00	6.77
Pond depth at overflow outlet (m)	4.00	4.50
Maximum water surface area (m2)	1250.00	5794.53
Pond footprint length (m)	35.36	135.05
Pond footprint width (m)	35.36	47.15
Pond catchment area (m2)	1250.00	6367.31
Average active volume (ML)	5.00	9.44



Irrigation pump limits:

Minimum pump rate limit (ML/day)	0.00
Maximum pump rate limit (ML/day)	500.00

Shandying water:

Annual allocation of fresh water available for shandying (ML/year)	0.00
Maximum rate of application of fresh water (ML/day)	0.00
Nitrogen concentration (mg/L)	0.00
Salinity (dS/m)	0.00
Minimum shandy water is used	False

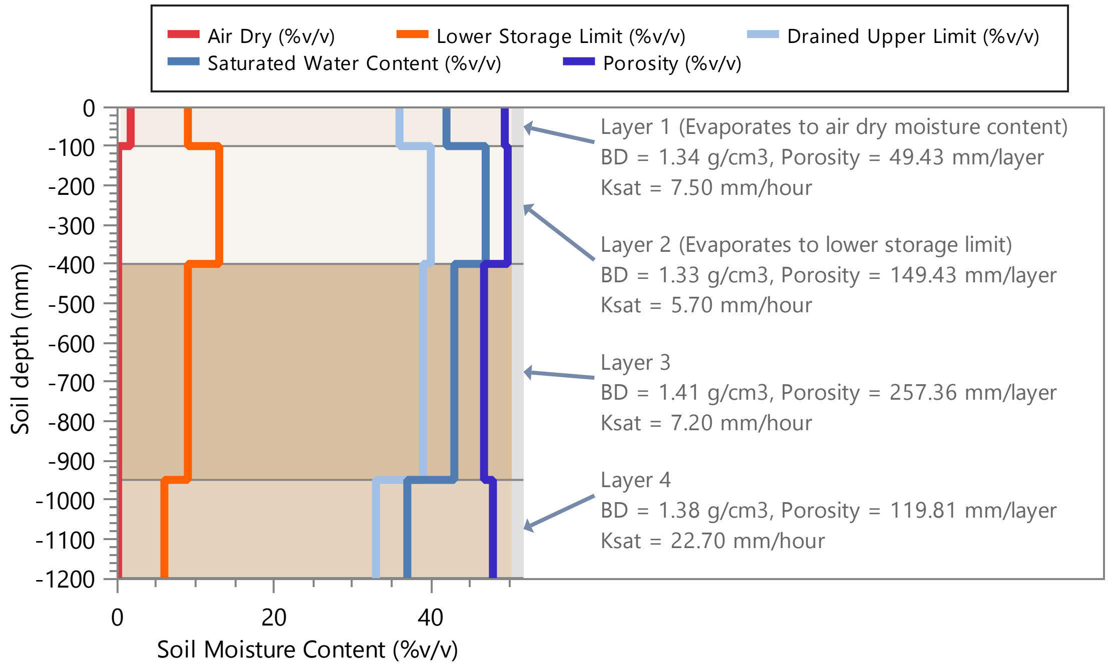
DESCRIPTION

Land: New Paddock

Area (ha): 56.00

Soil Type: Bicton (Kur-World), 1200.00 mm defined profile depth

Profile Porosity (mm)	576.04
Profile saturation water content (mm)	512.00
Profile drained upper limit (or field capacity) (mm)	453.00
Profile lower storage limit (or permanent wilting point) (mm)	112.50
Profile available water capacity (mm)	340.50
Profile limiting saturated hydraulic conductivity (mm/hour)	5.70
Surface saturated hydraulic conductivity (mm/hour)	7.50
Runoff curve number II (coefficient)	80.00
Soil evaporation U (mm)	8.50
Soil evaporation Cona (mm/sqrt day)	3.75



Plant Data: Continuous Coastal Couch Grass (Cynodon dactylon) Pasture_mod golf, kick started

Average monthly cover (fraction) (minimum - maximum)	1.00 (0.99 - 1.00)
Maximum crop factor at 100% cover (mm/mm) (Maximum crop coefficient 0.8 x Pan coefficient 1)	0.80
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Maximum potential root depth in defined soil profile (mm)	800.00
Salt tolerance	Tolerant
Salinity threshold EC sat. ext. (dS/m)	6.90
Proportion of yield decrease per dS/m increase (fraction/dS/m)	0.06

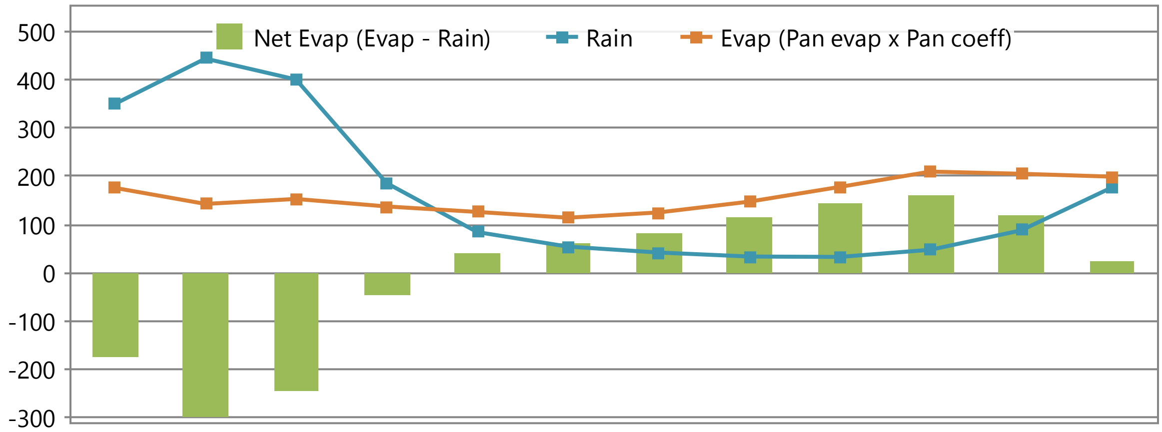
DIAGNOSTICS

Sustainability Diagnostics: Kur World

Averaged Historical Climate Data Used in Simulation (mm)

Location: KurWorlSTP, -16.8°, 145.6°

Run Period: 01/01/1967 to 31/12/2016 50 years, 0 days



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	349.9	444.0	400.6	185.8	84.3	54.1	41.9	33.6	32.8	47.6	87.8	176.5	1938.9
Evap	176.0	142.7	153.0	137.4	126.0	114.1	125.0	147.4	177.9	209.7	205.2	199.2	1913.4
Net Evap	-173.9	-301.3	-247.6	-48.4	41.8	59.9	83.1	113.8	145.1	162.1	117.4	22.7	-25.5
Net Evap/day	-5.6	-10.7	-8.0	-1.6	1.3	2.0	2.7	3.7	4.8	5.2	3.9	0.7	-0.1

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Pond System: 2 facultative, aerobic or storage ponds

Kur-world Stage 2 Low range, low ingress, added clippings - Sept 2017 - 298.01 ML/year or 0.82 ML/day generated on average

Effluent entering pond system after any pretreatment and recycling

Average (Minimum-Maximum) influent quality calculated for 365.26 non-zero flow days, after any pretreatment and recycling.

Constituent	Concentration (mg/L)	Load (kg/year)
Total Nitrogen	39.91 (5.60 - 44.00)	11893.99 (11885.52 - 11918.09)
Total Phosphorus	0.92 (0.13 - 1.01)	273.02 (272.83 - 273.57)
Total Dissolved Salts	526.10 (73.77 - 580.00)	156784.42 (156672.82 - 157102.06)
Volatile Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Total Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)

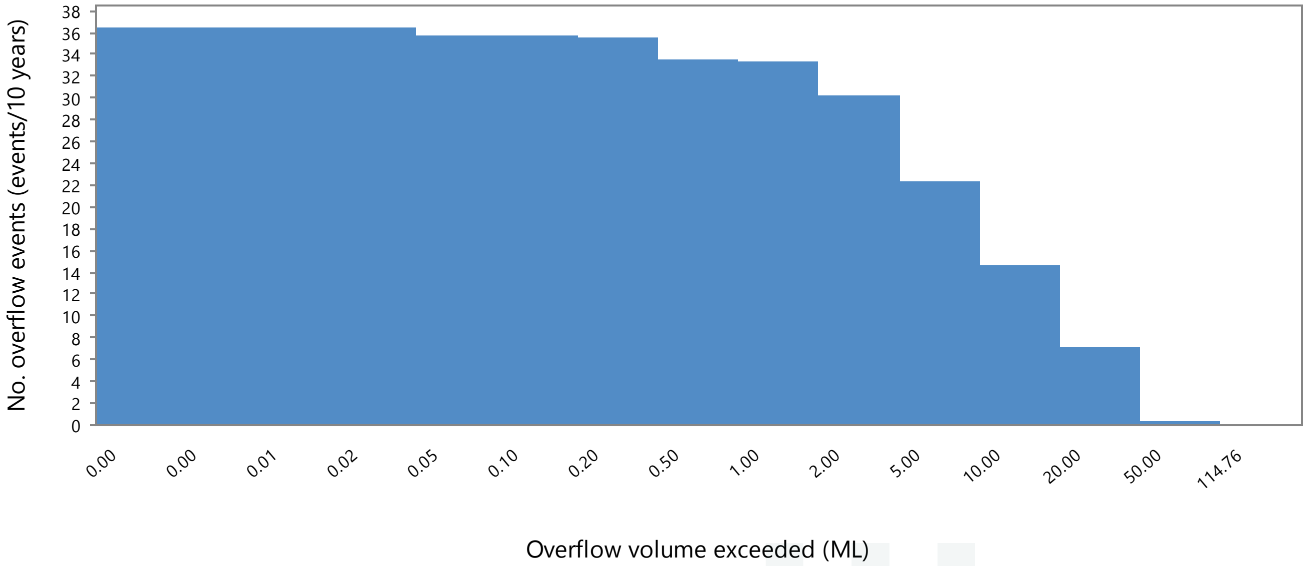
Last pond (Wet weather store): 19.00 ML

Theoretical hydraulic retention time (days)	23.29
Average volume of overflow (ML/year)	43.43
No. overflow events per year exceeding threshold* of 0.00 ML (no./year)	3.64
Average duration of overflow (days)	11.59
Effluent Reuse (Proportion of Inflow + Net Rain Gain that is Irrigated) (fraction)	0.86
Probability of at least 90% effluent reuse (fraction)	0.30
Average salinity of last pond (dS/m)	0.79
Salinity of last pond on final day of simulation (dS/m)	0.88
Ammonia loss from pond system water area (kg/m2/year)	0.00

* The threshold is the volume equivalent to the top 1 mm depth of water of a full pond

Overflow exceedance:

Chart Table



Export plot

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Irrigation Information

Irrigation: 56 ha total area (assumed 100% irrigation efficiency)

	Quantity/year	Quantity/ha/year
Total irrigation applied (ML)	260.42	4.65
Total nitrogen applied (kg)	10565.04	188.66
Total phosphorus applied (kg)	242.61	4.33
Total salts applied (kg)	139322.21	2487.90

Shandying

Annual allocation of fresh water for shandying (ML/year)	0.00
Average Shandy water irrigation (ML/year) (minimum - maximum)	0.00 (0.00 - 0.00)
Average exceedance as a proportion of annual shandy water allocation (% of allocation) (minimum - maximum)	0.00 (0.00 - 0.00)
Proportion of irrigation events requiring shandying (fraction of events)	0.00
Minimum shandy water is used	False

Irrigation Issues

Proportion of Days irrigation is prevented when triggered (fraction)	0.25
Proportion of Days water demand is too small to trigger irrigation (fraction)	0.13
Proportion of Days irrigation occurs (fraction)	0.62

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Land: New Paddock: 56 ha

Irrigation: Fixed Sprinkler with 0.2% ammonium loss during irrigation

Irrigation triggered when soil water deficit reaches 5.00 mm and rainfall is less than or equal to 3.00 mm
Irrigate up to a soil water content of drained upper limit plus 0.00 mm
Irrigation window from 1/1 to 31/12 including the days specified
A minimum of 0 days must be skipped between irrigation events

Soil Water Balance (mm): Bicton (Kur-World), 228.00 mm PAWC at maximum root depth

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	349.9	444.0	400.6	185.8	84.3	54.1	41.9	33.6	32.8	47.6	87.8	176.5	1938.9
Irrigation	37.7	24.1	33.5	36.4	42.1	42.8	42.4	41.1	40.3	41.7	41.0	41.9	465.0
Soil Evap	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Transpn.	127.1	112.1	120.9	109.7	100.8	91.2	100.0	117.9	138.3	138.4	108.7	121.0	1386.2
Rain Runoff	113.6	160.0	154.2	39.5	6.7	3.0	1.7	0.6	1.8	2.2	5.7	31.5	520.5
Irr. Runoff	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Drainage	57.9	145.9	157.7	78.8	29.5	13.2	6.5	1.6	0.1	0.6	0.2	10.3	502.2
Delta	89.1	50.1	1.3	-5.7	-10.6	-10.6	-24.0	-45.3	-67.1	-52.0	14.1	55.6	-5.0

Soil Nitrogen Balance

Average annual effluent nitrogen added (kg/ha/year)	188.66
Average annual soil nitrogen removed by plant uptake (kg/ha/year)	258.35
Average annual soil nitrogen removed by denitrification (kg/ha/year)	0.03
Average annual soil nitrogen leached (kg/ha/year)	1.40
Average annual nitrate-N loading to groundwater (kg/ha/year)	1.40
Soil organic-N kg/ha (Initial - Final)	3809.50 - 329.20
	74.41 - 0.02
Average nitrate-N concentration of deep drainage (mg/L)	0.28
Max. annual nitrate-N concentration of deep drainage (mg/L)	8.69

Soil Phosphorus Balance

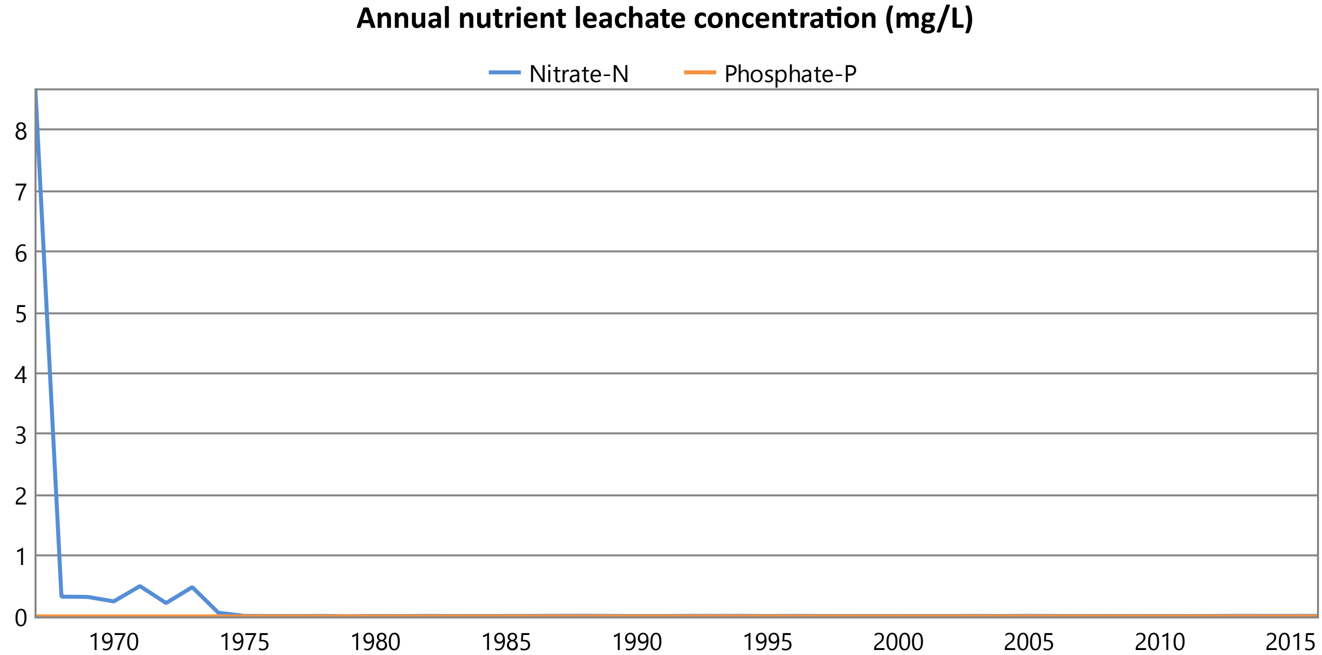
Average annual effluent phosphorus added (kg/ha/year)	4.33
Average annual soil phosphorus removed by plant uptake (kg/ha/year)	1.80E-03
Average annual soil phosphorus leached (kg/ha/year)	3.59E-04
Dissolved phosphorus (kg/ha) (Initial - Final)	2.86E-04 - 6.69E-04
Adsorbed phosphorus (kg/ha) (Initial - Final)	450.65 - 669.04
Average phosphate-P concentration in rootzone (mg/L)	2.11E-04
Average phosphate-P concentration of deep drainage (mg/L)	7.14E-05
Max. annual phosphate-P concentration of deep drainage (mg/L)	1.20E-04
Design soil profile storage life based on average infiltrated water phosphorus concn. of 0.23 mg/L (years)	999.90

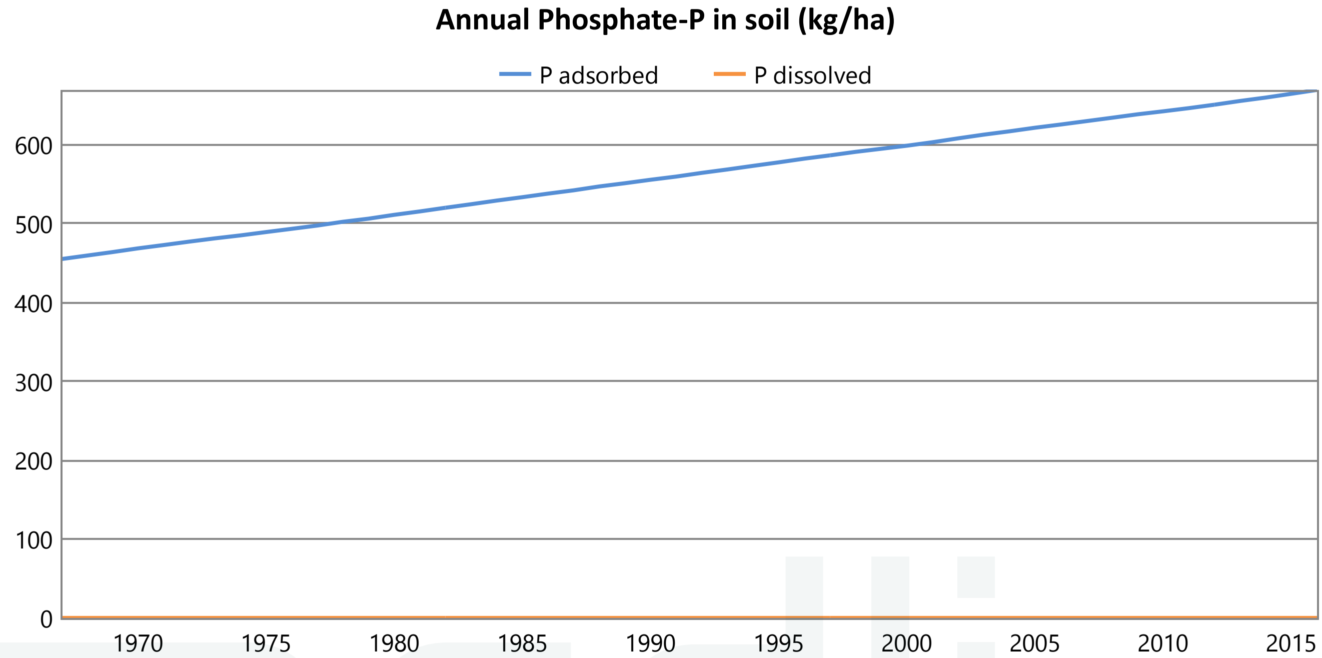
DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Land: New Paddock: 56 ha

Irrigation: Fixed Sprinkler with 0.2% ammonium loss during irrigation





DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Plant Performance: New Paddock: 56 ha

Average Plant Performance (Minimum - Maximum): Continuous Coastal Couch Grass (Cynodon dactylon) Pasture_mod golf, kick started

Average annual shoot dry matter yield (kg/ha/year)	16484.57 (13468.50 - 20125.74)
Average monthly plant (green) cover (fraction)	1.00 (0.99 - 1.00)
Average monthly crop factor (fraction)	0.80 (0.79 - 0.80)
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Average monthly root depth (mm)	799.36 (792.32 - 800.00)
Average number of normal harvests per year (no./year)	11.52 (9.00 - 14.00)
Average number of normal harvests for last five years only (no./year)	10.40
Average number of crop deaths per year (no./year)	0.00 (0.00 - 0.00)
Average number of crop deaths for last five years only (no./year)	0.00
Average annual nitrogen deficiency index (0 = no stress, 1 = full stress) (coefficient)	0.26 (0.05 - 0.42)
Average January temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.02 (0.00 - 0.07)
Average July temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.20 (0.00 - 0.41)
Average monthly water stress index (0 = no stress, 1 = full stress) (coefficient)	0.07 (0.00 - 0.32)
Average monthly waterlogging index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.00)
No. days without crop/year (days)	0.00

Soil Salinity - Plant salinity tolerance: Tolerant

Assumes 1.0 dS/m Electrical Conductivity = 640 mg/L Total Dissolved Salts
All values based on 10 year running averages

Salinity of infiltrated water (Average salinity of rainwater = 0.03 dS/m) (dS/m)	0.23
Salt added by rainfall (kg/ha/year)	272.33
Average annual effluent salt added & leached at steady state (kg/ha/year)	2760.23
Average leaching fraction based on 10 year running averages (fraction)	0.46
Average water-uptake-weighted rootzone salinity sat. ext. (dS/m)	0.22
Salinity of the soil solution (at drained upper limit) at base of rootzone (dS/m)	0.86
Relative crop yield expected due to salinity (fraction)	1.00
Proportion of years that crop yields would be expected to fall below 90% of potential due to salinity (fraction)	0.00

DIAGNOSTICS

Run Messages

Messages generated when the scenario was run:

Full run chosen

MEDLI REPORT - FULL RUN

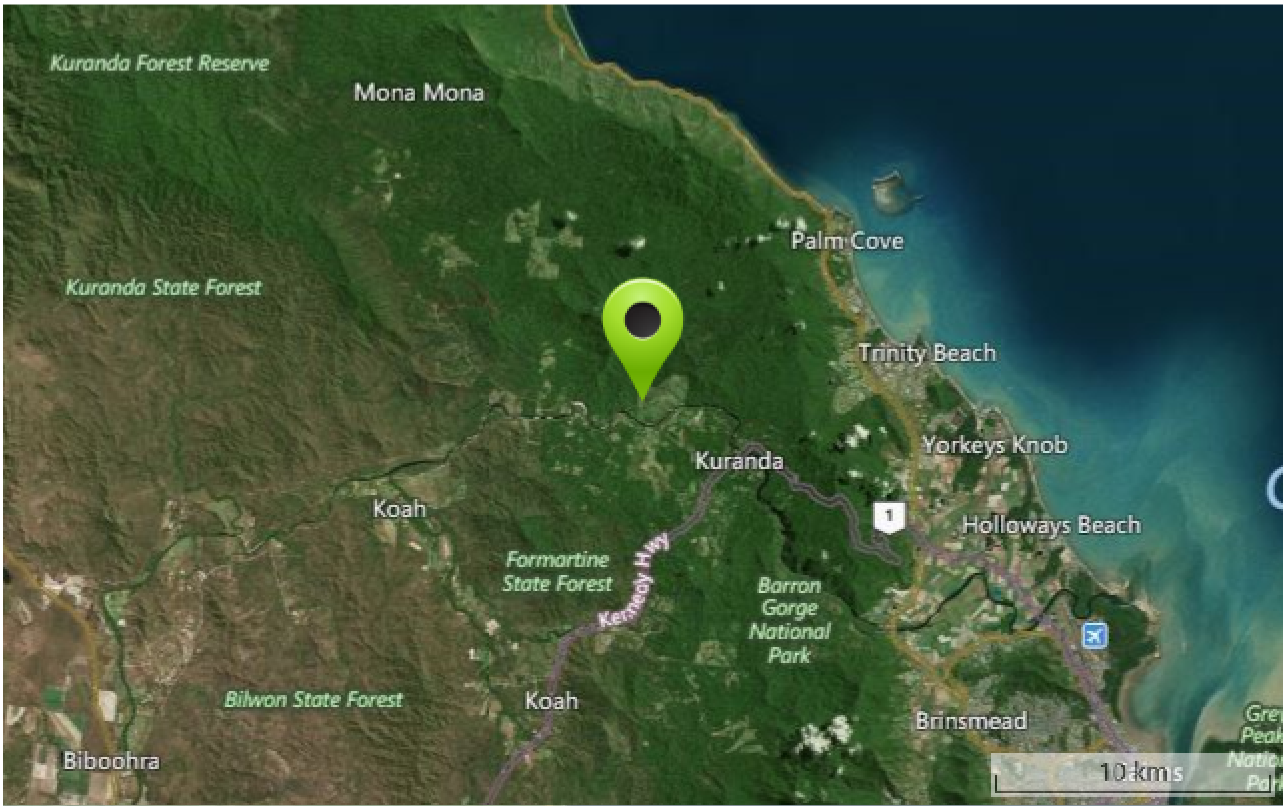
Enterprise: Kur World

Description:
Stage 2 High range low ingress 10% recycled 56ha Golf and amenity full run

Client: Reever and Ocean

MEDLI User: NATRES\andrew

Scenario Details:
High range ADWF, low infiltration efficiency, 10% ADWF recycled (simulated by reduced inflow) Full run
N 5mg/L, P 1 mg/L, TDS 580 mg 73% TON, 2% NH4-N, 25% Org N
5 ML tank and 19 ML dam
5mm SMD to UDL. Irrigation allowed on days with up to 3 mm rainfall. Coastal couch as amenity grass (kickstarted) assumed for golf course and amenity planting - 56ha
No additional nutrient addition to account for return of clippings

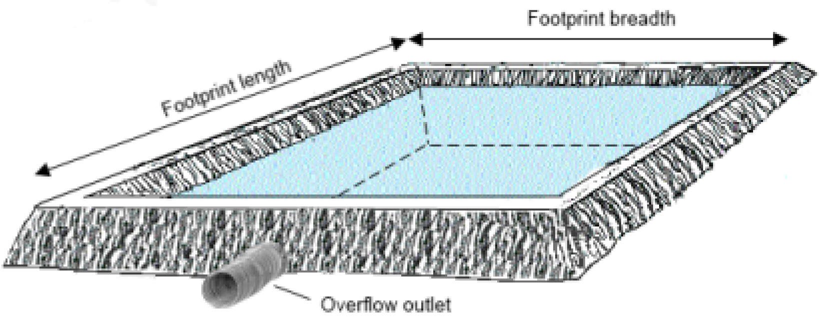


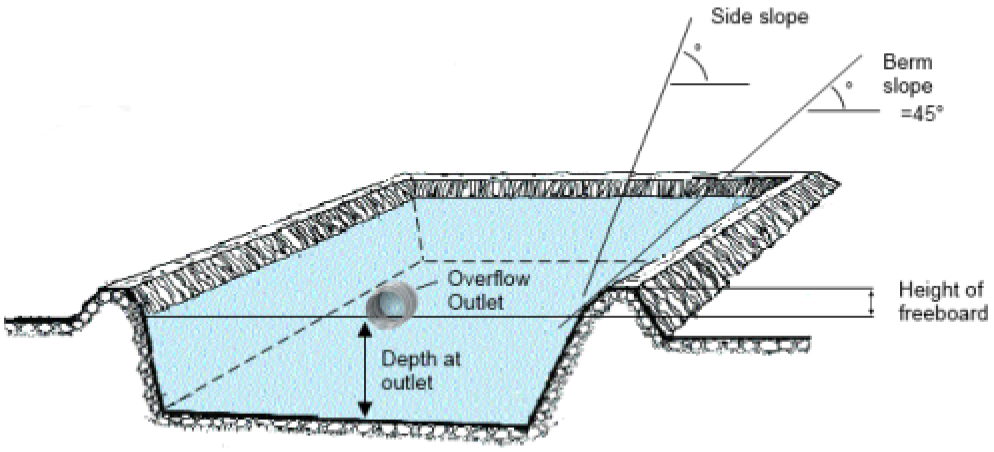
DESCRIPTION

Pond system: 2 facultative, aerobic or storage ponds

Pond system details:

	Pond 1	Pond 2
Maximum pond volume (ML)	5.00	19.00
Minimum allowable pond volume (ML)	0.00	6.77
Pond depth at overflow outlet (m)	4.00	4.50
Maximum water surface area (m2)	1250.00	5794.53
Pond footprint length (m)	35.36	135.05
Pond footprint width (m)	35.36	47.15
Pond catchment area (m2)	1250.00	6367.31
Average active volume (ML)	5.00	12.14





Irrigation pump limits:

Minimum pump rate limit (ML/day)	0.00
Maximum pump rate limit (ML/day)	100.00

Shandying water:

Annual allocation of fresh water available for shandying (ML/year)	0.00
Maximum rate of application of fresh water (ML/day)	0.00
Nitrogen concentration (mg/L)	0.00
Salinity (dS/m)	0.00
Minimum shandy water is used	False

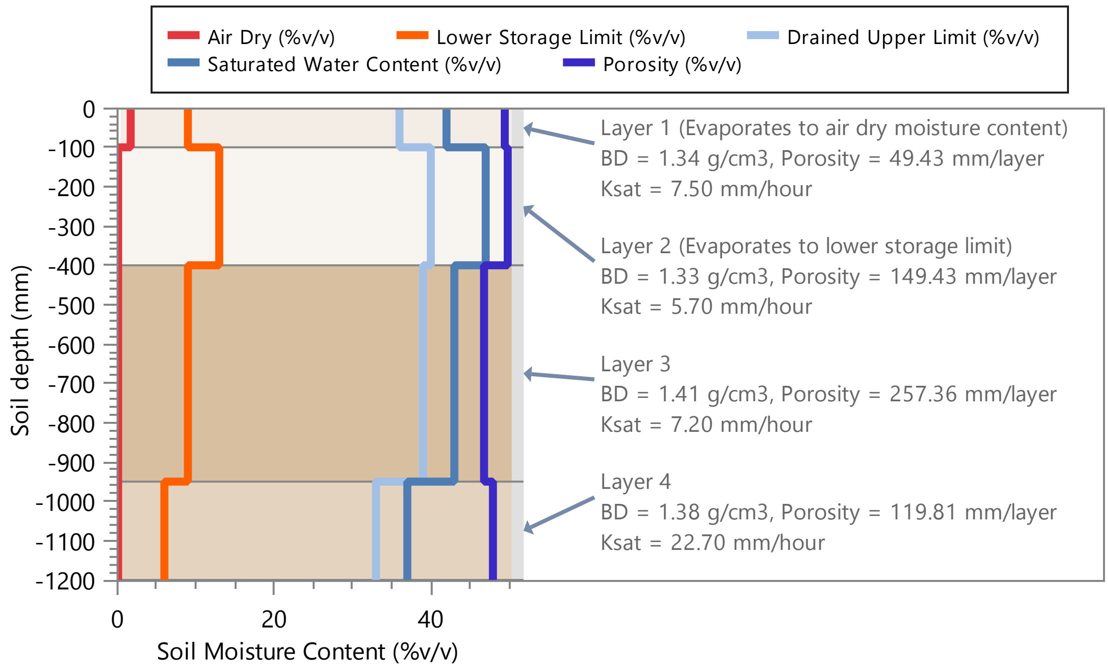
DESCRIPTION

Land: New Paddock

Area (ha): 56.00

Soil Type: Bicton (Kur-World), 1200.00 mm defined profile depth

Profile Porosity (mm)	576.04
Profile saturation water content (mm)	512.00
Profile drained upper limit (or field capacity) (mm)	453.00
Profile lower storage limit (or permanent wilting point) (mm)	112.50
Profile available water capacity (mm)	340.50
Profile limiting saturated hydraulic conductivity (mm/hour)	5.70
Surface saturated hydraulic conductivity (mm/hour)	7.50
Runoff curve number II (coefficient)	80.00
Soil evaporation U (mm)	8.50
Soil evaporation Cona (mm/sqrt day)	3.75



Plant Data: Continuous Coastal Couch Grass (Cynodon dactylon) Pasture_mod golf, kick started

Average monthly cover (fraction) (minimum - maximum)	1.00 (0.99 - 1.00)
Maximum crop factor at 100% cover (mm/mm) (Maximum crop coefficient 0.8 x Pan coefficient 1)	0.80
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Maximum potential root depth in defined soil profile (mm)	800.00
Salt tolerance	Tolerant
Salinity threshold EC sat. ext. (dS/m)	6.90
Proportion of yield decrease per dS/m increase (fraction/dS/m)	0.06

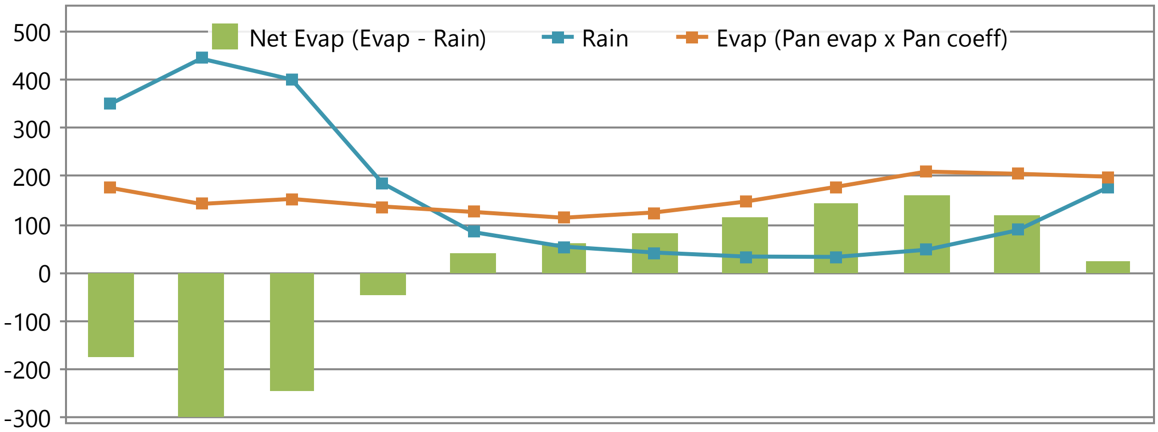
DIAGNOSTICS

Sustainability Diagnostics: Kur World

Averaged Historical Climate Data Used in Simulation (mm)

Location: KurWorlSTP, -16.8°, 145.6°

Run Period: 01/01/1967 to 31/12/2016 50 years, 0 days



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	349.9	444.0	400.6	185.8	84.3	54.1	41.9	33.6	32.8	47.6	87.8	176.5	1938.9
Evap	176.0	142.7	153.0	137.4	126.0	114.1	125.0	147.4	177.9	209.7	205.2	199.2	1913.4
Net Evap	-173.9	-301.3	-247.6	-48.4	41.8	59.9	83.1	113.8	145.1	162.1	117.4	22.7	-25.5
Net Evap/day	-5.6	-10.7	-8.0	-1.6	1.3	2.0	2.7	3.7	4.8	5.2	3.9	0.7	-0.1

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Pond System: 2 facultative, aerobic or storage ponds

Kur-world Stage 2 High range low ingress, 10% recycled- Sept 2017 - 608.85 ML/year or 1.67 ML/day generated on average

Effluent entering pond system after any pretreatment and recycling

Average (Minimum-Maximum) influent quality calculated for 365.26 non-zero flow days, after any pretreatment and recycling.

Constituent	Concentration (mg/L)	Load (kg/year)
Total Nitrogen	4.54 (0.64 - 5.00)	2761.37 (2759.40 - 2766.96)
Total Phosphorus	0.91 (0.13 - 1.00)	552.27 (551.88 - 553.39)
Total Dissolved Salts	526.10 (73.77 - 580.00)	320318.41 (320090.40 - 320967.36)
Volatile Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Total Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)

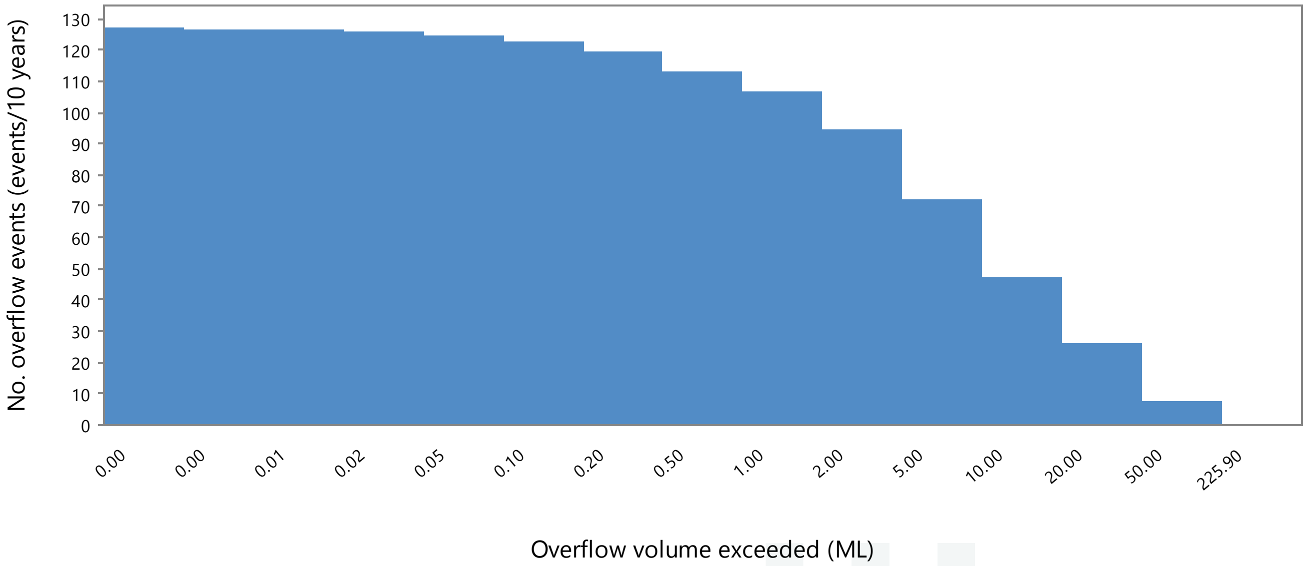
Last pond (Wet weather store): 19.00 ML

Theoretical hydraulic retention time (days)	11.40
Average volume of overflow (ML/year)	176.38
No. overflow events per year exceeding threshold* of 0.00 ML (no./year)	12.68
Average duration of overflow (days)	7.62
Effluent Reuse (Proportion of Inflow + Net Rain Gain that is Irrigated) (fraction)	0.71
Probability of at least 90% effluent reuse (fraction)	0.03
Average salinity of last pond (dS/m)	0.81
Salinity of last pond on final day of simulation (dS/m)	0.89
Ammonia loss from pond system water area (kg/m2/year)	0.00

* The threshold is the volume equivalent to the top 1 mm depth of water of a full pond

Overflow exceedance:

Chart Table



Export plot

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Irrigation Information

Irrigation: 56 ha total area (assumed 100% irrigation efficiency)

	Quantity/year	Quantity/ha/year
Total irrigation applied (ML)	437.76	7.82
Total nitrogen applied (kg)	2066.94	36.91
Total phosphorus applied (kg)	415.05	7.41
Total salts applied (kg)	240728.16	4298.72

Shandying

Annual allocation of fresh water for shandying (ML/year)	0.00
Average Shandy water irrigation (ML/year) (minimum - maximum)	0.00 (0.00 - 0.00)
Average exceedance as a proportion of annual shandy water allocation (% of allocation) (minimum - maximum)	0.00 (0.00 - 0.00)
Proportion of irrigation events requiring shandying (fraction of events)	0.00
Minimum shandy water is used	False

Irrigation Issues

Proportion of Days irrigation is prevented when triggered (fraction)	0.25
Proportion of Days water demand is too small to trigger irrigation (fraction)	0.26
Proportion of Days irrigation occurs (fraction)	0.50

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Land: New Paddock: 56 ha

Irrigation: Fixed Sprinkler with 0.2% ammonium loss during irrigation

Irrigation triggered when soil water deficit reaches 5.00 mm and rainfall is less than or equal to 3.00 mm
Irrigate up to a soil water content of drained upper limit plus 0.00 mm
Irrigation window from 1/1 to 31/12 including the days specified
A minimum of 0 days must be skipped between irrigation events

Soil Water Balance (mm): Bicton (Kur-World), 228.00 mm PAWC at maximum root depth

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	349.9	444.0	400.6	185.8	84.3	54.1	41.9	33.6	32.8	47.6	87.8	176.5	1938.9
Irrigation	57.8	30.8	43.2	47.9	58.2	62.1	73.9	83.5	82.0	83.3	79.9	79.1	781.7
Soil Evap	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Transpn.	136.1	114.1	121.1	109.7	100.8	91.2	100.0	117.9	142.3	167.7	162.2	155.2	1518.4
Rain Runoff	124.1	163.9	157.2	40.5	7.1	3.3	2.1	1.1	2.4	4.1	10.6	40.1	556.6
Irr. Runoff	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Drainage	93.4	174.1	170.3	86.6	38.7	20.8	17.7	6.7	5.1	3.9	3.8	28.8	649.9
Delta	54.1	22.7	-4.8	-3.1	-4.1	0.9	-4.0	-8.6	-35.1	-44.9	-8.9	31.5	-4.3

Soil Nitrogen Balance

Average annual effluent nitrogen added (kg/ha/year)	36.91
Average annual soil nitrogen removed by plant uptake (kg/ha/year)	110.52
Average annual soil nitrogen removed by denitrification (kg/ha/year)	0.02
Average annual soil nitrogen leached (kg/ha/year)	1.23
Average annual nitrate-N loading to groundwater (kg/ha/year)	1.23
Soil organic-N kg/ha (Initial - Final)	3809.50 - 141.65
	74.41 - 0.02
Average nitrate-N concentration of deep drainage (mg/L)	0.19
Max. annual nitrate-N concentration of deep drainage (mg/L)	8.36

Soil Phosphorus Balance

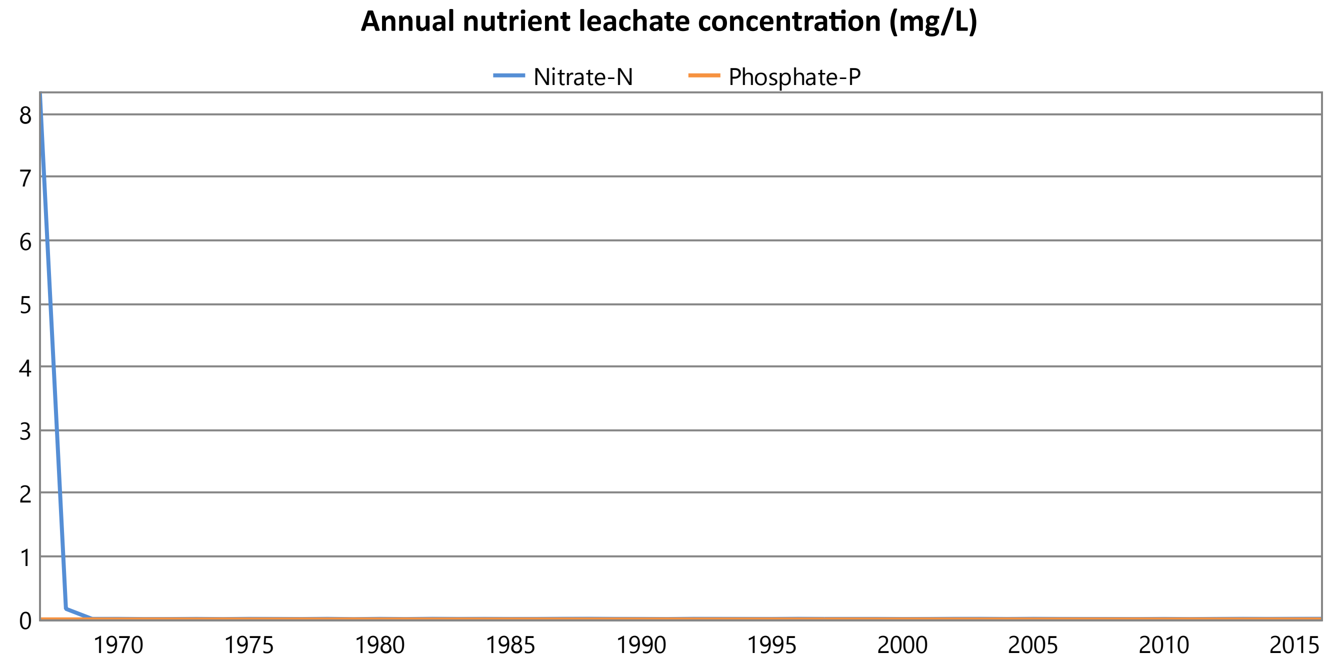
Average annual effluent phosphorus added (kg/ha/year)	7.41
Average annual soil phosphorus removed by plant uptake (kg/ha/year)	0.10
Average annual soil phosphorus leached (kg/ha/year)	4.74E-04
Dissolved phosphorus (kg/ha) (Initial - Final)	2.86E-04 - 3.68E-03
Adsorbed phosphorus (kg/ha) (Initial - Final)	450.65 - 817.20
Average phosphate-P concentration in rootzone (mg/L)	5.44E-04
Average phosphate-P concentration of deep drainage (mg/L)	7.29E-05
Max. annual phosphate-P concentration of deep drainage (mg/L)	8.36E-05
Design soil profile storage life based on average infiltrated water phosphorus concn. of 0.34 mg/L (years)	695.70

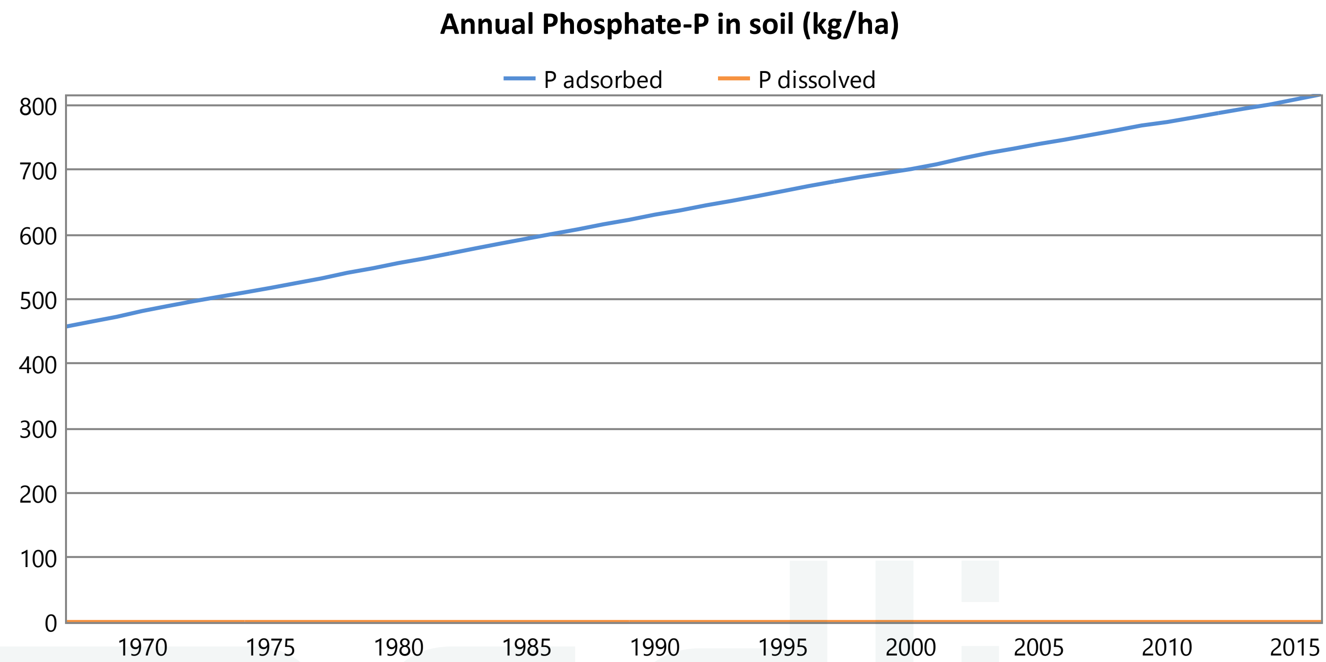
DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Land: New Paddock: 56 ha

Irrigation: Fixed Sprinkler with 0.2% ammonium loss during irrigation





DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Plant Performance: New Paddock: 56 ha

Average Plant Performance (Minimum - Maximum): Continuous Coastal Couch Grass (Cynodon dactylon) Pasture_mod golf, kick started

Average annual shoot dry matter yield (kg/ha/year)	10064.96 (6029.57 - 17006.71)
Average monthly plant (green) cover (fraction)	1.00 (0.99 - 1.00)
Average monthly crop factor (fraction)	0.80 (0.79 - 0.80)
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Average monthly root depth (mm)	799.36 (792.32 - 800.00)
Average number of normal harvests per year (no./year)	7.06 (4.00 - 12.00)
Average number of normal harvests for last five years only (no./year)	4.60
Average number of crop deaths per year (no./year)	0.00 (0.00 - 0.00)
Average number of crop deaths for last five years only (no./year)	0.00
Average annual nitrogen deficiency index (0 = no stress, 1 = full stress) (coefficient)	0.57 (0.14 - 0.74)
Average January temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.02 (0.00 - 0.07)
Average July temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.20 (0.00 - 0.41)
Average monthly water stress index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.02)
Average monthly waterlogging index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.00)
No. days without crop/year (days)	0.00

Soil Salinity - Plant salinity tolerance: Tolerant

Assumes 1.0 dS/m Electrical Conductivity = 640 mg/L Total Dissolved Salts
All values based on 10 year running averages

Salinity of infiltrated water (Average salinity of rainwater = 0.03 dS/m) (dS/m)	0.33
Salt added by rainfall (kg/ha/year)	265.40
Average annual effluent salt added & leached at steady state (kg/ha/year)	4564.12
Average leaching fraction based on 10 year running averages (fraction)	0.50
Average water-uptake-weighted rootzone salinity sat. ext. (dS/m)	0.30
Salinity of the soil solution (at drained upper limit) at base of rootzone (dS/m)	1.08
Relative crop yield expected due to salinity (fraction)	1.00
Proportion of years that crop yields would be expected to fall below 90% of potential due to salinity (fraction)	0.00

DIAGNOSTICS

Run Messages

Messages generated when the scenario was run:

Full run chosen

MEDLI REPORT - FULL RUN

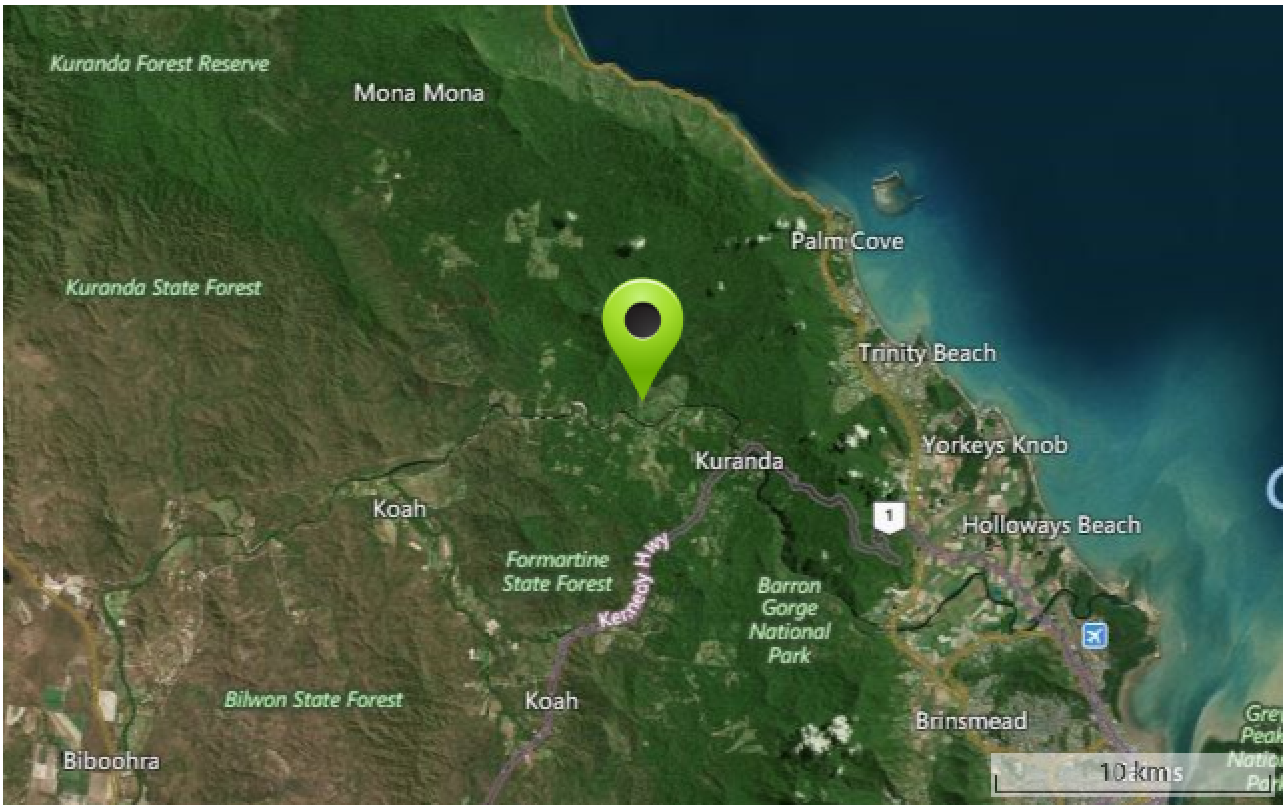
Enterprise: **Kur World**

Description:
Stage 2 High range low ingress 56ha Golf and amenity full run

Client: **Reever and Ocean**

MEDLI User: NATRES\andrew

Scenario Details:
High range ADWF, low infiltration efficiency, Full run
N 5mg/L, P 1 mg/L, TDS 580 mg 73% TON, 2% NH4-N, 25% Org N
5 ML tank and 19 ML dam
5mm SMD to UDL. Irrigation allowed on days with up to 3 mm rainfall. Coastal couch as amenity grass (kickstarted) assumed for golf course and amenity planting - 56ha
No additional nutrient addition to account for return of clippings

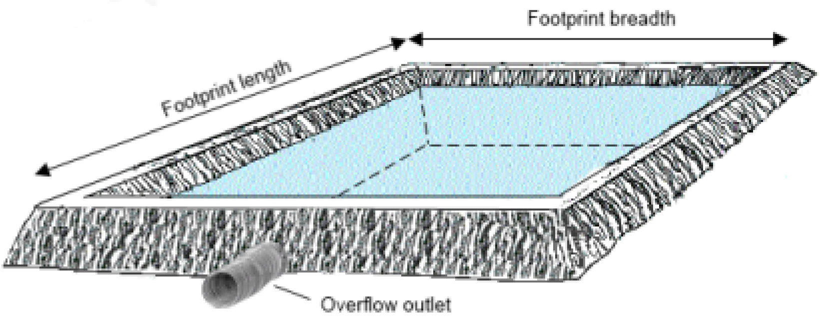


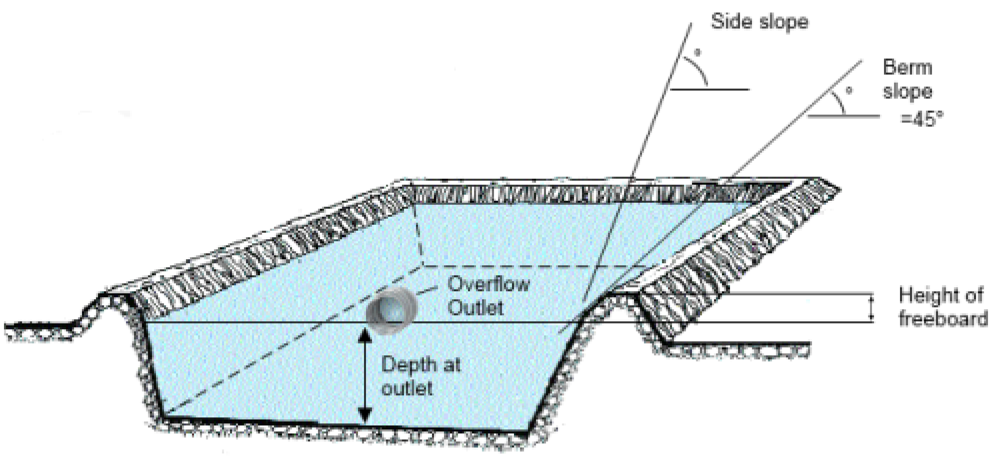
DESCRIPTION

Pond system: 2 facultative, aerobic or storage ponds

Pond system details:

	Pond 1	Pond 2
Maximum pond volume (ML)	5.00	19.00
Minimum allowable pond volume (ML)	0.00	6.77
Pond depth at overflow outlet (m)	4.00	4.50
Maximum water surface area (m2)	1250.00	5794.53
Pond footprint length (m)	35.36	135.05
Pond footprint width (m)	35.36	47.15
Pond catchment area (m2)	1250.00	6367.31
Average active volume (ML)	5.00	12.83





Irrigation pump limits:

Minimum pump rate limit (ML/day)	0.00
Maximum pump rate limit (ML/day)	100.00

Shandying water:

Annual allocation of fresh water available for shandying (ML/year)	0.00
Maximum rate of application of fresh water (ML/day)	0.00
Nitrogen concentration (mg/L)	0.00
Salinity (dS/m)	0.00
Minimum shandy water is used	False

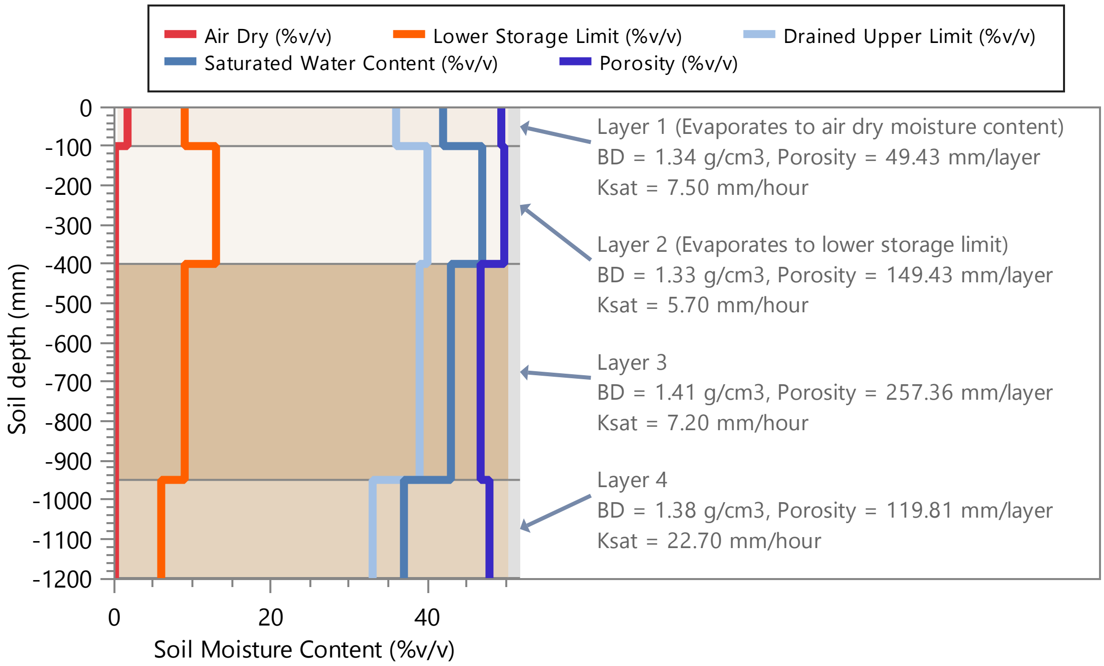
DESCRIPTION

Land: New Paddock

Area (ha): 56.00

Soil Type: Bicton (Kur-World), 1200.00 mm defined profile depth

Profile Porosity (mm)	576.04
Profile saturation water content (mm)	512.00
Profile drained upper limit (or field capacity) (mm)	453.00
Profile lower storage limit (or permanent wilting point) (mm)	112.50
Profile available water capacity (mm)	340.50
Profile limiting saturated hydraulic conductivity (mm/hour)	5.70
Surface saturated hydraulic conductivity (mm/hour)	7.50
Runoff curve number II (coefficient)	80.00
Soil evaporation U (mm)	8.50
Soil evaporation Cona (mm/sqrt day)	3.75



Plant Data: Continuous Coastal Couch Grass (Cynodon dactylon) Pasture_mod golf, kick started

Average monthly cover (fraction) (minimum - maximum)	1.00 (0.99 - 1.00)
Maximum crop factor at 100% cover (mm/mm) (Maximum crop coefficient 0.8 x Pan coefficient 1)	0.80
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Maximum potential root depth in defined soil profile (mm)	800.00
Salt tolerance	Tolerant
Salinity threshold EC sat. ext. (dS/m)	6.90
Proportion of yield decrease per dS/m increase (fraction/dS/m)	0.06

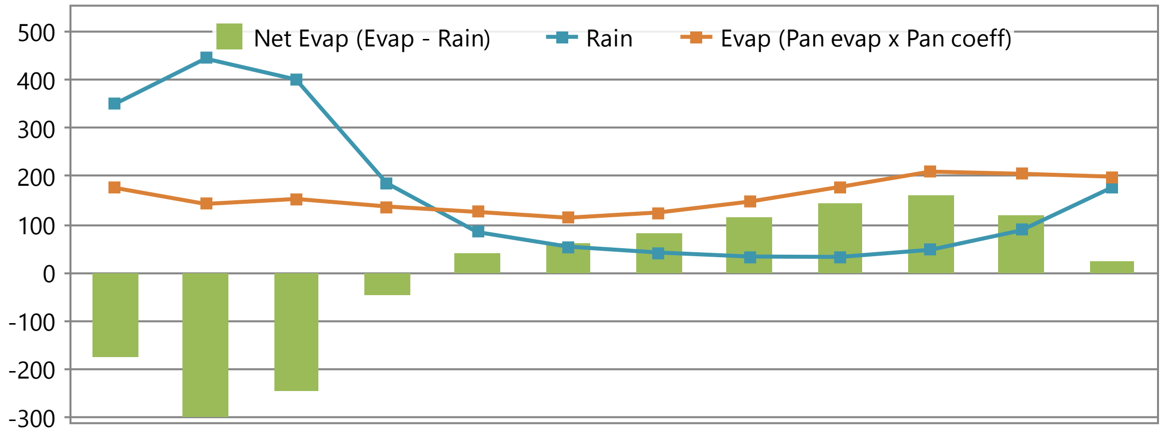
DIAGNOSTICS

Sustainability Diagnostics: Kur World

Averaged Historical Climate Data Used in Simulation (mm)

Location: KurWorlSTP, -16.8°, 145.6°

Run Period: 01/01/1967 to 31/12/2016   50 years, 0 days



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	349.9	444.0	400.6	185.8	84.3	54.1	41.9	33.6	32.8	47.6	87.8	176.5	1938.9
Evap	176.0	142.7	153.0	137.4	126.0	114.1	125.0	147.4	177.9	209.7	205.2	199.2	1913.4
Net Evap	-173.9	-301.3	-247.6	-48.4	41.8	59.9	83.1	113.8	145.1	162.1	117.4	22.7	-25.5
Net Evap/day	-5.6	-10.7	-8.0	-1.6	1.3	2.0	2.7	3.7	4.8	5.2	3.9	0.7	-0.1

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Pond System: 2 facultative, aerobic or storage ponds

Kur-world Stage 2 High range low ingress - Sept 2017 - 676.48 ML/year or 1.85 ML/day generated on average

Effluent entering pond system after any pretreatment and recycling

Average (Minimum-Maximum) influent quality calculated for 365.26 non-zero flow days, after any pretreatment and recycling.

Constituent	Concentration (mg/L)	Load (kg/year)
Total Nitrogen	4.54 (0.64 - 5.00)	3068.07 (3065.89 - 3074.29)
Total Phosphorus	0.91 (0.13 - 1.00)	613.61 (613.18 - 614.86)
Total Dissolved Salts	526.10 (73.77 - 580.00)	355896.63 (355643.30 - 356617.66)
Volatile Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Total Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)

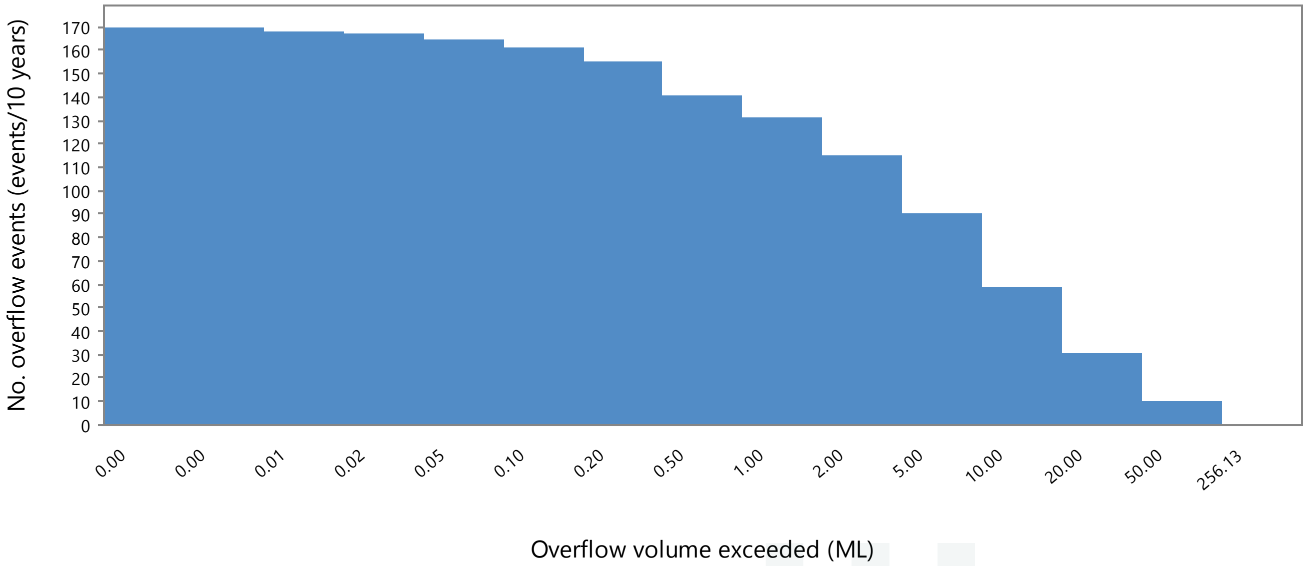
Last pond (Wet weather store): 19.00 ML

Theoretical hydraulic retention time (days)	10.26
Average volume of overflow (ML/year)	220.56
No. overflow events per year exceeding threshold* of 0.00 ML (no./year)	16.94
Average duration of overflow (days)	6.64
Effluent Reuse (Proportion of Inflow + Net Rain Gain that is Irrigated) (fraction)	0.68
Probability of at least 90% effluent reuse (fraction)	0.00
Average salinity of last pond (dS/m)	0.81
Salinity of last pond on final day of simulation (dS/m)	0.89
Ammonia loss from pond system water area (kg/m2/year)	0.00

* The threshold is the volume equivalent to the top 1 mm depth of water of a full pond

Overflow exceedance:

Chart Table



Export plot

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Irrigation Information

Irrigation: 56 ha total area (assumed 100% irrigation efficiency)

	Quantity/year	Quantity/ha/year
Total irrigation applied (ML)	461.07	8.23
Total nitrogen applied (kg)	2186.11	39.04
Total phosphorus applied (kg)	438.98	7.84
Total salts applied (kg)	254607.53	4546.56

Shandying

Annual allocation of fresh water for shandying (ML/year)	0.00
Average Shandy water irrigation (ML/year) (minimum - maximum)	0.00 (0.00 - 0.00)
Average exceedance as a proportion of annual shandy water allocation (% of allocation) (minimum - maximum)	0.00 (0.00 - 0.00)
Proportion of irrigation events requiring shandying (fraction of events)	0.00
Minimum shandy water is used	False

Irrigation Issues

Proportion of Days irrigation is prevented when triggered (fraction)	0.25
Proportion of Days water demand is too small to trigger irrigation (fraction)	0.28
Proportion of Days irrigation occurs (fraction)	0.48

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Land: New Paddock: 56 ha

Irrigation: Fixed Sprinkler with 0.2% ammonium loss during irrigation

Irrigation triggered when soil water deficit reaches 5.00 mm and rainfall is less than or equal to 3.00 mm
Irrigate up to a soil water content of drained upper limit plus 0.00 mm
Irrigation window from 1/1 to 31/12 including the days specified
A minimum of 0 days must be skipped between irrigation events

Soil Water Balance (mm): Bicton (Kur-World), 228.00 mm PAWC at maximum root depth

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	349.9	444.0	400.6	185.8	84.3	54.1	41.9	33.6	32.8	47.6	87.8	176.5	1938.9
Irrigation	60.4	30.6	44.4	48.8	58.9	62.8	75.9	89.6	89.8	92.1	85.9	84.3	823.3
Soil Evap	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Transpn.	137.3	114.1	121.1	109.7	100.8	91.2	100.0	117.9	142.3	167.7	163.6	158.5	1524.3
Rain Runoff	125.9	164.4	157.7	40.7	7.1	3.3	2.1	1.2	2.5	4.4	11.5	41.8	562.6
Irr. Runoff	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Drainage	104.2	178.9	171.7	87.5	39.2	21.2	18.5	7.7	6.1	5.0	6.3	32.7	679.1
Delta	42.9	17.1	-5.5	-3.2	-3.9	1.1	-2.8	-3.6	-28.4	-37.5	-7.7	27.8	-3.7

Soil Nitrogen Balance

Average annual effluent nitrogen added (kg/ha/year)	39.04
Average annual soil nitrogen removed by plant uptake (kg/ha/year)	112.66
Average annual soil nitrogen removed by denitrification (kg/ha/year)	0.02
Average annual soil nitrogen leached (kg/ha/year)	1.23
Average annual nitrate-N loading to groundwater (kg/ha/year)	1.23
Soil organic-N kg/ha (Initial - Final)	3809.50 - 140.99
	74.41 - 0.03
Average nitrate-N concentration of deep drainage (mg/L)	0.18
Max. annual nitrate-N concentration of deep drainage (mg/L)	8.36

Soil Phosphorus Balance

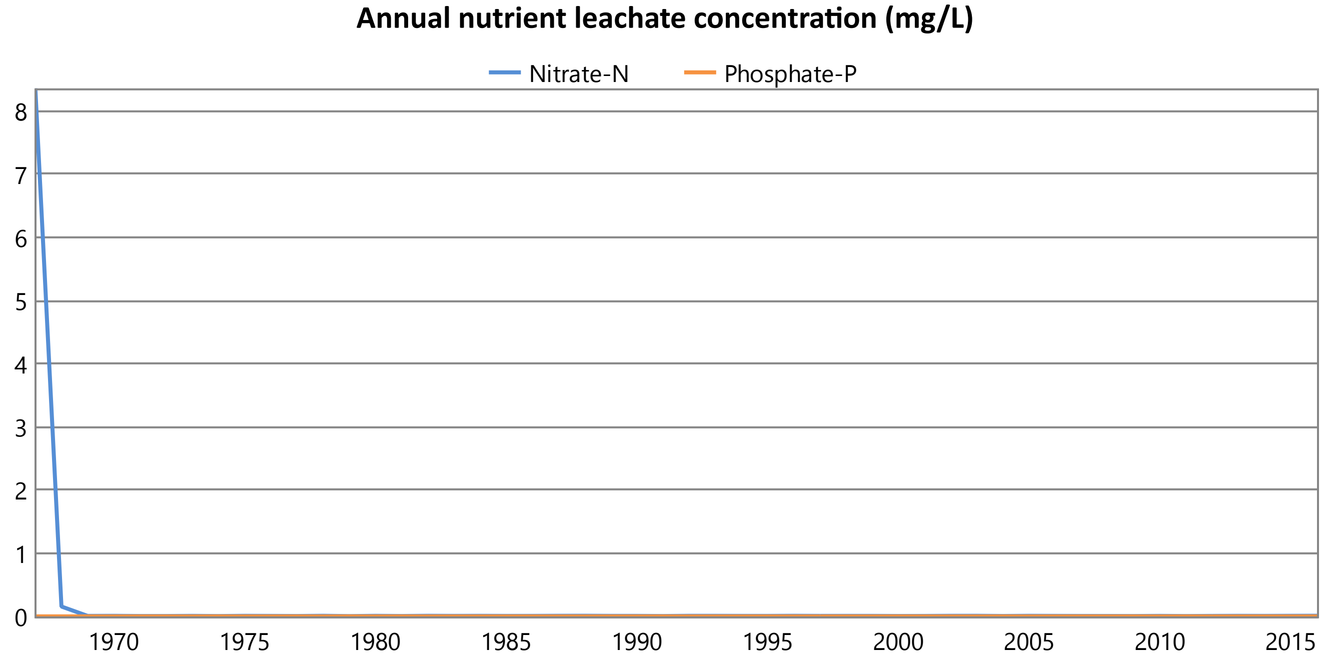
Average annual effluent phosphorus added (kg/ha/year)	7.84
Average annual soil phosphorus removed by plant uptake (kg/ha/year)	0.16
Average annual soil phosphorus leached (kg/ha/year)	5.02E-04
Dissolved phosphorus (kg/ha) (Initial - Final)	2.86E-04 - 3.58E-03
Adsorbed phosphorus (kg/ha) (Initial - Final)	450.65 - 835.61
Average phosphate-P concentration in rootzone (mg/L)	5.71E-04
Average phosphate-P concentration of deep drainage (mg/L)	7.39E-05
Max. annual phosphate-P concentration of deep drainage (mg/L)	8.19E-05
Design soil profile storage life based on average infiltrated water phosphorus concn. of 0.36 mg/L (years)	666.24

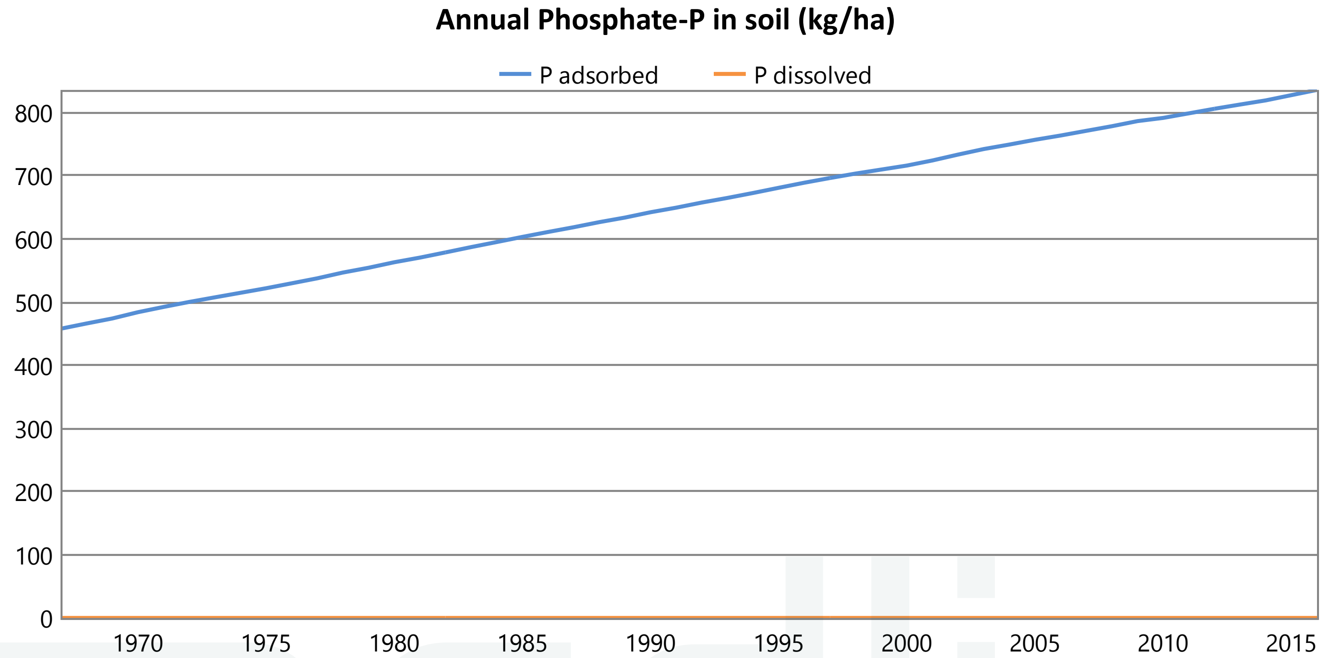
DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Land: New Paddock: 56 ha

Irrigation: Fixed Sprinkler with 0.2% ammonium loss during irrigation





DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Plant Performance: New Paddock: 56 ha

Average Plant Performance (Minimum - Maximum): Continuous Coastal Couch Grass (Cynodon dactylon) Pasture_mod golf, kick started

Average annual shoot dry matter yield (kg/ha/year)	10191.65 (5974.48 - 17106.11)
Average monthly plant (green) cover (fraction)	1.00 (0.99 - 1.00)
Average monthly crop factor (fraction)	0.80 (0.79 - 0.80)
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Average monthly root depth (mm)	799.36 (792.32 - 800.00)
Average number of normal harvests per year (no./year)	7.14 (4.00 - 12.00)
Average number of normal harvests for last five years only (no./year)	4.80
Average number of crop deaths per year (no./year)	0.00 (0.00 - 0.00)
Average number of crop deaths for last five years only (no./year)	0.00
Average annual nitrogen deficiency index (0 = no stress, 1 = full stress) (coefficient)	0.57 (0.14 - 0.74)
Average January temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.02 (0.00 - 0.07)
Average July temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.20 (0.00 - 0.41)
Average monthly water stress index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.01)
Average monthly waterlogging index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.00)
No. days without crop/year (days)	0.00

Soil Salinity - Plant salinity tolerance: Tolerant

Assumes 1.0 dS/m Electrical Conductivity = 640 mg/L Total Dissolved Salts
All values based on 10 year running averages

Salinity of infiltrated water (Average salinity of rainwater = 0.03 dS/m) (dS/m)	0.34
Salt added by rainfall (kg/ha/year)	264.25
Average annual effluent salt added & leached at steady state (kg/ha/year)	4810.81
Average leaching fraction based on 10 year running averages (fraction)	0.51
Average water-uptake-weighted rootzone salinity sat. ext. (dS/m)	0.30
Salinity of the soil solution (at drained upper limit) at base of rootzone (dS/m)	1.09
Relative crop yield expected due to salinity (fraction)	1.00
Proportion of years that crop yields would be expected to fall below 90% of potential due to salinity (fraction)	0.00

DIAGNOSTICS

Run Messages

Messages generated when the scenario was run:

Full run chosen

MEDLI REPORT - FULL RUN

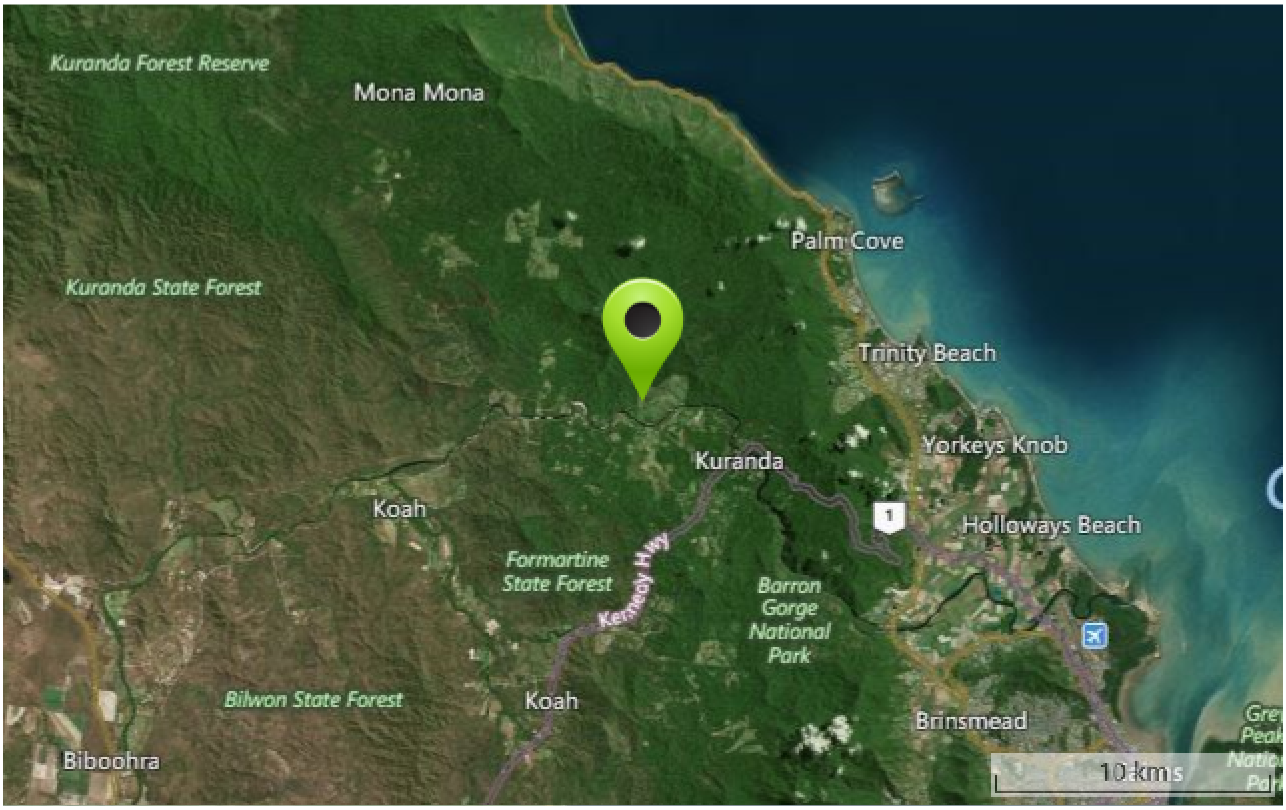
Enterprise: **Kur World**

Description:
Stage 2 High range 56ha Golf and amenity full run

Client: **Reever and Ocean**

MEDLI User: NATRES\andrew

Scenario Details:
High range ADWF, average infiltration efficiency, Full run
N 5mg/L, P 1 mg/L, TDS 580 mg 73% TON, 2% NH4-N, 25% Org N
5 ML tank and 19 ML dam
5mm SMD to UDL. Irrigation allowed on days with up to 3 mm rainfall. Coastal couch as amenity grass (kickstarted) assumed for golf course and amenity planting - 56ha
No additional nutrient addition to account for return of clippings

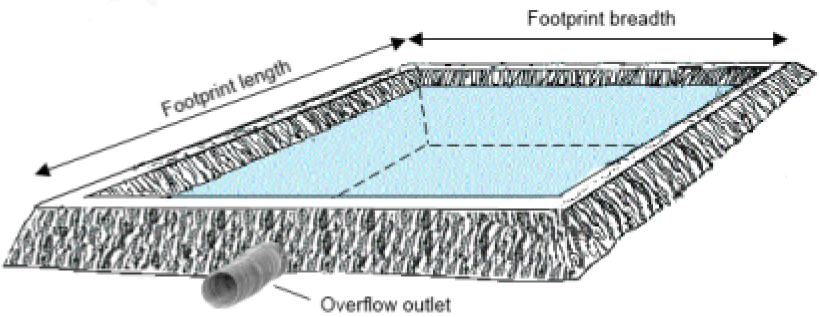


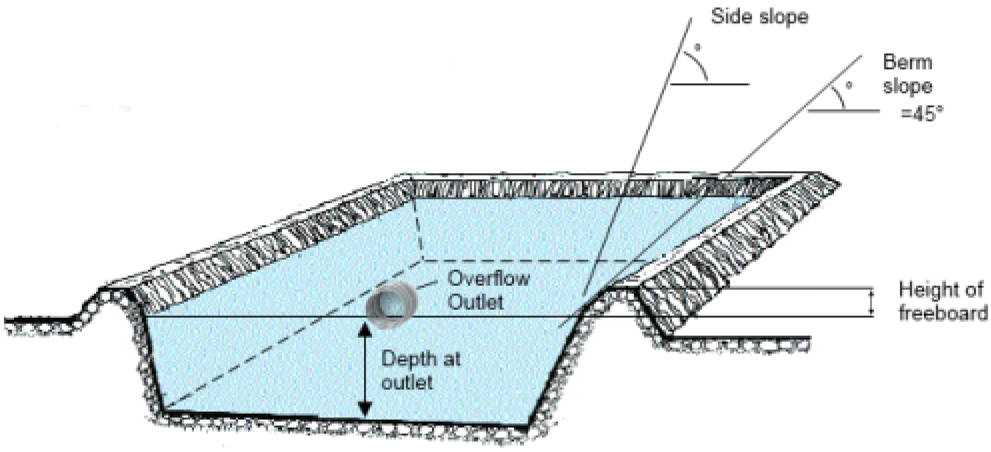
DESCRIPTION

Pond system: 2 facultative, aerobic or storage ponds

Pond system details:

	Pond 1	Pond 2
Maximum pond volume (ML)	5.00	19.00
Minimum allowable pond volume (ML)	0.00	6.77
Pond depth at overflow outlet (m)	4.00	4.50
Maximum water surface area (m2)	1250.00	5794.53
Pond footprint length (m)	35.36	135.05
Pond footprint width (m)	35.36	47.15
Pond catchment area (m2)	1250.00	6367.31
Average active volume (ML)	5.00	12.96





Irrigation pump limits:

Minimum pump rate limit (ML/day)	0.00
Maximum pump rate limit (ML/day)	100.00

Shandying water:

Annual allocation of fresh water available for shandying (ML/year)	0.00
Maximum rate of application of fresh water (ML/day)	0.00
Nitrogen concentration (mg/L)	0.00
Salinity (dS/m)	0.00
Minimum shandy water is used	False

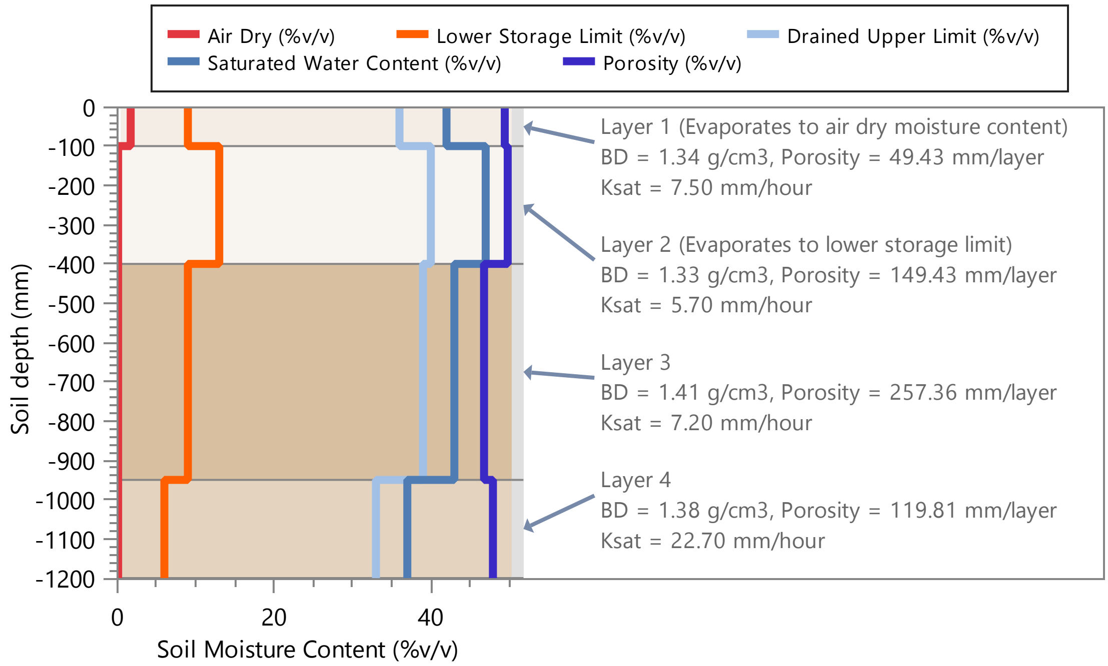
DESCRIPTION

Land: New Paddock

Area (ha): 56.00

Soil Type: Bicton (Kur-World), 1200.00 mm defined profile depth

Profile Porosity (mm)	576.04
Profile saturation water content (mm)	512.00
Profile drained upper limit (or field capacity) (mm)	453.00
Profile lower storage limit (or permanent wilting point) (mm)	112.50
Profile available water capacity (mm)	340.50
Profile limiting saturated hydraulic conductivity (mm/hour)	5.70
Surface saturated hydraulic conductivity (mm/hour)	7.50
Runoff curve number II (coefficient)	80.00
Soil evaporation U (mm)	8.50
Soil evaporation Cona (mm/sqrt day)	3.75



Plant Data: Continuous Coastal Couch Grass (Cynodon dactylon) Pasture_mod golf, kick started

Average monthly cover (fraction) (minimum - maximum)	1.00 (0.99 - 1.00)
Maximum crop factor at 100% cover (mm/mm) (Maximum crop coefficient 0.8 x Pan coefficient 1)	0.80
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Maximum potential root depth in defined soil profile (mm)	800.00
Salt tolerance	Tolerant
Salinity threshold EC sat. ext. (dS/m)	6.90
Proportion of yield decrease per dS/m increase (fraction/dS/m)	0.06

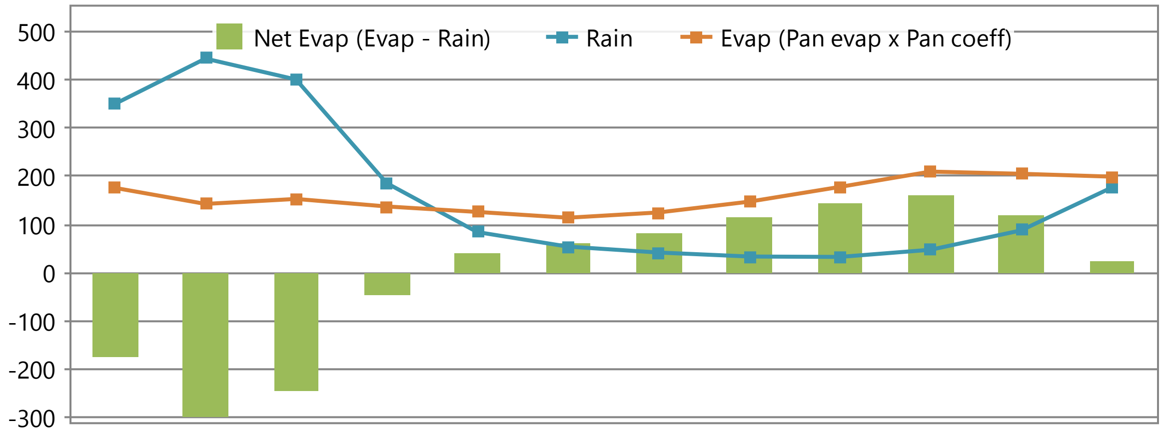
DIAGNOSTICS

Sustainability Diagnostics: Kur World

Averaged Historical Climate Data Used in Simulation (mm)

Location: KurWorlSTP, -16.8°, 145.6°

Run Period: 01/01/1967 to 31/12/2016 50 years, 0 days



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	349.9	444.0	400.6	185.8	84.3	54.1	41.9	33.6	32.8	47.6	87.8	176.5	1938.9
Evap	176.0	142.7	153.0	137.4	126.0	114.1	125.0	147.4	177.9	209.7	205.2	199.2	1913.4
Net Evap	-173.9	-301.3	-247.6	-48.4	41.8	59.9	83.1	113.8	145.1	162.1	117.4	22.7	-25.5
Net Evap/day	-5.6	-10.7	-8.0	-1.6	1.3	2.0	2.7	3.7	4.8	5.2	3.9	0.7	-0.1

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Pond System: 2 facultative, aerobic or storage ponds

Kur-world Stage 2 High range - Sept 2017 - 738.37 ML/year or 2.02 ML/day generated on average

Effluent entering pond system after any pretreatment and recycling

Average (Minimum-Maximum) influent quality calculated for 365.26 non-zero flow days, after any pretreatment and recycling.

Constituent	Concentration (mg/L)	Load (kg/year)
Total Nitrogen	4.16 (0.34 - 5.00)	3068.07 (3065.89 - 3074.29)
Total Phosphorus	0.83 (0.07 - 1.00)	613.61 (613.18 - 614.86)
Total Dissolved Salts	482.00 (39.55 - 580.00)	355896.63 (355643.30 - 356617.66)
Volatile Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Total Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)

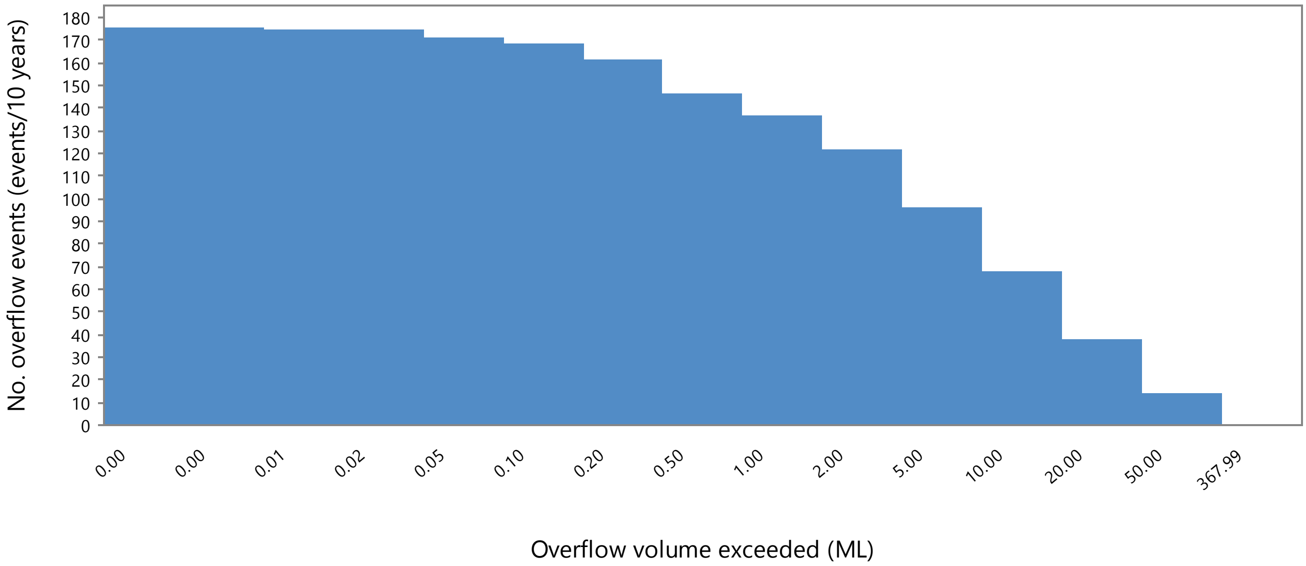
Last pond (Wet weather store): 19.00 ML

Theoretical hydraulic retention time (days)	9.40
Average volume of overflow (ML/year)	277.76
No. overflow events per year exceeding threshold* of 0.00 ML (no./year)	17.52
Average duration of overflow (days)	6.77
Effluent Reuse (Proportion of Inflow + Net Rain Gain that is Irrigated) (fraction)	0.63
Probability of at least 90% effluent reuse (fraction)	0.00
Average salinity of last pond (dS/m)	0.75
Salinity of last pond on final day of simulation (dS/m)	0.87
Ammonia loss from pond system water area (kg/m2/year)	0.00

* The threshold is the volume equivalent to the top 1 mm depth of water of a full pond

Overflow exceedance:

■ Chart ☐ Table



Export plot

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Irrigation Information

Irrigation: 56 ha total area (assumed 100% irrigation efficiency)

	Quantity/year	Quantity/ha/year
Total irrigation applied (ML)	465.73	8.32
Total nitrogen applied (kg)	2124.46	37.94
Total phosphorus applied (kg)	426.60	7.62
Total salts applied (kg)	247426.66	4418.33

Shandying

Annual allocation of fresh water for shandying (ML/year)	0.00
Average Shandy water irrigation (ML/year) (minimum - maximum)	0.00 (0.00 - 0.00)
Average exceedance as a proportion of annual shandy water allocation (% of allocation) (minimum - maximum)	0.00 (0.00 - 0.00)
Proportion of irrigation events requiring shandying (fraction of events)	0.00
Minimum shandy water is used	False

Irrigation Issues

Proportion of Days irrigation is prevented when triggered (fraction)	0.25
Proportion of Days water demand is too small to trigger irrigation (fraction)	0.28
Proportion of Days irrigation occurs (fraction)	0.47

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Land: New Paddock: 56 ha

Irrigation: Fixed Sprinkler with 0.2% ammonium loss during irrigation

Irrigation triggered when soil water deficit reaches 5.00 mm and rainfall is less than or equal to 3.00 mm
Irrigate up to a soil water content of drained upper limit plus 0.00 mm
Irrigation window from 1/1 to 31/12 including the days specified
A minimum of 0 days must be skipped between irrigation events

Soil Water Balance (mm): Bicton (Kur-World), 228.00 mm PAWC at maximum root depth

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	349.9	444.0	400.6	185.8	84.3	54.1	41.9	33.6	32.8	47.6	87.8	176.5	1938.9
Irrigation	62.2	30.1	44.5	48.9	59.0	62.8	75.9	89.9	90.3	93.9	88.2	86.0	831.7
Soil Evap	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Transpn.	137.4	114.1	121.1	109.7	100.8	91.2	100.0	117.9	142.3	167.7	163.6	158.7	1524.6
Rain Runoff	126.3	164.6	157.7	40.7	7.1	3.4	2.1	1.2	2.5	4.4	11.6	42.0	563.4
Irr. Runoff	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Drainage	107.0	180.3	172.1	87.6	39.2	21.3	18.5	7.9	6.2	5.3	7.0	33.9	686.1
Delta	41.4	15.1	-5.7	-3.2	-3.9	1.1	-2.8	-3.5	-27.9	-36.0	-6.2	28.0	-3.6

Soil Nitrogen Balance

Average annual effluent nitrogen added (kg/ha/year)	37.94
Average annual soil nitrogen removed by plant uptake (kg/ha/year)	111.56
Average annual soil nitrogen removed by denitrification (kg/ha/year)	0.02
Average annual soil nitrogen leached (kg/ha/year)	1.23
Average annual nitrate-N loading to groundwater (kg/ha/year)	1.23
Soil organic-N kg/ha (Initial - Final)	3809.50 - 140.83
	74.41 - 0.03
Average nitrate-N concentration of deep drainage (mg/L)	0.18
Max. annual nitrate-N concentration of deep drainage (mg/L)	8.35

Soil Phosphorus Balance

Average annual effluent phosphorus added (kg/ha/year)	7.62
Average annual soil phosphorus removed by plant uptake (kg/ha/year)	0.12
Average annual soil phosphorus leached (kg/ha/year)	5.07E-04
Dissolved phosphorus (kg/ha) (Initial - Final)	2.86E-04 - 3.68E-03
Adsorbed phosphorus (kg/ha) (Initial - Final)	450.65 - 826.46
Average phosphate-P concentration in rootzone (mg/L)	5.48E-04
Average phosphate-P concentration of deep drainage (mg/L)	7.39E-05
Max. annual phosphate-P concentration of deep drainage (mg/L)	8.26E-05
Design soil profile storage life based on average infiltrated water phosphorus concn. of 0.35 mg/L (years)	678.39

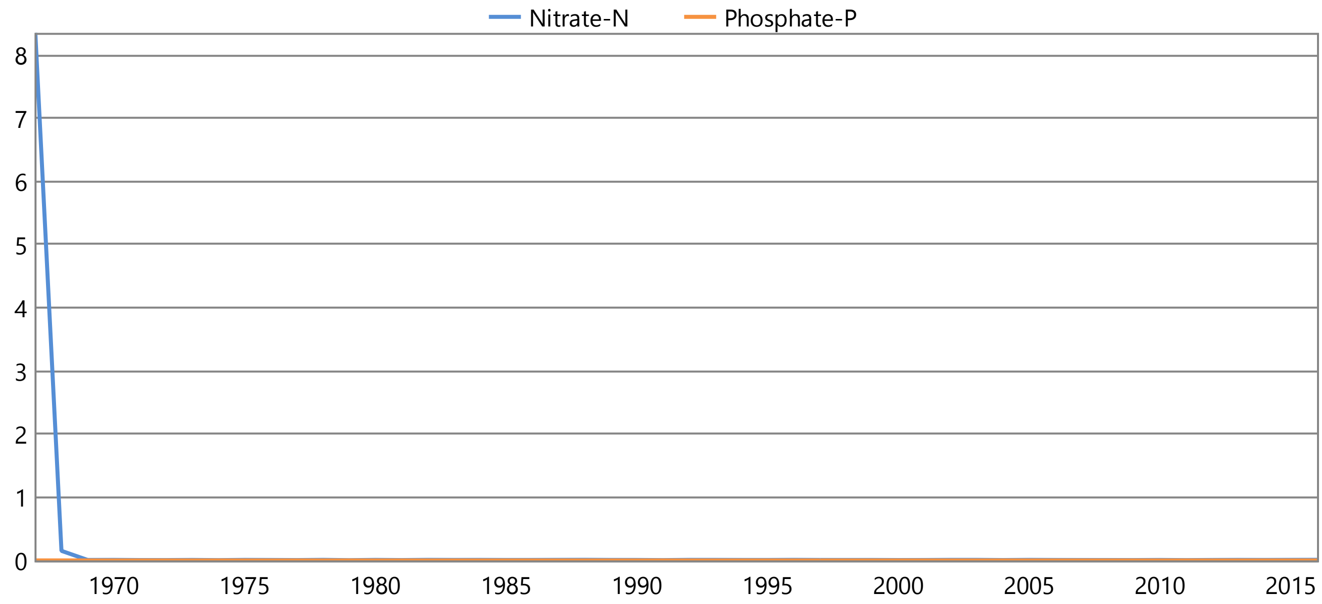
DIAGNOSTICS

Sustainability Diagnostics: Kur World

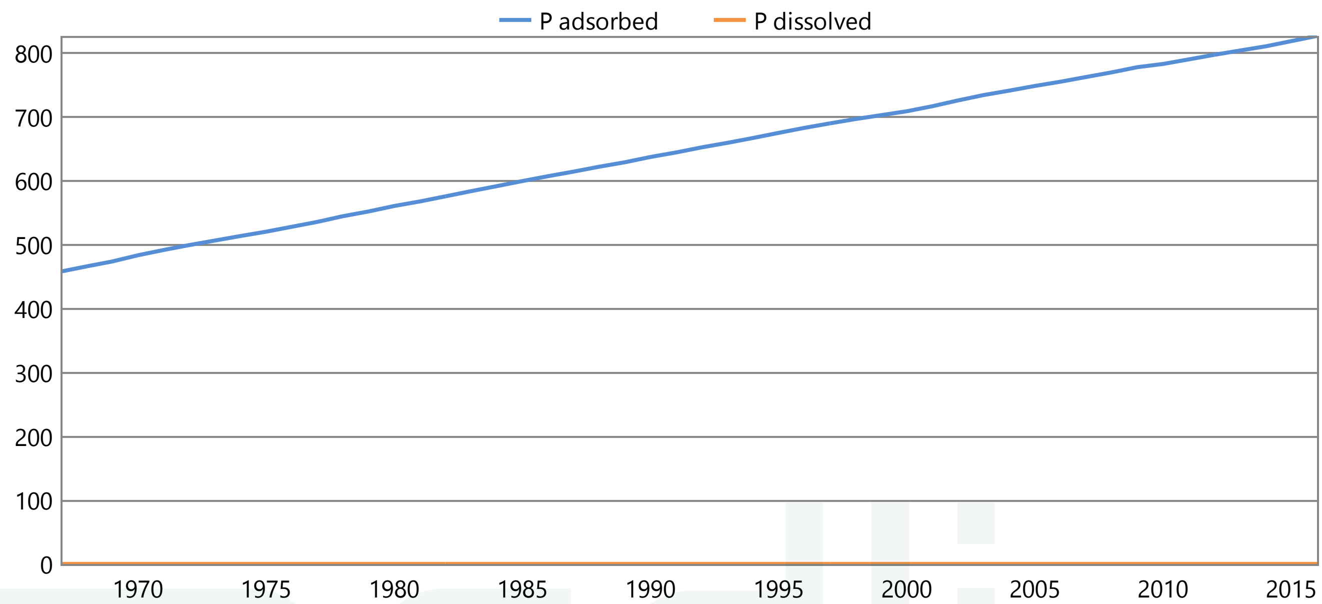
Paddock Land: New Paddock: 56 ha

Irrigation: Fixed Sprinkler with 0.2% ammonium loss during irrigation

Annual nutrient leachate concentration (mg/L)



Annual Phosphate-P in soil (kg/ha)



DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Plant Performance: New Paddock: 56 ha

Average Plant Performance (Minimum - Maximum): Continuous Coastal Couch Grass (Cynodon dactylon) Pasture_mod golf, kick started

Average annual shoot dry matter yield (kg/ha/year)	10114.60 (5909.52 - 17083.33)
Average monthly plant (green) cover (fraction)	1.00 (0.99 - 1.00)
Average monthly crop factor (fraction)	0.80 (0.79 - 0.80)
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Average monthly root depth (mm)	799.36 (792.32 - 800.00)
Average number of normal harvests per year (no./year)	7.10 (4.00 - 12.00)
Average number of normal harvests for last five years only (no./year)	4.80
Average number of crop deaths per year (no./year)	0.00 (0.00 - 0.00)
Average number of crop deaths for last five years only (no./year)	0.00
Average annual nitrogen deficiency index (0 = no stress, 1 = full stress) (coefficient)	0.57 (0.14 - 0.74)
Average January temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.02 (0.00 - 0.07)
Average July temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.20 (0.00 - 0.41)
Average monthly water stress index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.01)
Average monthly waterlogging index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.00)
No. days without crop/year (days)	0.00

Soil Salinity - Plant salinity tolerance: Tolerant

Assumes 1.0 dS/m Electrical Conductivity = 640 mg/L Total Dissolved Salts
All values based on 10 year running averages

Salinity of infiltrated water (Average salinity of rainwater = 0.03 dS/m) (dS/m)	0.33
Salt added by rainfall (kg/ha/year)	264.10
Average annual effluent salt added & leached at steady state (kg/ha/year)	4682.43
Average leaching fraction based on 10 year running averages (fraction)	0.51
Average water-uptake-weighted rootzone salinity sat. ext. (dS/m)	0.29
Salinity of the soil solution (at drained upper limit) at base of rootzone (dS/m)	1.05
Relative crop yield expected due to salinity (fraction)	1.00
Proportion of years that crop yields would be expected to fall below 90% of potential due to salinity (fraction)	0.00

DIAGNOSTICS

Run Messages

Messages generated when the scenario was run:

Full run chosen

MEDLI REPORT - FULL RUN

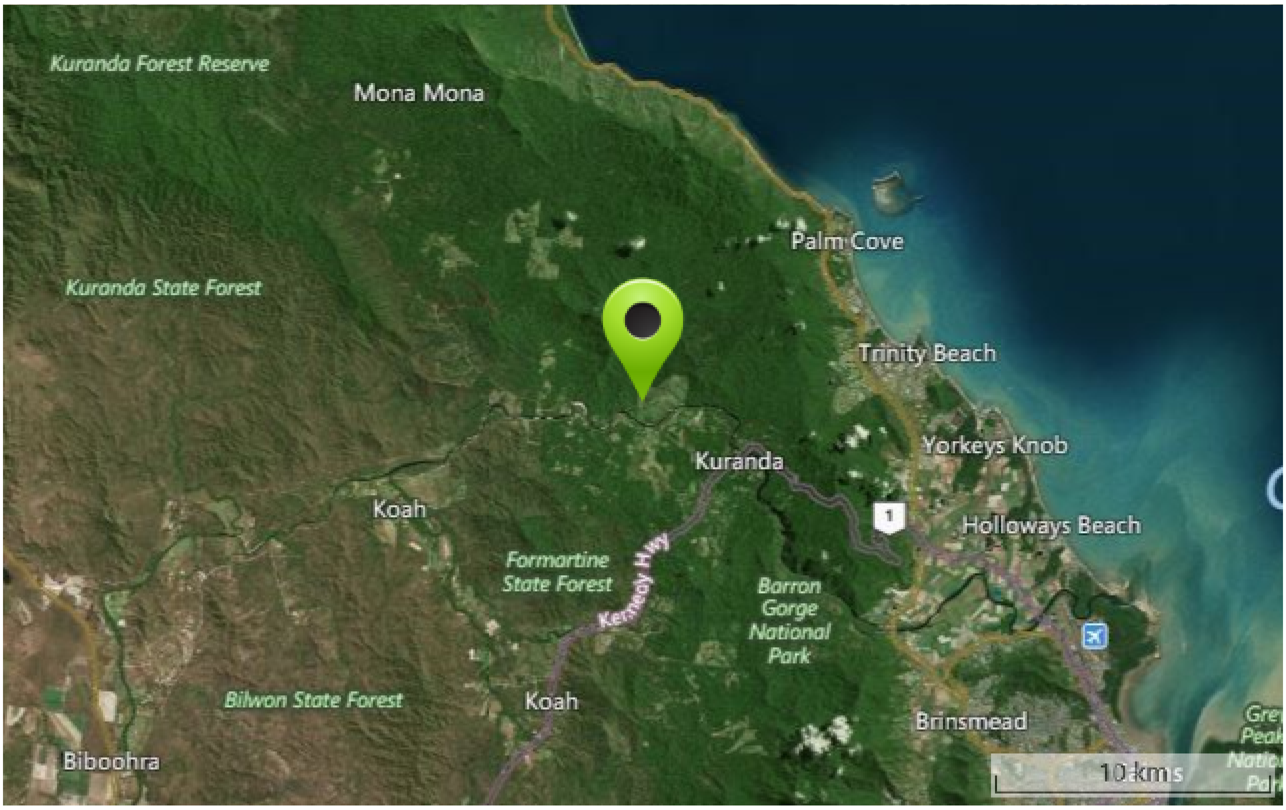
Enterprise: Kur World

Description:
Stage 2 High range low ingress 56ha Golf and amenity, clippings returned full run

Client: Reever and Ocean

MEDLI User: NATRES\andrew

Scenario Details:
High range ADWF, low infiltration efficiency, clippings retuned Full run
STP design specs N 5mg/L, P 1 mg/L, TDS 580 mg 73% TON, 2% NH4-N, 25% Org N modified to allow application of N&P removed in clipping (assuming 75% of clippins mineralised and returne in organic N form) reults in 24.58 mg/L TN 1.10 mg/L TP and 14.9% TON,0.4% NH4-N, 84.7% Org N
5 ML tank and 19 ML dam
5mm SMD to UDL. Irrigation allowed on days with up to 3 mm rainfall. Coastal couch as amenity grass (kickstarted) assumed for golf course and amenity planting - 56ha

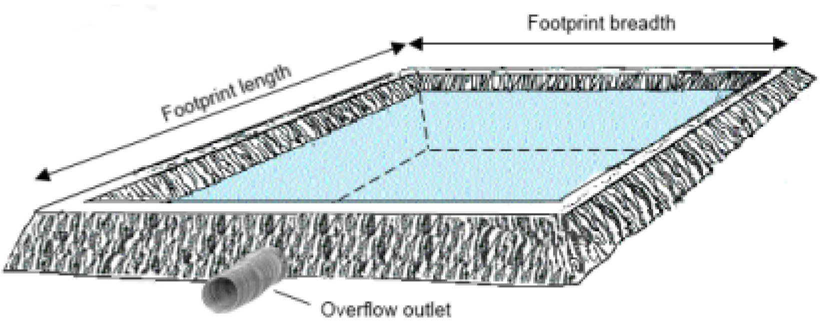


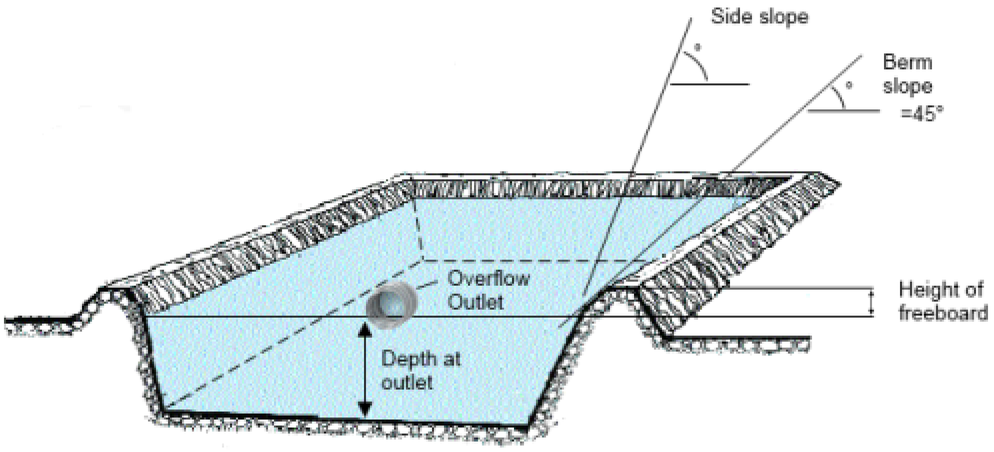
DESCRIPTION

Pond system: 2 facultative, aerobic or storage ponds

Pond system details:

	Pond 1	Pond 2
Maximum pond volume (ML)	5.00	19.00
Minimum allowable pond volume (ML)	0.00	6.77
Pond depth at overflow outlet (m)	4.00	4.50
Maximum water surface area (m2)	1250.00	5794.53
Pond footprint length (m)	35.36	135.05
Pond footprint width (m)	35.36	47.15
Pond catchment area (m2)	1250.00	6367.31
Average active volume (ML)	5.00	12.83





Irrigation pump limits:

Minimum pump rate limit (ML/day)	0.00
Maximum pump rate limit (ML/day)	100.00

Shandying water:

Annual allocation of fresh water available for shandying (ML/year)	0.00
Maximum rate of application of fresh water (ML/day)	0.00
Nitrogen concentration (mg/L)	0.00
Salinity (dS/m)	0.00
Minimum shandy water is used	False

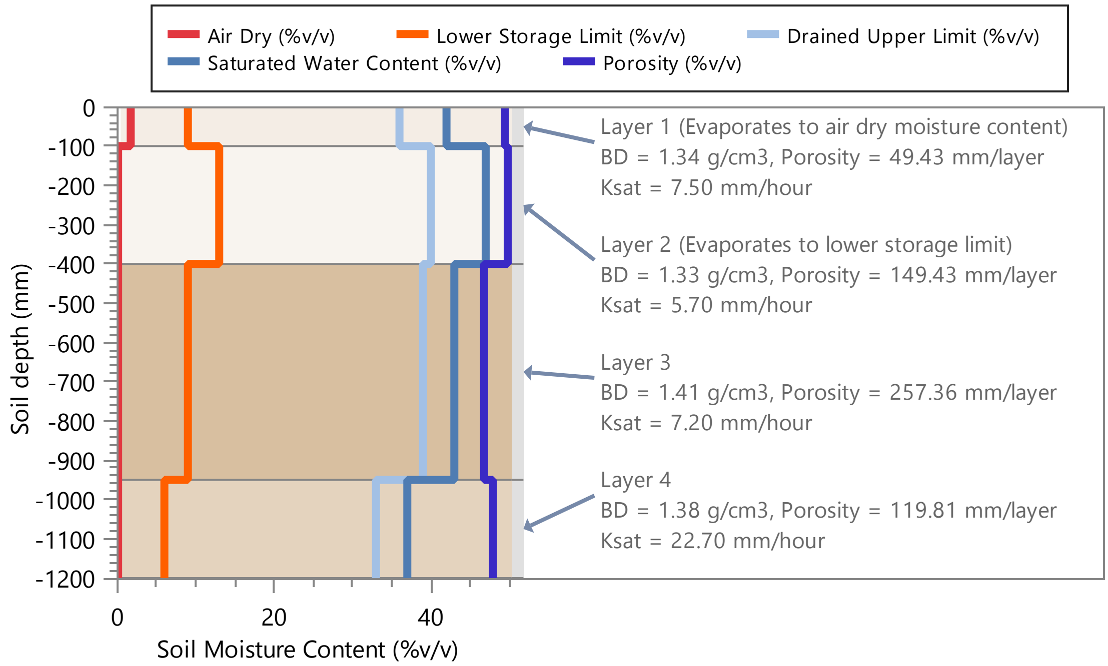
DESCRIPTION

Land: New Paddock

Area (ha): 56.00

Soil Type: Bicton (Kur-World), 1200.00 mm defined profile depth

Profile Porosity (mm)	576.04
Profile saturation water content (mm)	512.00
Profile drained upper limit (or field capacity) (mm)	453.00
Profile lower storage limit (or permanent wilting point) (mm)	112.50
Profile available water capacity (mm)	340.50
Profile limiting saturated hydraulic conductivity (mm/hour)	5.70
Surface saturated hydraulic conductivity (mm/hour)	7.50
Runoff curve number II (coefficient)	80.00
Soil evaporation U (mm)	8.50
Soil evaporation Cona (mm/sqrt day)	3.75



Plant Data: Continuous Coastal Couch Grass (Cynodon dactylon) Pasture_mod golf, kick started

Average monthly cover (fraction) (minimum - maximum)	1.00 (0.99 - 1.00)
Maximum crop factor at 100% cover (mm/mm) (Maximum crop coefficient 0.8 x Pan coefficient 1)	0.80
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Maximum potential root depth in defined soil profile (mm)	800.00
Salt tolerance	Tolerant
Salinity threshold EC sat. ext. (dS/m)	6.90
Proportion of yield decrease per dS/m increase (fraction/dS/m)	0.06

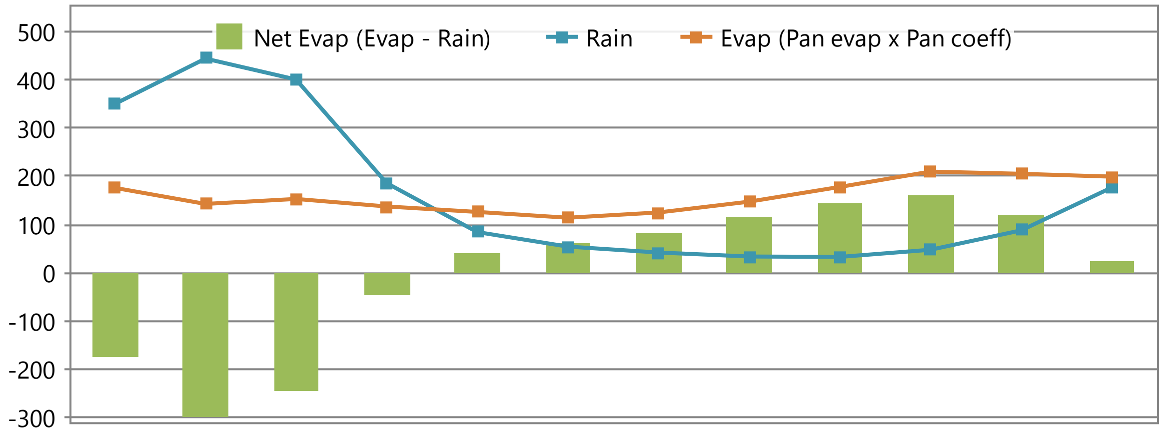
DIAGNOSTICS

Sustainability Diagnostics: Kur World

Averaged Historical Climate Data Used in Simulation (mm)

Location: KurWorlSTP, -16.8°, 145.6°

Run Period: 01/01/1967 to 31/12/2016   50 years, 0 days



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	349.9	444.0	400.6	185.8	84.3	54.1	41.9	33.6	32.8	47.6	87.8	176.5	1938.9
Evap	176.0	142.7	153.0	137.4	126.0	114.1	125.0	147.4	177.9	209.7	205.2	199.2	1913.4
Net Evap	-173.9	-301.3	-247.6	-48.4	41.8	59.9	83.1	113.8	145.1	162.1	117.4	22.7	-25.5
Net Evap/day	-5.6	-10.7	-8.0	-1.6	1.3	2.0	2.7	3.7	4.8	5.2	3.9	0.7	-0.1

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Pond System: 2 facultative, aerobic or storage ponds

Kur-world Stage 2 High range low ingress, clippings returned - Sept 2017 - 676.48 ML/year or 1.85 ML/day generated on average

Effluent entering pond system after any pretreatment and recycling

Average (Minimum-Maximum) influent quality calculated for 365.26 non-zero flow days, after any pretreatment and recycling.

Constituent	Concentration (mg/L)	Load (kg/year)
Total Nitrogen	22.30 (3.13 - 24.58)	15082.65 (15071.92 - 15113.21)
Total Phosphorus	0.92 (0.13 - 1.01)	619.75 (619.31 - 621.01)
Total Dissolved Salts	526.10 (73.77 - 580.00)	355896.63 (355643.30 - 356617.66)
Volatile Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Total Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)

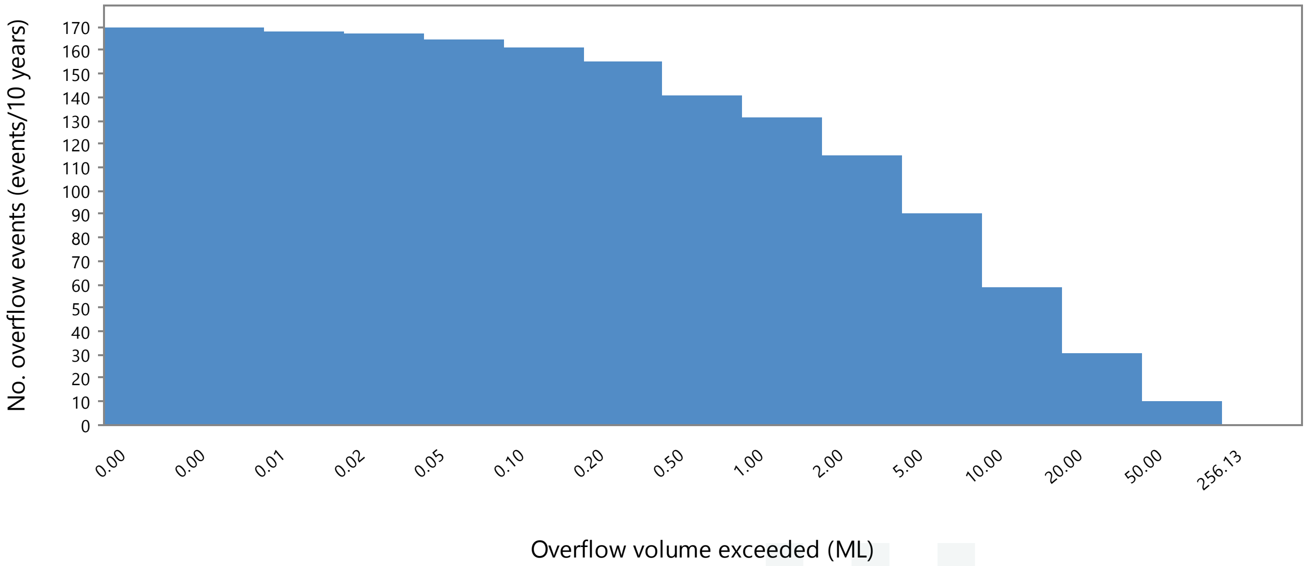
Last pond (Wet weather store): 19.00 ML

Theoretical hydraulic retention time (days)	10.26
Average volume of overflow (ML/year)	220.56
No. overflow events per year exceeding threshold* of 0.00 ML (no./year)	16.94
Average duration of overflow (days)	6.64
Effluent Reuse (Proportion of Inflow + Net Rain Gain that is Irrigated) (fraction)	0.68
Probability of at least 90% effluent reuse (fraction)	0.00
Average salinity of last pond (dS/m)	0.81
Salinity of last pond on final day of simulation (dS/m)	0.89
Ammonia loss from pond system water area (kg/m2/year)	0.00

* The threshold is the volume equivalent to the top 1 mm depth of water of a full pond

Overflow exceedance:

Chart Table



Export plot

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Irrigation Information

Irrigation: 56 ha total area (assumed 100% irrigation efficiency)

	Quantity/year	Quantity/ha/year
Total irrigation applied (ML)	461.07	8.23
Total nitrogen applied (kg)	10781.46	192.53
Total phosphorus applied (kg)	443.37	7.92
Total salts applied (kg)	254607.53	4546.56

Shandying

Annual allocation of fresh water for shandying (ML/year)	0.00
Average Shandy water irrigation (ML/year) (minimum - maximum)	0.00 (0.00 - 0.00)
Average exceedance as a proportion of annual shandy water allocation (% of allocation) (minimum - maximum)	0.00 (0.00 - 0.00)
Proportion of irrigation events requiring shandying (fraction of events)	0.00
Minimum shandy water is used	False

Irrigation Issues

Proportion of Days irrigation is prevented when triggered (fraction)	0.25
Proportion of Days water demand is too small to trigger irrigation (fraction)	0.28
Proportion of Days irrigation occurs (fraction)	0.48

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Land: New Paddock: 56 ha

Irrigation: Fixed Sprinkler with 0.2% ammonium loss during irrigation

Irrigation triggered when soil water deficit reaches 5.00 mm and rainfall is less than or equal to 3.00 mm
Irrigate up to a soil water content of drained upper limit plus 0.00 mm
Irrigation window from 1/1 to 31/12 including the days specified
A minimum of 0 days must be skipped between irrigation events

Soil Water Balance (mm): Bicton (Kur-World), 228.00 mm PAWC at maximum root depth

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	349.9	444.0	400.6	185.8	84.3	54.1	41.9	33.6	32.8	47.6	87.8	176.5	1938.9
Irrigation	60.4	30.6	44.4	48.8	58.9	62.8	75.9	89.6	89.8	92.1	85.9	84.3	823.3
Soil Evap	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Transpn.	137.3	114.1	121.1	109.7	100.8	91.2	100.0	117.9	142.3	167.7	163.6	158.5	1524.3
Rain Runoff	125.9	164.4	157.7	40.7	7.1	3.3	2.1	1.2	2.5	4.4	11.5	41.8	562.6
Irr. Runoff	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Drainage	104.2	178.9	171.7	87.5	39.2	21.2	18.5	7.7	6.1	5.0	6.3	32.7	679.1
Delta	42.9	17.1	-5.5	-3.2	-3.9	1.1	-2.8	-3.6	-28.4	-37.5	-7.7	27.8	-3.7

Soil Nitrogen Balance

Average annual effluent nitrogen added (kg/ha/year)	192.53
Average annual soil nitrogen removed by plant uptake (kg/ha/year)	263.66
Average annual soil nitrogen removed by denitrification (kg/ha/year)	0.02
Average annual soil nitrogen leached (kg/ha/year)	1.28
Average annual nitrate-N loading to groundwater (kg/ha/year)	1.28
Soil organic-N kg/ha (Initial - Final)	3809.50 - 262.46
	74.41 - 0.03
Average nitrate-N concentration of deep drainage (mg/L)	0.19
Max. annual nitrate-N concentration of deep drainage (mg/L)	8.51

Soil Phosphorus Balance

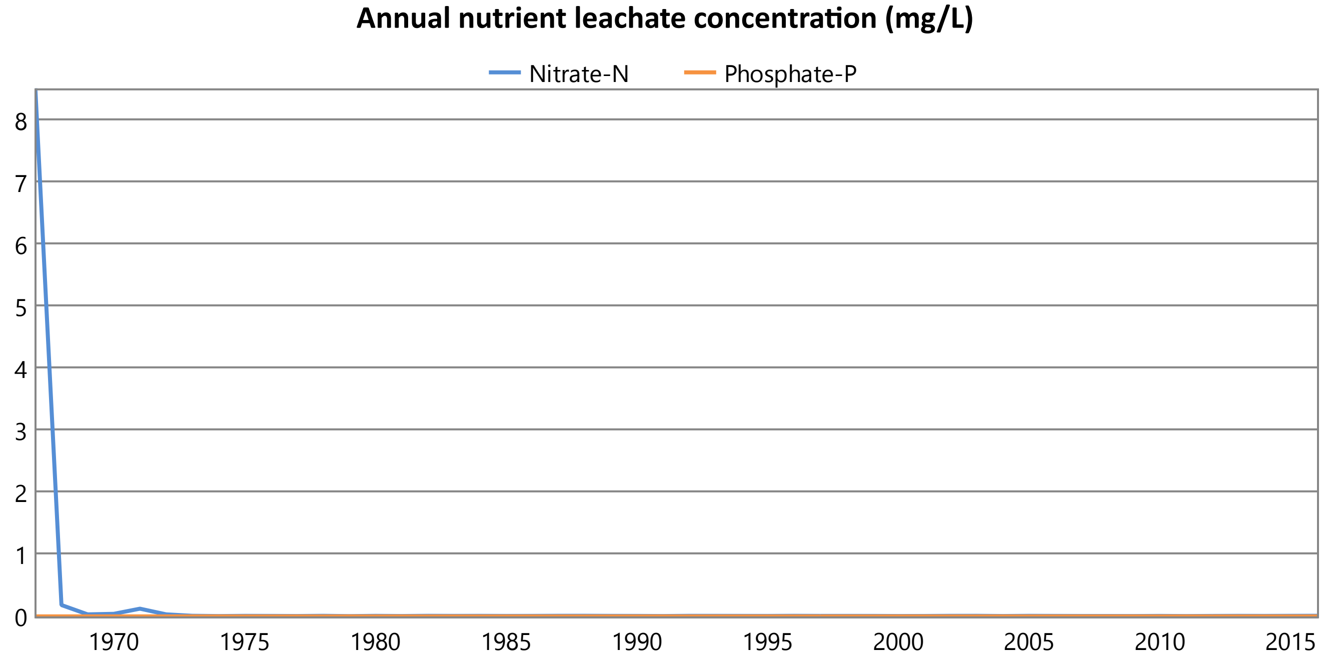
Average annual effluent phosphorus added (kg/ha/year)	7.92
Average annual soil phosphorus removed by plant uptake (kg/ha/year)	0.18
Average annual soil phosphorus leached (kg/ha/year)	4.97E-04
Dissolved phosphorus (kg/ha) (Initial - Final)	2.86E-04 - 3.58E-03
Adsorbed phosphorus (kg/ha) (Initial - Final)	450.65 - 838.84
Average phosphate-P concentration in rootzone (mg/L)	5.79E-04
Average phosphate-P concentration of deep drainage (mg/L)	7.31E-05
Max. annual phosphate-P concentration of deep drainage (mg/L)	8.46E-05
Design soil profile storage life based on average infiltrated water phosphorus concn. of 0.36 mg/L (years)	661.09

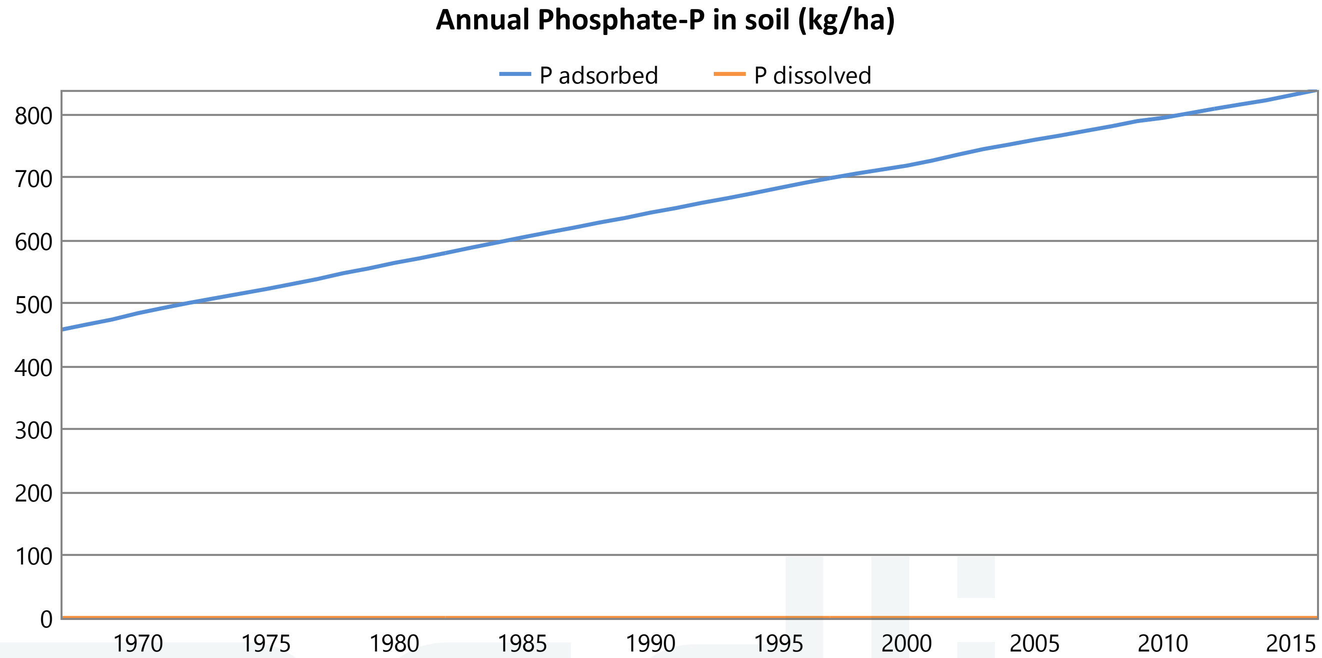
DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Land: New Paddock: 56 ha

Irrigation: Fixed Sprinkler with 0.2% ammonium loss during irrigation





DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Plant Performance: New Paddock: 56 ha

Average Plant Performance (Minimum - Maximum): Continuous Coastal Couch Grass (Cynodon dactylon) Pasture_mod golf, kick started

Average annual shoot dry matter yield (kg/ha/year)	17038.37 (13712.05 - 22169.03)
Average monthly plant (green) cover (fraction)	1.00 (0.99 - 1.00)
Average monthly crop factor (fraction)	0.80 (0.79 - 0.80)
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Average monthly root depth (mm)	799.36 (792.32 - 800.00)
Average number of normal harvests per year (no./year)	11.90 (9.00 - 16.00)
Average number of normal harvests for last five years only (no./year)	11.00
Average number of crop deaths per year (no./year)	0.00 (0.00 - 0.00)
Average number of crop deaths for last five years only (no./year)	0.00
Average annual nitrogen deficiency index (0 = no stress, 1 = full stress) (coefficient)	0.27 (0.04 - 0.42)
Average January temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.02 (0.00 - 0.07)
Average July temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.20 (0.00 - 0.41)
Average monthly water stress index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.01)
Average monthly waterlogging index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.00)
No. days without crop/year (days)	0.00

Soil Salinity - Plant salinity tolerance: Tolerant

Assumes 1.0 dS/m Electrical Conductivity = 640 mg/L Total Dissolved Salts
All values based on 10 year running averages

Salinity of infiltrated water (Average salinity of rainwater = 0.03 dS/m) (dS/m)	0.34
Salt added by rainfall (kg/ha/year)	264.25
Average annual effluent salt added & leached at steady state (kg/ha/year)	4810.81
Average leaching fraction based on 10 year running averages (fraction)	0.51
Average water-uptake-weighted rootzone salinity sat. ext. (dS/m)	0.30
Salinity of the soil solution (at drained upper limit) at base of rootzone (dS/m)	1.09
Relative crop yield expected due to salinity (fraction)	1.00
Proportion of years that crop yields would be expected to fall below 90% of potential due to salinity (fraction)	0.00

DIAGNOSTICS

Run Messages

Messages generated when the scenario was run:

Full run chosen

Stage 3

MEDLI REPORT - FULL RUN

Enterprise: **Kur World**

Description:
Stage 3 low range low ingress 10% recycled 56ha Golf and amenity full run

Client: **Reever and Ocean**

MEDLI User: NATRES\andrew

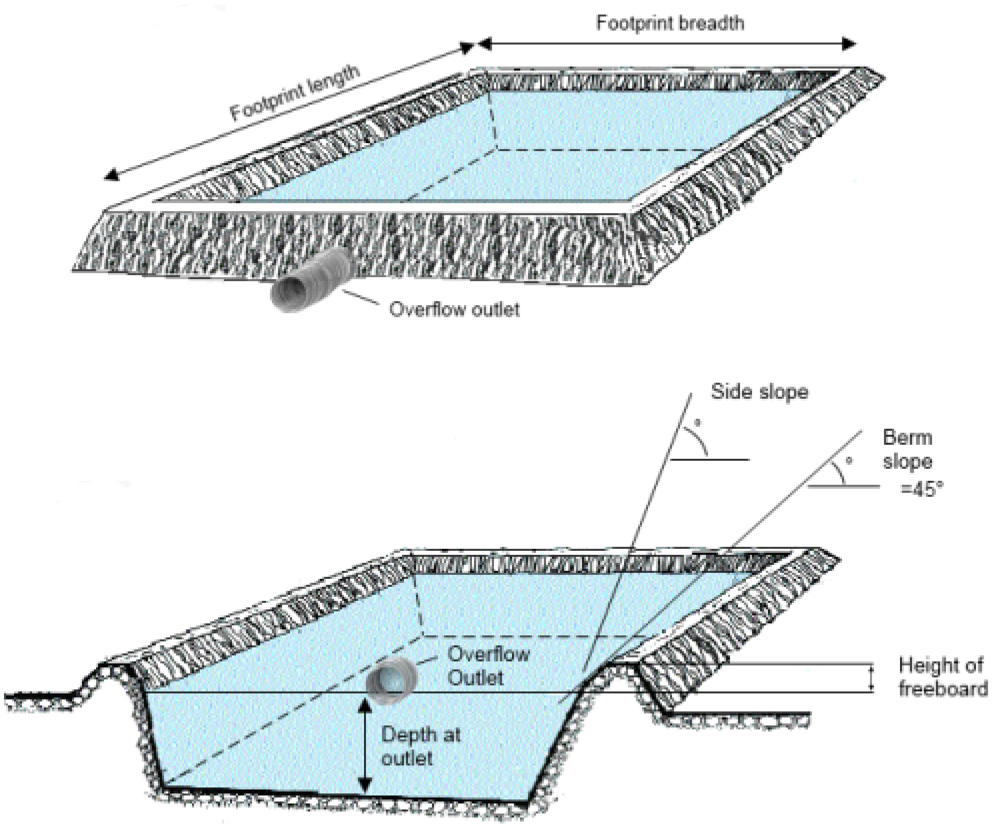
Scenario Details:
low range ADWF, low infiltration efficiency, 10 % ADWF recycled (simulated as a reduction in ADWF) Full run
N 5mg/L, P 1 mg/L, TDS 580 mg 73% TON, 2% NH4-N, 25% Org N
5 ML tank and 19 ML dam
5mm SMD to UDL. Irrigation allowed on days with up to 3 mm rainfall. Coastal couch as amenity grass (kickstarted) assumed for golf course and amenity planting - 56ha
No additional nutrient addition to account for return of clippings

DESCRIPTION

Pond system: 2 facultative, aerobic or storage ponds

Pond system details:

	Pond 1	Pond 2
Maximum pond volume (ML)	5.00	19.00
Minimum allowable pond volume (ML)	0.00	6.77
Pond depth at overflow outlet (m)	4.00	4.50
Maximum water surface area (m2)	1250.00	5794.53
Pond footprint length (m)	35.36	135.05
Pond footprint width (m)	35.36	47.15
Pond catchment area (m2)	1250.00	6367.31
Average active volume (ML)	5.00	9.44



Irrigation pump limits:

Minimum pump rate limit (ML/day)	0.00
Maximum pump rate limit (ML/day)	100.00

Shandying water:

Annual allocation of fresh water available for shandying (ML/year)	0.00
Maximum rate of application of fresh water (ML/day)	0.00
Nitrogen concentration (mg/L)	0.00
Salinity (dS/m)	0.00
Minimum shandy water is used	False

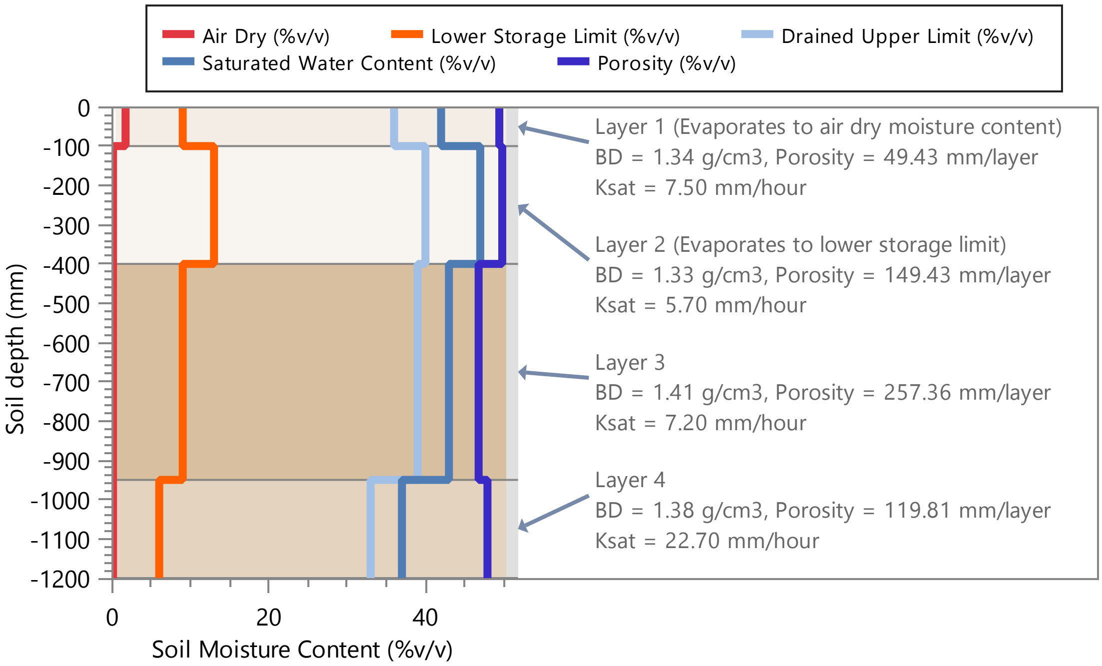
DESCRIPTION

Land: New Paddock

Area (ha): 56.00

Soil Type: Bicton (Kur-World), 1200.00 mm defined profile depth

Profile Porosity (mm)	576.04
Profile saturation water content (mm)	512.00
Profile drained upper limit (or field capacity) (mm)	453.00
Profile lower storage limit (or permanent wilting point) (mm)	112.50
Profile available water capacity (mm)	340.50
Profile limiting saturated hydraulic conductivity (mm/hour)	5.70
Surface saturated hydraulic conductivity (mm/hour)	7.50
Runoff curve number II (coefficient)	80.00
Soil evaporation U (mm)	8.50
Soil evaporation Cona (mm/sqrt day)	3.75



Plant Data: Continuous Coastal Couch Grass (Cynodon dactylon) Pasture_mod golf, kick started

Average monthly cover (fraction) (minimum - maximum)	1.00 (0.99 - 1.00)
Maximum crop factor at 100% cover (mm/mm) (Maximum crop coefficient 0.8 x Pan coefficient 1)	0.80
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Maximum potential root depth in defined soil profile (mm)	800.00
Salt tolerance	Tolerant
Salinity threshold EC sat. ext. (dS/m)	6.90
Proportion of yield decrease per dS/m increase (fraction/dS/m)	0.06

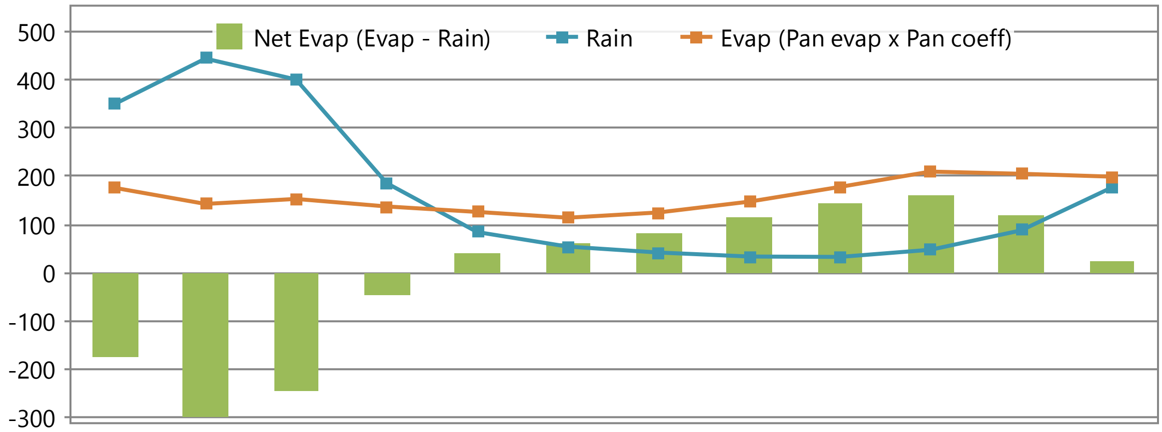
DIAGNOSTICS

Sustainability Diagnostics: Kur World

Averaged Historical Climate Data Used in Simulation (mm)

Location: KurWorlSTP, -16.8°, 145.6°

Run Period: 01/01/1967 to 31/12/2016 50 years, 0 days



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	349.9	444.0	400.6	185.8	84.3	54.1	41.9	33.6	32.8	47.6	87.8	176.5	1938.9
Evap	176.0	142.7	153.0	137.4	126.0	114.1	125.0	147.4	177.9	209.7	205.2	199.2	1913.4
Net Evap	-173.9	-301.3	-247.6	-48.4	41.8	59.9	83.1	113.8	145.1	162.1	117.4	22.7	-25.5
Net Evap/day	-5.6	-10.7	-8.0	-1.6	1.3	2.0	2.7	3.7	4.8	5.2	3.9	0.7	-0.1

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Pond System: 2 facultative, aerobic or storage ponds

Kur-world Stage 3 Low range, low ingress, 10% recycled - Sept 2017 - 297.14 ML/year or 0.81 ML/day generated on average

Effluent entering pond system after any pretreatment and recycling

Average (Minimum-Maximum) influent quality calculated for 365.26 non-zero flow days, after any pretreatment and recycling.

Constituent	Concentration (mg/L)	Load (kg/year)
Total Nitrogen	4.54 (0.64 - 5.00)	1347.65 (1346.69 - 1350.38)
Total Phosphorus	0.91 (0.13 - 1.00)	269.53 (269.34 - 270.08)
Total Dissolved Salts	526.10 (73.77 - 580.00)	156326.82 (156215.55 - 156643.53)
Volatile Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Total Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)

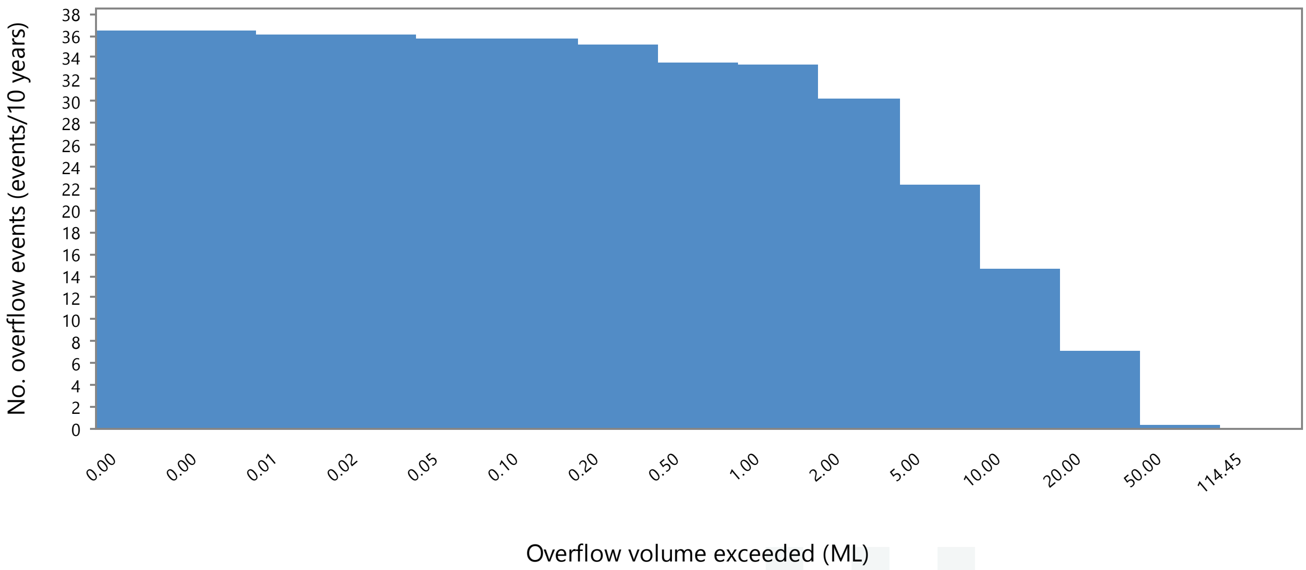
Last pond (Wet weather store): 19.00 ML

Theoretical hydraulic retention time (days)	23.36
Average volume of overflow (ML/year)	43.23
No. overflow events per year exceeding threshold* of 0.00 ML (no./year)	3.64
Average duration of overflow (days)	11.57
Effluent Reuse (Proportion of Inflow + Net Rain Gain that is Irrigated) (fraction)	0.86
Probability of at least 90% effluent reuse (fraction)	0.31
Average salinity of last pond (dS/m)	0.79
Salinity of last pond on final day of simulation (dS/m)	0.88
Ammonia loss from pond system water area (kg/m2/year)	0.00

* The threshold is the volume equivalent to the top 1 mm depth of water of a full pond

Overflow exceedance:

Chart Table



Export plot

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Irrigation Information

Irrigation: 56 ha total area (assumed 100% irrigation efficiency)

	Quantity/year	Quantity/ha/year
Total irrigation applied (ML)	259.75	4.64
Total nitrogen applied (kg)	1193.04	21.30
Total phosphorus applied (kg)	239.57	4.28
Total salts applied (kg)	138948.57	2481.22

Shandying

Annual allocation of fresh water for shandying (ML/year)	0.00
Average Shandy water irrigation (ML/year) (minimum - maximum)	0.00 (0.00 - 0.00)
Average exceedance as a proportion of annual shandy water allocation (% of allocation) (minimum - maximum)	0.00 (0.00 - 0.00)
Proportion of irrigation events requiring shandying (fraction of events)	0.00
Minimum shandy water is used	False

Irrigation Issues

Proportion of Days irrigation is prevented when triggered (fraction)	0.25
Proportion of Days water demand is too small to trigger irrigation (fraction)	0.13
Proportion of Days irrigation occurs (fraction)	0.62

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Land: New Paddock: 56 ha

Irrigation: Fixed Sprinkler with 0.2% ammonium loss during irrigation

Irrigation triggered when soil water deficit reaches 5.00 mm and rainfall is less than or equal to 3.00 mm
Irrigate up to a soil water content of drained upper limit plus 0.00 mm
Irrigation window from 1/1 to 31/12 including the days specified
A minimum of 0 days must be skipped between irrigation events

Soil Water Balance (mm): Bicton (Kur-World), 228.00 mm PAWC at maximum root depth

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	349.9	444.0	400.6	185.8	84.3	54.1	41.9	33.6	32.8	47.6	87.8	176.5	1938.9
Irrigation	37.6	24.1	33.4	36.4	42.0	42.7	42.2	41.0	40.2	41.6	40.8	41.8	463.8
Soil Evap	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Transpn.	127.1	112.1	120.9	109.7	100.8	91.2	100.0	117.9	138.3	138.2	108.5	120.9	1385.6
Rain Runoff	113.6	159.9	154.2	39.5	6.7	3.0	1.7	0.6	1.8	2.2	5.7	31.5	520.4
Irr. Runoff	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Drainage	57.8	145.8	157.7	78.7	29.4	13.2	6.5	1.6	0.1	0.6	0.2	10.3	501.8
Delta	89.2	50.2	1.3	-5.7	-10.7	-10.6	-24.1	-45.4	-67.2	-51.8	14.2	55.6	-5.0

Soil Nitrogen Balance

Average annual effluent nitrogen added (kg/ha/year)	21.30
Average annual soil nitrogen removed by plant uptake (kg/ha/year)	94.00
Average annual soil nitrogen removed by denitrification (kg/ha/year)	0.01
Average annual soil nitrogen leached (kg/ha/year)	1.19
Average annual nitrate-N loading to groundwater (kg/ha/year)	1.19
Soil organic-N kg/ha (Initial - Final)	3809.50 - 189.26
	74.41 - 0.02
Average nitrate-N concentration of deep drainage (mg/L)	0.24
Max. annual nitrate-N concentration of deep drainage (mg/L)	8.49

Soil Phosphorus Balance

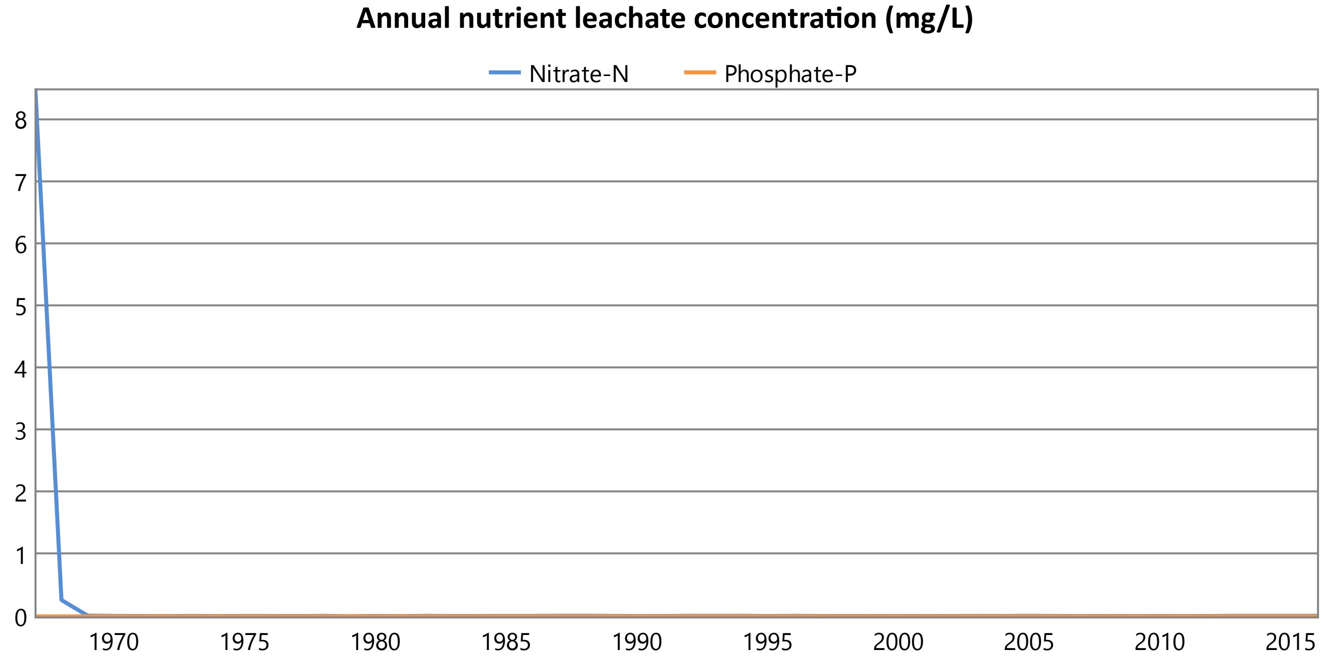
Average annual effluent phosphorus added (kg/ha/year)	4.28
Average annual soil phosphorus removed by plant uptake (kg/ha/year)	1.80E-03
Average annual soil phosphorus leached (kg/ha/year)	3.54E-04
Dissolved phosphorus (kg/ha) (Initial - Final)	2.86E-04 - 1.18E-03
Adsorbed phosphorus (kg/ha) (Initial - Final)	450.65 - 666.32
Average phosphate-P concentration in rootzone (mg/L)	2.07E-04
Average phosphate-P concentration of deep drainage (mg/L)	7.06E-05
Max. annual phosphate-P concentration of deep drainage (mg/L)	7.99E-05
Design soil profile storage life based on average infiltrated water phosphorus concn. of 0.23 mg/L (years)	999.90

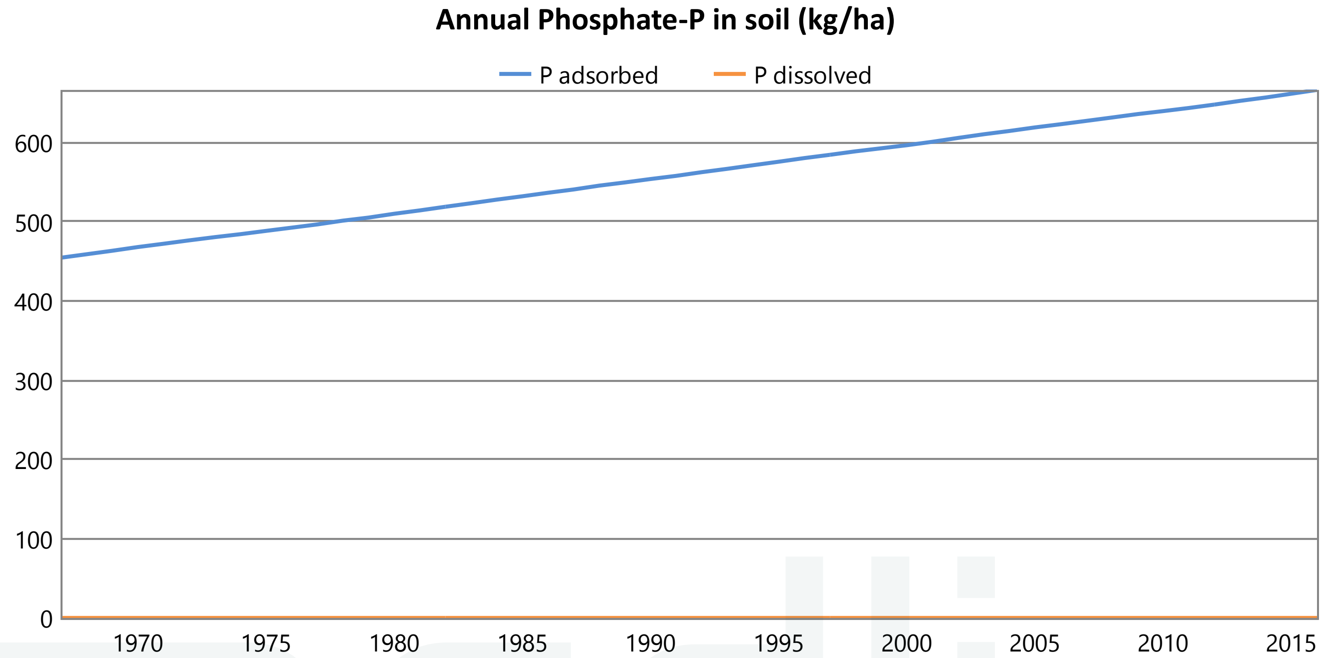
DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Land: New Paddock: 56 ha

Irrigation: Fixed Sprinkler with 0.2% ammonium loss during irrigation





DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Plant Performance: New Paddock: 56 ha

Average Plant Performance (Minimum - Maximum): Continuous Coastal Couch Grass (Cynodon dactylon) Pasture_mod golf, kick started

Average annual shoot dry matter yield (kg/ha/year)	9007.69 (5019.78 - 15716.14)
Average monthly plant (green) cover (fraction)	1.00 (0.99 - 1.00)
Average monthly crop factor (fraction)	0.80 (0.79 - 0.80)
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Average monthly root depth (mm)	799.36 (792.32 - 800.00)
Average number of normal harvests per year (no./year)	6.32 (3.00 - 11.00)
Average number of normal harvests for last five years only (no./year)	3.80
Average number of crop deaths per year (no./year)	0.00 (0.00 - 0.00)
Average number of crop deaths for last five years only (no./year)	0.00
Average annual nitrogen deficiency index (0 = no stress, 1 = full stress) (coefficient)	0.61 (0.18 - 0.79)
Average January temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.02 (0.00 - 0.07)
Average July temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.20 (0.00 - 0.41)
Average monthly water stress index (0 = no stress, 1 = full stress) (coefficient)	0.07 (0.00 - 0.32)
Average monthly waterlogging index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.00)
No. days without crop/year (days)	0.00

Soil Salinity - Plant salinity tolerance: Tolerant

Assumes 1.0 dS/m Electrical Conductivity = 640 mg/L Total Dissolved Salts
All values based on 10 year running averages

Salinity of infiltrated water (Average salinity of rainwater = 0.03 dS/m) (dS/m)	0.23
Salt added by rainfall (kg/ha/year)	272.35
Average annual effluent salt added & leached at steady state (kg/ha/year)	2753.58
Average leaching fraction based on 10 year running averages (fraction)	0.46
Average water-uptake-weighted rootzone salinity sat. ext. (dS/m)	0.22
Salinity of the soil solution (at drained upper limit) at base of rootzone (dS/m)	0.86
Relative crop yield expected due to salinity (fraction)	1.00
Proportion of years that crop yields would be expected to fall below 90% of potential due to salinity (fraction)	0.00

DIAGNOSTICS

Run Messages

Messages generated when the scenario was run:

Full run chosen

MEDLI REPORT - FULL RUN

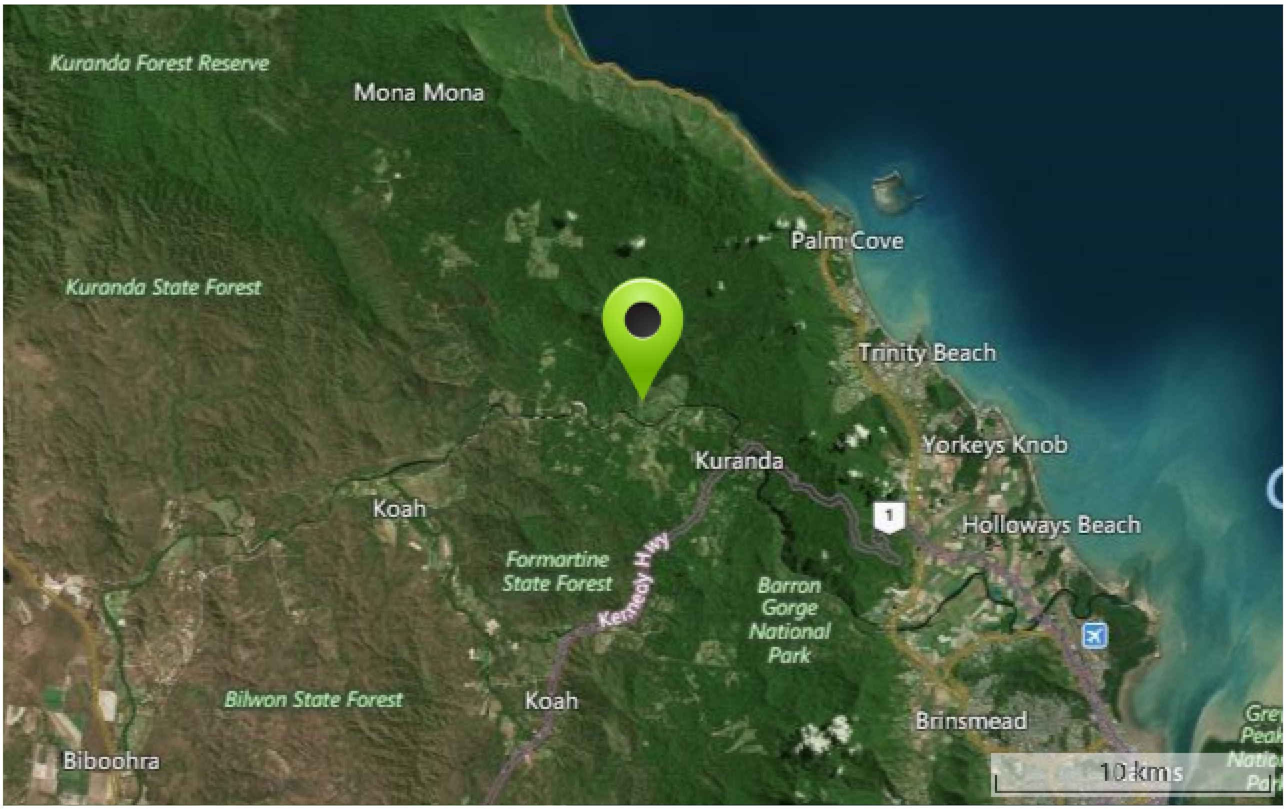
Enterprise: **Kur World**

Description:
Stage 3 low range low ingress 56ha Golf and amenity full run

Client: **Reever and Ocean**

MEDLI User: NATRES\andrew

Scenario Details:
low range ADWF, low infiltration efficiency, Full run
N 5mg/L, P 1 mg/L, TDS 580 mg 73% TON, 2% NH4-N, 25% Org N
5 ML tank and 19 ML dam
5mm SMD to UDL. Irrigation allowed on days with up to 3 mm rainfall. Coastal couch as amenity grass (kickstarted) assumed for golf course and amenity planting - 56ha
No additional nutrient addition to account for return of clippings

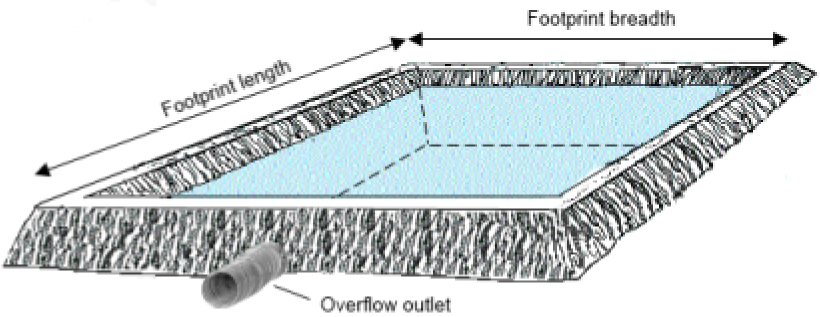


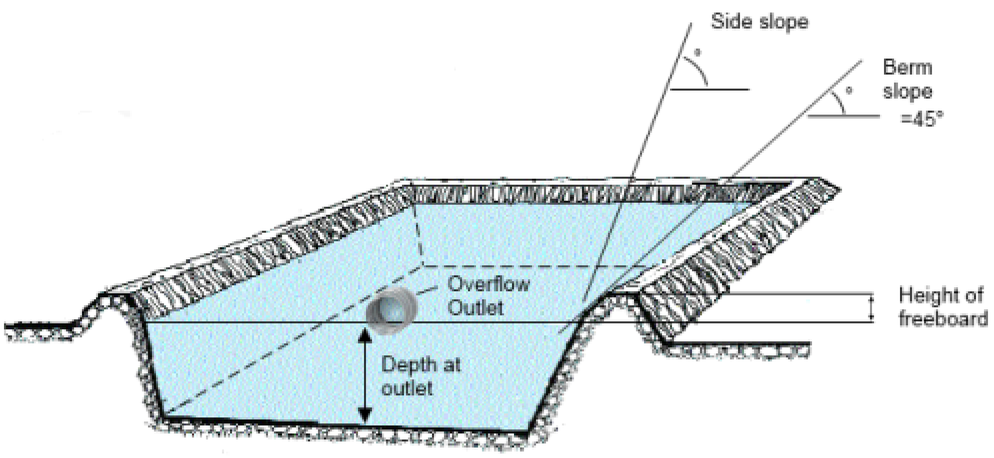
DESCRIPTION

Pond system: 2 facultative, aerobic or storage ponds

Pond system details:

	Pond 1	Pond 2
Maximum pond volume (ML)	5.00	19.00
Minimum allowable pond volume (ML)	0.00	6.77
Pond depth at overflow outlet (m)	4.00	4.50
Maximum water surface area (m2)	1250.00	5794.53
Pond footprint length (m)	35.36	135.05
Pond footprint width (m)	35.36	47.15
Pond catchment area (m2)	1250.00	6367.31
Average active volume (ML)	5.00	9.68





Irrigation pump limits:

Minimum pump rate limit (ML/day)	0.00
Maximum pump rate limit (ML/day)	100.00

Shandying water:

Annual allocation of fresh water available for shandying (ML/year)	0.00
Maximum rate of application of fresh water (ML/day)	0.00
Nitrogen concentration (mg/L)	0.00
Salinity (dS/m)	0.00
Minimum shandy water is used	False

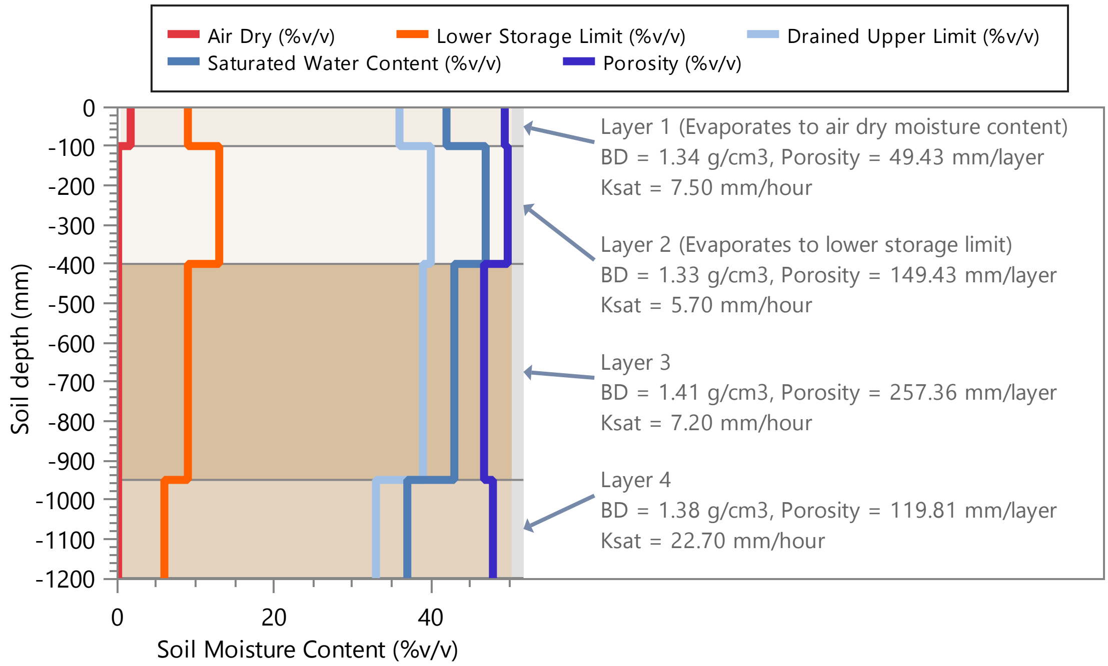
DESCRIPTION

Land: New Paddock

Area (ha): 56.00

Soil Type: Bicton (Kur-World), 1200.00 mm defined profile depth

Profile Porosity (mm)	576.04
Profile saturation water content (mm)	512.00
Profile drained upper limit (or field capacity) (mm)	453.00
Profile lower storage limit (or permanent wilting point) (mm)	112.50
Profile available water capacity (mm)	340.50
Profile limiting saturated hydraulic conductivity (mm/hour)	5.70
Surface saturated hydraulic conductivity (mm/hour)	7.50
Runoff curve number II (coefficient)	80.00
Soil evaporation U (mm)	8.50
Soil evaporation Cona (mm/sqrt day)	3.75



Plant Data: Continuous Coastal Couch Grass (Cynodon dactylon) Pasture_mod golf, kick started

Average monthly cover (fraction) (minimum - maximum)	1.00 (0.99 - 1.00)
Maximum crop factor at 100% cover (mm/mm) (Maximum crop coefficient 0.8 x Pan coefficient 1)	0.80
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Maximum potential root depth in defined soil profile (mm)	800.00
Salt tolerance	Tolerant
Salinity threshold EC sat. ext. (dS/m)	6.90
Proportion of yield decrease per dS/m increase (fraction/dS/m)	0.06

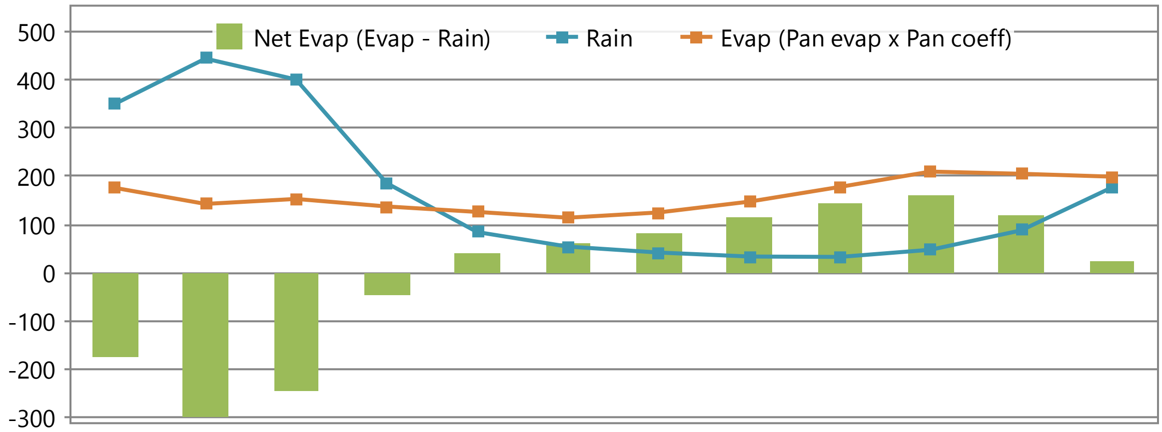
DIAGNOSTICS

Sustainability Diagnostics: Kur World

Averaged Historical Climate Data Used in Simulation (mm)

Location: KurWorlSTP, -16.8°, 145.6°

Run Period: 01/01/1967 to 31/12/2016 50 years, 0 days



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	349.9	444.0	400.6	185.8	84.3	54.1	41.9	33.6	32.8	47.6	87.8	176.5	1938.9
Evap	176.0	142.7	153.0	137.4	126.0	114.1	125.0	147.4	177.9	209.7	205.2	199.2	1913.4
Net Evap	-173.9	-301.3	-247.6	-48.4	41.8	59.9	83.1	113.8	145.1	162.1	117.4	22.7	-25.5
Net Evap/day	-5.6	-10.7	-8.0	-1.6	1.3	2.0	2.7	3.7	4.8	5.2	3.9	0.7	-0.1

Sustainability Diagnostics: Kur World

Pond System: 2 facultative, aerobic or storage ponds

Kur-world Stage 3 Low range, low ingress - Sept 2017 - 330.19 ML/year or 0.90 ML/day generated on average

Effluent entering pond system after any pretreatment and recycling

Average (Minimum-Maximum) influent quality calculated for 365.26 non-zero flow days, after any pretreatment and recycling.

Constituent	Concentration (mg/L)	Load (kg/year)
Total Nitrogen	4.54 (0.64 - 5.00)	1497.55 (1496.48 - 1500.58)
Total Phosphorus	0.91 (0.13 - 1.00)	299.51 (299.30 - 300.12)
Total Dissolved Salts	526.10 (73.77 - 580.00)	173715.54 (173591.88 - 174067.48)
Volatile Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Total Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)

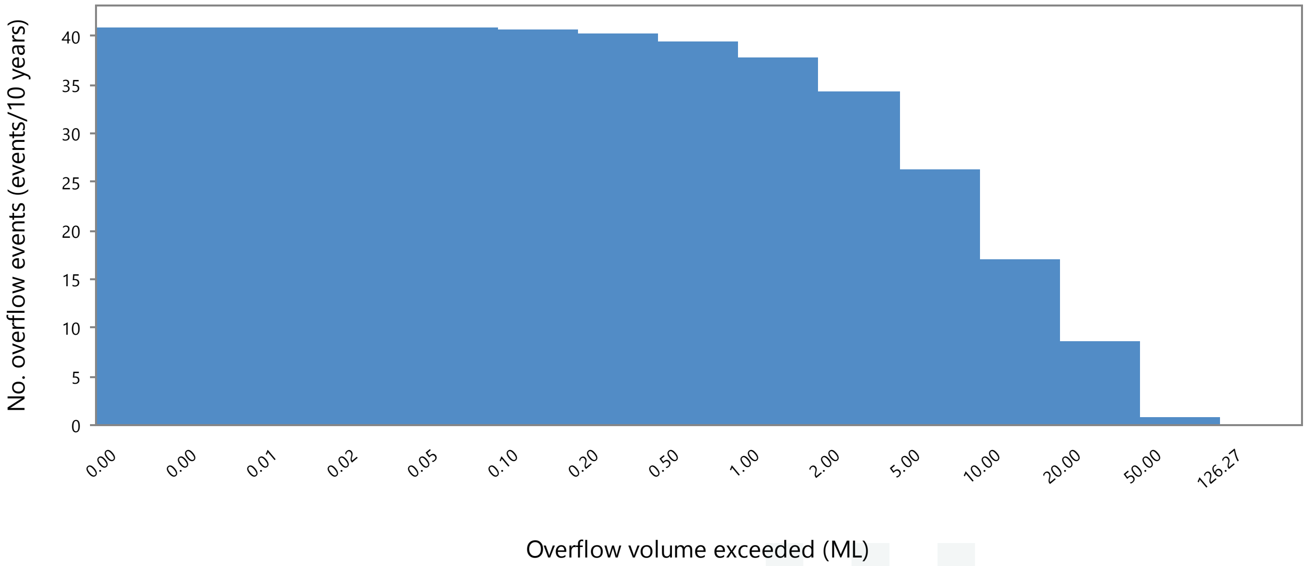
Last pond (Wet weather store): 19.00 ML

Theoretical hydraulic retention time (days)	21.02
Average volume of overflow (ML/year)	53.06
No. overflow events per year exceeding threshold* of 0.00 ML (no./year)	4.08
Average duration of overflow (days)	11.55
Effluent Reuse (Proportion of Inflow + Net Rain Gain that is Irrigated) (fraction)	0.84
Probability of at least 90% effluent reuse (fraction)	0.29
Average salinity of last pond (dS/m)	0.79
Salinity of last pond on final day of simulation (dS/m)	0.88
Ammonia loss from pond system water area (kg/m2/year)	0.00

* The threshold is the volume equivalent to the top 1 mm depth of water of a full pond

Overflow exceedance:

Chart Table



Export plot

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Irrigation Information

Irrigation: 56 ha total area (assumed 100% irrigation efficiency)

	Quantity/year	Quantity/ha/year
Total irrigation applied (ML)	282.93	5.05
Total nitrogen applied (kg)	1305.29	23.31
Total phosphorus applied (kg)	262.11	4.68
Total salts applied (kg)	152021.40	2714.67

Shandying

Annual allocation of fresh water for shandying (ML/year)	0.00
Average Shandy water irrigation (ML/year) (minimum - maximum)	0.00 (0.00 - 0.00)
Average exceedance as a proportion of annual shandy water allocation (% of allocation) (minimum - maximum)	0.00 (0.00 - 0.00)
Proportion of irrigation events requiring shandying (fraction of events)	0.00
Minimum shandy water is used	False

Irrigation Issues

Proportion of Days irrigation is prevented when triggered (fraction)	0.25
Proportion of Days water demand is too small to trigger irrigation (fraction)	0.14
Proportion of Days irrigation occurs (fraction)	0.61

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Land: New Paddock: 56 ha

Irrigation: Fixed Sprinkler with 0.2% ammonium loss during irrigation

Irrigation triggered when soil water deficit reaches 5.00 mm and rainfall is less than or equal to 3.00 mm
Irrigate up to a soil water content of drained upper limit plus 0.00 mm
Irrigation window from 1/1 to 31/12 including the days specified
A minimum of 0 days must be skipped between irrigation events

Soil Water Balance (mm): Bicton (Kur-World), 228.00 mm PAWC at maximum root depth

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	349.9	444.0	400.6	185.8	84.3	54.1	41.9	33.6	32.8	47.6	87.8	176.5	1938.9
Irrigation	41.2	25.3	34.8	37.8	45.4	46.6	46.6	45.8	44.7	46.2	45.4	45.5	505.2
Soil Evap	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Transpn.	128.0	112.5	120.9	109.7	100.8	91.2	100.0	117.9	139.9	146.6	117.3	123.8	1408.6
Rain Runoff	114.6	160.5	154.6	39.6	6.8	3.1	1.8	0.6	1.9	2.4	6.1	32.2	524.4
Irr. Runoff	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Drainage	59.7	149.1	159.6	79.6	31.2	14.4	7.5	1.9	0.2	0.9	0.4	11.7	516.2
Delta	88.8	47.2	0.3	-5.3	-9.2	-8.0	-20.8	-41.0	-64.4	-56.1	9.4	54.3	-5.0

Soil Nitrogen Balance

Average annual effluent nitrogen added (kg/ha/year)	23.31
Average annual soil nitrogen removed by plant uptake (kg/ha/year)	96.19
Average annual soil nitrogen removed by denitrification (kg/ha/year)	0.01
Average annual soil nitrogen leached (kg/ha/year)	1.20
Average annual nitrate-N loading to groundwater (kg/ha/year)	1.20
Soil organic-N kg/ha (Initial - Final)	3809.50 - 179.64
	74.41 - 0.02
Average nitrate-N concentration of deep drainage (mg/L)	0.23
Max. annual nitrate-N concentration of deep drainage (mg/L)	8.48

Soil Phosphorus Balance

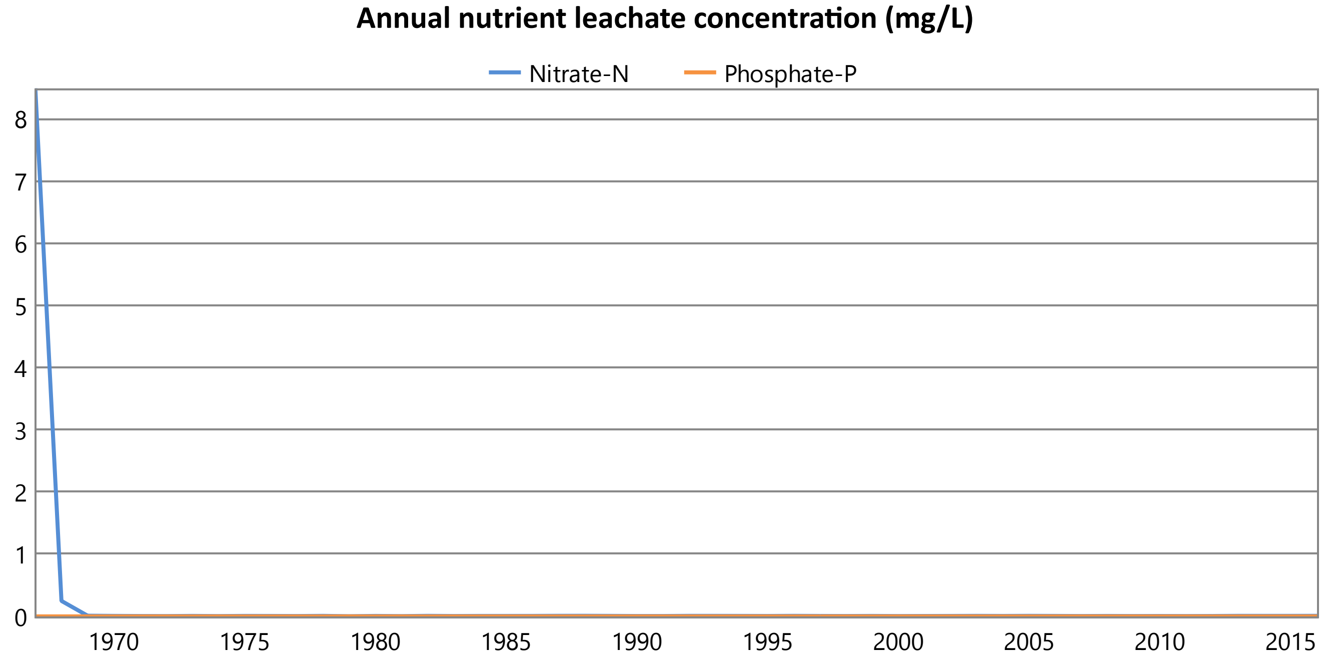
Average annual effluent phosphorus added (kg/ha/year)	4.68
Average annual soil phosphorus removed by plant uptake (kg/ha/year)	1.80E-03
Average annual soil phosphorus leached (kg/ha/year)	3.72E-04
Dissolved phosphorus (kg/ha) (Initial - Final)	2.86E-04 - 9.27E-04
Adsorbed phosphorus (kg/ha) (Initial - Final)	450.65 - 686.35
Average phosphate-P concentration in rootzone (mg/L)	2.42E-04
Average phosphate-P concentration of deep drainage (mg/L)	7.21E-05
Max. annual phosphate-P concentration of deep drainage (mg/L)	8.83E-05
Design soil profile storage life based on average infiltrated water phosphorus concn. of 0.24 mg/L (years)	989.53

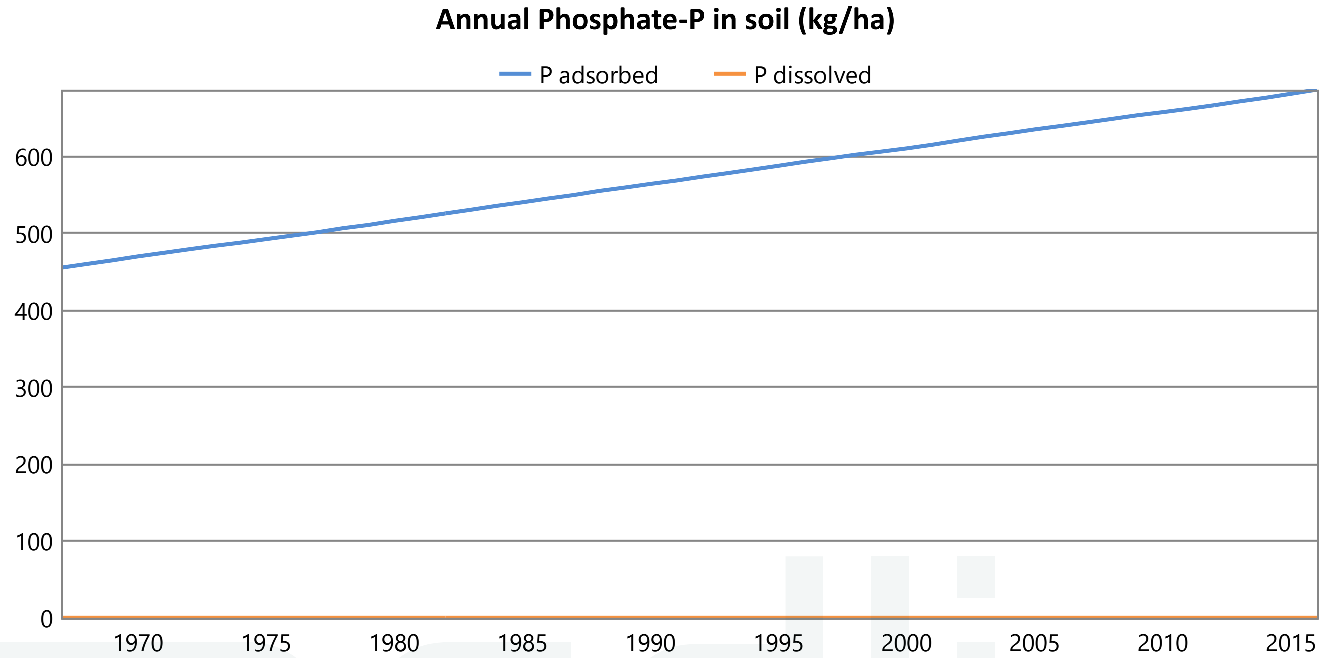
DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Land: New Paddock: 56 ha

Irrigation: Fixed Sprinkler with 0.2% ammonium loss during irrigation





DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Plant Performance: New Paddock: 56 ha

Average Plant Performance (Minimum - Maximum): Continuous Coastal Couch Grass (Cynodon dactylon) Pasture_mod golf, kick started

Average annual shoot dry matter yield (kg/ha/year)	9151.53 (5149.71 - 16017.01)
Average monthly plant (green) cover (fraction)	1.00 (0.99 - 1.00)
Average monthly crop factor (fraction)	0.80 (0.79 - 0.80)
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Average monthly root depth (mm)	799.36 (792.32 - 800.00)
Average number of normal harvests per year (no./year)	6.42 (3.00 - 11.00)
Average number of normal harvests for last five years only (no./year)	3.80
Average number of crop deaths per year (no./year)	0.00 (0.00 - 0.00)
Average number of crop deaths for last five years only (no./year)	0.00
Average annual nitrogen deficiency index (0 = no stress, 1 = full stress) (coefficient)	0.61 (0.17 - 0.78)
Average January temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.02 (0.00 - 0.07)
Average July temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.20 (0.00 - 0.41)
Average monthly water stress index (0 = no stress, 1 = full stress) (coefficient)	0.06 (0.00 - 0.26)
Average monthly waterlogging index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.00)
No. days without crop/year (days)	0.00

Soil Salinity - Plant salinity tolerance: Tolerant

Assumes 1.0 dS/m Electrical Conductivity = 640 mg/L Total Dissolved Salts
All values based on 10 year running averages

Salinity of infiltrated water (Average salinity of rainwater = 0.03 dS/m) (dS/m)	0.24
Salt added by rainfall (kg/ha/year)	271.60
Average annual effluent salt added & leached at steady state (kg/ha/year)	2986.26
Average leaching fraction based on 10 year running averages (fraction)	0.47
Average water-uptake-weighted rootzone salinity sat. ext. (dS/m)	0.24
Salinity of the soil solution (at drained upper limit) at base of rootzone (dS/m)	0.90
Relative crop yield expected due to salinity (fraction)	1.00
Proportion of years that crop yields would be expected to fall below 90% of potential due to salinity (fraction)	0.00

DIAGNOSTICS

Run Messages

Messages generated when the scenario was run:

Full run chosen

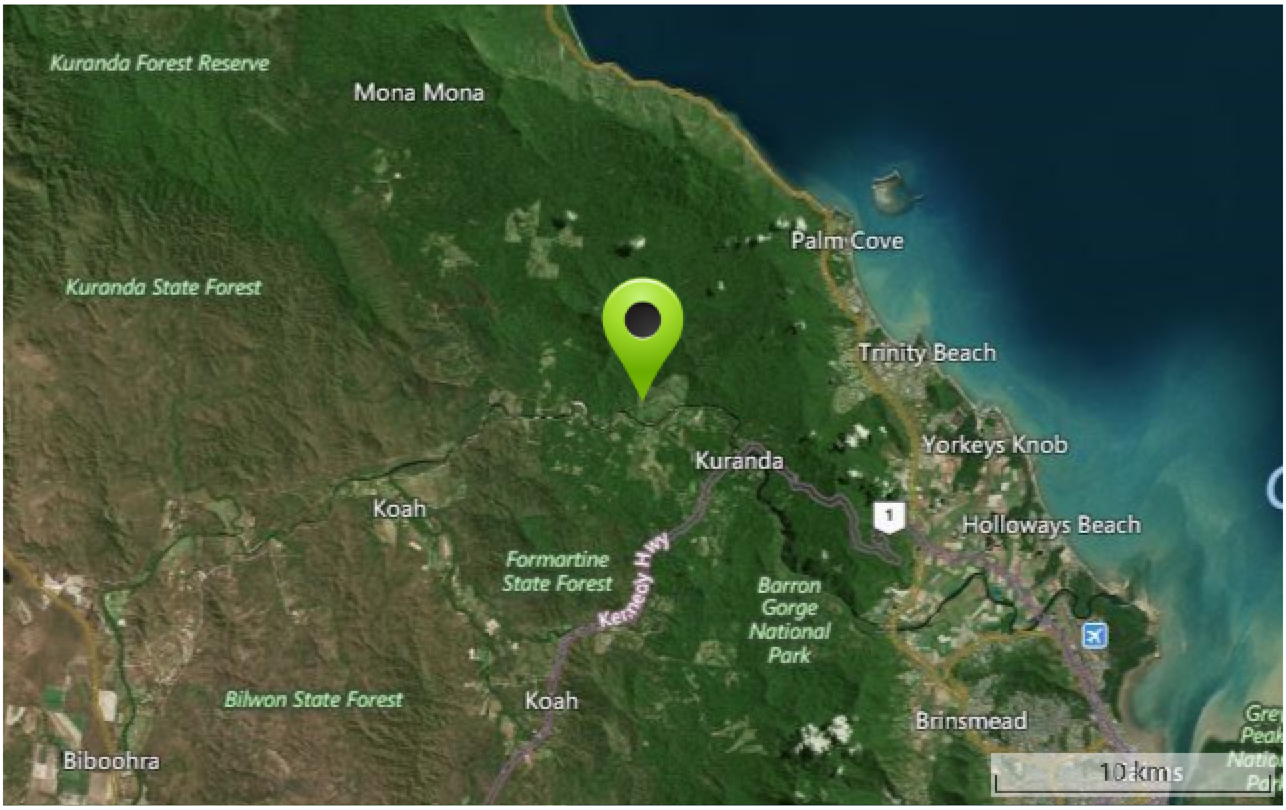
Enterprise: **Kur World**

Description:
Stage 3 low range low ingress 56ha Golf and amenity NO DAM full run

Client: **Reever and Ocean**

MEDLI User: NATRES\andrew

Scenario Details:
low range ADWF, low infiltration efficiency, Full run
N 5mg/L, P 1 mg/L, TDS 580 mg 73% TON, 2% NH4-N, 25% Org N
5 ML tank NO DAM
5mm SMD to UDL. Irrigation allowed on days with up to 3 mm rainfall. Coastal couch as amenity grass (kickstarted) assumed for golf course and amenity planting - 56ha
No additional nutrient addition to account for return of clippings

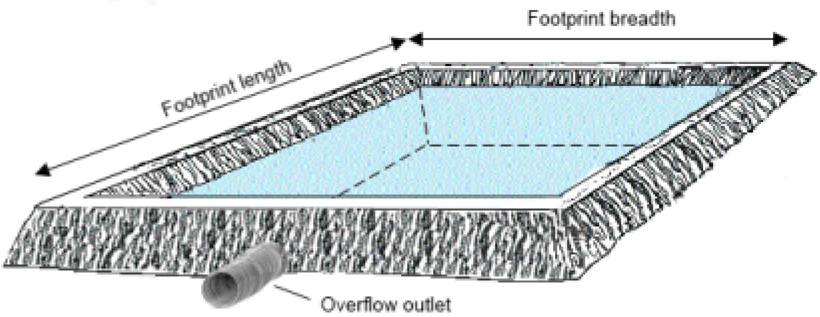


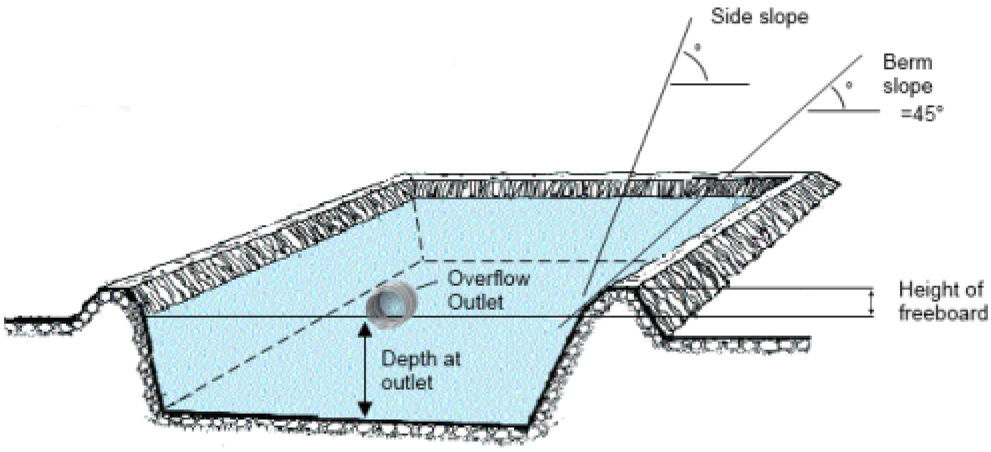
DESCRIPTION

Pond system: 1 closed storage tank

Pond system details:

	Pond 1
Maximum pond volume (ML)	5.00
Minimum allowable pond volume (ML)	1.88
Pond depth at overflow outlet (m)	4.00
Maximum water surface area (m2)	1250.00
Pond footprint length (m)	35.36
Pond footprint width (m)	35.36
Pond catchment area (m2)	1250.00
Average active volume (ML)	2.69





Irrigation pump limits:

Minimum pump rate limit (ML/day)	0.00
Maximum pump rate limit (ML/day)	100.00

Shandying water:

Annual allocation of fresh water available for shandying (ML/year)	0.00
Maximum rate of application of fresh water (ML/day)	0.00
Nitrogen concentration (mg/L)	0.00
Salinity (dS/m)	0.00
Minimum shandy water is used	False

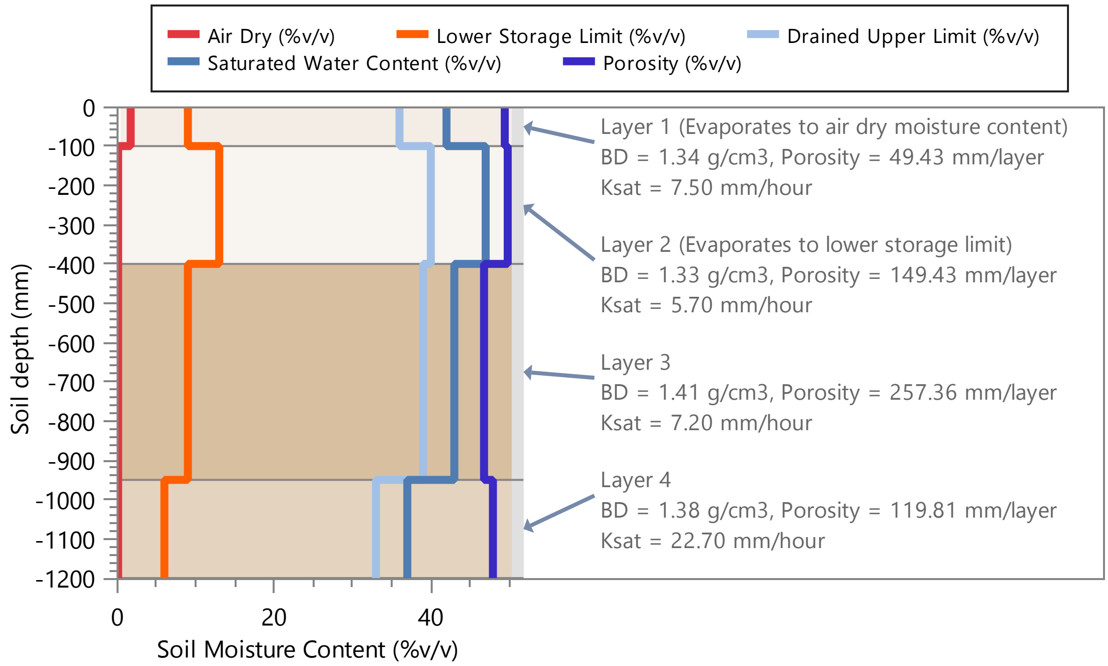
DESCRIPTION

Land: New Paddock

Area (ha): 56.00

Soil Type: Bicton (Kur-World), 1200.00 mm defined profile depth

Profile Porosity (mm)	576.04
Profile saturation water content (mm)	512.00
Profile drained upper limit (or field capacity) (mm)	453.00
Profile lower storage limit (or permanent wilting point) (mm)	112.50
Profile available water capacity (mm)	340.50
Profile limiting saturated hydraulic conductivity (mm/hour)	5.70
Surface saturated hydraulic conductivity (mm/hour)	7.50
Runoff curve number II (coefficient)	80.00
Soil evaporation U (mm)	8.50
Soil evaporation Cona (mm/sqrt day)	3.75



Plant Data: Continuous Coastal Couch Grass (Cynodon dactylon) Pasture_mod golf, kick started

Average monthly cover (fraction) (minimum - maximum)	1.00 (0.99 - 1.00)
Maximum crop factor at 100% cover (mm/mm) (Maximum crop coefficient 0.8 x Pan coefficient 1)	0.80
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Maximum potential root depth in defined soil profile (mm)	800.00
Salt tolerance	Tolerant
Salinity threshold EC sat. ext. (dS/m)	6.90
Proportion of yield decrease per dS/m increase (fraction/dS/m)	0.06

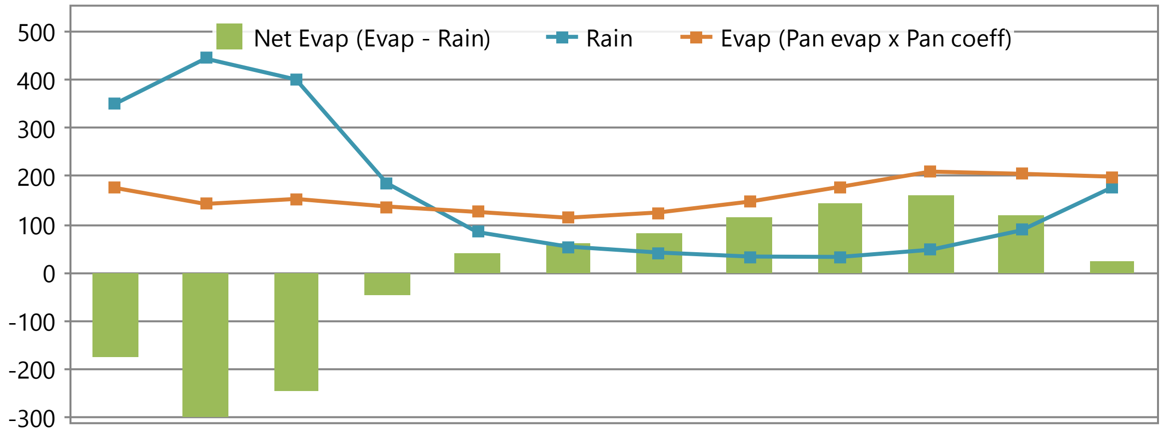
DIAGNOSTICS

Sustainability Diagnostics: Kur World

Averaged Historical Climate Data Used in Simulation (mm)

Location: KurWorlSTP, -16.8°, 145.6°

Run Period: 01/01/1967 to 31/12/2016 50 years, 0 days



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	349.9	444.0	400.6	185.8	84.3	54.1	41.9	33.6	32.8	47.6	87.8	176.5	1938.9
Evap	176.0	142.7	153.0	137.4	126.0	114.1	125.0	147.4	177.9	209.7	205.2	199.2	1913.4
Net Evap	-173.9	-301.3	-247.6	-48.4	41.8	59.9	83.1	113.8	145.1	162.1	117.4	22.7	-25.5
Net Evap/day	-5.6	-10.7	-8.0	-1.6	1.3	2.0	2.7	3.7	4.8	5.2	3.9	0.7	-0.1

Sustainability Diagnostics: Kur World

Pond System: 1 closed storage tank

Kur-world Stage 3 Low range, low ingress - Sept 2017 - 330.19 ML/year or 0.90 ML/day generated on average

Effluent entering pond system after any pretreatment and recycling

Average (Minimum-Maximum) influent quality calculated for 365.26 non-zero flow days, after any pretreatment and recycling.

Constituent	Concentration (mg/L)	Load (kg/year)
Total Nitrogen	4.54 (0.64 - 5.00)	1497.55 (1496.48 - 1500.58)
Total Phosphorus	0.91 (0.13 - 1.00)	299.51 (299.30 - 300.12)
Total Dissolved Salts	526.10 (73.77 - 580.00)	173715.54 (173591.88 - 174067.48)
Volatile Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Total Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)

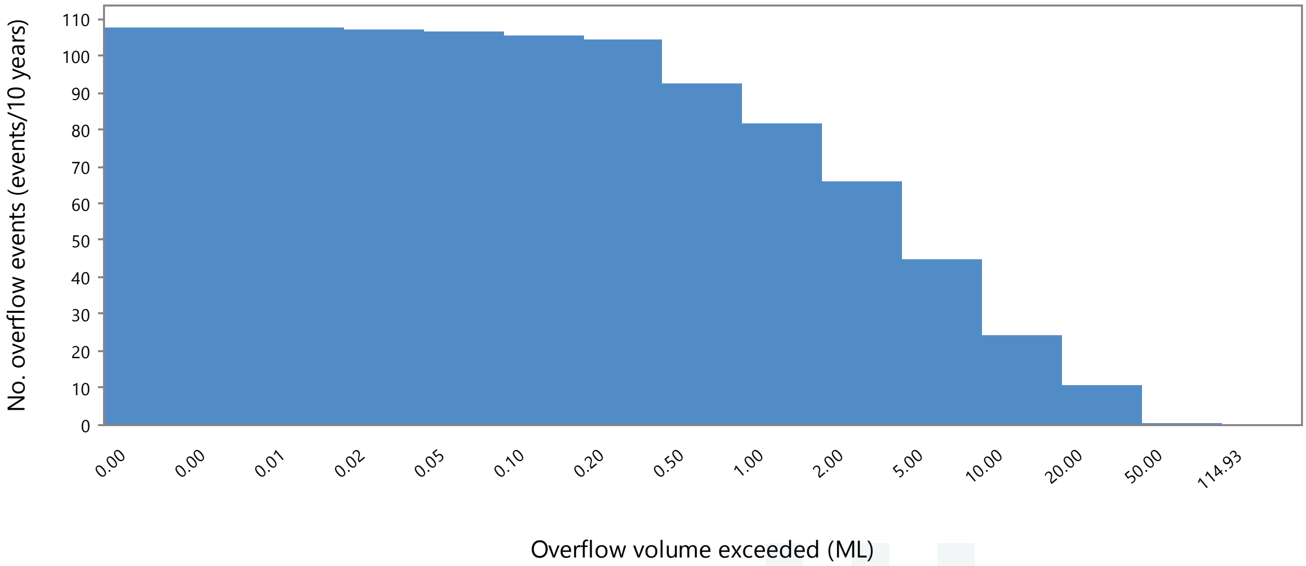
Last pond (Wet weather store): 5.00 ML

Theoretical hydraulic retention time (days)	5.53
Average volume of overflow (ML/year)	80.32
No. overflow events per year exceeding threshold* of 0.00 ML (no./year)	10.74
Average duration of overflow (days)	7.38
Effluent Reuse (Proportion of Inflow + Net Rain Gain that is Irrigated) (fraction)	0.76
Probability of at least 90% effluent reuse (fraction)	0.06
Average salinity of last pond (dS/m)	0.81
Salinity of last pond on final day of simulation (dS/m)	0.90
Ammonia loss from pond system water area (kg/m2/year)	0.00

* The threshold is the volume equivalent to the top 1 mm depth of water of a full pond

Overflow exceedance:

Chart Table



Export plot

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Irrigation Information

Irrigation: 56 ha total area (assumed 100% irrigation efficiency)

	Quantity/year	Quantity/ha/year
Total irrigation applied (ML)	249.83	4.46
Total nitrogen applied (kg)	1189.06	21.23
Total phosphorus applied (kg)	238.77	4.26
Total salts applied (kg)	138485.47	2472.95

Shandying

Annual allocation of fresh water for shandying (ML/year)	0.00
Average Shandy water irrigation (ML/year) (minimum - maximum)	0.00 (0.00 - 0.00)
Average exceedance as a proportion of annual shandy water allocation (% of allocation) (minimum - maximum)	0.00 (0.00 - 0.00)
Proportion of irrigation events requiring shandying (fraction of events)	0.00
Minimum shandy water is used	False

Irrigation Issues

Proportion of Days irrigation is prevented when triggered (fraction)	0.25
Proportion of Days water demand is too small to trigger irrigation (fraction)	0.10
Proportion of Days irrigation occurs (fraction)	0.66

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Land: New Paddock: 56 ha

Irrigation: Fixed Sprinkler with 0.2% ammonium loss during irrigation

Irrigation triggered when soil water deficit reaches 5.00 mm and rainfall is less than or equal to 3.00 mm
Irrigate up to a soil water content of drained upper limit plus 0.00 mm
Irrigation window from 1/1 to 31/12 including the days specified
A minimum of 0 days must be skipped between irrigation events

Soil Water Balance (mm): Bicton (Kur-World), 228.00 mm PAWC at maximum root depth

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	349.9	444.0	400.6	185.8	84.3	54.1	41.9	33.6	32.8	47.6	87.8	176.5	1938.9
Irrigation	34.5	18.9	23.0	28.4	36.4	39.7	43.7	44.8	44.2	45.9	43.5	43.3	446.1
Soil Evap	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Transpn.	127.7	112.2	120.9	109.7	100.8	91.2	100.0	117.9	139.4	142.7	113.4	122.9	1398.8
Rain Runoff	113.8	159.3	153.5	39.0	6.6	2.9	1.7	0.6	1.8	2.3	6.0	31.8	519.3
Irr. Runoff	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Drainage	56.4	140.6	151.3	72.3	24.1	9.8	5.3	1.2	0.1	0.6	0.1	10.2	472.0
Delta	86.4	50.7	-2.1	-6.8	-11.0	-10.2	-21.3	-41.3	-64.3	-52.0	11.9	54.9	-5.0

Soil Nitrogen Balance

Average annual effluent nitrogen added (kg/ha/year)	21.23
Average annual soil nitrogen removed by plant uptake (kg/ha/year)	94.12
Average annual soil nitrogen removed by denitrification (kg/ha/year)	0.01
Average annual soil nitrogen leached (kg/ha/year)	1.19
Average annual nitrate-N loading to groundwater (kg/ha/year)	1.19
Soil organic-N kg/ha (Initial - Final)	3809.50 - 179.89
	74.41 - 0.02
Average nitrate-N concentration of deep drainage (mg/L)	0.25
Max. annual nitrate-N concentration of deep drainage (mg/L)	9.01

Soil Phosphorus Balance

Average annual effluent phosphorus added (kg/ha/year)	4.26
Average annual soil phosphorus removed by plant uptake (kg/ha/year)	1.80E-03
Average annual soil phosphorus leached (kg/ha/year)	3.36E-04
Dissolved phosphorus (kg/ha) (Initial - Final)	2.86E-04 - 1.49E-03
Adsorbed phosphorus (kg/ha) (Initial - Final)	450.65 - 665.61
Average phosphate-P concentration in rootzone (mg/L)	2.19E-04
Average phosphate-P concentration of deep drainage (mg/L)	7.11E-05
Max. annual phosphate-P concentration of deep drainage (mg/L)	1.15E-04
Design soil profile storage life based on average infiltrated water phosphorus concn. of 0.23 mg/L (years)	999.90

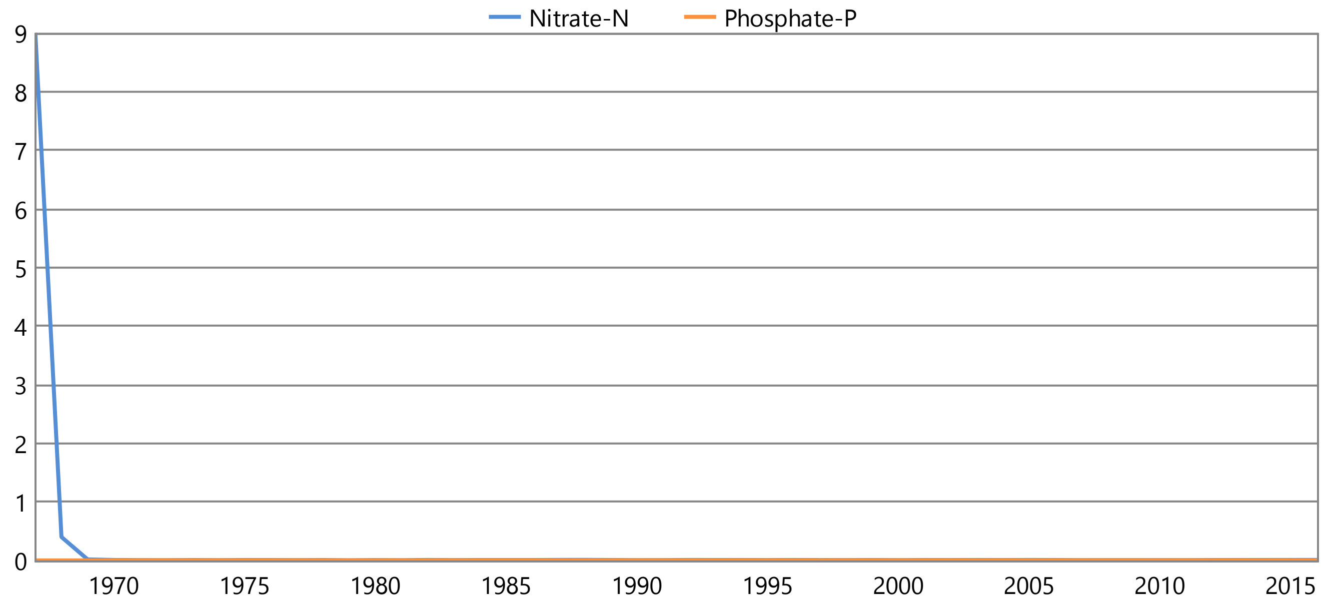
DIAGNOSTICS

Sustainability Diagnostics: Kur World

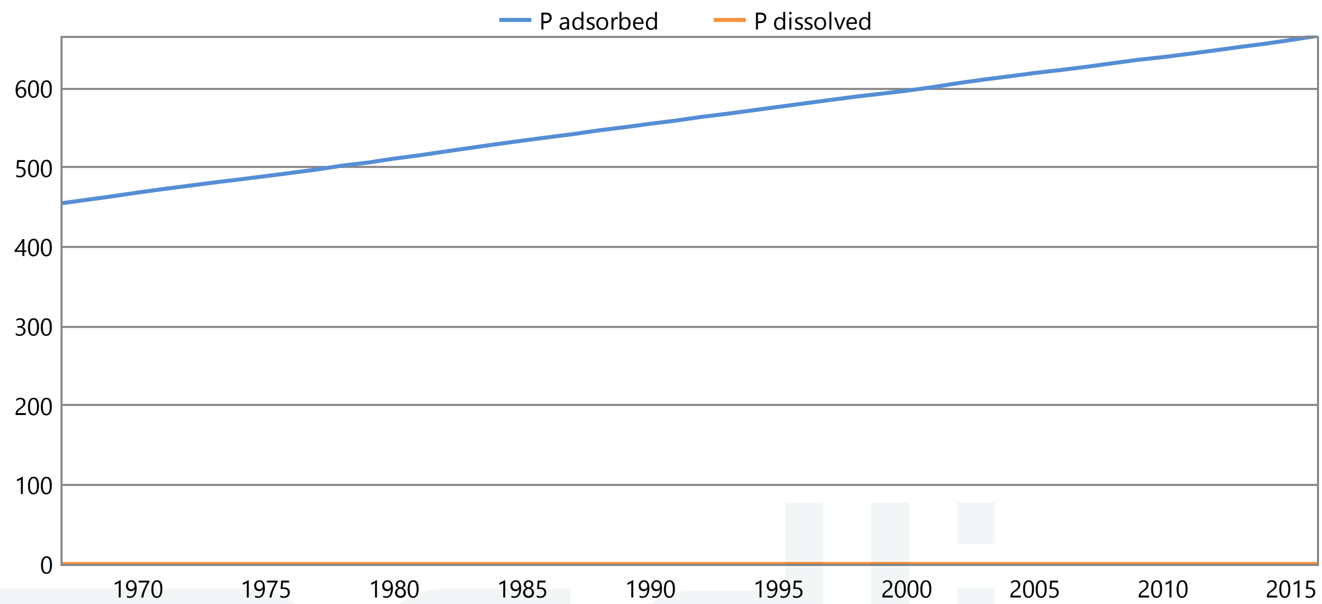
Paddock Land: New Paddock: 56 ha

Irrigation: Fixed Sprinkler with 0.2% ammonium loss during irrigation

Annual nutrient leachate concentration (mg/L)



Annual Phosphate-P in soil (kg/ha)



DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Plant Performance: New Paddock: 56 ha

Average Plant Performance (Minimum - Maximum): Continuous Coastal Couch Grass (Cynodon dactylon) Pasture_mod golf, kick started

Average annual shoot dry matter yield (kg/ha/year)	9018.06 (4916.87 - 15980.85)
Average monthly plant (green) cover (fraction)	1.00 (0.99 - 1.00)
Average monthly crop factor (fraction)	0.80 (0.79 - 0.80)
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Average monthly root depth (mm)	799.36 (792.32 - 800.00)
Average number of normal harvests per year (no./year)	6.32 (3.00 - 11.00)
Average number of normal harvests for last five years only (no./year)	3.60
Average number of crop deaths per year (no./year)	0.00 (0.00 - 0.00)
Average number of crop deaths for last five years only (no./year)	0.00
Average annual nitrogen deficiency index (0 = no stress, 1 = full stress) (coefficient)	0.61 (0.18 - 0.79)
Average January temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.02 (0.00 - 0.07)
Average July temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.20 (0.00 - 0.41)
Average monthly water stress index (0 = no stress, 1 = full stress) (coefficient)	0.06 (0.00 - 0.29)
Average monthly waterlogging index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.00)
No. days without crop/year (days)	0.00

Soil Salinity - Plant salinity tolerance: Tolerant

Assumes 1.0 dS/m Electrical Conductivity = 640 mg/L Total Dissolved Salts
All values based on 10 year running averages

Salinity of infiltrated water (Average salinity of rainwater = 0.03 dS/m) (dS/m)	0.23
Salt added by rainfall (kg/ha/year)	272.57
Average annual effluent salt added & leached at steady state (kg/ha/year)	2745.52
Average leaching fraction based on 10 year running averages (fraction)	0.45
Average water-uptake-weighted rootzone salinity sat. ext. (dS/m)	0.23
Salinity of the soil solution (at drained upper limit) at base of rootzone (dS/m)	0.91
Relative crop yield expected due to salinity (fraction)	1.00
Proportion of years that crop yields would be expected to fall below 90% of potential due to salinity (fraction)	0.00

DIAGNOSTICS

Run Messages

Messages generated when the scenario was run:

Full run chosen

MEDLI REPORT - FULL RUN

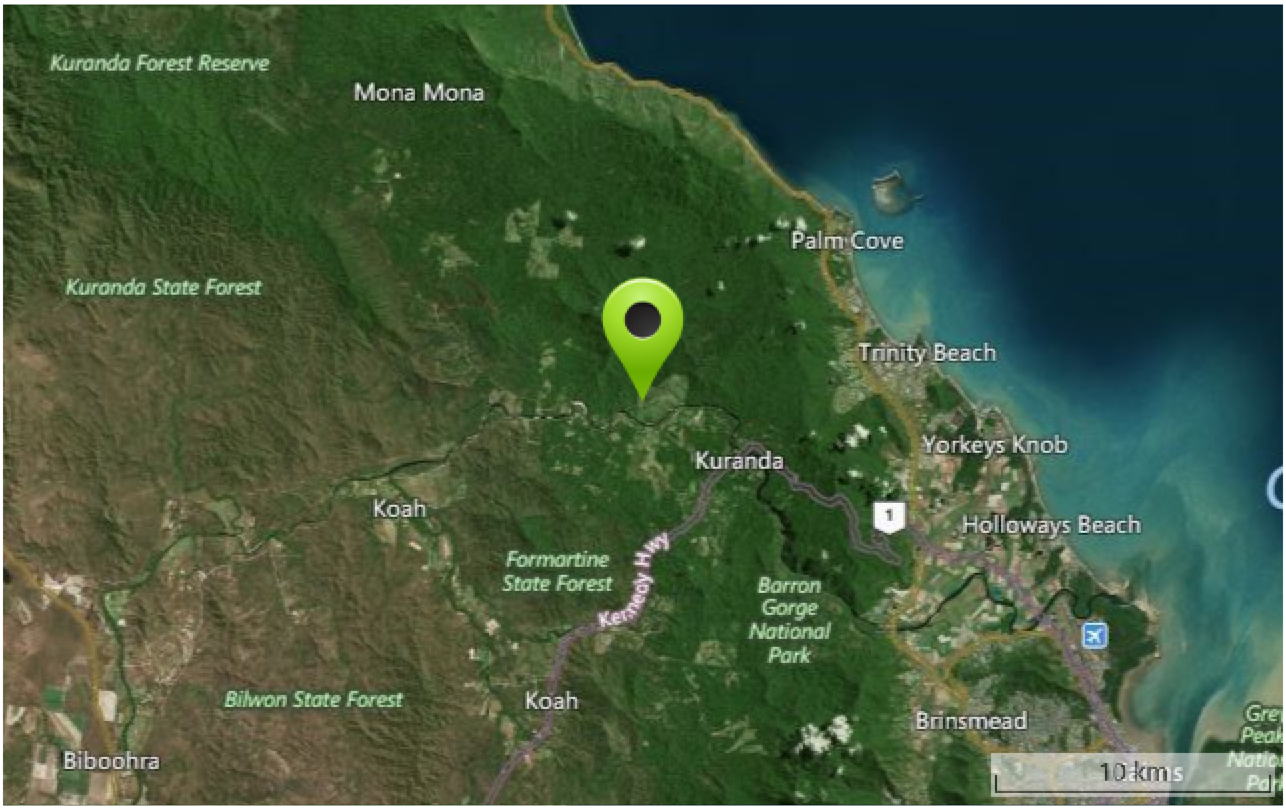
Enterprise: Kur World

Description:
Stage 3 High range 56ha Golf and amenity full run

Client: Reever and Ocean

MEDLI User: NATRES\andrew

Scenario Details:
low range ADWF, average infiltration efficiency, Full run
N 5mg/L, P 1 mg/L, TDS 580 mg 73% TON, 2% NH4-N, 25% Org N
5 ML tank and 19 ML dam
5mm SMD to UDL. Irrigation allowed on days with up to 3 mm rainfall. Coastal couch as amenity grass (kickstarted) assumed for golf course and amenity planting - 56ha
No additional nutrient addition to account for return of clippings

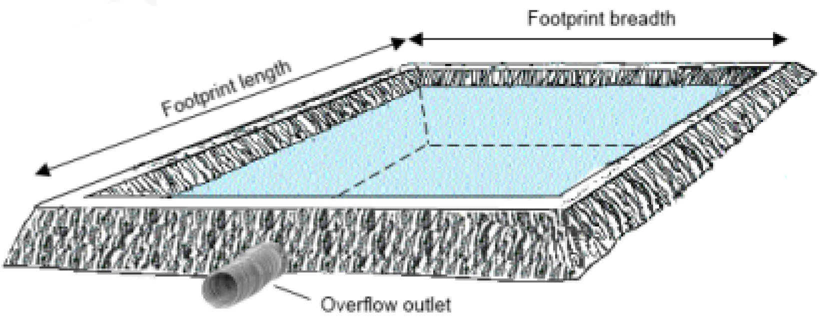


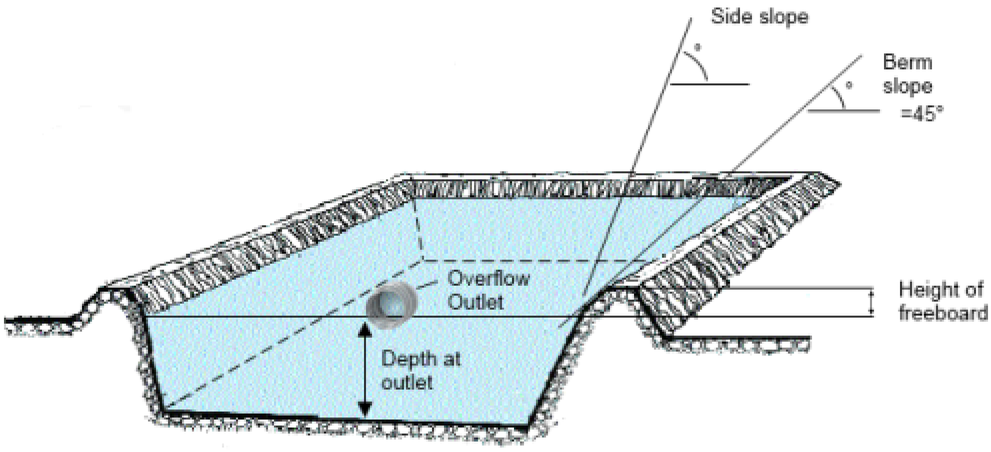
DESCRIPTION

Pond system: 2 facultative, aerobic or storage ponds

Pond system details:

	Pond 1	Pond 2
Maximum pond volume (ML)	5.00	19.00
Minimum allowable pond volume (ML)	0.00	6.77
Pond depth at overflow outlet (m)	4.00	4.50
Maximum water surface area (m2)	1250.00	5794.53
Pond footprint length (m)	35.36	135.05
Pond footprint width (m)	35.36	47.15
Pond catchment area (m2)	1250.00	6367.31
Average active volume (ML)	5.00	9.87





Irrigation pump limits:

Minimum pump rate limit (ML/day)	0.00
Maximum pump rate limit (ML/day)	100.00

Shandying water:

Annual allocation of fresh water available for shandying (ML/year)	0.00
Maximum rate of application of fresh water (ML/day)	0.00
Nitrogen concentration (mg/L)	0.00
Salinity (dS/m)	0.00
Minimum shandy water is used	False

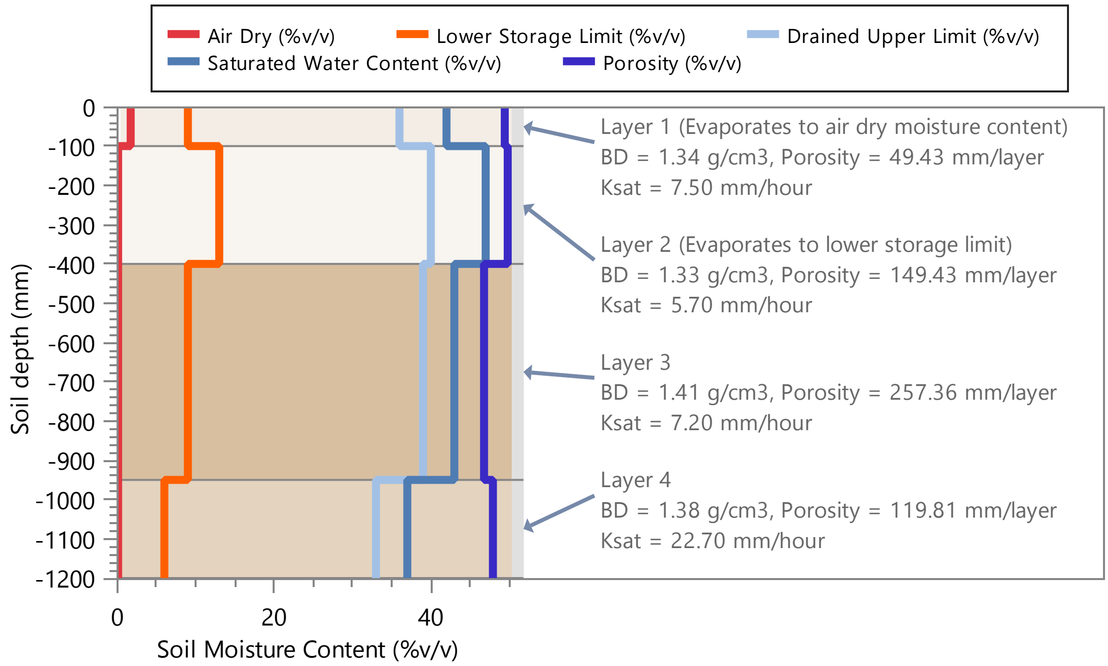
DESCRIPTION

Land: New Paddock

Area (ha): 56.00

Soil Type: Bicton (Kur-World), 1200.00 mm defined profile depth

Profile Porosity (mm)	576.04
Profile saturation water content (mm)	512.00
Profile drained upper limit (or field capacity) (mm)	453.00
Profile lower storage limit (or permanent wilting point) (mm)	112.50
Profile available water capacity (mm)	340.50
Profile limiting saturated hydraulic conductivity (mm/hour)	5.70
Surface saturated hydraulic conductivity (mm/hour)	7.50
Runoff curve number II (coefficient)	80.00
Soil evaporation U (mm)	8.50
Soil evaporation Cona (mm/sqrt day)	3.75



Plant Data: Continuous Coastal Couch Grass (Cynodon dactylon) Pasture_mod golf, kick started

Average monthly cover (fraction) (minimum - maximum)	1.00 (0.99 - 1.00)
Maximum crop factor at 100% cover (mm/mm) (Maximum crop coefficient 0.8 x Pan coefficient 1)	0.80
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Maximum potential root depth in defined soil profile (mm)	800.00
Salt tolerance	Tolerant
Salinity threshold EC sat. ext. (dS/m)	6.90
Proportion of yield decrease per dS/m increase (fraction/dS/m)	0.06

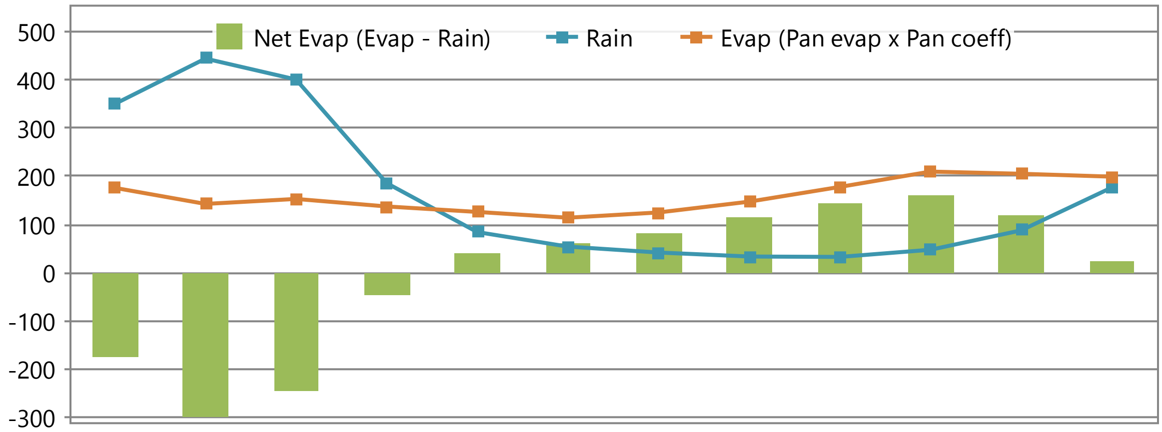
DIAGNOSTICS

Sustainability Diagnostics: Kur World

Averaged Historical Climate Data Used in Simulation (mm)

Location: KurWorlSTP, -16.8°, 145.6°

Run Period: 01/01/1967 to 31/12/2016 50 years, 0 days



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	349.9	444.0	400.6	185.8	84.3	54.1	41.9	33.6	32.8	47.6	87.8	176.5	1938.9
Evap	176.0	142.7	153.0	137.4	126.0	114.1	125.0	147.4	177.9	209.7	205.2	199.2	1913.4
Net Evap	-173.9	-301.3	-247.6	-48.4	41.8	59.9	83.1	113.8	145.1	162.1	117.4	22.7	-25.5
Net Evap/day	-5.6	-10.7	-8.0	-1.6	1.3	2.0	2.7	3.7	4.8	5.2	3.9	0.7	-0.1

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Pond System: 2 facultative, aerobic or storage ponds

Kur-world Stage 3 Low range - Sept 2017 - 360.40 ML/year or 0.99 ML/day generated on average

Effluent entering pond system after any pretreatment and recycling

Average (Minimum-Maximum) influent quality calculated for 365.26 non-zero flow days, after any pretreatment and recycling.

Constituent	Concentration (mg/L)	Load (kg/year)
Total Nitrogen	4.16 (0.34 - 5.00)	1497.55 (1496.48 - 1500.58)
Total Phosphorus	0.83 (0.07 - 1.00)	299.51 (299.30 - 300.12)
Total Dissolved Salts	482.00 (39.55 - 580.00)	173715.54 (173591.88 - 174067.48)
Volatile Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Total Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)

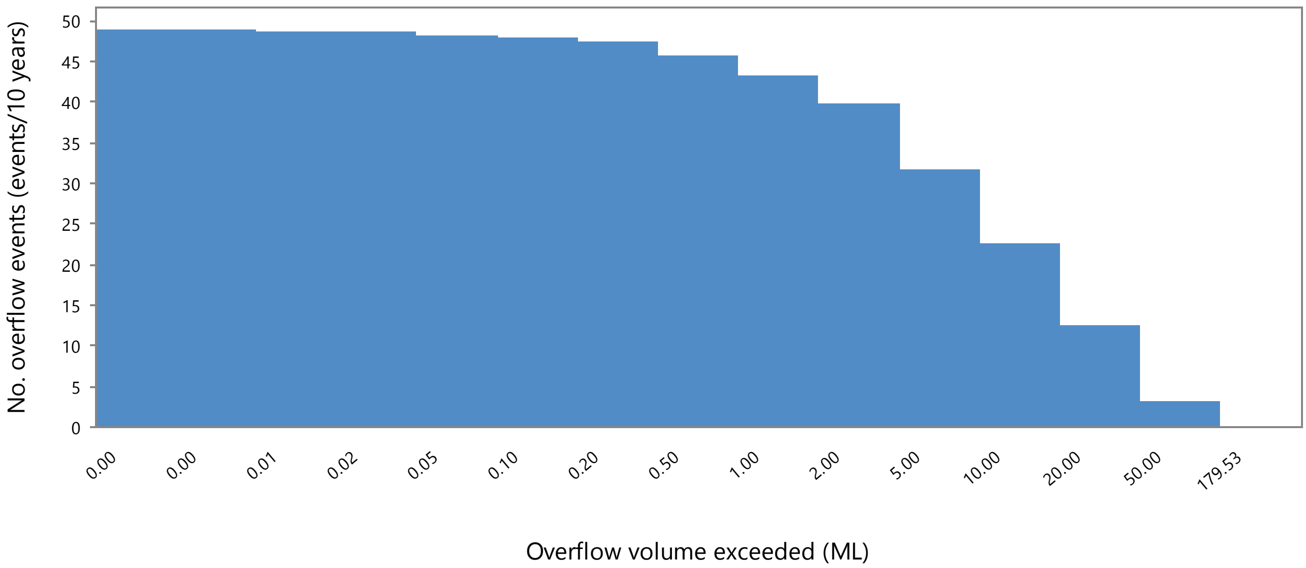
Last pond (Wet weather store): 19.00 ML

Theoretical hydraulic retention time (days)	19.26
Average volume of overflow (ML/year)	74.32
No. overflow events per year exceeding threshold* of 0.00 ML (no./year)	4.88
Average duration of overflow (days)	11.05
Effluent Reuse (Proportion of Inflow + Net Rain Gain that is Irrigated) (fraction)	0.80
Probability of at least 90% effluent reuse (fraction)	0.18
Average salinity of last pond (dS/m)	0.73
Salinity of last pond on final day of simulation (dS/m)	0.85
Ammonia loss from pond system water area (kg/m2/year)	0.00

* The threshold is the volume equivalent to the top 1 mm depth of water of a full pond

Overflow exceedance:

■ Chart ☐ Table



Export plot

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Irrigation Information

Irrigation: 56 ha total area (assumed 100% irrigation efficiency)

	Quantity/year	Quantity/ha/year
Total irrigation applied (ML)	291.84	5.21
Total nitrogen applied (kg)	1276.31	22.79
Total phosphorus applied (kg)	256.29	4.58
Total salts applied (kg)	148646.45	2654.40

Shandying

Annual allocation of fresh water for shandying (ML/year)	0.00
Average Shandy water irrigation (ML/year) (minimum - maximum)	0.00 (0.00 - 0.00)
Average exceedance as a proportion of annual shandy water allocation (% of allocation) (minimum - maximum)	0.00 (0.00 - 0.00)
Proportion of irrigation events requiring shandying (fraction of events)	0.00
Minimum shandy water is used	False

Irrigation Issues

Proportion of Days irrigation is prevented when triggered (fraction)	0.25
Proportion of Days water demand is too small to trigger irrigation (fraction)	0.15
Proportion of Days irrigation occurs (fraction)	0.61

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Land: New Paddock: 56 ha

Irrigation: Fixed Sprinkler with 0.2% ammonium loss during irrigation

Irrigation triggered when soil water deficit reaches 5.00 mm and rainfall is less than or equal to 3.00 mm
Irrigate up to a soil water content of drained upper limit plus 0.00 mm
Irrigation window from 1/1 to 31/12 including the days specified
A minimum of 0 days must be skipped between irrigation events

Soil Water Balance (mm): Bicton (Kur-World), 228.00 mm PAWC at maximum root depth

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	349.9	444.0	400.6	185.8	84.3	54.1	41.9	33.6	32.8	47.6	87.8	176.5	1938.9
Irrigation	44.1	26.1	35.3	38.7	46.3	47.0	48.0	46.6	45.7	47.3	47.6	48.3	521.1
Soil Evap	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Transpn.	128.2	112.7	120.9	109.7	100.8	91.2	100.0	117.9	140.0	147.7	119.3	124.6	1413.1
Rain Runoff	115.3	160.9	154.8	39.7	6.9	3.1	1.8	0.7	1.9	2.4	6.2	32.6	526.2
Irr. Runoff	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Drainage	61.8	151.7	161.1	80.0	32.0	14.6	8.0	2.0	0.2	1.0	0.4	12.8	525.7
Delta	88.7	44.8	-0.9	-4.9	-9.1	-7.7	-19.9	-40.3	-63.7	-56.3	9.5	54.9	-4.9

Soil Nitrogen Balance

Average annual effluent nitrogen added (kg/ha/year)	22.79
Average annual soil nitrogen removed by plant uptake (kg/ha/year)	95.70
Average annual soil nitrogen removed by denitrification (kg/ha/year)	0.01
Average annual soil nitrogen leached (kg/ha/year)	1.20
Average annual nitrate-N loading to groundwater (kg/ha/year)	1.20
Soil organic-N kg/ha (Initial - Final)	3809.50 - 178.18
	74.41 - 0.02
Average nitrate-N concentration of deep drainage (mg/L)	0.23
Max. annual nitrate-N concentration of deep drainage (mg/L)	8.49

Soil Phosphorus Balance

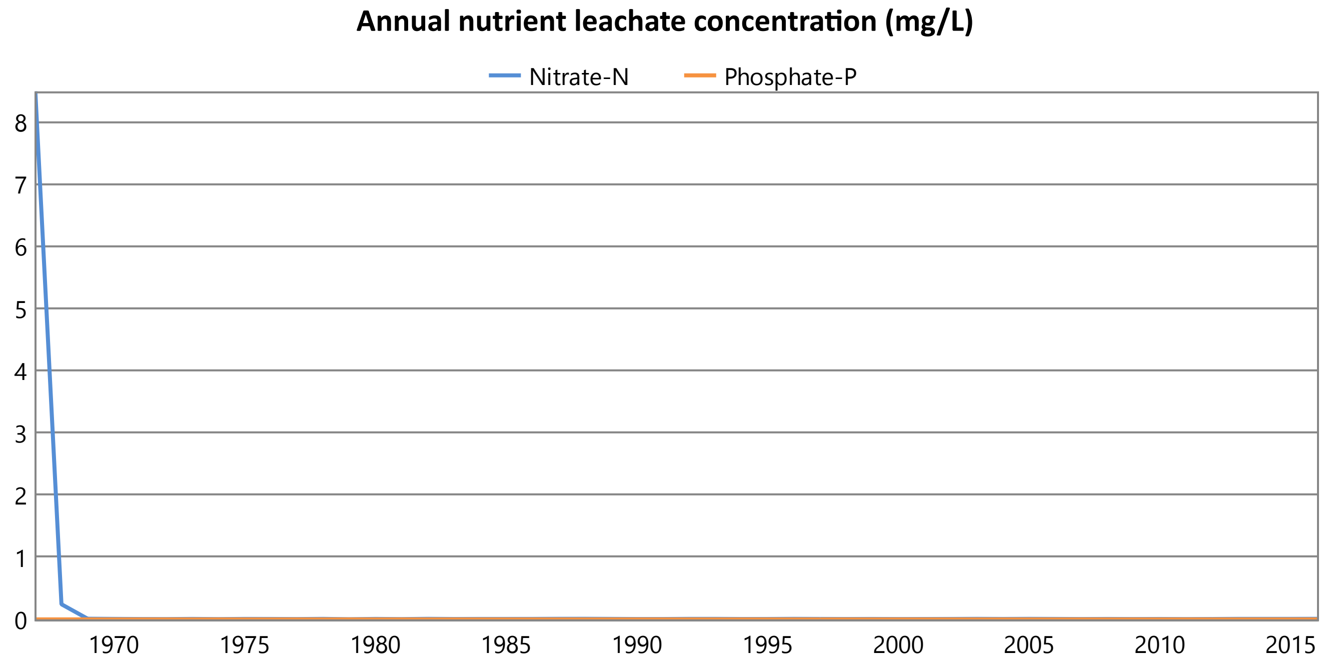
Average annual effluent phosphorus added (kg/ha/year)	4.58
Average annual soil phosphorus removed by plant uptake (kg/ha/year)	1.80E-03
Average annual soil phosphorus leached (kg/ha/year)	3.76E-04
Dissolved phosphorus (kg/ha) (Initial - Final)	2.86E-04 - 8.74E-04
Adsorbed phosphorus (kg/ha) (Initial - Final)	450.65 - 681.14
Average phosphate-P concentration in rootzone (mg/L)	2.29E-04
Average phosphate-P concentration of deep drainage (mg/L)	7.15E-05
Max. annual phosphate-P concentration of deep drainage (mg/L)	8.05E-05
Design soil profile storage life based on average infiltrated water phosphorus concn. of 0.24 mg/L (years)	999.90

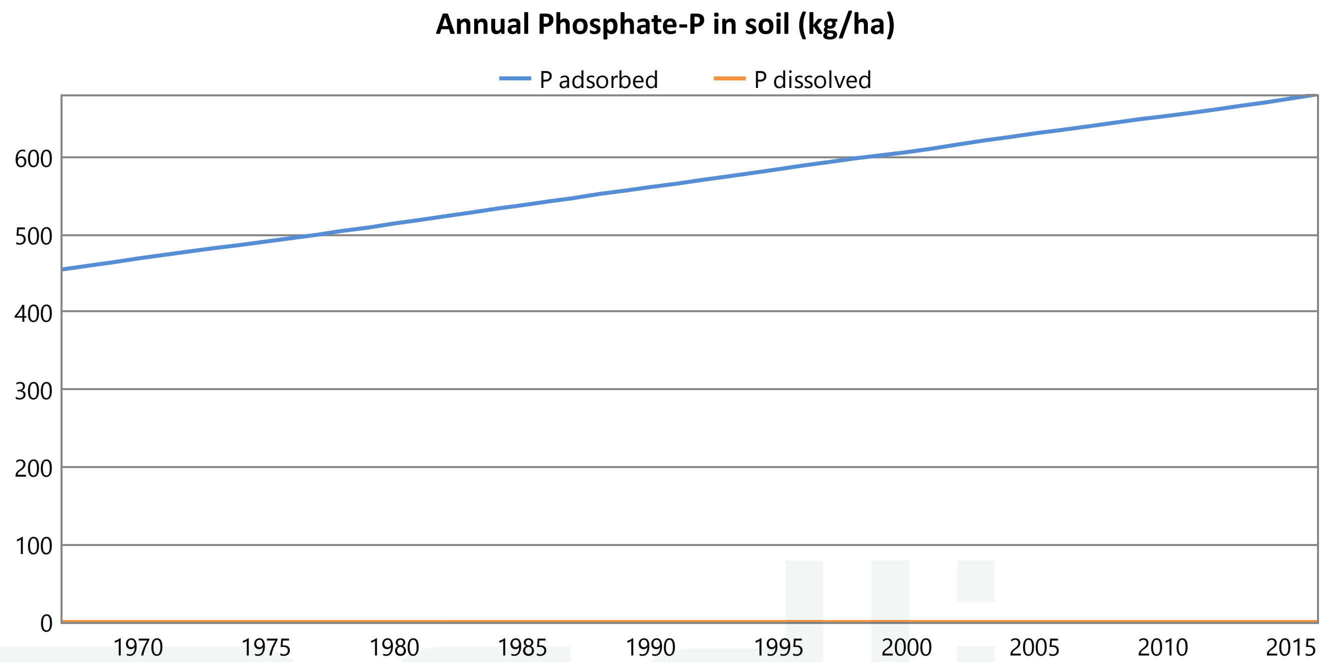
DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Land: New Paddock: 56 ha

Irrigation: Fixed Sprinkler with 0.2% ammonium loss during irrigation





DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Plant Performance: New Paddock: 56 ha

Average Plant Performance (Minimum - Maximum): Continuous Coastal Couch Grass (Cynodon dactylon) Pasture_mod golf, kick started

Average annual shoot dry matter yield (kg/ha/year)	9123.58 (5101.95 - 16028.89)
Average monthly plant (green) cover (fraction)	1.00 (0.99 - 1.00)
Average monthly crop factor (fraction)	0.80 (0.79 - 0.80)
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Average monthly root depth (mm)	799.36 (792.32 - 800.00)
Average number of normal harvests per year (no./year)	6.40 (3.00 - 11.00)
Average number of normal harvests for last five years only (no./year)	3.80
Average number of crop deaths per year (no./year)	0.00 (0.00 - 0.00)
Average number of crop deaths for last five years only (no./year)	0.00
Average annual nitrogen deficiency index (0 = no stress, 1 = full stress) (coefficient)	0.61 (0.17 - 0.78)
Average January temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.02 (0.00 - 0.07)
Average July temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.20 (0.00 - 0.41)
Average monthly water stress index (0 = no stress, 1 = full stress) (coefficient)	0.05 (0.00 - 0.25)
Average monthly waterlogging index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.00)
No. days without crop/year (days)	0.00

Soil Salinity - Plant salinity tolerance: Tolerant

Assumes 1.0 dS/m Electrical Conductivity = 640 mg/L Total Dissolved Salts
All values based on 10 year running averages

Salinity of infiltrated water (Average salinity of rainwater = 0.03 dS/m) (dS/m)	0.24
Salt added by rainfall (kg/ha/year)	271.24
Average annual effluent salt added & leached at steady state (kg/ha/year)	2925.64
Average leaching fraction based on 10 year running averages (fraction)	0.47
Average water-uptake-weighted rootzone salinity sat. ext. (dS/m)	0.23
Salinity of the soil solution (at drained upper limit) at base of rootzone (dS/m)	0.87
Relative crop yield expected due to salinity (fraction)	1.00
Proportion of years that crop yields would be expected to fall below 90% of potential due to salinity (fraction)	0.00

DIAGNOSTICS

Run Messages

Messages generated when the scenario was run:

Full run chosen

MEDLI REPORT - FULL RUN

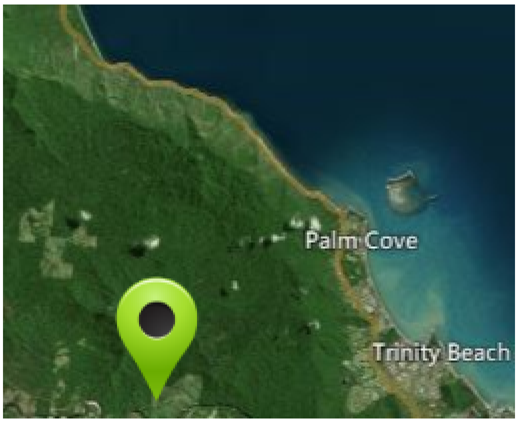
Enterprise: **Kur World**

Description:
Stage 3 low range low ingress clippings returned 56ha Golf and amenity full run

Client: **Reever and Ocean**

MEDLI User: NATRES\andrew

Scenario Details:
low range ADWF, low infiltration efficiency, clippings returned Full run
WWTP design specs N 5mg/L, P 1 mg/L, TDS 580 mg 73% TON, 2% NH4-N, 25% Org N adjusted to allow N return in clippings (simulated at 75% mineralisation of nutrients removed returned as organic N) resulting in
41.21 mg/L TN, 1.01 mg/L TP 8.9% TON, 0.2% NH4-N, 90.9% organic N
5 ML tank and 19 ML dam
5mm SMD to UDL. Irrigation allowed on days with up to 3 mm rainfall. Coastal couch as amenity grass (kickstarted) assumed for golf course and amenity planting - 56ha



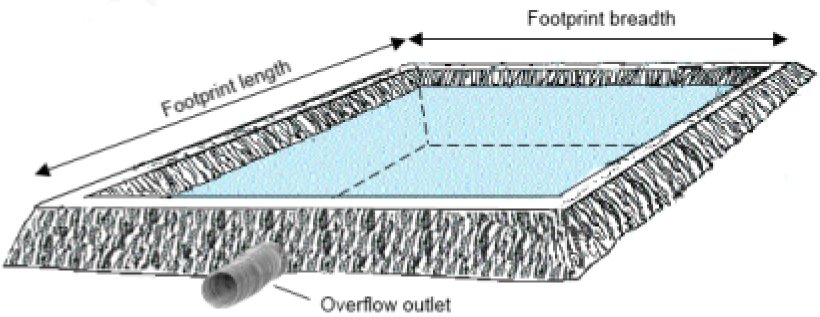
10 km

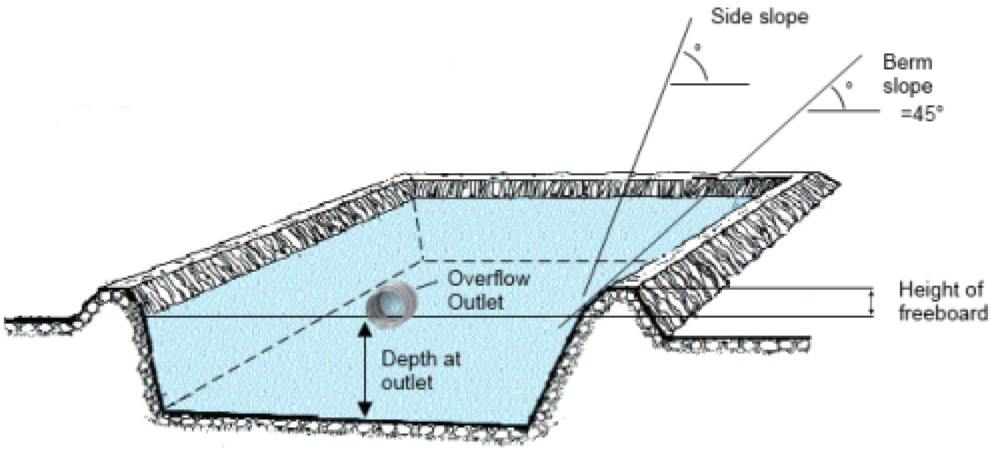
DESCRIPTION

Pond system: 2 facultative, aerobic or storage ponds

Pond system details:

	Pond 1	Pond 2
Maximum pond volume (ML)	5.00	19.00
Minimum allowable pond volume (ML)	0.00	6.77
Pond depth at overflow outlet (m)	4.00	4.50
Maximum water surface area (m2)	1250.00	5794.53
Pond footprint length (m)	35.36	135.05
Pond footprint width (m)	35.36	47.15
Pond catchment area (m2)	1250.00	6367.31
Average active volume (ML)	5.00	9.68





Irrigation pump limits:

Minimum pump rate limit (ML/day)	0.00
Maximum pump rate limit (ML/day)	100.00

Shandying water:

Annual allocation of fresh water available for shandying (ML/year)	0.00
Maximum rate of application of fresh water (ML/day)	0.00
Nitrogen concentration (mg/L)	0.00
Salinity (dS/m)	0.00
Minimum shandy water is used	False

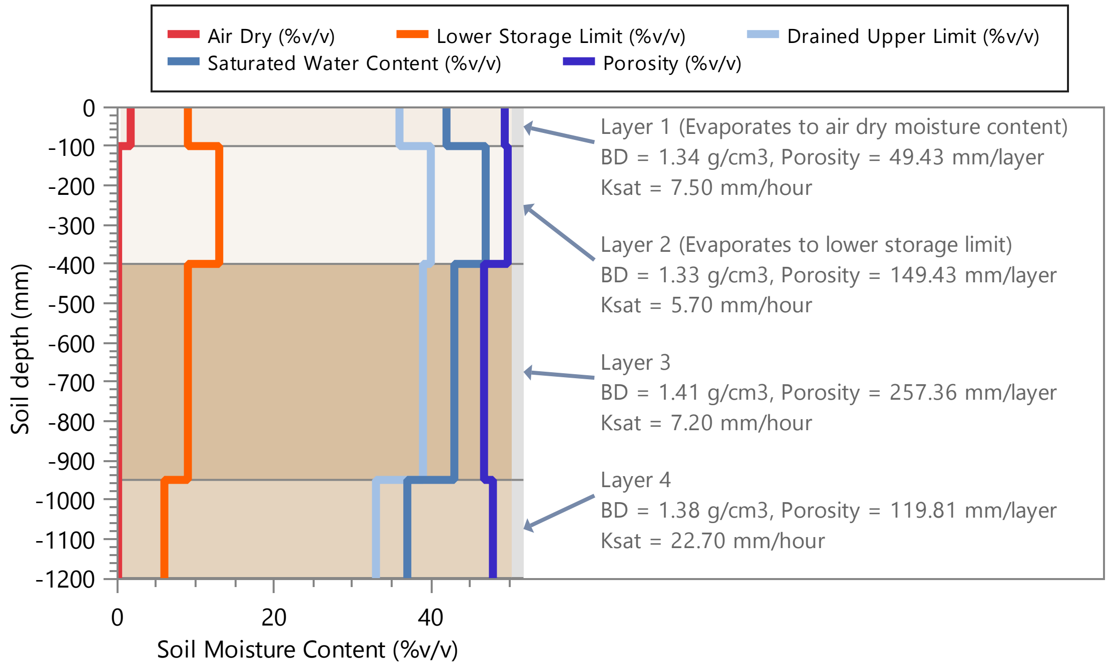
DESCRIPTION

Land: New Paddock

Area (ha): 56.00

Soil Type: Bicton (Kur-World), 1200.00 mm defined profile depth

Profile Porosity (mm)	576.04
Profile saturation water content (mm)	512.00
Profile drained upper limit (or field capacity) (mm)	453.00
Profile lower storage limit (or permanent wilting point) (mm)	112.50
Profile available water capacity (mm)	340.50
Profile limiting saturated hydraulic conductivity (mm/hour)	5.70
Surface saturated hydraulic conductivity (mm/hour)	7.50
Runoff curve number II (coefficient)	80.00
Soil evaporation U (mm)	8.50
Soil evaporation Cona (mm/sqrt day)	3.75



Plant Data: Continuous Coastal Couch Grass (Cynodon dactylon) Pasture_mod golf, kick started

Average monthly cover (fraction) (minimum - maximum)	1.00 (0.99 - 1.00)
Maximum crop factor at 100% cover (mm/mm) (Maximum crop coefficient 0.8 x Pan coefficient 1)	0.80
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Maximum potential root depth in defined soil profile (mm)	800.00
Salt tolerance	Tolerant
Salinity threshold EC sat. ext. (dS/m)	6.90
Proportion of yield decrease per dS/m increase (fraction/dS/m)	0.06

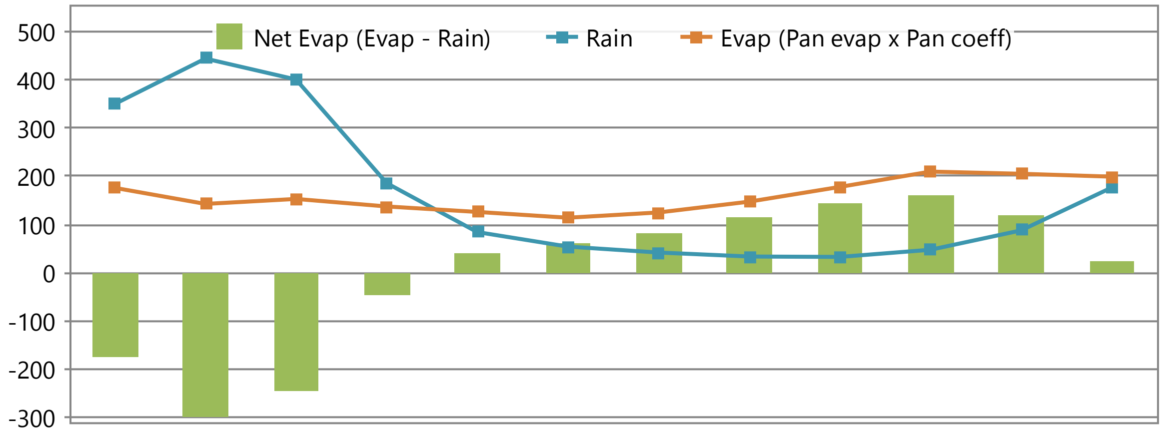
DIAGNOSTICS

Sustainability Diagnostics: Kur World

Averaged Historical Climate Data Used in Simulation (mm)

Location: KurWorlSTP, -16.8°, 145.6°

Run Period: 01/01/1967 to 31/12/2016 50 years, 0 days



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	349.9	444.0	400.6	185.8	84.3	54.1	41.9	33.6	32.8	47.6	87.8	176.5	1938.9
Evap	176.0	142.7	153.0	137.4	126.0	114.1	125.0	147.4	177.9	209.7	205.2	199.2	1913.4
Net Evap	-173.9	-301.3	-247.6	-48.4	41.8	59.9	83.1	113.8	145.1	162.1	117.4	22.7	-25.5
Net Evap/day	-5.6	-10.7	-8.0	-1.6	1.3	2.0	2.7	3.7	4.8	5.2	3.9	0.7	-0.1

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Pond System: 2 facultative, aerobic or storage ponds

Kur-world Stage 3 Low range, low ingress clippings returned - Sept 2017 - 330.19 ML/year or 0.90 ML/day generated on average

Effluent entering pond system after any pretreatment and recycling

Average (Minimum-Maximum) influent quality calculated for 365.26 non-zero flow days, after any pretreatment and recycling.

Constituent	Concentration (mg/L)	Load (kg/year)
Total Nitrogen	37.38 (5.24 - 41.21)	12342.79 (12334.00 - 12367.79)
Total Phosphorus	0.92 (0.13 - 1.01)	302.50 (302.29 - 303.12)
Total Dissolved Salts	526.10 (73.77 - 580.00)	173715.54 (173591.88 - 174067.48)
Volatile Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Total Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)

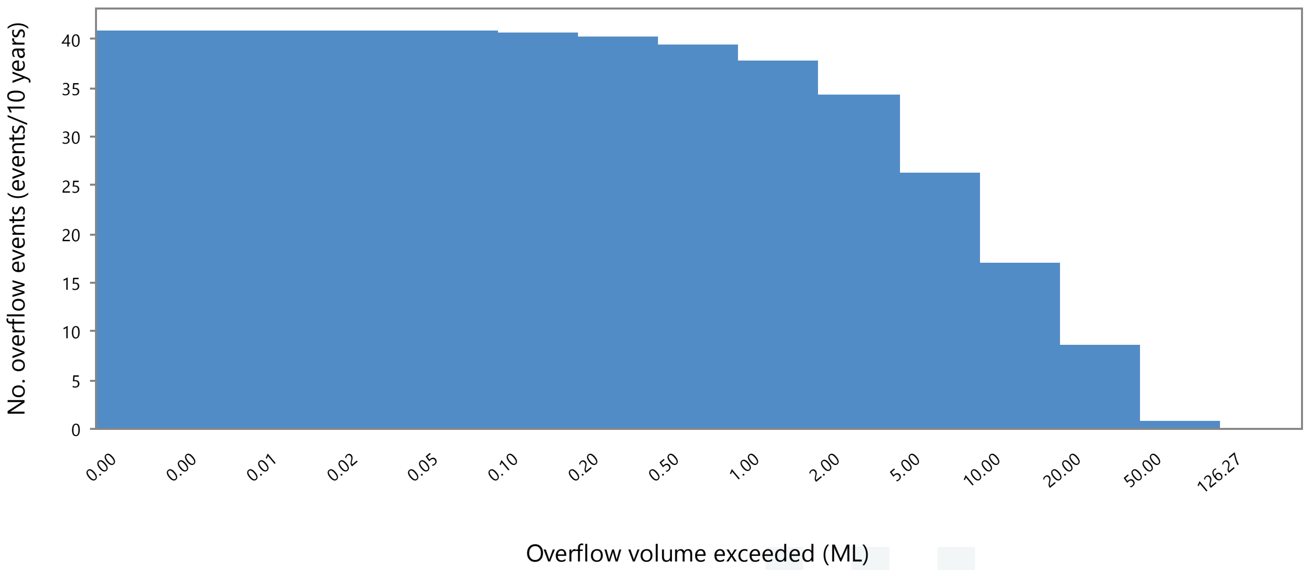
Last pond (Wet weather store): 19.00 ML

Theoretical hydraulic retention time (days)	21.02
Average volume of overflow (ML/year)	53.06
No. overflow events per year exceeding threshold* of 0.00 ML (no./year)	4.08
Average duration of overflow (days)	11.55
Effluent Reuse (Proportion of Inflow + Net Rain Gain that is Irrigated) (fraction)	0.84
Probability of at least 90% effluent reuse (fraction)	0.29
Average salinity of last pond (dS/m)	0.79
Salinity of last pond on final day of simulation (dS/m)	0.88
Ammonia loss from pond system water area (kg/m2/year)	0.00

* The threshold is the volume equivalent to the top 1 mm depth of water of a full pond

Overflow exceedance:

Chart Table



Export plot

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Irrigation Information

Irrigation: 56 ha total area (assumed 100% irrigation efficiency)

	Quantity/year	Quantity/ha/year
Total irrigation applied (ML)	282.93	5.05
Total nitrogen applied (kg)	10797.06	192.80
Total phosphorus applied (kg)	264.73	4.73
Total salts applied (kg)	152021.40	2714.67

Shandying

Annual allocation of fresh water for shandying (ML/year)	0.00
Average Shandy water irrigation (ML/year) (minimum - maximum)	0.00 (0.00 - 0.00)
Average exceedance as a proportion of annual shandy water allocation (% of allocation) (minimum - maximum)	0.00 (0.00 - 0.00)
Proportion of irrigation events requiring shandying (fraction of events)	0.00
Minimum shandy water is used	False

Irrigation Issues

Proportion of Days irrigation is prevented when triggered (fraction)	0.25
Proportion of Days water demand is too small to trigger irrigation (fraction)	0.14
Proportion of Days irrigation occurs (fraction)	0.61

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Land: New Paddock: 56 ha

Irrigation: Fixed Sprinkler with 0.2% ammonium loss during irrigation

Irrigation triggered when soil water deficit reaches 5.00 mm and rainfall is less than or equal to 3.00 mm
Irrigate up to a soil water content of drained upper limit plus 0.00 mm
Irrigation window from 1/1 to 31/12 including the days specified
A minimum of 0 days must be skipped between irrigation events

Soil Water Balance (mm): Bicton (Kur-World), 228.00 mm PAWC at maximum root depth

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	349.9	444.0	400.6	185.8	84.3	54.1	41.9	33.6	32.8	47.6	87.8	176.5	1938.9
Irrigation	41.2	25.3	34.8	37.8	45.4	46.6	46.6	45.8	44.7	46.2	45.4	45.5	505.2
Soil Evap	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Transpn.	128.0	112.5	120.9	109.7	100.8	91.2	100.0	117.9	139.9	146.6	117.3	123.8	1408.6
Rain Runoff	114.6	160.5	154.6	39.6	6.8	3.1	1.8	0.6	1.9	2.4	6.1	32.2	524.4
Irr. Runoff	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Drainage	59.7	149.1	159.6	79.6	31.2	14.4	7.5	1.9	0.2	0.9	0.4	11.7	516.2
Delta	88.8	47.2	0.3	-5.3	-9.2	-8.0	-20.8	-41.0	-64.4	-56.1	9.4	54.3	-5.0

Soil Nitrogen Balance

Average annual effluent nitrogen added (kg/ha/year)	192.80
Average annual soil nitrogen removed by plant uptake (kg/ha/year)	262.70
Average annual soil nitrogen removed by denitrification (kg/ha/year)	0.02
Average annual soil nitrogen leached (kg/ha/year)	1.35
Average annual nitrate-N loading to groundwater (kg/ha/year)	1.35
Soil organic-N kg/ha (Initial - Final)	3809.50 - 321.03
	74.41 - 0.02
Average nitrate-N concentration of deep drainage (mg/L)	0.26
Max. annual nitrate-N concentration of deep drainage (mg/L)	8.69

Soil Phosphorus Balance

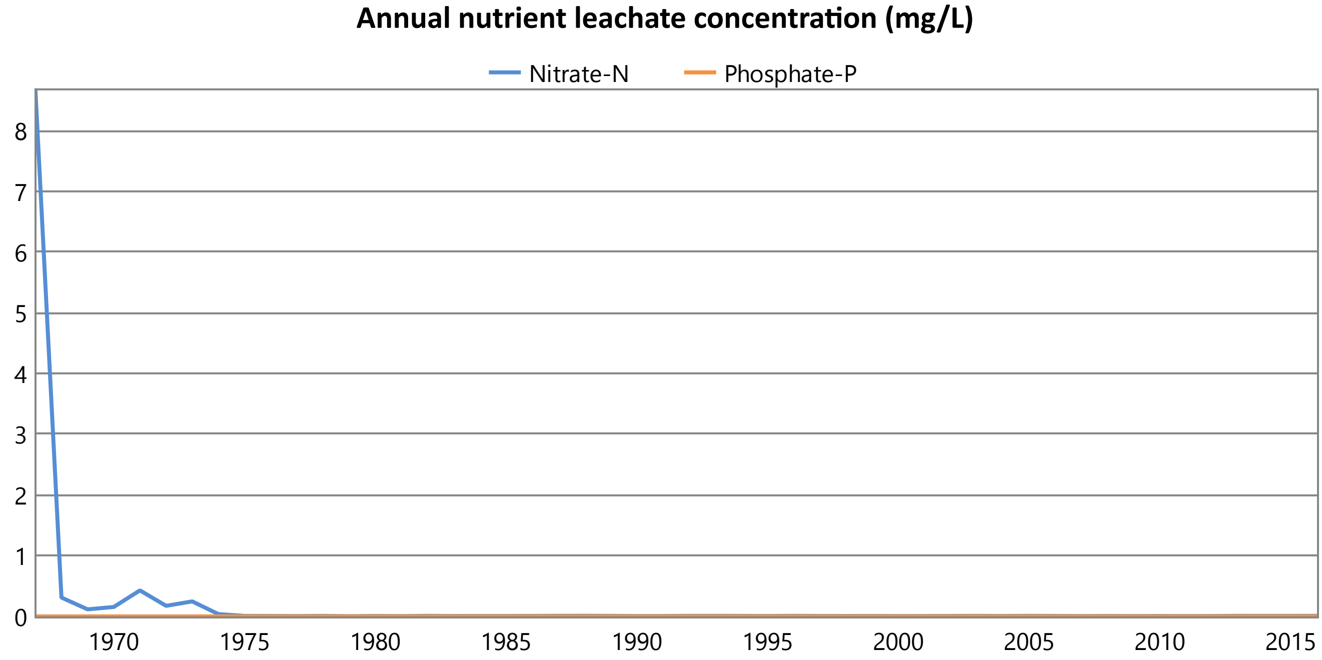
Average annual effluent phosphorus added (kg/ha/year)	4.73
Average annual soil phosphorus removed by plant uptake (kg/ha/year)	1.80E-03
Average annual soil phosphorus leached (kg/ha/year)	3.69E-04
Dissolved phosphorus (kg/ha) (Initial - Final)	2.86E-04 - 9.89E-04
Adsorbed phosphorus (kg/ha) (Initial - Final)	450.65 - 688.68
Average phosphate-P concentration in rootzone (mg/L)	2.47E-04
Average phosphate-P concentration of deep drainage (mg/L)	7.15E-05
Max. annual phosphate-P concentration of deep drainage (mg/L)	8.00E-05
Design soil profile storage life based on average infiltrated water phosphorus concn. of 0.25 mg/L (years)	982.80

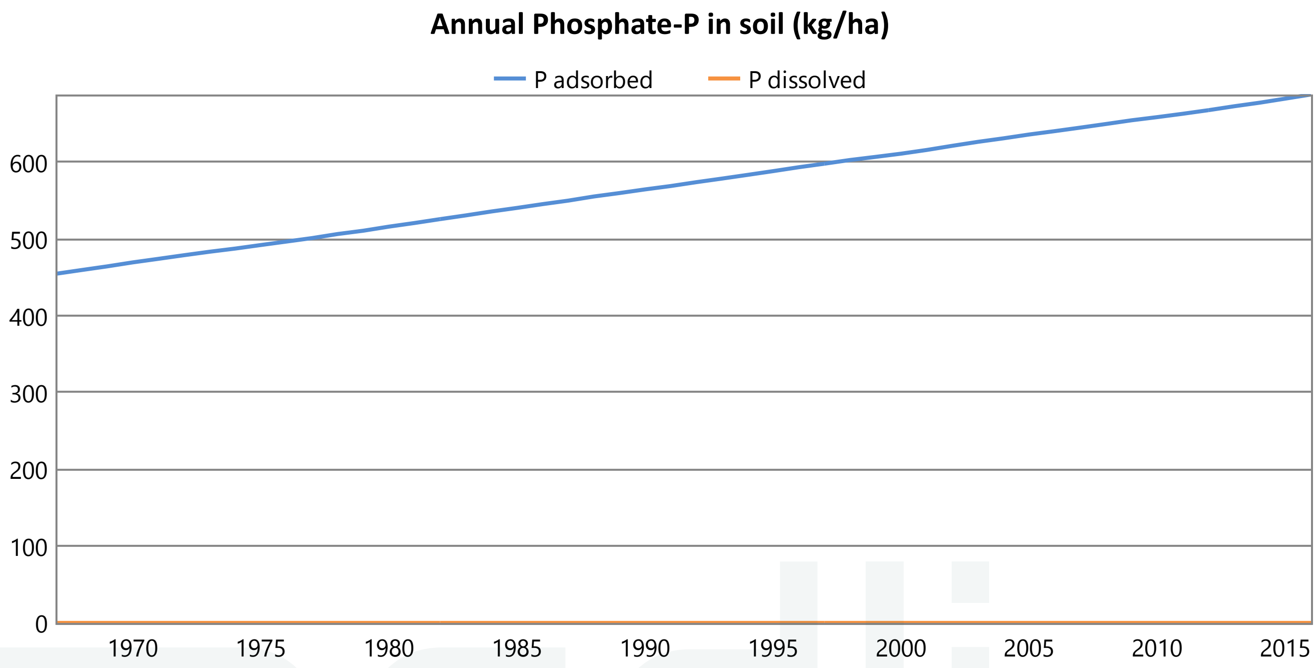
DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Land: New Paddock: 56 ha

Irrigation: Fixed Sprinkler with 0.2% ammonium loss during irrigation





DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Plant Performance: New Paddock: 56 ha

Average Plant Performance (Minimum - Maximum): Continuous Coastal Couch Grass (Cynodon dactylon) Pasture_mod golf, kick started

Average annual shoot dry matter yield (kg/ha/year)	16713.96 (13696.74 - 20327.04)
Average monthly plant (green) cover (fraction)	1.00 (0.99 - 1.00)
Average monthly crop factor (fraction)	0.80 (0.79 - 0.80)
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Average monthly root depth (mm)	799.36 (792.32 - 800.00)
Average number of normal harvests per year (no./year)	11.68 (9.00 - 14.00)
Average number of normal harvests for last five years only (no./year)	10.60
Average number of crop deaths per year (no./year)	0.00 (0.00 - 0.00)
Average number of crop deaths for last five years only (no./year)	0.00
Average annual nitrogen deficiency index (0 = no stress, 1 = full stress) (coefficient)	0.26 (0.05 - 0.41)
Average January temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.02 (0.00 - 0.07)
Average July temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.20 (0.00 - 0.41)
Average monthly water stress index (0 = no stress, 1 = full stress) (coefficient)	0.06 (0.00 - 0.26)
Average monthly waterlogging index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.00)
No. days without crop/year (days)	0.00

Soil Salinity - Plant salinity tolerance: Tolerant

Assumes 1.0 dS/m Electrical Conductivity = 640 mg/L Total Dissolved Salts
All values based on 10 year running averages

Salinity of infiltrated water (Average salinity of rainwater = 0.03 dS/m) (dS/m)	0.24
Salt added by rainfall (kg/ha/year)	271.60
Average annual effluent salt added & leached at steady state (kg/ha/year)	2986.26
Average leaching fraction based on 10 year running averages (fraction)	0.47
Average water-uptake-weighted rootzone salinity sat. ext. (dS/m)	0.24
Salinity of the soil solution (at drained upper limit) at base of rootzone (dS/m)	0.90
Relative crop yield expected due to salinity (fraction)	1.00
Proportion of years that crop yields would be expected to fall below 90% of potential due to salinity (fraction)	0.00

DIAGNOSTICS

Run Messages

Messages generated when the scenario was run:

Full run chosen

MEDLI REPORT - FULL RUN

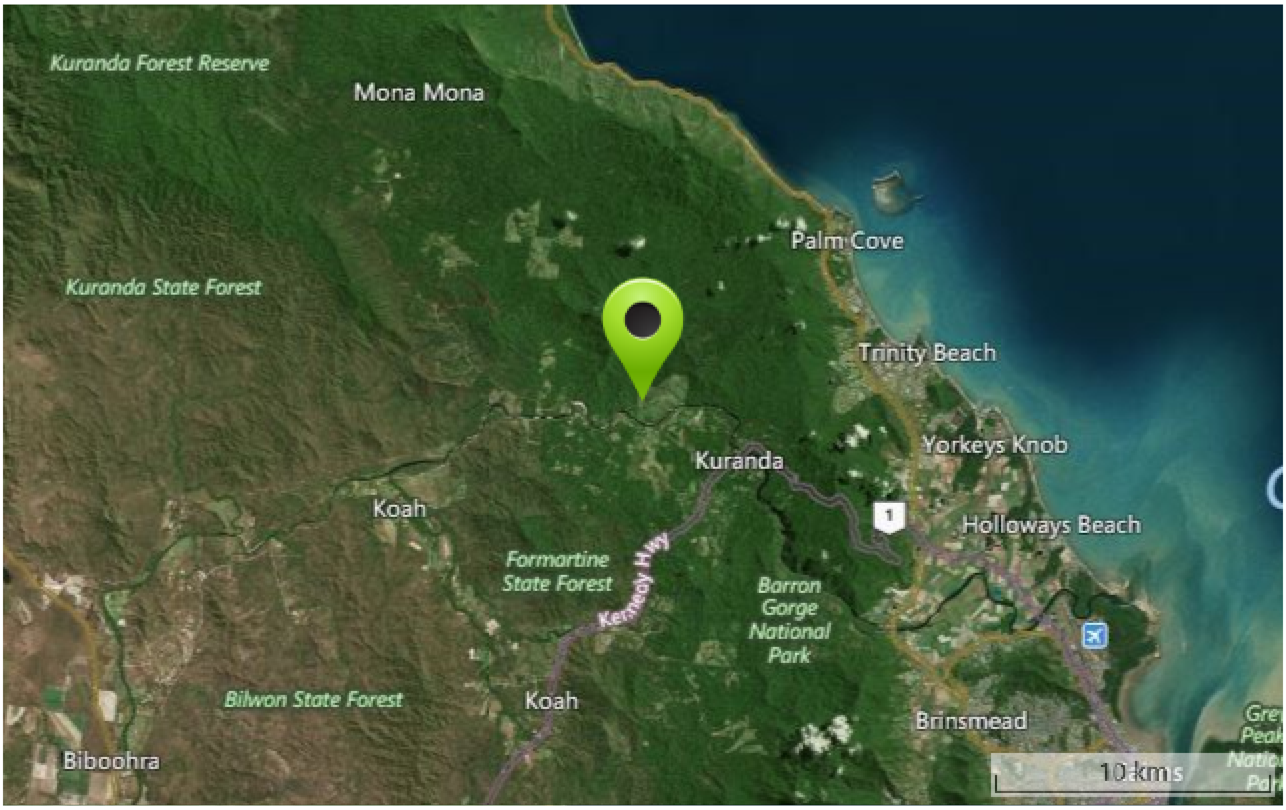
Enterprise: Kur World

Description:
Stage 3 High range low ingress 10% recycled 56ha Golf and amenity full run

Client: Reever and Ocean

MEDLI User: NATRES\andrew

Scenario Details:
High range ADWF, low infiltration efficiency, 10% ADWF recycled, Full run
N 5mg/L, P 1 mg/L, TDS 580 mg 73% TON, 2% NH4-N, 25% Org N
5 ML tank and 19 ML dam
5mm SMD to UDL. Irrigation allowed on days with up to 3 mm rainfall. Coastal couch as amenity grass (kickstarted) assumed for golf course and amenity planting - 56ha
No additional nutrient addition to account for return of clippings

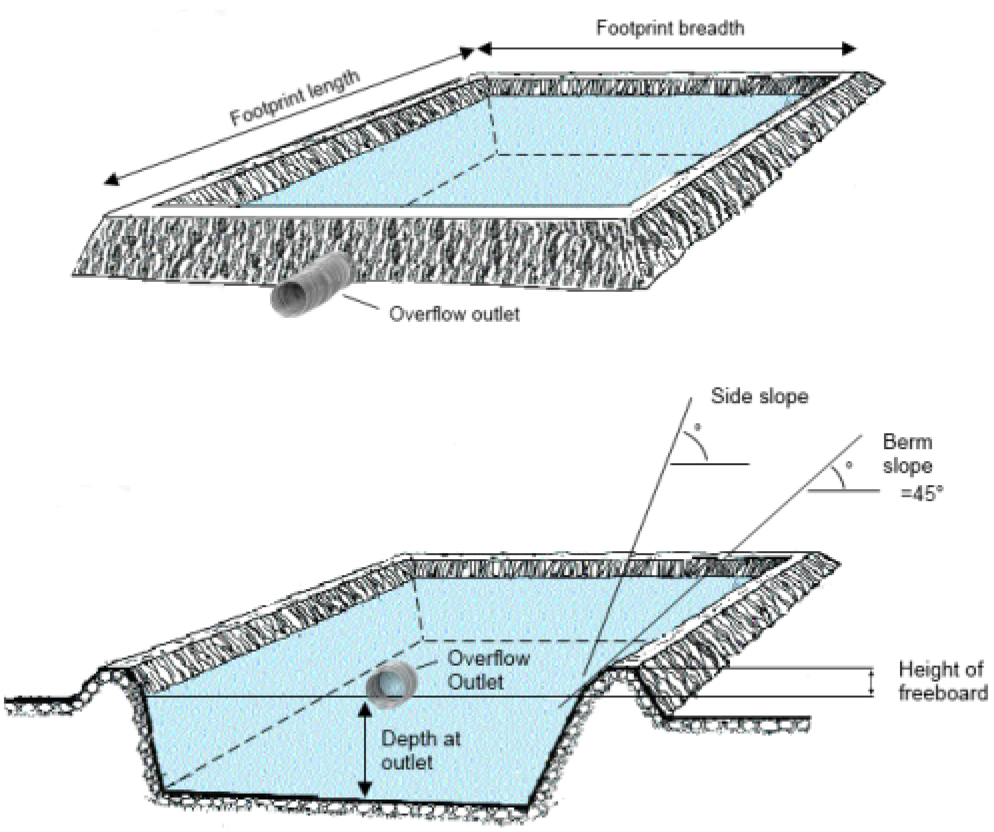


DESCRIPTION

Pond system: 2 facultative, aerobic or storage ponds

Pond system details:

	Pond 1	Pond 2
Maximum pond volume (ML)	5.00	19.00
Minimum allowable pond volume (ML)	0.00	6.77
Pond depth at overflow outlet (m)	4.00	4.50
Maximum water surface area (m2)	1250.00	5794.53
Pond footprint length (m)	35.36	135.05
Pond footprint width (m)	35.36	47.15
Pond catchment area (m2)	1250.00	6367.31
Average active volume (ML)	5.00	12.63



Irrigation pump limits:

Minimum pump rate limit (ML/day)	0.00
Maximum pump rate limit (ML/day)	100.00

Shandying water:

Annual allocation of fresh water available for shandying (ML/year)	0.00
Maximum rate of application of fresh water (ML/day)	0.00
Nitrogen concentration (mg/L)	0.00
Salinity (dS/m)	0.00
Minimum shandy water is used	False

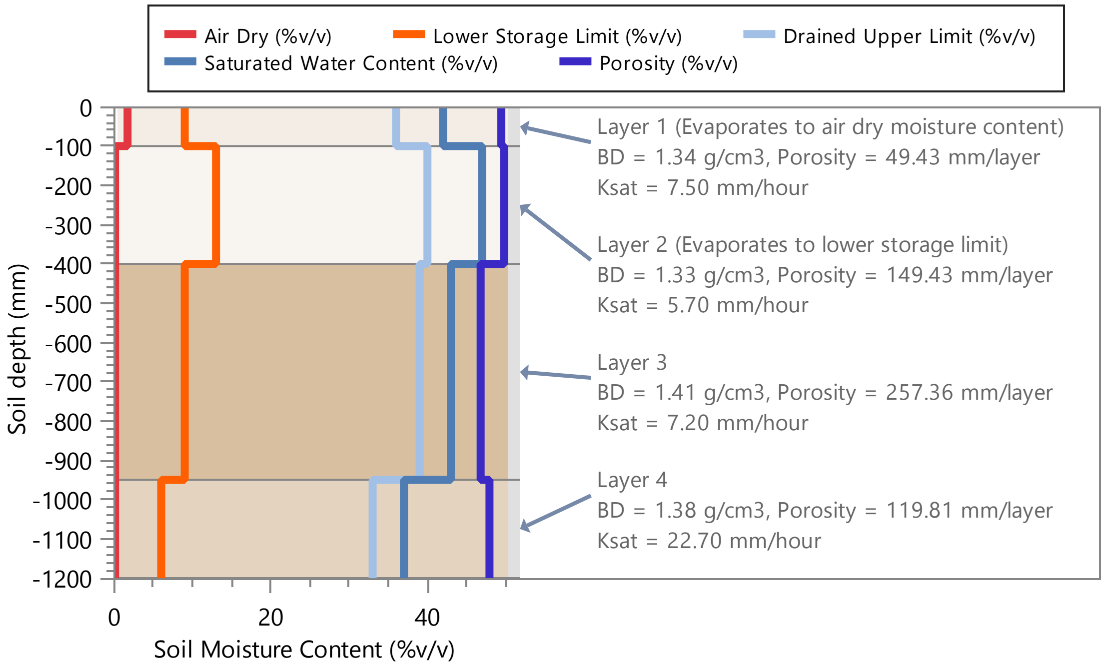
DESCRIPTION

Land: New Paddock

Area (ha): 56.00

Soil Type: Bicton (Kur-World), 1200.00 mm defined profile depth

Profile Porosity (mm)	576.04
Profile saturation water content (mm)	512.00
Profile drained upper limit (or field capacity) (mm)	453.00
Profile lower storage limit (or permanent wilting point) (mm)	112.50
Profile available water capacity (mm)	340.50
Profile limiting saturated hydraulic conductivity (mm/hour)	5.70
Surface saturated hydraulic conductivity (mm/hour)	7.50
Runoff curve number II (coefficient)	80.00
Soil evaporation U (mm)	8.50
Soil evaporation Cona (mm/sqrt day)	3.75



Plant Data: Continuous Coastal Couch Grass (Cynodon dactylon) Pasture_mod golf, kick started

Average monthly cover (fraction) (minimum - maximum)	1.00 (0.99 - 1.00)
Maximum crop factor at 100% cover (mm/mm) (Maximum crop coefficient 0.8 x Pan coefficient 1)	0.80
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Maximum potential root depth in defined soil profile (mm)	800.00
Salt tolerance	Tolerant
Salinity threshold EC sat. ext. (dS/m)	6.90
Proportion of yield decrease per dS/m increase (fraction/dS/m)	0.06

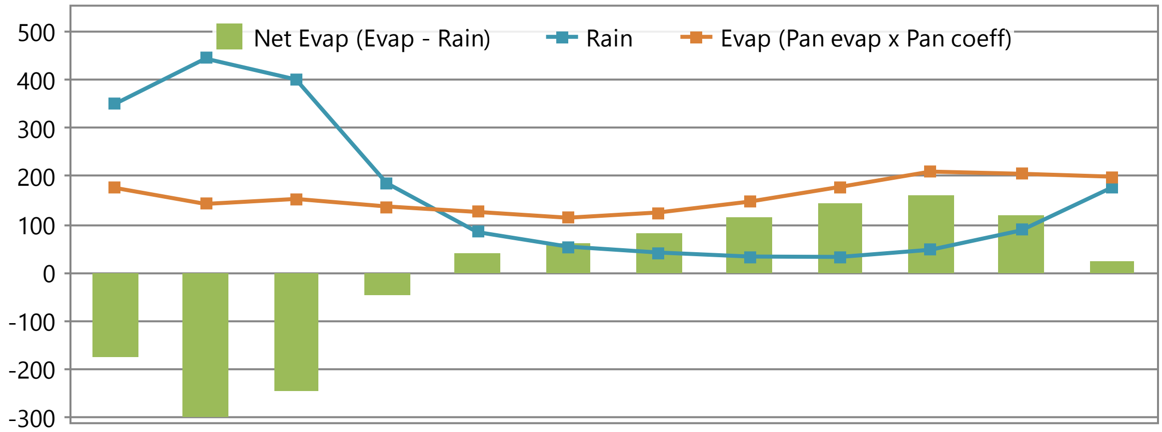
DIAGNOSTICS

Sustainability Diagnostics: Kur World

Averaged Historical Climate Data Used in Simulation (mm)

Location: KurWorlSTP, -16.8°, 145.6°

Run Period: 01/01/1967 to 31/12/2016 50 years, 0 days



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	349.9	444.0	400.6	185.8	84.3	54.1	41.9	33.6	32.8	47.6	87.8	176.5	1938.9
Evap	176.0	142.7	153.0	137.4	126.0	114.1	125.0	147.4	177.9	209.7	205.2	199.2	1913.4
Net Evap	-173.9	-301.3	-247.6	-48.4	41.8	59.9	83.1	113.8	145.1	162.1	117.4	22.7	-25.5
Net Evap/day	-5.6	-10.7	-8.0	-1.6	1.3	2.0	2.7	3.7	4.8	5.2	3.9	0.7	-0.1

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Pond System: 2 facultative, aerobic or storage ponds

Kur-world Stage 3 High range low ingress 10% reduction - Sept 2017 - 655.93 ML/year or 1.80 ML/day generated on average

Effluent entering pond system after any pretreatment and recycling

Average (Minimum-Maximum) influent quality calculated for 365.26 non-zero flow days, after any pretreatment and recycling.

Constituent	Concentration (mg/L)	Load (kg/year)
Total Nitrogen	4.54 (0.64 - 5.00)	2974.88 (2972.76 - 2980.91)
Total Phosphorus	0.91 (0.13 - 1.00)	594.98 (594.55 - 596.18)
Total Dissolved Salts	526.10 (73.77 - 580.00)	345085.89 (344840.25 - 345785.01)
Volatile Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Total Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)

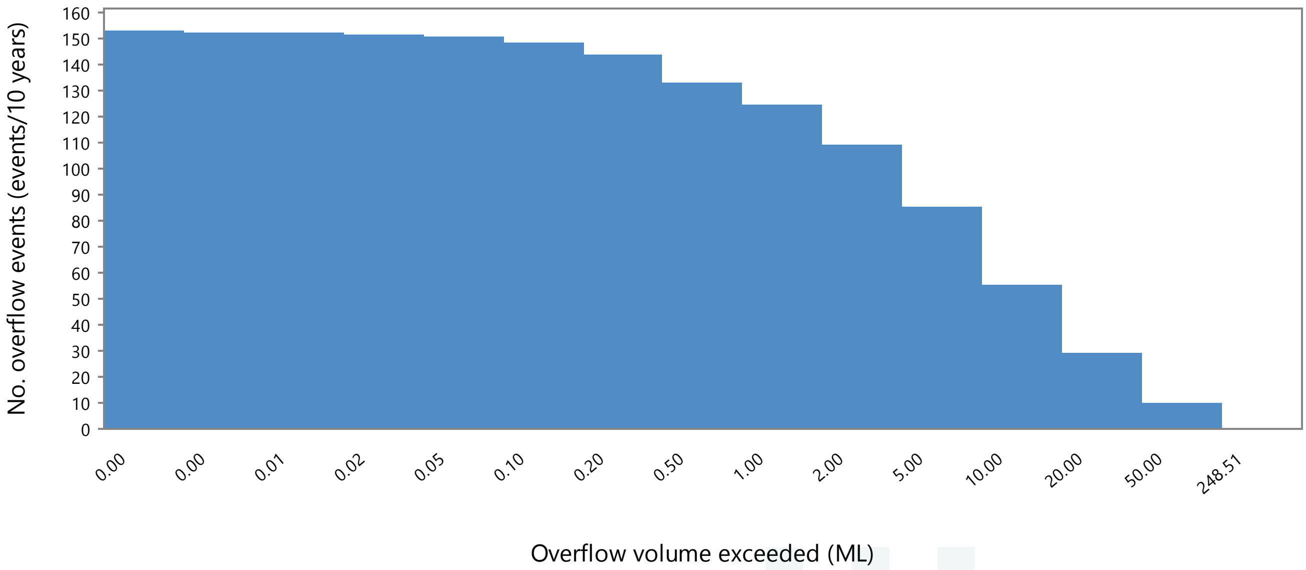
Last pond (Wet weather store): 19.00 ML

Theoretical hydraulic retention time (days)	10.58
Average volume of overflow (ML/year)	206.58
No. overflow events per year exceeding threshold* of 0.00 ML (no./year)	15.24
Average duration of overflow (days)	7.04
Effluent Reuse (Proportion of Inflow + Net Rain Gain that is Irrigated) (fraction)	0.69
Probability of at least 90% effluent reuse (fraction)	0.00
Average salinity of last pond (dS/m)	0.81
Salinity of last pond on final day of simulation (dS/m)	0.89
Ammonia loss from pond system water area (kg/m2/year)	0.00

* The threshold is the volume equivalent to the top 1 mm depth of water of a full pond

Overflow exceedance:

Chart Table



Export plot

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Irrigation Information

Irrigation: 56 ha total area (assumed 100% irrigation efficiency)

	Quantity/year	Quantity/ha/year
Total irrigation applied (ML)	454.54	8.12
Total nitrogen applied (kg)	2152.25	38.43
Total phosphorus applied (kg)	432.18	7.72
Total salts applied (kg)	250663.95	4476.14

Shandying

Annual allocation of fresh water for shandying (ML/year)	0.00
Average Shandy water irrigation (ML/year) (minimum - maximum)	0.00 (0.00 - 0.00)
Average exceedance as a proportion of annual shandy water allocation (% of allocation) (minimum - maximum)	0.00 (0.00 - 0.00)
Proportion of irrigation events requiring shandying (fraction of events)	0.00
Minimum shandy water is used	False

Irrigation Issues

Proportion of Days irrigation is prevented when triggered (fraction)	0.25
Proportion of Days water demand is too small to trigger irrigation (fraction)	0.27
Proportion of Days irrigation occurs (fraction)	0.48

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Land: New Paddock: 56 ha

Irrigation: Fixed Sprinkler with 0.2% ammonium loss during irrigation

Irrigation triggered when soil water deficit reaches 5.00 mm and rainfall is less than or equal to 3.00 mm
Irrigate up to a soil water content of drained upper limit plus 0.00 mm
Irrigation window from 1/1 to 31/12 including the days specified
A minimum of 0 days must be skipped between irrigation events

Soil Water Balance (mm): Bicton (Kur-World), 228.00 mm PAWC at maximum root depth

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	349.9	444.0	400.6	185.8	84.3	54.1	41.9	33.6	32.8	47.6	87.8	176.5	1938.9
Irrigation	59.2	30.8	44.0	48.4	59.0	62.4	75.3	88.1	87.5	89.5	83.9	83.3	811.7
Soil Evap	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Transpn.	137.0	114.1	121.1	109.7	100.8	91.2	100.0	117.9	142.3	167.7	163.5	158.0	1523.3
Rain Runoff	125.4	164.3	157.5	40.6	7.1	3.3	2.1	1.2	2.4	4.4	11.2	41.3	560.8
Irr. Runoff	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Drainage	101.1	177.6	171.3	87.2	39.1	21.0	18.4	7.5	5.8	4.8	5.3	31.3	670.4
Delta	45.8	18.9	-5.2	-3.3	-3.7	0.9	-3.2	-4.8	-30.2	-39.8	-8.3	29.1	-4.0

Soil Nitrogen Balance

Average annual effluent nitrogen added (kg/ha/year)	38.43
Average annual soil nitrogen removed by plant uptake (kg/ha/year)	112.05
Average annual soil nitrogen removed by denitrification (kg/ha/year)	0.02
Average annual soil nitrogen leached (kg/ha/year)	1.23
Average annual nitrate-N loading to groundwater (kg/ha/year)	1.23
Soil organic-N kg/ha (Initial - Final)	3809.50 - 141.27
	74.41 - 0.02
Average nitrate-N concentration of deep drainage (mg/L)	0.18
Max. annual nitrate-N concentration of deep drainage (mg/L)	8.36

Soil Phosphorus Balance

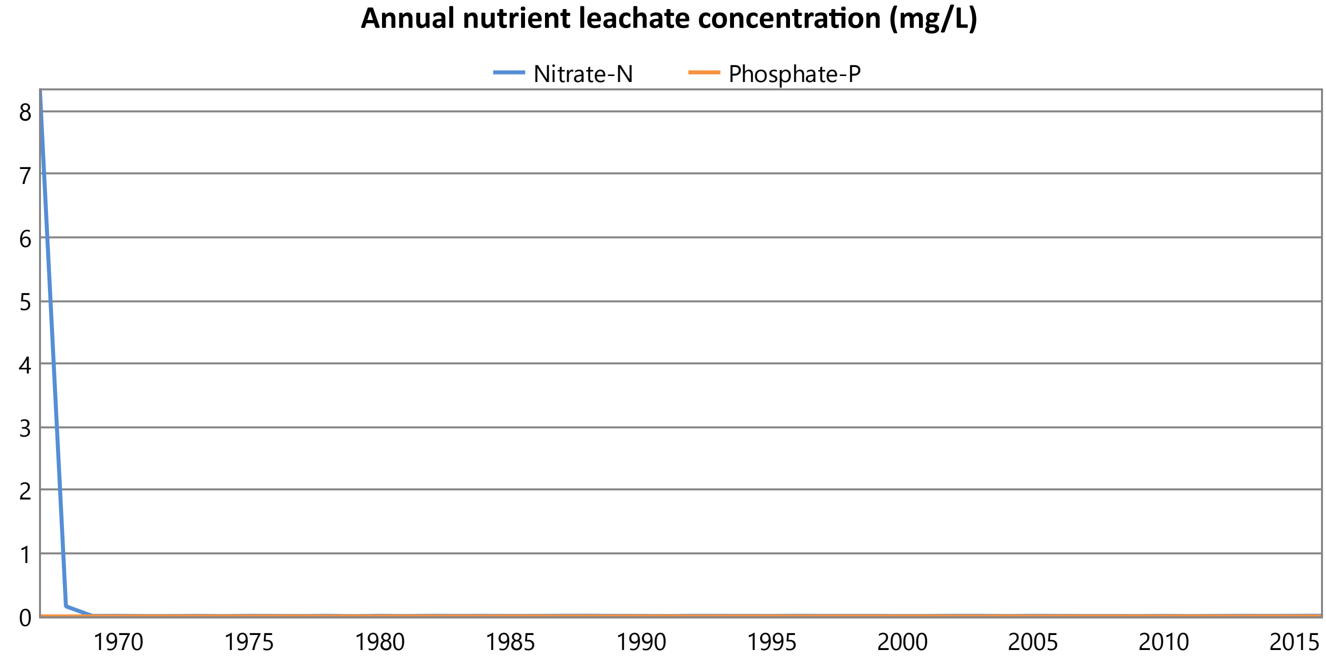
Average annual effluent phosphorus added (kg/ha/year)	7.72
Average annual soil phosphorus removed by plant uptake (kg/ha/year)	0.15
Average annual soil phosphorus leached (kg/ha/year)	4.88E-04
Dissolved phosphorus (kg/ha) (Initial - Final)	2.86E-04 - 3.67E-03
Adsorbed phosphorus (kg/ha) (Initial - Final)	450.65 - 830.42
Average phosphate-P concentration in rootzone (mg/L)	5.64E-04
Average phosphate-P concentration of deep drainage (mg/L)	7.28E-05
Max. annual phosphate-P concentration of deep drainage (mg/L)	8.67E-05
Design soil profile storage life based on average infiltrated water phosphorus concn. of 0.35 mg/L (years)	674.16

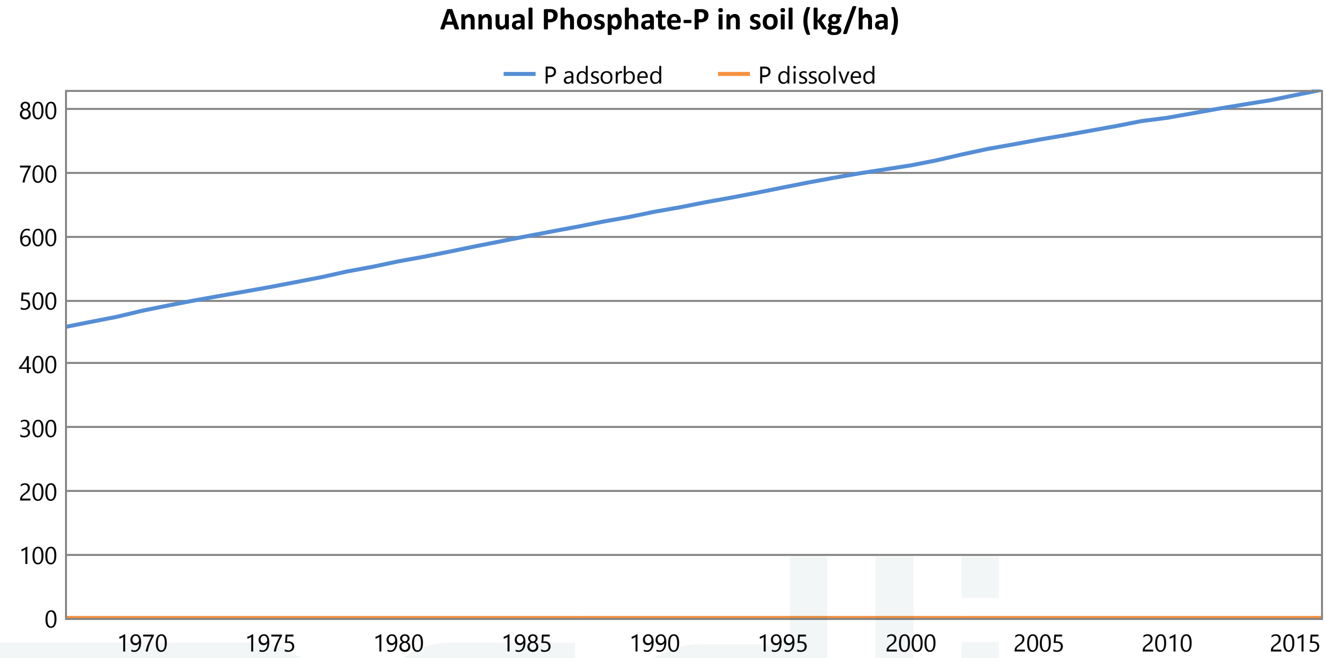
DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Land: New Paddock: 56 ha

Irrigation: Fixed Sprinkler with 0.2% ammonium loss during irrigation





DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Plant Performance: New Paddock: 56 ha

Average Plant Performance (Minimum - Maximum): Continuous Coastal Couch Grass (Cynodon dactylon) Pasture_mod golf, kick started

Average annual shoot dry matter yield (kg/ha/year)	10152.33 (5972.09 - 17075.30)
Average monthly plant (green) cover (fraction)	1.00 (0.99 - 1.00)
Average monthly crop factor (fraction)	0.80 (0.79 - 0.80)
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Average monthly root depth (mm)	799.36 (792.32 - 800.00)
Average number of normal harvests per year (no./year)	7.12 (4.00 - 12.00)
Average number of normal harvests for last five years only (no./year)	4.80
Average number of crop deaths per year (no./year)	0.00 (0.00 - 0.00)
Average number of crop deaths for last five years only (no./year)	0.00
Average annual nitrogen deficiency index (0 = no stress, 1 = full stress) (coefficient)	0.57 (0.14 - 0.74)
Average January temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.02 (0.00 - 0.07)
Average July temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.20 (0.00 - 0.41)
Average monthly water stress index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.01)
Average monthly waterlogging index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.00)
No. days without crop/year (days)	0.00

Soil Salinity - Plant salinity tolerance: Tolerant

Assumes 1.0 dS/m Electrical Conductivity = 640 mg/L Total Dissolved Salts
All values based on 10 year running averages

Salinity of infiltrated water (Average salinity of rainwater = 0.03 dS/m) (dS/m)	0.34
Salt added by rainfall (kg/ha/year)	264.59
Average annual effluent salt added & leached at steady state (kg/ha/year)	4740.73
Average leaching fraction based on 10 year running averages (fraction)	0.51
Average water-uptake-weighted rootzone salinity sat. ext. (dS/m)	0.30
Salinity of the soil solution (at drained upper limit) at base of rootzone (dS/m)	1.08
Relative crop yield expected due to salinity (fraction)	1.00
Proportion of years that crop yields would be expected to fall below 90% of potential due to salinity (fraction)	0.00

DIAGNOSTICS

Run Messages

Messages generated when the scenario was run:

Full run chosen

MEDLI REPORT - FULL RUN

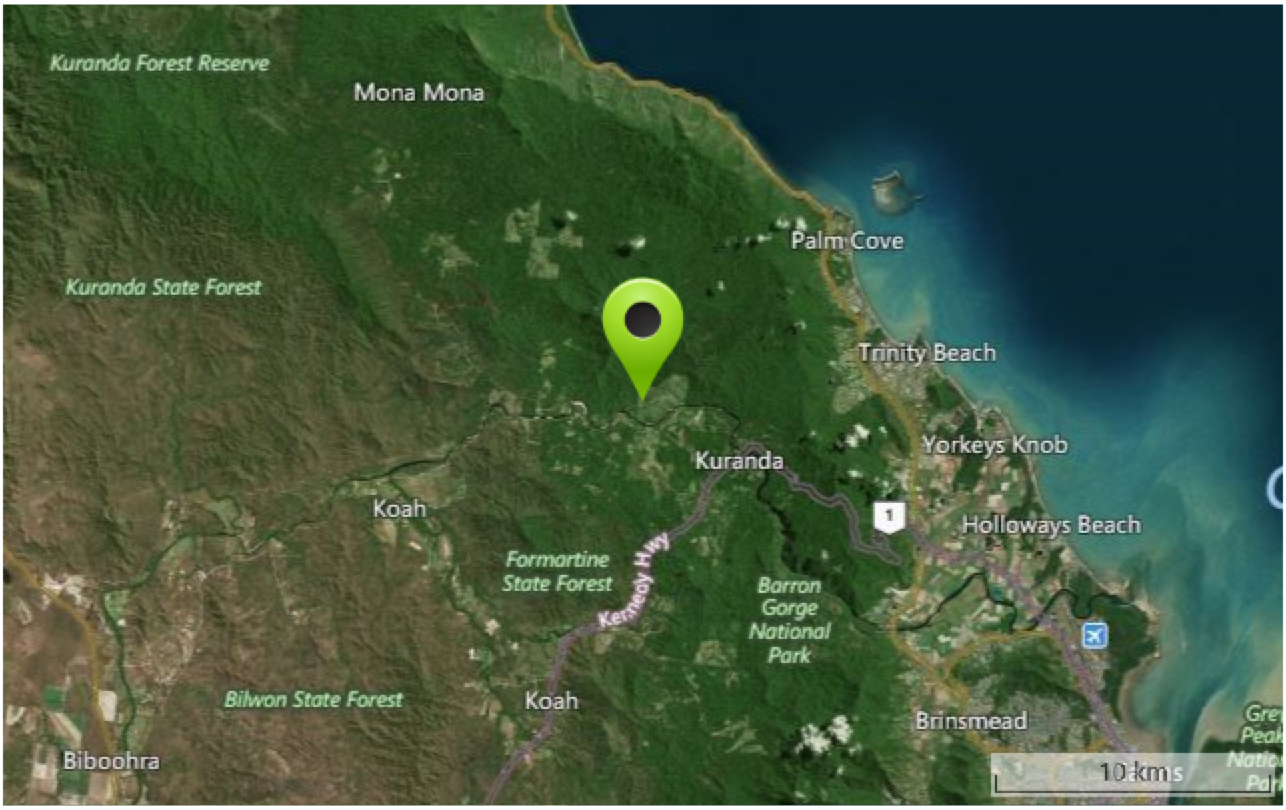
Enterprise: **Kur World**

Description:
Stage 3 High range low ingress 56ha Golf and amenity full run

Client: **Reever and Ocean**

MEDLI User: NATRES\andrew

Scenario Details:
High range ADWF, low infiltration efficiency, Full run
N 5mg/L, P 1 mg/L, TDS 580 mg 73% TON, 2% NH4-N, 25% Org N
5 ML tank and 19 ML dam
5mm SMD to UDL. Irrigation allowed on days with up to 3 mm rainfall. Coastal couch as amenity grass (kickstarted) assumed for golf course and amenity planting - 56ha
No additional nutrient addition to account for return of clippings

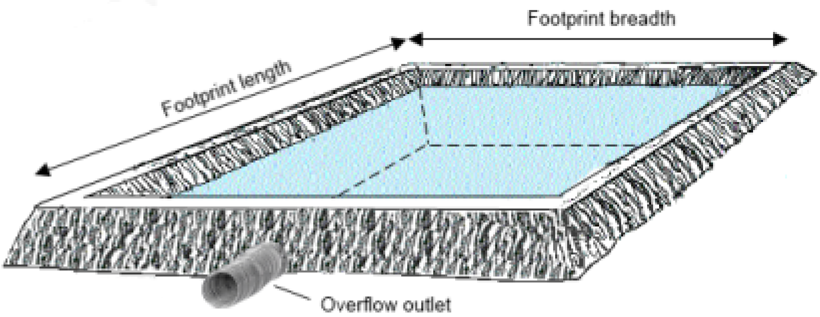


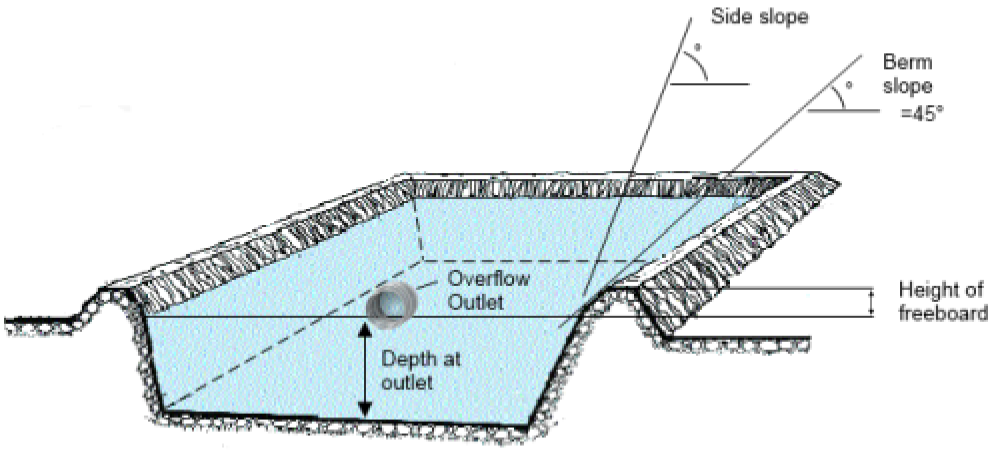
DESCRIPTION

Pond system: 2 facultative, aerobic or storage ponds

Pond system details:

	Pond 1	Pond 2
Maximum pond volume (ML)	5.00	19.00
Minimum allowable pond volume (ML)	0.00	6.77
Pond depth at overflow outlet (m)	4.00	4.50
Maximum water surface area (m2)	1250.00	5794.53
Pond footprint length (m)	35.36	135.05
Pond footprint width (m)	35.36	47.15
Pond catchment area (m2)	1250.00	6367.31
Average active volume (ML)	5.00	13.31





Irrigation pump limits:

Minimum pump rate limit (ML/day)	0.00
Maximum pump rate limit (ML/day)	100.00

Shandying water:

Annual allocation of fresh water available for shandying (ML/year)	0.00
Maximum rate of application of fresh water (ML/day)	0.00
Nitrogen concentration (mg/L)	0.00
Salinity (dS/m)	0.00
Minimum shandy water is used	False

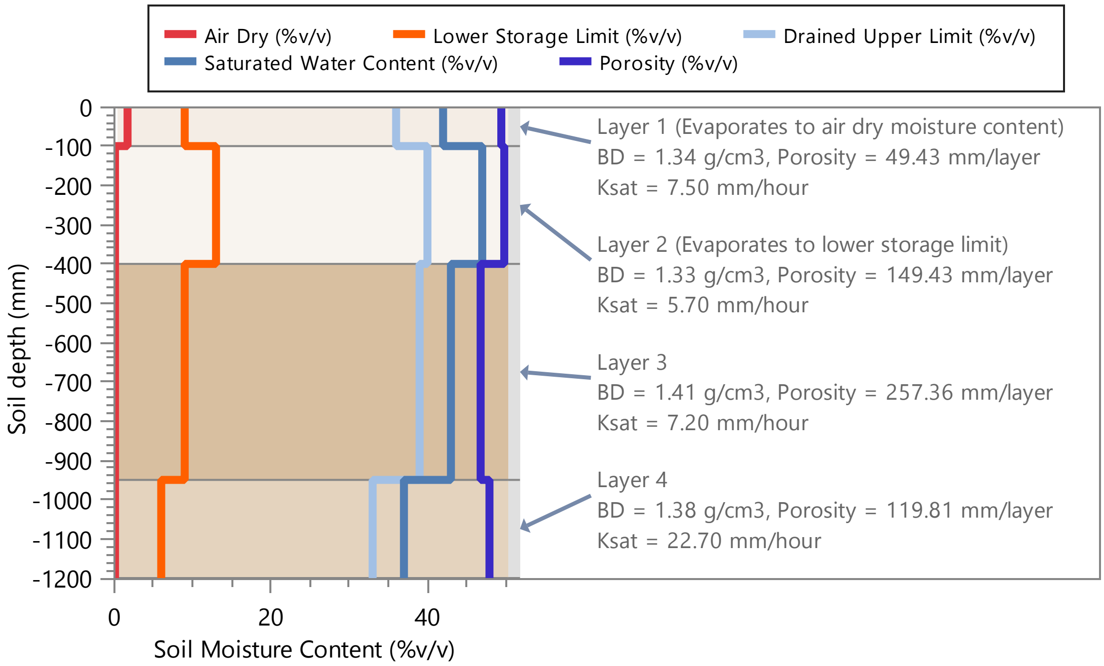
DESCRIPTION

Land: New Paddock

Area (ha): 56.00

Soil Type: Bicton (Kur-World), 1200.00 mm defined profile depth

Profile Porosity (mm)	576.04
Profile saturation water content (mm)	512.00
Profile drained upper limit (or field capacity) (mm)	453.00
Profile lower storage limit (or permanent wilting point) (mm)	112.50
Profile available water capacity (mm)	340.50
Profile limiting saturated hydraulic conductivity (mm/hour)	5.70
Surface saturated hydraulic conductivity (mm/hour)	7.50
Runoff curve number II (coefficient)	80.00
Soil evaporation U (mm)	8.50
Soil evaporation Cona (mm/sqrt day)	3.75



Plant Data: Continuous Coastal Couch Grass (Cynodon dactylon) Pasture_mod golf, kick started

Average monthly cover (fraction) (minimum - maximum)	1.00 (0.99 - 1.00)
Maximum crop factor at 100% cover (mm/mm) (Maximum crop coefficient 0.8 x Pan coefficient 1)	0.80
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Maximum potential root depth in defined soil profile (mm)	800.00
Salt tolerance	Tolerant
Salinity threshold EC sat. ext. (dS/m)	6.90
Proportion of yield decrease per dS/m increase (fraction/dS/m)	0.06

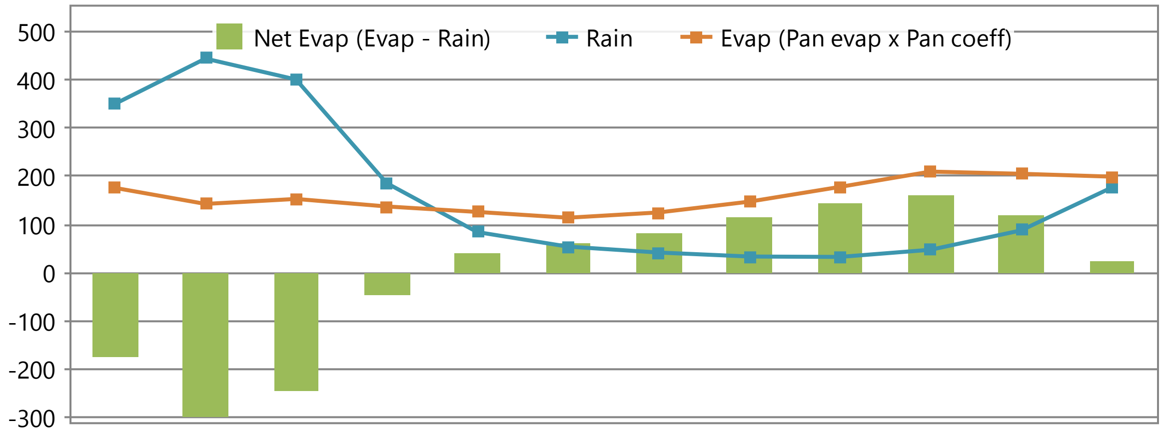
DIAGNOSTICS

Sustainability Diagnostics: Kur World

Averaged Historical Climate Data Used in Simulation (mm)

Location: KurWorlSTP, -16.8°, 145.6°

Run Period: 01/01/1967 to 31/12/2016 50 years, 0 days



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	349.9	444.0	400.6	185.8	84.3	54.1	41.9	33.6	32.8	47.6	87.8	176.5	1938.9
Evap	176.0	142.7	153.0	137.4	126.0	114.1	125.0	147.4	177.9	209.7	205.2	199.2	1913.4
Net Evap	-173.9	-301.3	-247.6	-48.4	41.8	59.9	83.1	113.8	145.1	162.1	117.4	22.7	-25.5
Net Evap/day	-5.6	-10.7	-8.0	-1.6	1.3	2.0	2.7	3.7	4.8	5.2	3.9	0.7	-0.1

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Pond System: 2 facultative, aerobic or storage ponds

Kur-world Stage 3 High range low ingress - Sept 2017 - 728.88 ML/year or 2.00 ML/day generated on average

Effluent entering pond system after any pretreatment and recycling

Average (Minimum-Maximum) influent quality calculated for 365.26 non-zero flow days, after any pretreatment and recycling.

Constituent	Concentration (mg/L)	Load (kg/year)
Total Nitrogen	4.54 (0.64 - 5.00)	3305.75 (3303.40 - 3312.45)
Total Phosphorus	0.91 (0.13 - 1.00)	661.15 (660.68 - 662.49)
Total Dissolved Salts	526.10 (73.77 - 580.00)	383466.90 (383193.94 - 384243.78)
Volatile Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Total Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)

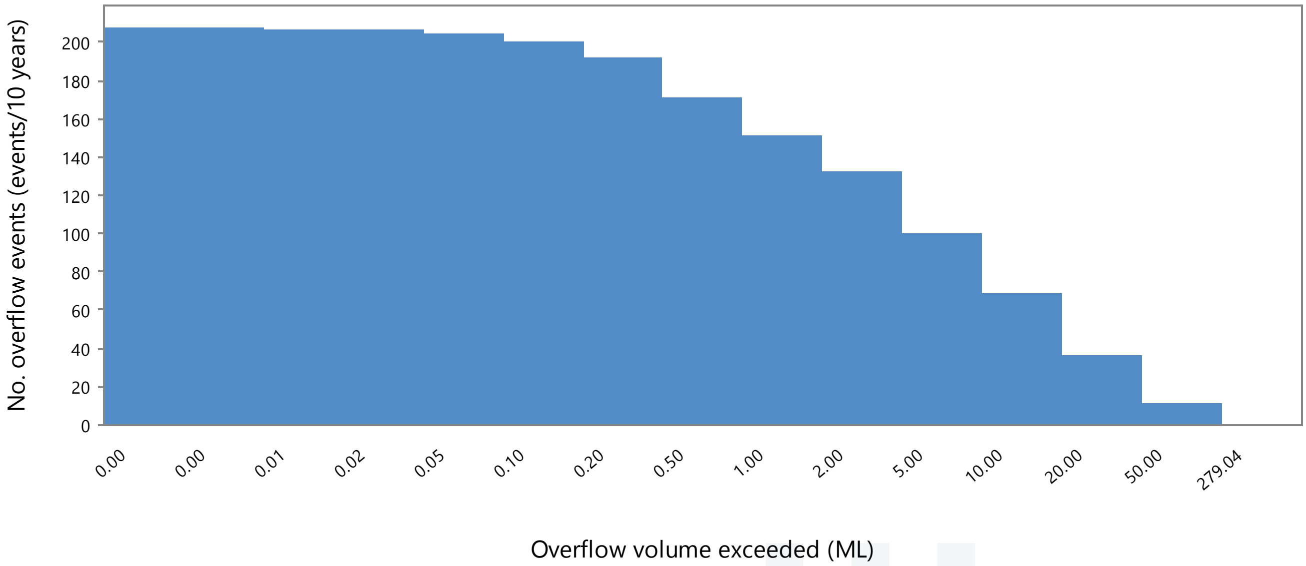
Last pond (Wet weather store): 19.00 ML

Theoretical hydraulic retention time (days)	9.52
Average volume of overflow (ML/year)	257.40
No. overflow events per year exceeding threshold* of 0.00 ML (no./year)	20.74
Average duration of overflow (days)	6.00
Effluent Reuse (Proportion of Inflow + Net Rain Gain that is Irrigated) (fraction)	0.65
Probability of at least 90% effluent reuse (fraction)	0.00
Average salinity of last pond (dS/m)	0.81
Salinity of last pond on final day of simulation (dS/m)	0.89
Ammonia loss from pond system water area (kg/m2/year)	0.00

* The threshold is the volume equivalent to the top 1 mm depth of water of a full pond

Overflow exceedance:

Chart Table



Export plot

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Irrigation Information

Irrigation: 56 ha total area (assumed 100% irrigation efficiency)

	Quantity/year	Quantity/ha/year
Total irrigation applied (ML)	476.54	8.51
Total nitrogen applied (kg)	2265.88	40.46
Total phosphorus applied (kg)	454.99	8.12
Total salts applied (kg)	263897.10	4712.45

Shandying

Annual allocation of fresh water for shandying (ML/year)	0.00
Average Shandy water irrigation (ML/year) (minimum - maximum)	0.00 (0.00 - 0.00)
Average exceedance as a proportion of annual shandy water allocation (% of allocation) (minimum - maximum)	0.00 (0.00 - 0.00)
Proportion of irrigation events requiring shandying (fraction of events)	0.00
Minimum shandy water is used	False

Irrigation Issues

Proportion of Days irrigation is prevented when triggered (fraction)	0.25
Proportion of Days water demand is too small to trigger irrigation (fraction)	0.29
Proportion of Days irrigation occurs (fraction)	0.46

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Land: New Paddock: 56 ha

Irrigation: Fixed Sprinkler with 0.2% ammonium loss during irrigation

Irrigation triggered when soil water deficit reaches 5.00 mm and rainfall is less than or equal to 3.00 mm
Irrigate up to a soil water content of drained upper limit plus 0.00 mm
Irrigation window from 1/1 to 31/12 including the days specified
A minimum of 0 days must be skipped between irrigation events

Soil Water Balance (mm): Bicton (Kur-World), 228.00 mm PAWC at maximum root depth

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	349.9	444.0	400.6	185.8	84.3	54.1	41.9	33.6	32.8	47.6	87.8	176.5	1938.9
Irrigation	62.1	29.9	45.2	49.4	59.4	62.6	76.4	93.5	95.7	98.0	91.0	87.8	851.0
Soil Evap	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Transpn.	138.3	114.1	121.1	109.7	100.8	91.2	100.0	117.9	142.3	167.7	163.9	158.9	1526.0
Rain Runoff	127.3	164.8	157.9	40.7	7.1	3.4	2.1	1.2	2.5	4.5	12.2	42.7	566.3
Irr. Runoff	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Drainage	110.9	182.4	172.7	88.1	39.6	21.5	18.4	8.6	7.1	6.1	8.7	36.6	700.7
Delta	35.4	12.7	-5.9	-3.3	-3.8	0.6	-2.2	-0.6	-23.4	-32.8	-6.1	26.1	-3.3

Soil Nitrogen Balance

Average annual effluent nitrogen added (kg/ha/year)	40.46
Average annual soil nitrogen removed by plant uptake (kg/ha/year)	114.08
Average annual soil nitrogen removed by denitrification (kg/ha/year)	0.02
Average annual soil nitrogen leached (kg/ha/year)	1.23
Average annual nitrate-N loading to groundwater (kg/ha/year)	1.23
Soil organic-N kg/ha (Initial - Final)	3809.50 - 141.12
	74.41 - 0.03
Average nitrate-N concentration of deep drainage (mg/L)	0.18
Max. annual nitrate-N concentration of deep drainage (mg/L)	8.36

Soil Phosphorus Balance

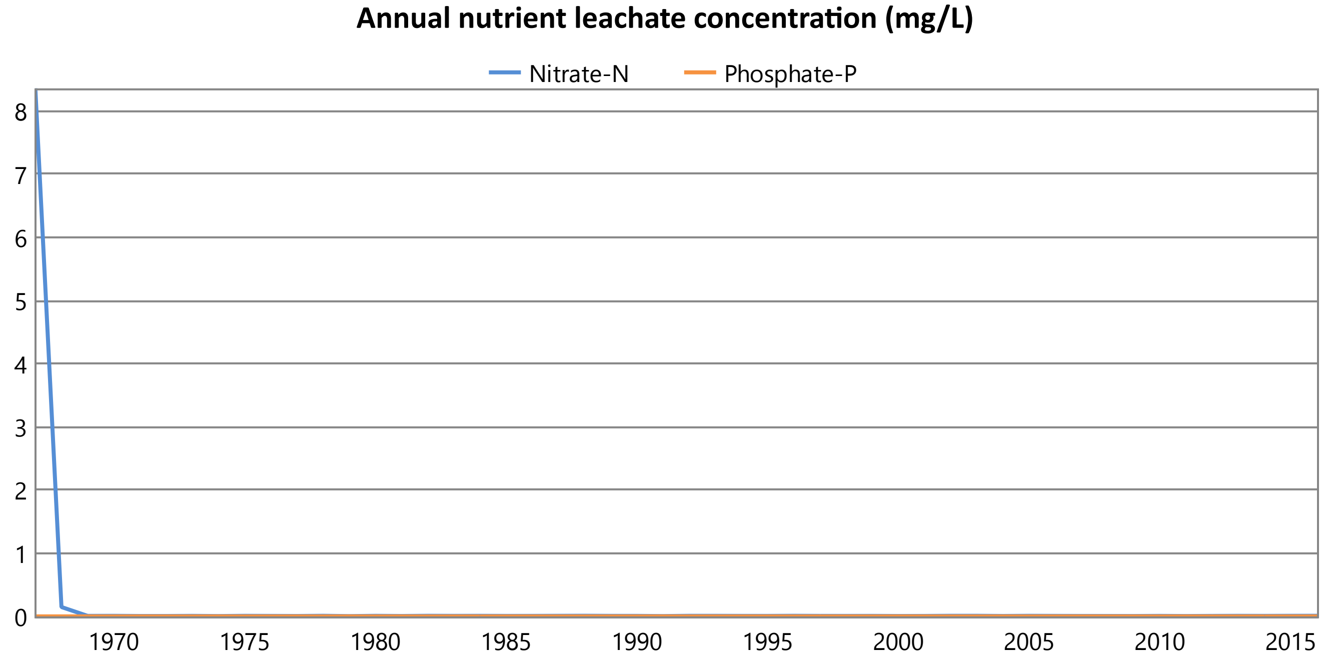
Average annual effluent phosphorus added (kg/ha/year)	8.12
Average annual soil phosphorus removed by plant uptake (kg/ha/year)	0.21
Average annual soil phosphorus leached (kg/ha/year)	5.16E-04
Dissolved phosphorus (kg/ha) (Initial - Final)	2.86E-04 - 3.94E-03
Adsorbed phosphorus (kg/ha) (Initial - Final)	450.65 - 847.67
Average phosphate-P concentration in rootzone (mg/L)	5.86E-04
Average phosphate-P concentration of deep drainage (mg/L)	7.37E-05
Max. annual phosphate-P concentration of deep drainage (mg/L)	8.41E-05
Design soil profile storage life based on average infiltrated water phosphorus concn. of 0.37 mg/L (years)	647.78

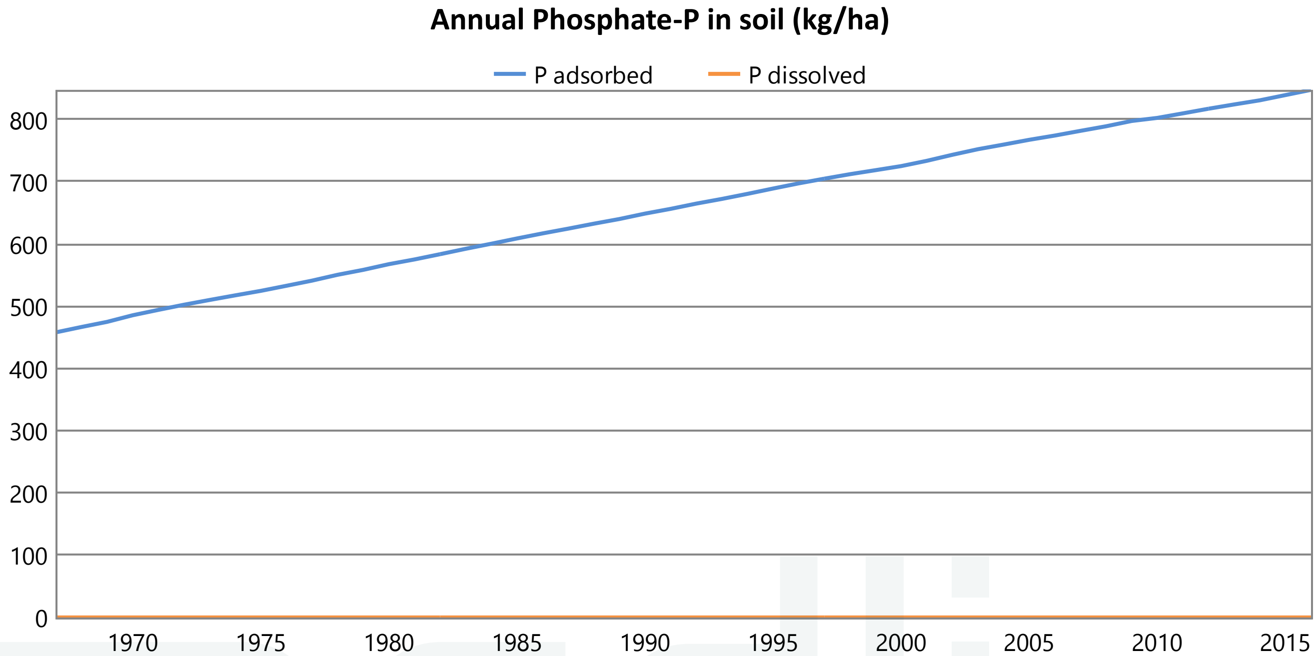
DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Land: New Paddock: 56 ha

Irrigation: Fixed Sprinkler with 0.2% ammonium loss during irrigation





DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Plant Performance: New Paddock: 56 ha

Average Plant Performance (Minimum - Maximum): Continuous Coastal Couch Grass (Cynodon dactylon) Pasture_mod golf, kick started

Average annual shoot dry matter yield (kg/ha/year)	10274.01 (6102.58 - 17169.61)
Average monthly plant (green) cover (fraction)	1.00 (0.99 - 1.00)
Average monthly crop factor (fraction)	0.80 (0.79 - 0.80)
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Average monthly root depth (mm)	799.36 (792.32 - 800.00)
Average number of normal harvests per year (no./year)	7.20 (4.00 - 12.00)
Average number of normal harvests for last five years only (no./year)	4.80
Average number of crop deaths per year (no./year)	0.00 (0.00 - 0.00)
Average number of crop deaths for last five years only (no./year)	0.00
Average annual nitrogen deficiency index (0 = no stress, 1 = full stress) (coefficient)	0.57 (0.14 - 0.73)
Average January temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.02 (0.00 - 0.07)
Average July temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.20 (0.00 - 0.41)
Average monthly water stress index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.01)
Average monthly waterlogging index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.00)
No. days without crop/year (days)	0.00

Soil Salinity - Plant salinity tolerance: Tolerant

Assumes 1.0 dS/m Electrical Conductivity = 640 mg/L Total Dissolved Salts
All values based on 10 year running averages

Salinity of infiltrated water (Average salinity of rainwater = 0.03 dS/m) (dS/m)	0.35
Salt added by rainfall (kg/ha/year)	263.53
Average annual effluent salt added & leached at steady state (kg/ha/year)	4975.98
Average leaching fraction based on 10 year running averages (fraction)	0.52
Average water-uptake-weighted rootzone salinity sat. ext. (dS/m)	0.31
Salinity of the soil solution (at drained upper limit) at base of rootzone (dS/m)	1.09
Relative crop yield expected due to salinity (fraction)	1.00
Proportion of years that crop yields would be expected to fall below 90% of potential due to salinity (fraction)	0.00

DIAGNOSTICS

Run Messages

Messages generated when the scenario was run:

Full run chosen

MEDLI REPORT - FULL RUN

Enterprise: **Kur World**

Description:
Stage 3 High range low ingress NO DAM 56ha Golf and amenity full run

Client: **Reever and Ocean**

MEDLI User: NATRES\andrew

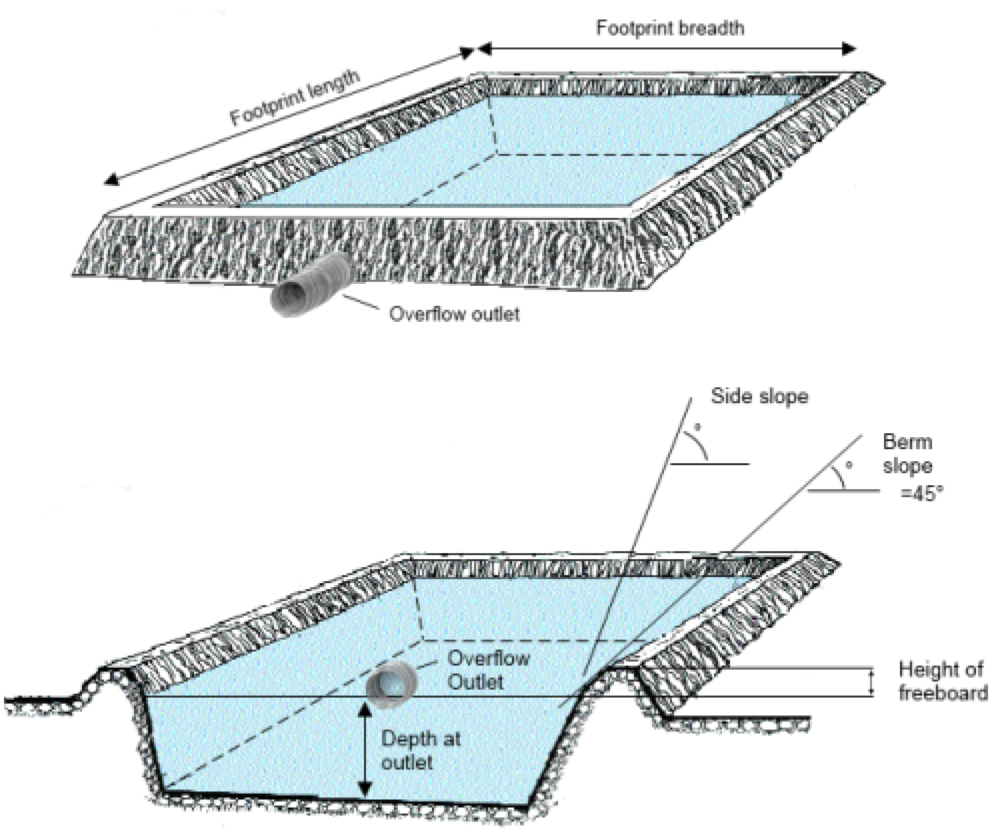
Scenario Details:
High range ADWF, low infiltration efficiency, Full run
N 5mg/L, P 1 mg/L, TDS 580 mg 73% TON, 2% NH4-N, 25% Org N
5 ML tank, NO DAM
5mm SMD to UDL. Irrigation allowed on days with up to 3 mm rainfall. Coastal couch as amenity grass (kickstarted) assumed for golf course and amenity planting - 56ha
No additional nutrient addition to account for return of clippings

DESCRIPTION

Pond system: 1 closed storage tank

Pond system details:

	Pond 1
Maximum pond volume (ML)	5.00
Minimum allowable pond volume (ML)	1.88
Pond depth at overflow outlet (m)	4.00
Maximum water surface area (m2)	1250.00
Pond footprint length (m)	35.36
Pond footprint width (m)	35.36
Pond catchment area (m2)	1250.00
Average active volume (ML)	3.08



Irrigation pump limits:

Minimum pump rate limit (ML/day)	0.00
Maximum pump rate limit (ML/day)	100.00

Shandying water:

Annual allocation of fresh water available for shandying (ML/year)	0.00
Maximum rate of application of fresh water (ML/day)	0.00
Nitrogen concentration (mg/L)	0.00
Salinity (dS/m)	0.00
Minimum shandy water is used	False

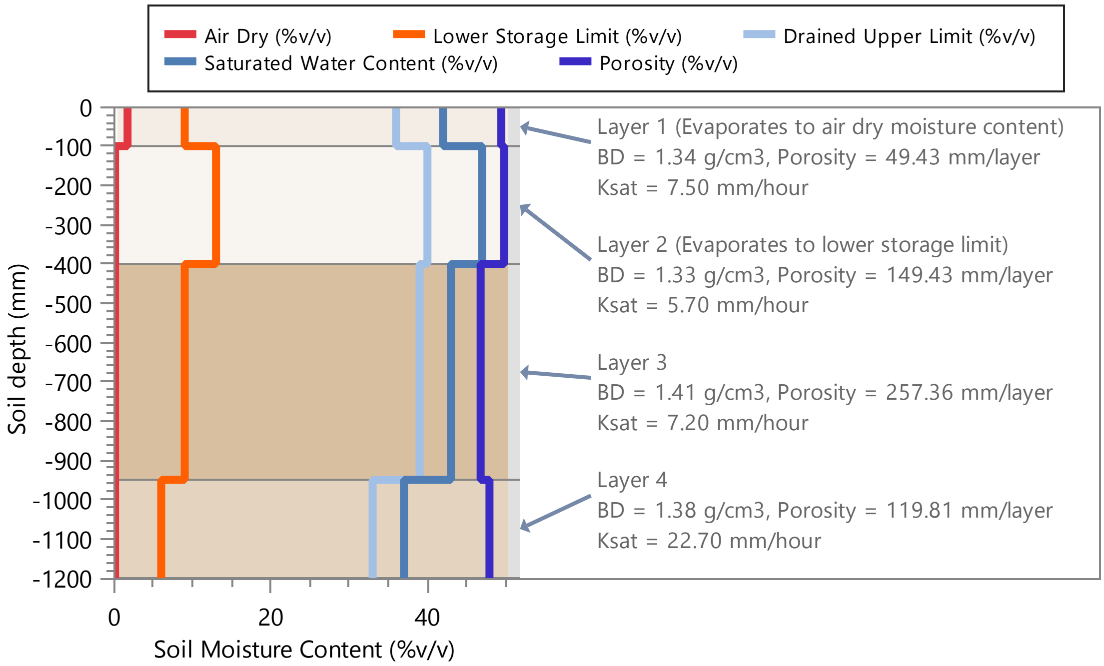
DESCRIPTION

Land: New Paddock

Area (ha): 56.00

Soil Type: Bicton (Kur-World), 1200.00 mm defined profile depth

Profile Porosity (mm)	576.04
Profile saturation water content (mm)	512.00
Profile drained upper limit (or field capacity) (mm)	453.00
Profile lower storage limit (or permanent wilting point) (mm)	112.50
Profile available water capacity (mm)	340.50
Profile limiting saturated hydraulic conductivity (mm/hour)	5.70
Surface saturated hydraulic conductivity (mm/hour)	7.50
Runoff curve number II (coefficient)	80.00
Soil evaporation U (mm)	8.50
Soil evaporation Cona (mm/sqrt day)	3.75



Plant Data: Continuous Coastal Couch Grass (Cynodon dactylon) Pasture_mod golf, kick started

Average monthly cover (fraction) (minimum - maximum)	1.00 (0.99 - 1.00)
Maximum crop factor at 100% cover (mm/mm) (Maximum crop coefficient 0.8 x Pan coefficient 1)	0.80
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Maximum potential root depth in defined soil profile (mm)	800.00
Salt tolerance	Tolerant
Salinity threshold EC sat. ext. (dS/m)	6.90
Proportion of yield decrease per dS/m increase (fraction/dS/m)	0.06

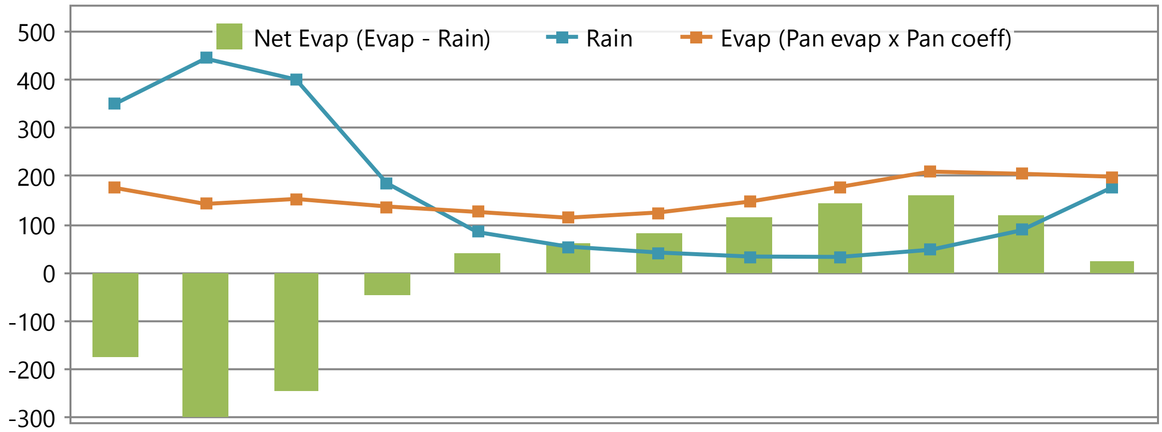
DIAGNOSTICS

Sustainability Diagnostics: Kur World

Averaged Historical Climate Data Used in Simulation (mm)

Location: KurWorlSTP, -16.8°, 145.6°

Run Period: 01/01/1967 to 31/12/2016 50 years, 0 days



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	349.9	444.0	400.6	185.8	84.3	54.1	41.9	33.6	32.8	47.6	87.8	176.5	1938.9
Evap	176.0	142.7	153.0	137.4	126.0	114.1	125.0	147.4	177.9	209.7	205.2	199.2	1913.4
Net Evap	-173.9	-301.3	-247.6	-48.4	41.8	59.9	83.1	113.8	145.1	162.1	117.4	22.7	-25.5
Net Evap/day	-5.6	-10.7	-8.0	-1.6	1.3	2.0	2.7	3.7	4.8	5.2	3.9	0.7	-0.1

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Pond System: 1 closed storage tank

Kur-world Stage 3 High range low ingress - Sept 2017 - 728.88 ML/year or 2.00 ML/day generated on average

Effluent entering pond system after any pretreatment and recycling

Average (Minimum-Maximum) influent quality calculated for 365.26 non-zero flow days, after any pretreatment and recycling.

Constituent	Concentration (mg/L)	Load (kg/year)
Total Nitrogen	4.54 (0.64 - 5.00)	3305.75 (3303.40 - 3312.45)
Total Phosphorus	0.91 (0.13 - 1.00)	661.15 (660.68 - 662.49)
Total Dissolved Salts	526.10 (73.77 - 580.00)	383466.90 (383193.94 - 384243.78)
Volatile Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Total Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)

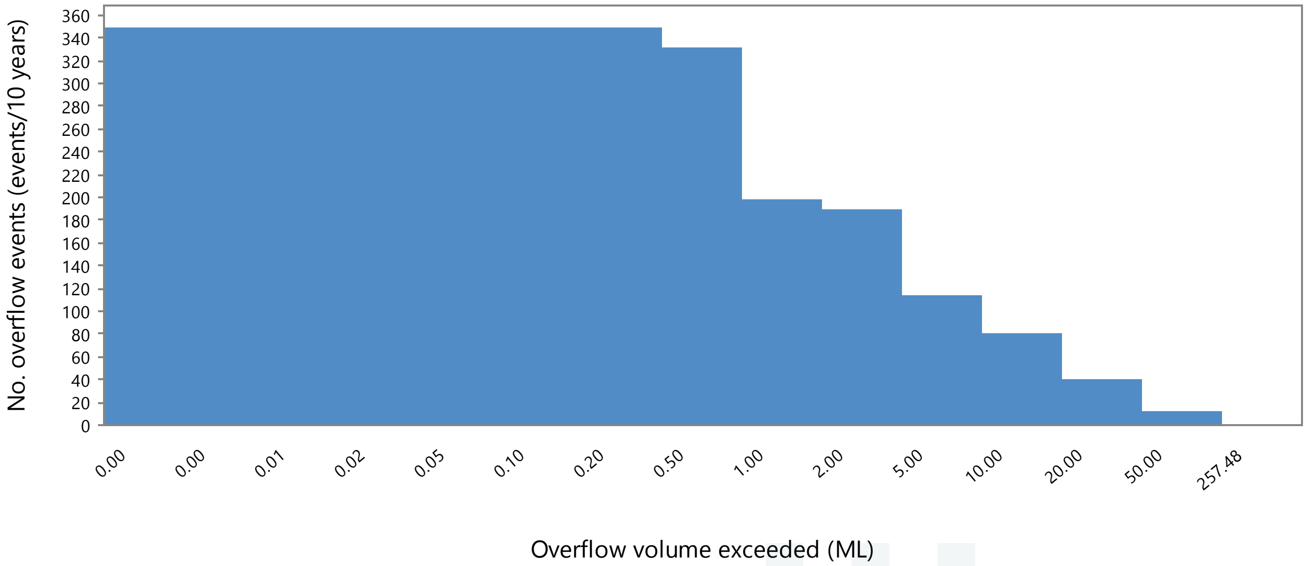
Last pond (Wet weather store): 5.00 ML

Theoretical hydraulic retention time (days)	2.51
Average volume of overflow (ML/year)	297.81
No. overflow events per year exceeding threshold* of 0.00 ML (no./year)	34.84
Average duration of overflow (days)	4.42
Effluent Reuse (Proportion of Inflow + Net Rain Gain that is Irrigated) (fraction)	0.59
Probability of at least 90% effluent reuse (fraction)	0.00
Average salinity of last pond (dS/m)	0.81
Salinity of last pond on final day of simulation (dS/m)	0.90
Ammonia loss from pond system water area (kg/m2/year)	0.00

* The threshold is the volume equivalent to the top 1 mm depth of water of a full pond

Overflow exceedance:

Chart Table



Export plot

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Irrigation Information

Irrigation: 56 ha total area (assumed 100% irrigation efficiency)

	Quantity/year	Quantity/ha/year
Total irrigation applied (ML)	431.03	7.70
Total nitrogen applied (kg)	2094.03	37.39
Total phosphorus applied (kg)	420.49	7.51
Total salts applied (kg)	243883.24	4355.06

Shandying

Annual allocation of fresh water for shandying (ML/year)	0.00
Average Shandy water irrigation (ML/year) (minimum - maximum)	0.00 (0.00 - 0.00)
Average exceedance as a proportion of annual shandy water allocation (% of allocation) (minimum - maximum)	0.00 (0.00 - 0.00)
Proportion of irrigation events requiring shandying (fraction of events)	0.00
Minimum shandy water is used	False

Irrigation Issues

Proportion of Days irrigation is prevented when triggered (fraction)	0.25
Proportion of Days water demand is too small to trigger irrigation (fraction)	0.17
Proportion of Days irrigation occurs (fraction)	0.58

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Land: New Paddock: 56 ha

Irrigation: Fixed Sprinkler with 0.2% ammonium loss during irrigation

Irrigation triggered when soil water deficit reaches 5.00 mm and rainfall is less than or equal to 3.00 mm
Irrigate up to a soil water content of drained upper limit plus 0.00 mm
Irrigation window from 1/1 to 31/12 including the days specified
A minimum of 0 days must be skipped between irrigation events

Soil Water Balance (mm): Bicton (Kur-World), 228.00 mm PAWC at maximum root depth

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	349.9	444.0	400.6	185.8	84.3	54.1	41.9	33.6	32.8	47.6	87.8	176.5	1938.9
Irrigation	51.1	25.8	35.4	43.2	56.6	61.7	72.9	84.3	87.3	91.5	83.0	76.9	769.7
Soil Evap	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Transpn.	137.3	114.1	121.1	109.7	100.8	91.2	100.0	117.9	142.3	167.7	163.8	158.4	1524.4
Rain Runoff	125.3	163.7	156.5	40.4	7.0	3.4	2.2	1.2	2.5	4.4	11.6	41.2	559.4
Irr. Runoff	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Drainage	93.8	170.2	165.7	81.9	35.3	19.6	16.6	6.0	4.7	3.5	4.2	27.3	628.9
Delta	44.6	21.7	-7.3	-3.0	-2.3	1.6	-4.0	-7.2	-29.4	-36.7	-8.7	26.5	-4.1

Soil Nitrogen Balance

Average annual effluent nitrogen added (kg/ha/year)	37.39
Average annual soil nitrogen removed by plant uptake (kg/ha/year)	111.07
Average annual soil nitrogen removed by denitrification (kg/ha/year)	0.02
Average annual soil nitrogen leached (kg/ha/year)	1.22
Average annual nitrate-N loading to groundwater (kg/ha/year)	1.22
Soil organic-N kg/ha (Initial - Final)	3809.50 - 138.98
	74.41 - 0.02
Average nitrate-N concentration of deep drainage (mg/L)	0.19
Max. annual nitrate-N concentration of deep drainage (mg/L)	8.48

Soil Phosphorus Balance

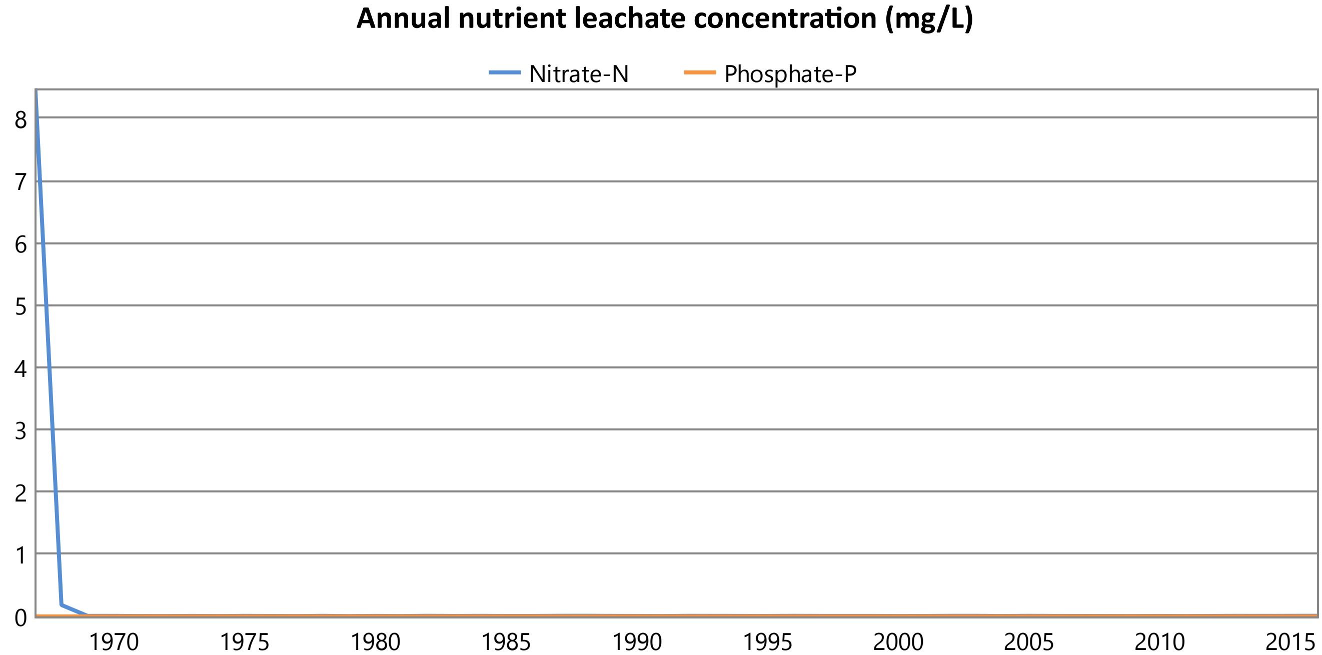
Average annual effluent phosphorus added (kg/ha/year)	7.51
Average annual soil phosphorus removed by plant uptake (kg/ha/year)	0.16
Average annual soil phosphorus leached (kg/ha/year)	4.61E-04
Dissolved phosphorus (kg/ha) (Initial - Final)	2.86E-04 - 3.68E-03
Adsorbed phosphorus (kg/ha) (Initial - Final)	450.65 - 819.38
Average phosphate-P concentration in rootzone (mg/L)	5.77E-04
Average phosphate-P concentration of deep drainage (mg/L)	7.33E-05
Max. annual phosphate-P concentration of deep drainage (mg/L)	8.63E-05
Design soil profile storage life based on average infiltrated water phosphorus concn. of 0.35 mg/L (years)	691.02

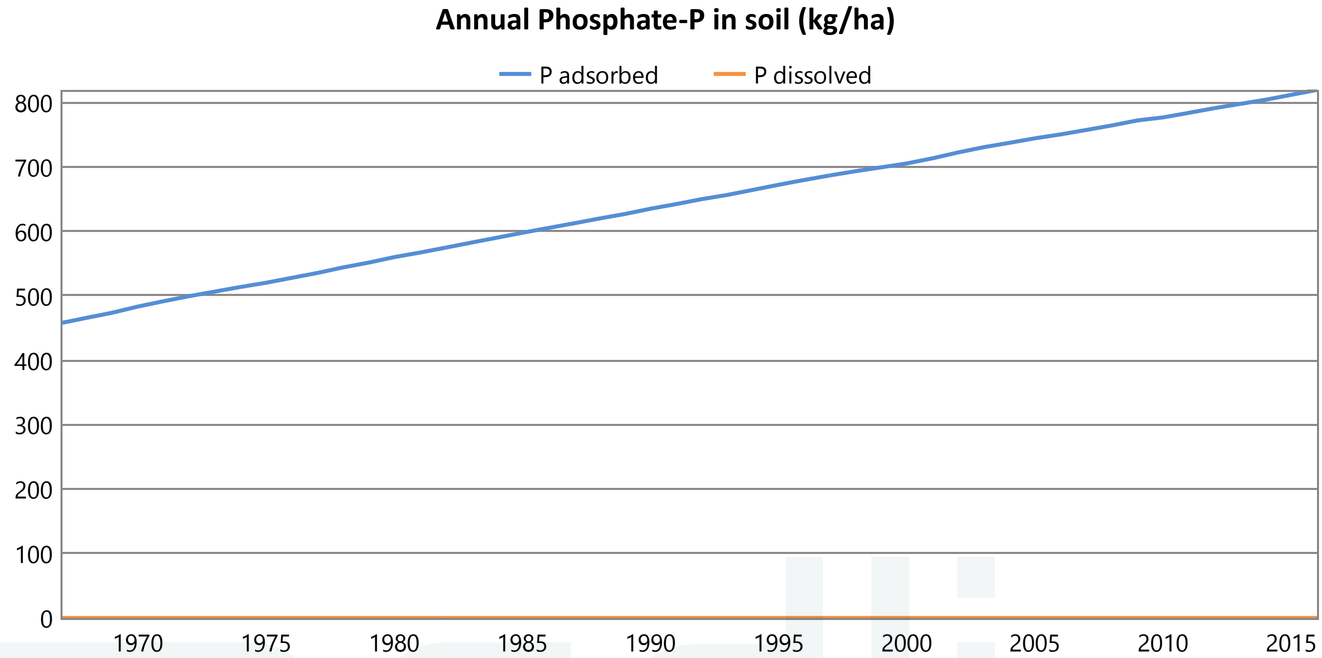
DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Land: New Paddock: 56 ha

Irrigation: Fixed Sprinkler with 0.2% ammonium loss during irrigation





DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Plant Performance: New Paddock: 56 ha

Average Plant Performance (Minimum - Maximum): Continuous Coastal Couch Grass (Cynodon dactylon) Pasture_mod golf, kick started

Average annual shoot dry matter yield (kg/ha/year)	10086.33 (5815.82 - 17091.36)
Average monthly plant (green) cover (fraction)	1.00 (0.99 - 1.00)
Average monthly crop factor (fraction)	0.80 (0.79 - 0.80)
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Average monthly root depth (mm)	799.36 (792.32 - 800.00)
Average number of normal harvests per year (no./year)	7.08 (4.00 - 12.00)
Average number of normal harvests for last five years only (no./year)	4.80
Average number of crop deaths per year (no./year)	0.00 (0.00 - 0.00)
Average number of crop deaths for last five years only (no./year)	0.00
Average annual nitrogen deficiency index (0 = no stress, 1 = full stress) (coefficient)	0.57 (0.14 - 0.74)
Average January temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.02 (0.00 - 0.07)
Average July temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.20 (0.00 - 0.41)
Average monthly water stress index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.01)
Average monthly waterlogging index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.00)
No. days without crop/year (days)	0.00

Soil Salinity - Plant salinity tolerance: Tolerant

Assumes 1.0 dS/m Electrical Conductivity = 640 mg/L Total Dissolved Salts
All values based on 10 year running averages

Salinity of infiltrated water (Average salinity of rainwater = 0.03 dS/m) (dS/m)	0.33
Salt added by rainfall (kg/ha/year)	264.88
Average annual effluent salt added & leached at steady state (kg/ha/year)	4619.93
Average leaching fraction based on 10 year running averages (fraction)	0.50
Average water-uptake-weighted rootzone salinity sat. ext. (dS/m)	0.31
Salinity of the soil solution (at drained upper limit) at base of rootzone (dS/m)	1.13
Relative crop yield expected due to salinity (fraction)	1.00
Proportion of years that crop yields would be expected to fall below 90% of potential due to salinity (fraction)	0.00

DIAGNOSTICS

Run Messages

Messages generated when the scenario was run:

Full run chosen

MEDLI REPORT - FULL RUN

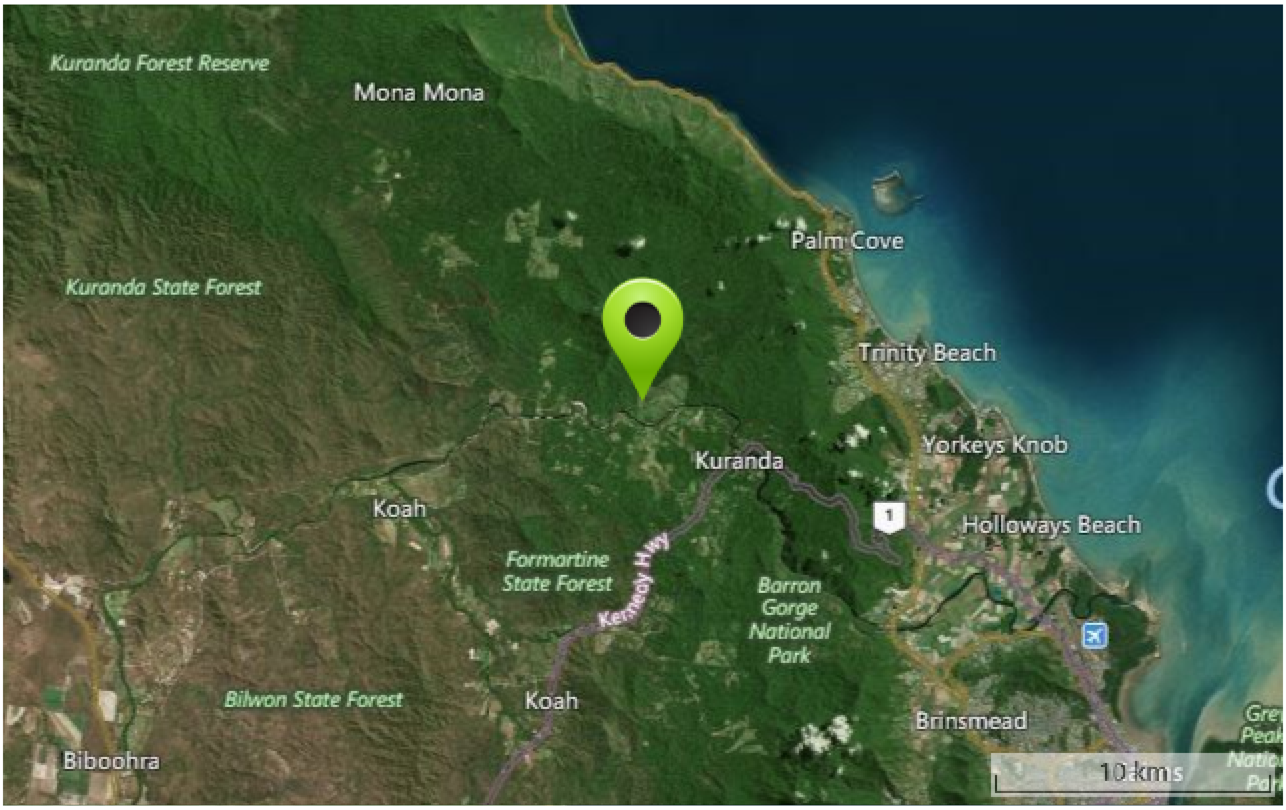
Enterprise: Kur World

Description:
Stage 3 High range 56ha Golf and amenity full run

Client: Reever and Ocean

MEDLI User: NATRES\andrew

Scenario Details:
High range ADWF, average infiltration efficiency, Full run
N 5mg/L, P 1 mg/L, TDS 580 mg 73% TON, 2% NH4-N, 25% Org N
5 ML tank and 19 ML dam
5mm SMD to UDL. Irrigation allowed on days with up to 3 mm rainfall. Coastal couch as amenity grass (kickstarted) assumed for golf course and amenity planting - 56ha
No additional nutrient addition to account for return of clippings

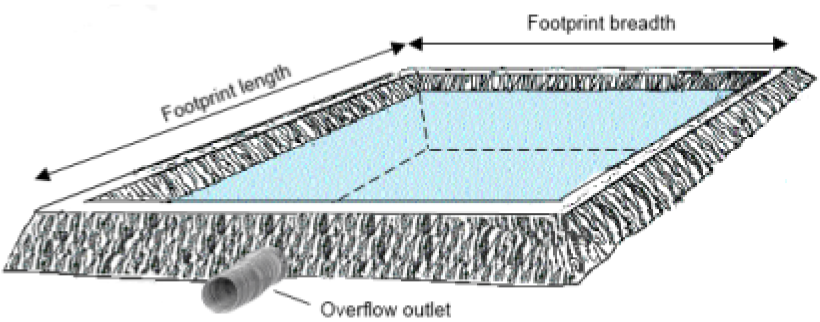


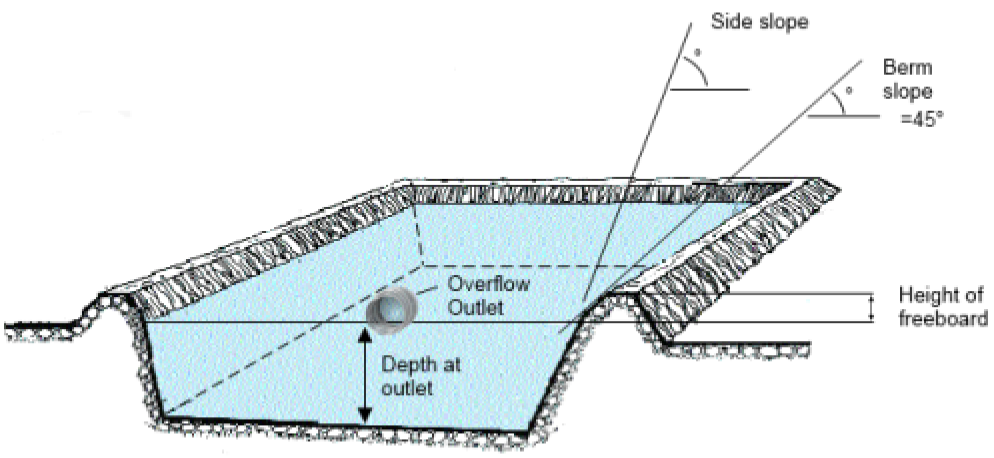
DESCRIPTION

Pond system: 2 facultative, aerobic or storage ponds

Pond system details:

	Pond 1	Pond 2
Maximum pond volume (ML)	5.00	19.00
Minimum allowable pond volume (ML)	0.00	6.77
Pond depth at overflow outlet (m)	4.00	4.50
Maximum water surface area (m2)	1250.00	5794.53
Pond footprint length (m)	35.36	135.05
Pond footprint width (m)	35.36	47.15
Pond catchment area (m2)	1250.00	6367.31
Average active volume (ML)	5.00	13.44





Irrigation pump limits:

Minimum pump rate limit (ML/day)	0.00
Maximum pump rate limit (ML/day)	100.00

Shandying water:

Annual allocation of fresh water available for shandying (ML/year)	0.00
Maximum rate of application of fresh water (ML/day)	0.00
Nitrogen concentration (mg/L)	0.00
Salinity (dS/m)	0.00
Minimum shandy water is used	False

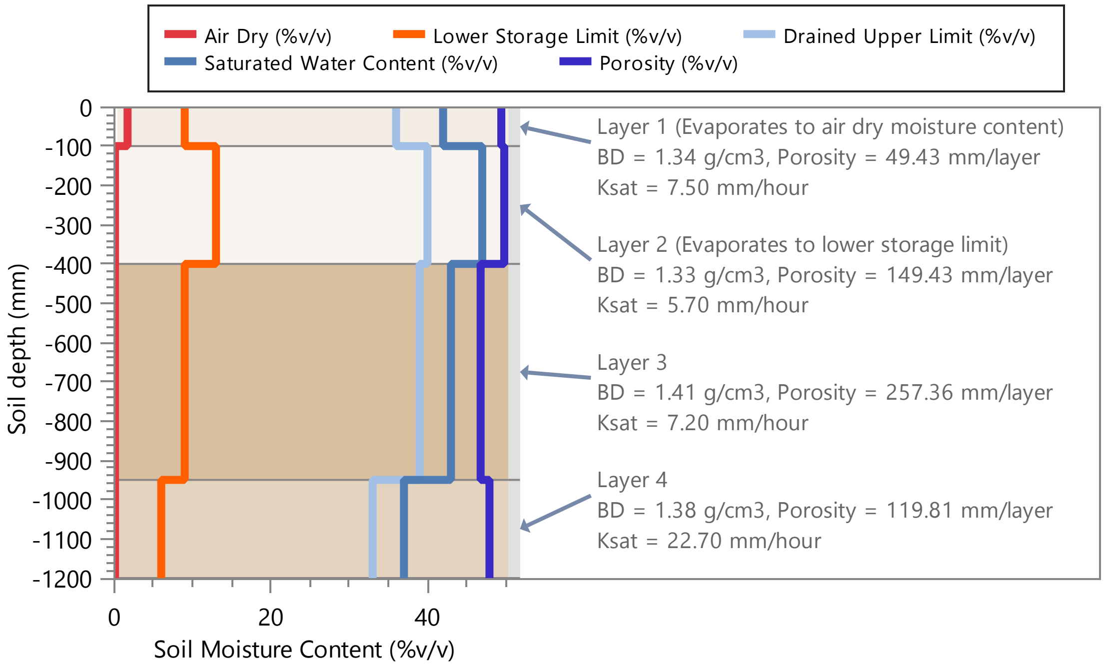
DESCRIPTION

Land: New Paddock

Area (ha): 56.00

Soil Type: Bicton (Kur-World), 1200.00 mm defined profile depth

Profile Porosity (mm)	576.04
Profile saturation water content (mm)	512.00
Profile drained upper limit (or field capacity) (mm)	453.00
Profile lower storage limit (or permanent wilting point) (mm)	112.50
Profile available water capacity (mm)	340.50
Profile limiting saturated hydraulic conductivity (mm/hour)	5.70
Surface saturated hydraulic conductivity (mm/hour)	7.50
Runoff curve number II (coefficient)	80.00
Soil evaporation U (mm)	8.50
Soil evaporation Cona (mm/sqrt day)	3.75



Plant Data: Continuous Coastal Couch Grass (Cynodon dactylon) Pasture_mod golf, kick started

Average monthly cover (fraction) (minimum - maximum)	1.00 (0.99 - 1.00)
Maximum crop factor at 100% cover (mm/mm) (Maximum crop coefficient 0.8 x Pan coefficient 1)	0.80
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Maximum potential root depth in defined soil profile (mm)	800.00
Salt tolerance	Tolerant
Salinity threshold EC sat. ext. (dS/m)	6.90
Proportion of yield decrease per dS/m increase (fraction/dS/m)	0.06

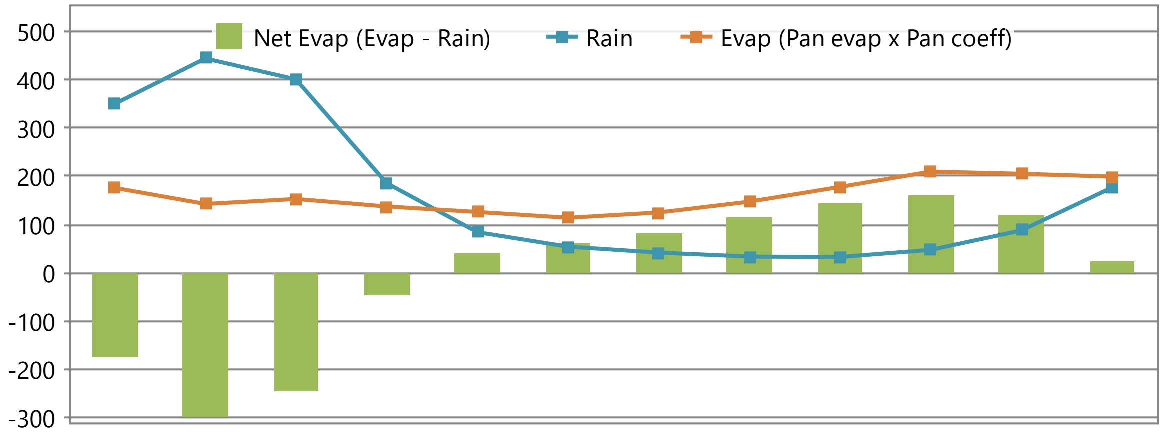
DIAGNOSTICS

Sustainability Diagnostics: Kur World

Averaged Historical Climate Data Used in Simulation (mm)

Location: KurWorlSTP, -16.8°, 145.6°

Run Period: 01/01/1967 to 31/12/2016   50 years, 0 days



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	349.9	444.0	400.6	185.8	84.3	54.1	41.9	33.6	32.8	47.6	87.8	176.5	1938.9
Evap	176.0	142.7	153.0	137.4	126.0	114.1	125.0	147.4	177.9	209.7	205.2	199.2	1913.4
Net Evap	-173.9	-301.3	-247.6	-48.4	41.8	59.9	83.1	113.8	145.1	162.1	117.4	22.7	-25.5
Net Evap/day	-5.6	-10.7	-8.0	-1.6	1.3	2.0	2.7	3.7	4.8	5.2	3.9	0.7	-0.1

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Pond System: 2 facultative, aerobic or storage ponds

Kur-world Stage 3 High range - Sept 2017 - 795.57 ML/year or 2.18 ML/day generated on average

Effluent entering pond system after any pretreatment and recycling

Average (Minimum-Maximum) influent quality calculated for 365.26 non-zero flow days, after any pretreatment and recycling.

Constituent	Concentration (mg/L)	Load (kg/year)
Total Nitrogen	4.16 (0.34 - 5.00)	3305.75 (3303.40 - 3312.45)
Total Phosphorus	0.83 (0.07 - 1.00)	661.15 (660.68 - 662.49)
Total Dissolved Salts	482.00 (39.55 - 580.00)	383466.90 (383193.94 - 384243.78)
Volatile Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Total Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)

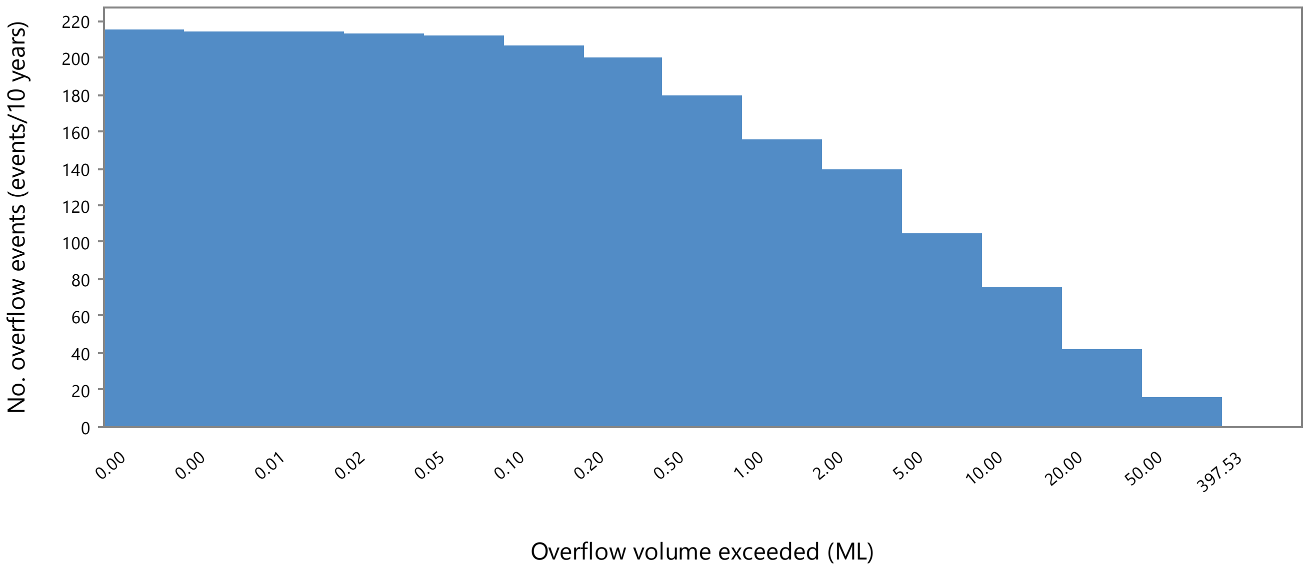
Last pond (Wet weather store): 19.00 ML

Theoretical hydraulic retention time (days)	8.72
Average volume of overflow (ML/year)	320.02
No. overflow events per year exceeding threshold* of 0.00 ML (no./year)	21.44
Average duration of overflow (days)	6.07
Effluent Reuse (Proportion of Inflow + Net Rain Gain that is Irrigated) (fraction)	0.60
Probability of at least 90% effluent reuse (fraction)	0.00
Average salinity of last pond (dS/m)	0.76
Salinity of last pond on final day of simulation (dS/m)	0.88
Ammonia loss from pond system water area (kg/m2/year)	0.00

* The threshold is the volume equivalent to the top 1 mm depth of water of a full pond

Overflow exceedance:

Chart Table



Export plot

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Irrigation Information

Irrigation: 56 ha total area (assumed 100% irrigation efficiency)

	Quantity/year	Quantity/ha/year
Total irrigation applied (ML)	480.58	8.58
Total nitrogen applied (kg)	2201.97	39.32
Total phosphorus applied (kg)	442.16	7.90
Total salts applied (kg)	256454.53	4579.55

Shandying

Annual allocation of fresh water for shandying (ML/year)	0.00
Average Shandy water irrigation (ML/year) (minimum - maximum)	0.00 (0.00 - 0.00)
Average exceedance as a proportion of annual shandy water allocation (% of allocation) (minimum - maximum)	0.00 (0.00 - 0.00)
Proportion of irrigation events requiring shandying (fraction of events)	0.00
Minimum shandy water is used	False

Irrigation Issues

Proportion of Days irrigation is prevented when triggered (fraction)	0.25
Proportion of Days water demand is too small to trigger irrigation (fraction)	0.30
Proportion of Days irrigation occurs (fraction)	0.46

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Land: New Paddock: 56 ha

Irrigation: Fixed Sprinkler with 0.2% ammonium loss during irrigation

Irrigation triggered when soil water deficit reaches 5.00 mm and rainfall is less than or equal to 3.00 mm
Irrigate up to a soil water content of drained upper limit plus 0.00 mm
Irrigation window from 1/1 to 31/12 including the days specified
A minimum of 0 days must be skipped between irrigation events

Soil Water Balance (mm): Bicton (Kur-World), 228.00 mm PAWC at maximum root depth

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	349.9	444.0	400.6	185.8	84.3	54.1	41.9	33.6	32.8	47.6	87.8	176.5	1938.9
Irrigation	62.8	30.2	45.2	49.4	59.6	62.5	76.6	93.4	96.3	99.4	93.0	89.9	858.2
Soil Evap	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Transpn.	138.4	114.1	121.1	109.7	100.8	91.2	100.0	117.9	142.3	167.7	163.9	158.9	1526.2
Rain Runoff	127.6	165.0	157.9	40.7	7.1	3.4	2.1	1.2	2.5	4.5	12.3	42.9	567.2
Irr. Runoff	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Drainage	112.7	184.0	172.9	88.1	39.7	21.5	18.4	8.6	7.1	6.4	9.6	37.8	706.9
Delta	33.8	11.1	-6.1	-3.4	-3.8	0.5	-2.0	-0.6	-22.8	-31.7	-5.0	26.8	-3.1

Soil Nitrogen Balance

Average annual effluent nitrogen added (kg/ha/year)	39.32
Average annual soil nitrogen removed by plant uptake (kg/ha/year)	112.94
Average annual soil nitrogen removed by denitrification (kg/ha/year)	0.02
Average annual soil nitrogen leached (kg/ha/year)	1.23
Average annual nitrate-N loading to groundwater (kg/ha/year)	1.23
Soil organic-N kg/ha (Initial - Final)	3809.50 - 141.19
	74.41 - 0.03
Average nitrate-N concentration of deep drainage (mg/L)	0.17
Max. annual nitrate-N concentration of deep drainage (mg/L)	8.35

Soil Phosphorus Balance

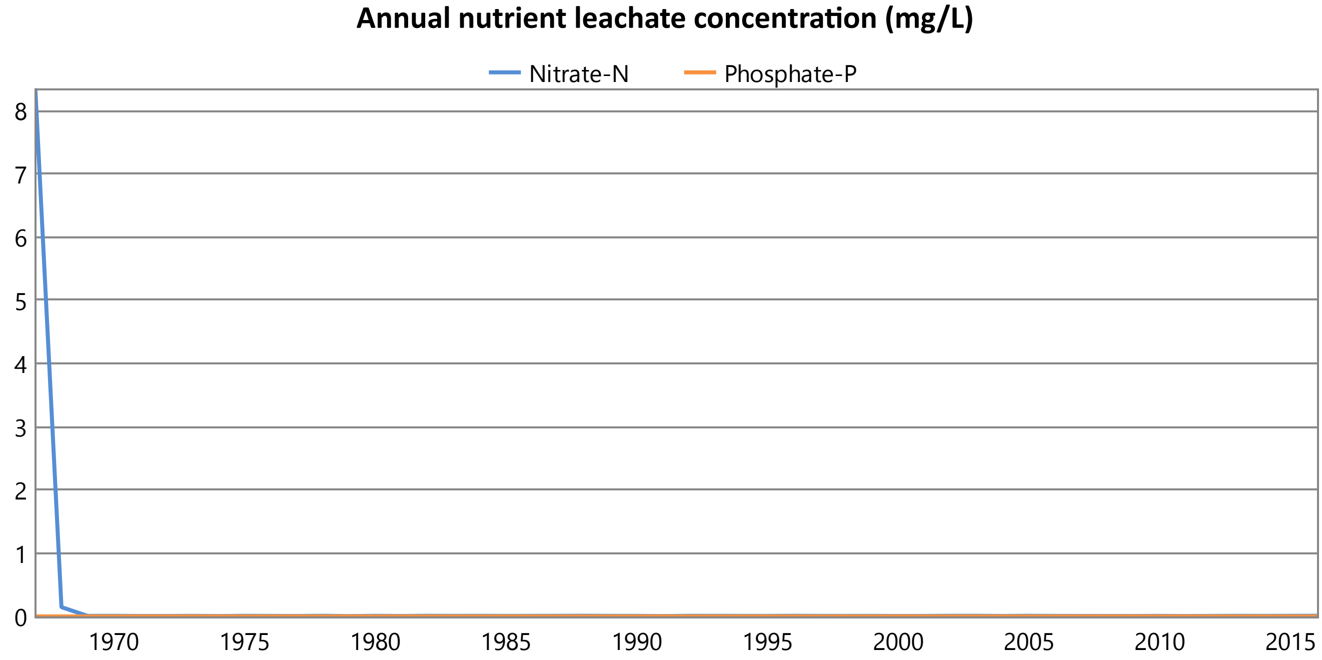
Average annual effluent phosphorus added (kg/ha/year)	7.90
Average annual soil phosphorus removed by plant uptake (kg/ha/year)	0.16
Average annual soil phosphorus leached (kg/ha/year)	5.20E-04
Dissolved phosphorus (kg/ha) (Initial - Final)	2.86E-04 - 3.72E-03
Adsorbed phosphorus (kg/ha) (Initial - Final)	450.65 - 838.43
Average phosphate-P concentration in rootzone (mg/L)	5.64E-04
Average phosphate-P concentration of deep drainage (mg/L)	7.36E-05
Max. annual phosphate-P concentration of deep drainage (mg/L)	8.51E-05
Design soil profile storage life based on average infiltrated water phosphorus concn. of 0.35 mg/L (years)	659.77

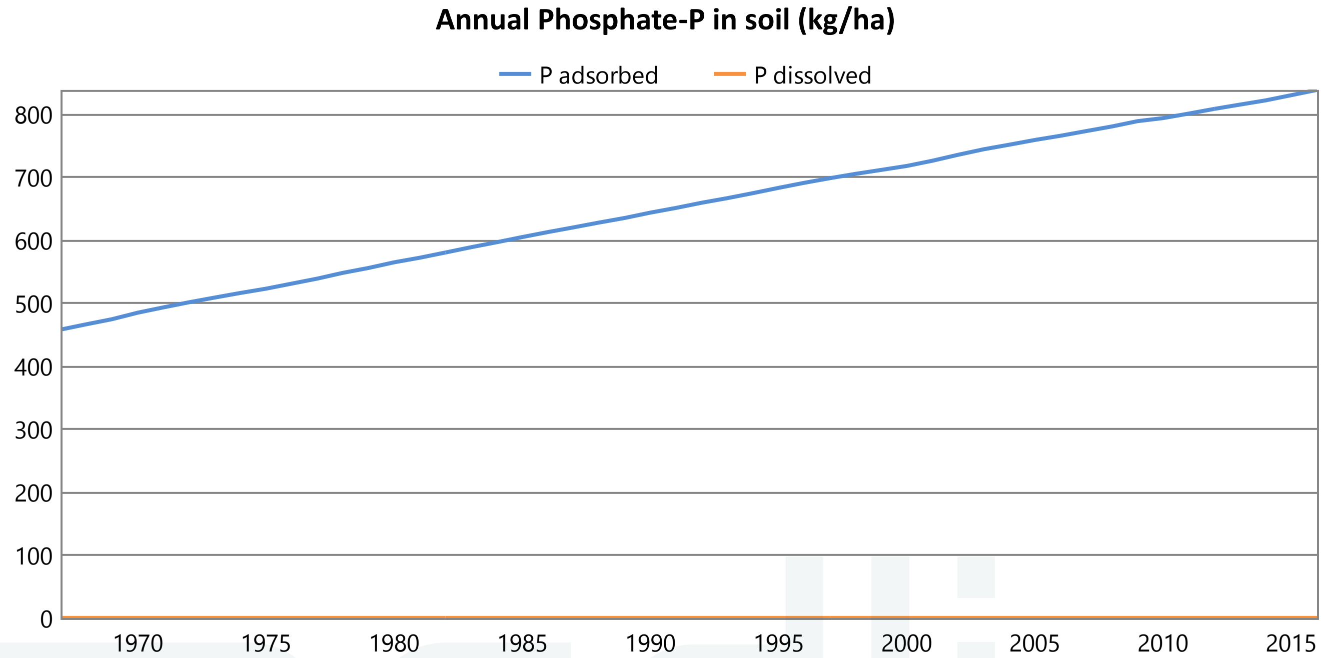
DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Land: New Paddock: 56 ha

Irrigation: Fixed Sprinkler with 0.2% ammonium loss during irrigation





DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Plant Performance: New Paddock: 56 ha

Average Plant Performance (Minimum - Maximum): Continuous Coastal Couch Grass (Cynodon dactylon) Pasture_mod golf, kick started

Average annual shoot dry matter yield (kg/ha/year)	10201.37 (5980.58 - 17135.02)
Average monthly plant (green) cover (fraction)	1.00 (0.99 - 1.00)
Average monthly crop factor (fraction)	0.80 (0.79 - 0.80)
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Average monthly root depth (mm)	799.36 (792.32 - 800.00)
Average number of normal harvests per year (no./year)	7.16 (4.00 - 12.00)
Average number of normal harvests for last five years only (no./year)	4.80
Average number of crop deaths per year (no./year)	0.00 (0.00 - 0.00)
Average number of crop deaths for last five years only (no./year)	0.00
Average annual nitrogen deficiency index (0 = no stress, 1 = full stress) (coefficient)	0.57 (0.14 - 0.74)
Average January temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.02 (0.00 - 0.07)
Average July temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.20 (0.00 - 0.41)
Average monthly water stress index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.01)
Average monthly waterlogging index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.00)
No. days without crop/year (days)	0.00

Soil Salinity - Plant salinity tolerance: Tolerant

Assumes 1.0 dS/m Electrical Conductivity = 640 mg/L Total Dissolved Salts
All values based on 10 year running averages

Salinity of infiltrated water (Average salinity of rainwater = 0.03 dS/m) (dS/m)	0.34
Salt added by rainfall (kg/ha/year)	263.38
Average annual effluent salt added & leached at steady state (kg/ha/year)	4842.92
Average leaching fraction based on 10 year running averages (fraction)	0.52
Average water-uptake-weighted rootzone salinity sat. ext. (dS/m)	0.30
Salinity of the soil solution (at drained upper limit) at base of rootzone (dS/m)	1.05
Relative crop yield expected due to salinity (fraction)	1.00
Proportion of years that crop yields would be expected to fall below 90% of potential due to salinity (fraction)	0.00

DIAGNOSTICS

Run Messages

Messages generated when the scenario was run:

Full run chosen

MEDLI REPORT - FULL RUN

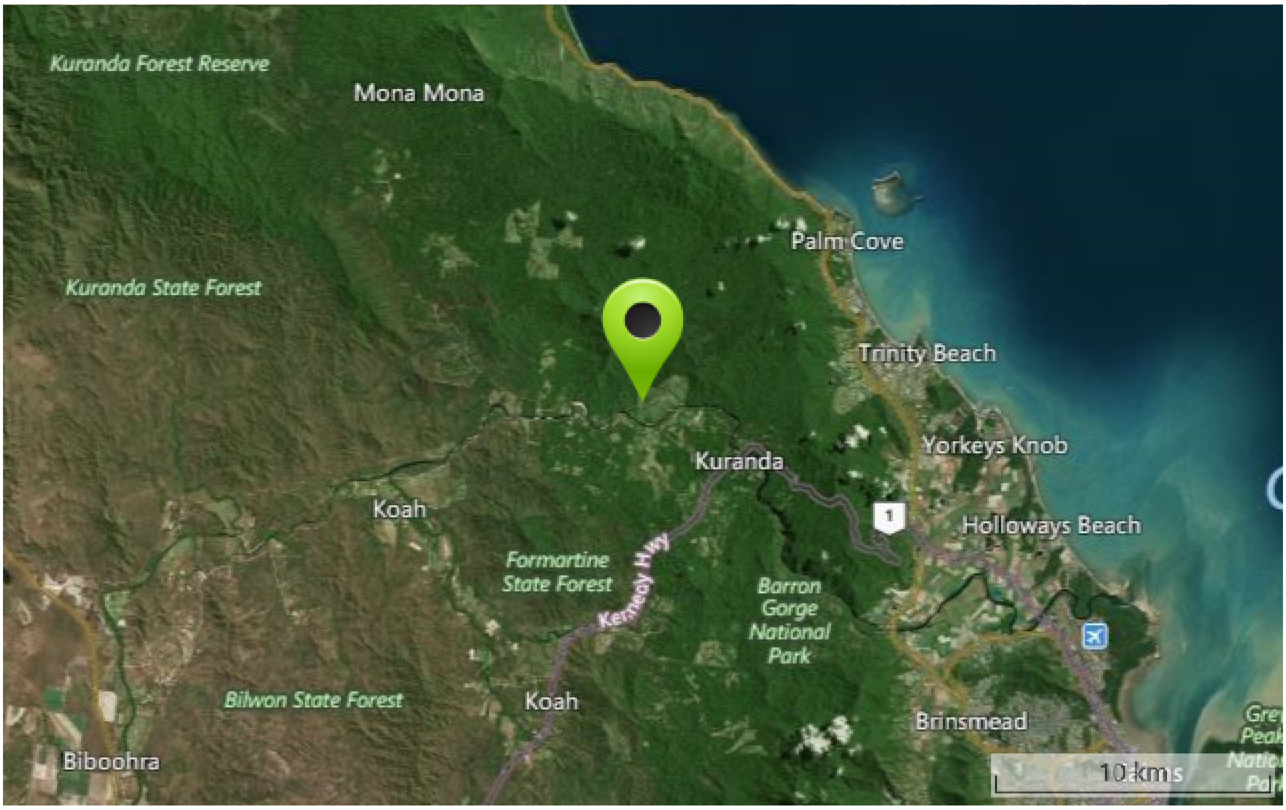
Enterprise: Kur World

Description:
Stage 3 High range low ingress clippings returned 56ha Golf and amenity full run

Client: Reever and Ocean

MEDLI User: NATRES\andrew

Scenario Details:
High range ADWF, low infiltration efficiency, clippings returned Full run
WWTP design specs N 5mg/L, P 1 mg/L, TDS 580 mg 73% TON, 2% NH4-N, 25% Org N adjusted to allow N return in clippings (simulated at 75% mineralisation of nutrients removed returned as organic N) resulting in
23.23 mg/L TN, 1.11 mg/L TP 15.7% TON, 0.4% NH4-N, 83.9% organic N
5 ML tank and 19 ML dam
5mm SMD to UDL. Irrigation allowed on days with up to 3 mm rainfall. Coastal couch as amenity grass (kickstarted) assumed for golf course and amenity planting - 56ha

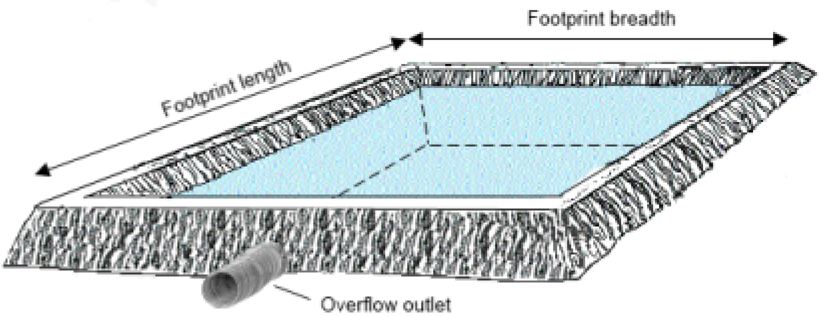


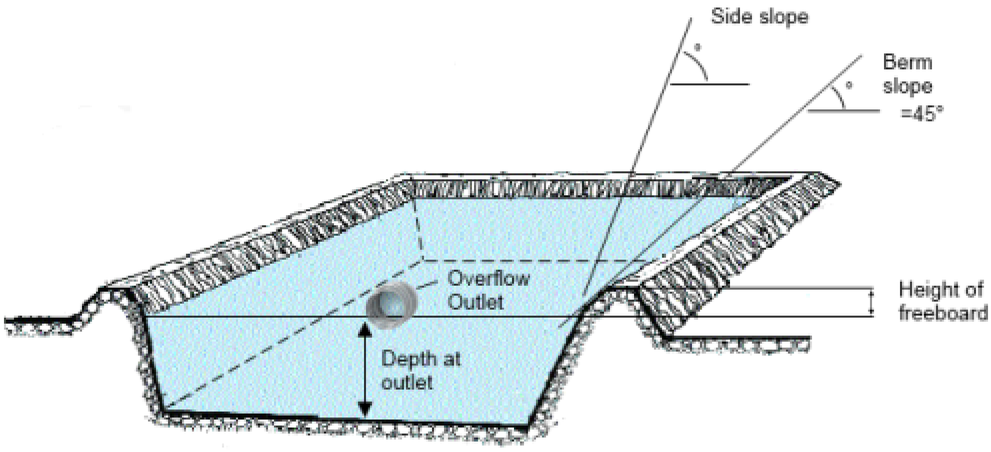
DESCRIPTION

Pond system: 2 facultative, aerobic or storage ponds

Pond system details:

	Pond 1	Pond 2
Maximum pond volume (ML)	5.00	19.00
Minimum allowable pond volume (ML)	0.00	6.77
Pond depth at overflow outlet (m)	4.00	4.50
Maximum water surface area (m2)	1250.00	5794.53
Pond footprint length (m)	35.36	135.05
Pond footprint width (m)	35.36	47.15
Pond catchment area (m2)	1250.00	6367.31
Average active volume (ML)	5.00	13.31





Irrigation pump limits:

Minimum pump rate limit (ML/day)	0.00
Maximum pump rate limit (ML/day)	100.00

Shandying water:

Annual allocation of fresh water available for shandying (ML/year)	0.00
Maximum rate of application of fresh water (ML/day)	0.00
Nitrogen concentration (mg/L)	0.00
Salinity (dS/m)	0.00
Minimum shandy water is used	False

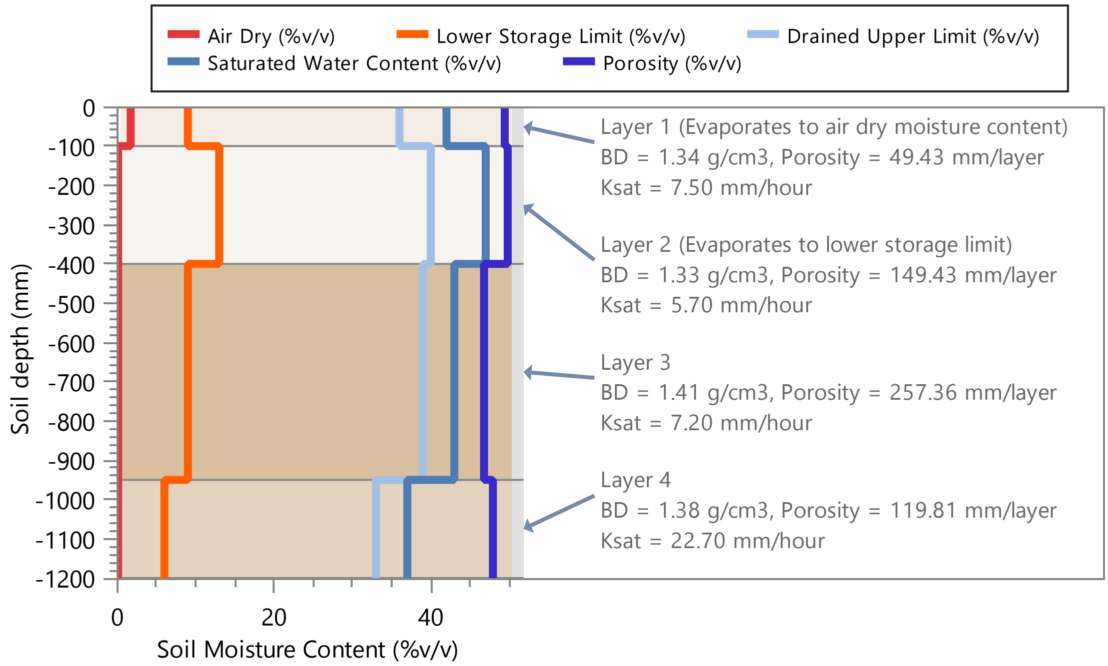
DESCRIPTION

Land: New Paddock

Area (ha): 56.00

Soil Type: Bicton (Kur-World), 1200.00 mm defined profile depth

Profile Porosity (mm)	576.04
Profile saturation water content (mm)	512.00
Profile drained upper limit (or field capacity) (mm)	453.00
Profile lower storage limit (or permanent wilting point) (mm)	112.50
Profile available water capacity (mm)	340.50
Profile limiting saturated hydraulic conductivity (mm/hour)	5.70
Surface saturated hydraulic conductivity (mm/hour)	7.50
Runoff curve number II (coefficient)	80.00
Soil evaporation U (mm)	8.50
Soil evaporation Cona (mm/sqrt day)	3.75



Plant Data: Continuous Coastal Couch Grass (Cynodon dactylon) Pasture_mod golf, kick started

Average monthly cover (fraction) (minimum - maximum)	1.00 (0.99 - 1.00)
Maximum crop factor at 100% cover (mm/mm) (Maximum crop coefficient 0.8 x Pan coefficient 1)	0.80
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Maximum potential root depth in defined soil profile (mm)	800.00
Salt tolerance	Tolerant
Salinity threshold EC sat. ext. (dS/m)	6.90
Proportion of yield decrease per dS/m increase (fraction/dS/m)	0.06

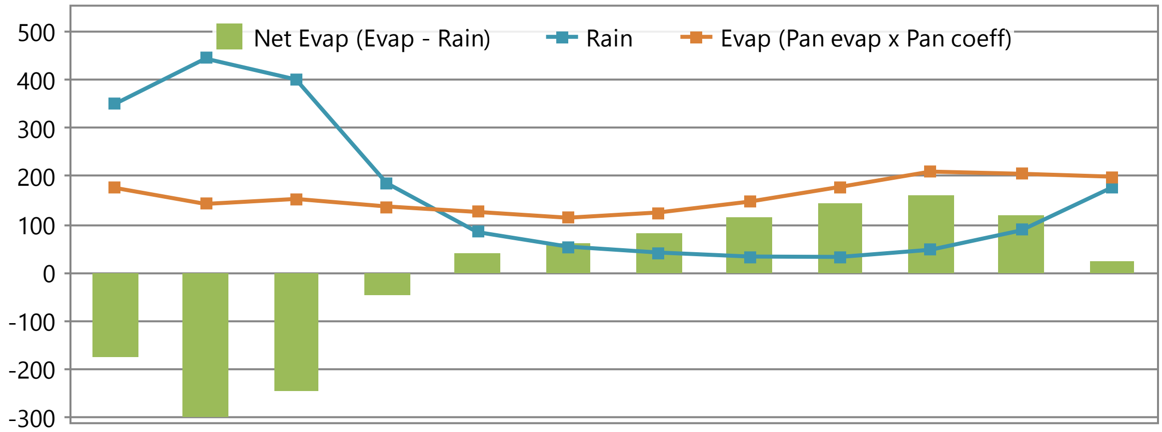
DIAGNOSTICS

Sustainability Diagnostics: Kur World

Averaged Historical Climate Data Used in Simulation (mm)

Location: KurWorlSTP, -16.8°, 145.6°

Run Period: 01/01/1967 to 31/12/2016 50 years, 0 days



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	349.9	444.0	400.6	185.8	84.3	54.1	41.9	33.6	32.8	47.6	87.8	176.5	1938.9
Evap	176.0	142.7	153.0	137.4	126.0	114.1	125.0	147.4	177.9	209.7	205.2	199.2	1913.4
Net Evap	-173.9	-301.3	-247.6	-48.4	41.8	59.9	83.1	113.8	145.1	162.1	117.4	22.7	-25.5
Net Evap/day	-5.6	-10.7	-8.0	-1.6	1.3	2.0	2.7	3.7	4.8	5.2	3.9	0.7	-0.1

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Pond System: 2 facultative, aerobic or storage ponds

Kur-world Stage 3 high range, low ingress clippings returned - Sept 2017 - 728.88 ML/year or 2.00 ML/day generated on average

Effluent entering pond system after any pretreatment and recycling

Average (Minimum-Maximum) influent quality calculated for 365.26 non-zero flow days, after any pretreatment and recycling.

Constituent	Concentration (mg/L)	Load (kg/year)
Total Nitrogen	21.07 (2.95 - 23.23)	15358.51 (15347.58 - 15389.63)
Total Phosphorus	1.01 (0.14 - 1.11)	733.88 (733.35 - 735.36)
Total Dissolved Salts	526.10 (73.77 - 580.00)	383466.90 (383193.94 - 384243.78)
Volatile Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)
Total Solids	0.00 (0.00 - 0.00)	0.00 (0.00 - 0.00)

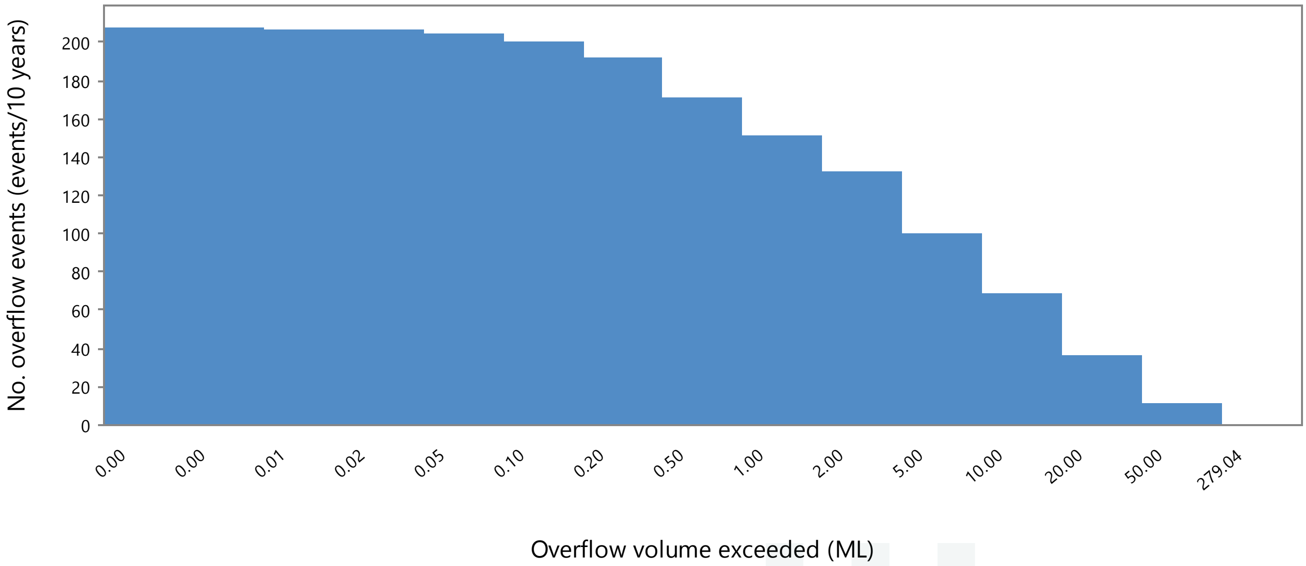
Last pond (Wet weather store): 19.00 ML

Theoretical hydraulic retention time (days)	9.52
Average volume of overflow (ML/year)	257.40
No. overflow events per year exceeding threshold* of 0.00 ML (no./year)	20.74
Average duration of overflow (days)	6.00
Effluent Reuse (Proportion of Inflow + Net Rain Gain that is Irrigated) (fraction)	0.65
Probability of at least 90% effluent reuse (fraction)	0.00
Average salinity of last pond (dS/m)	0.81
Salinity of last pond on final day of simulation (dS/m)	0.89
Ammonia loss from pond system water area (kg/m2/year)	0.00

* The threshold is the volume equivalent to the top 1 mm depth of water of a full pond

Overflow exceedance:

Chart Table



Export plot

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Irrigation Information

Irrigation: 56 ha total area (assumed 100% irrigation efficiency)

	Quantity/year	Quantity/ha/year
Total irrigation applied (ML)	476.54	8.51
Total nitrogen applied (kg)	10561.08	188.59
Total phosphorus applied (kg)	505.04	9.02
Total salts applied (kg)	263897.10	4712.45

Shandying

Annual allocation of fresh water for shandying (ML/year)	0.00
Average Shandy water irrigation (ML/year) (minimum - maximum)	0.00 (0.00 - 0.00)
Average exceedance as a proportion of annual shandy water allocation (% of allocation) (minimum - maximum)	0.00 (0.00 - 0.00)
Proportion of irrigation events requiring shandying (fraction of events)	0.00
Minimum shandy water is used	False

Irrigation Issues

Proportion of Days irrigation is prevented when triggered (fraction)	0.25
Proportion of Days water demand is too small to trigger irrigation (fraction)	0.29
Proportion of Days irrigation occurs (fraction)	0.46

DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Land: New Paddock: 56 ha

Irrigation: Fixed Sprinkler with 0.2% ammonium loss during irrigation

Irrigation triggered when soil water deficit reaches 5.00 mm and rainfall is less than or equal to 3.00 mm
Irrigate up to a soil water content of drained upper limit plus 0.00 mm
Irrigation window from 1/1 to 31/12 including the days specified
A minimum of 0 days must be skipped between irrigation events

Soil Water Balance (mm): Bicton (Kur-World), 228.00 mm PAWC at maximum root depth

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Rain	349.9	444.0	400.6	185.8	84.3	54.1	41.9	33.6	32.8	47.6	87.8	176.5	1938.9
Irrigation	62.1	29.9	45.2	49.4	59.4	62.6	76.4	93.5	95.7	98.0	91.0	87.8	851.0
Soil Evap	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Transpn.	138.3	114.1	121.1	109.7	100.8	91.2	100.0	117.9	142.3	167.7	163.9	158.9	1526.0
Rain Runoff	127.3	164.8	157.9	40.7	7.1	3.4	2.1	1.2	2.5	4.5	12.2	42.7	566.3
Irr. Runoff	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Drainage	110.9	182.4	172.7	88.1	39.6	21.5	18.4	8.6	7.1	6.1	8.7	36.6	700.7
Delta	35.4	12.7	-5.9	-3.3	-3.8	0.6	-2.2	-0.6	-23.4	-32.8	-6.1	26.1	-3.3

Soil Nitrogen Balance

Average annual effluent nitrogen added (kg/ha/year)	188.59
Average annual soil nitrogen removed by plant uptake (kg/ha/year)	259.81
Average annual soil nitrogen removed by denitrification (kg/ha/year)	0.02
Average annual soil nitrogen leached (kg/ha/year)	1.27
Average annual nitrate-N loading to groundwater (kg/ha/year)	1.27
Soil organic-N kg/ha (Initial - Final)	3809.50 - 258.61
	74.41 - 0.03
Average nitrate-N concentration of deep drainage (mg/L)	0.18
Max. annual nitrate-N concentration of deep drainage (mg/L)	8.50

Soil Phosphorus Balance

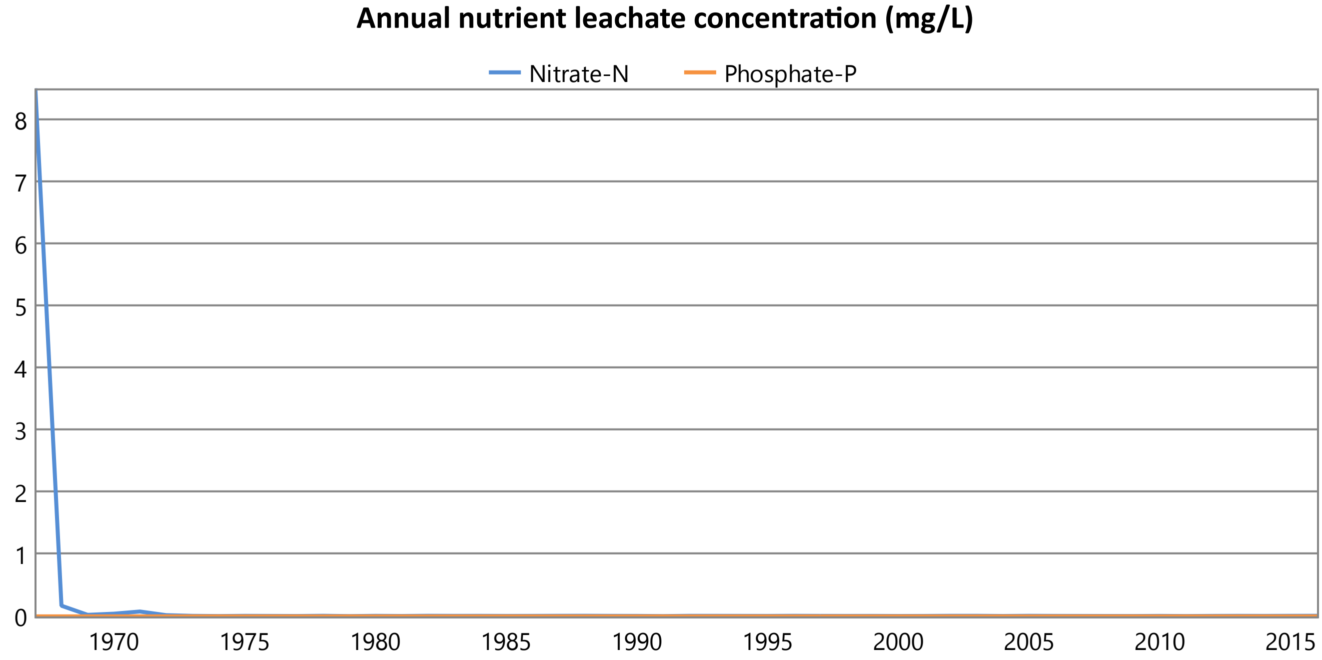
Average annual effluent phosphorus added (kg/ha/year)	9.02
Average annual soil phosphorus removed by plant uptake (kg/ha/year)	0.41
Average annual soil phosphorus leached (kg/ha/year)	5.15E-04
Dissolved phosphorus (kg/ha) (Initial - Final)	2.86E-04 - 3.85E-03
Adsorbed phosphorus (kg/ha) (Initial - Final)	450.65 - 882.22
Average phosphate-P concentration in rootzone (mg/L)	6.55E-04
Average phosphate-P concentration of deep drainage (mg/L)	7.35E-05
Max. annual phosphate-P concentration of deep drainage (mg/L)	8.19E-05
Design soil profile storage life based on average infiltrated water phosphorus concn. of 0.41 mg/L (years)	602.43

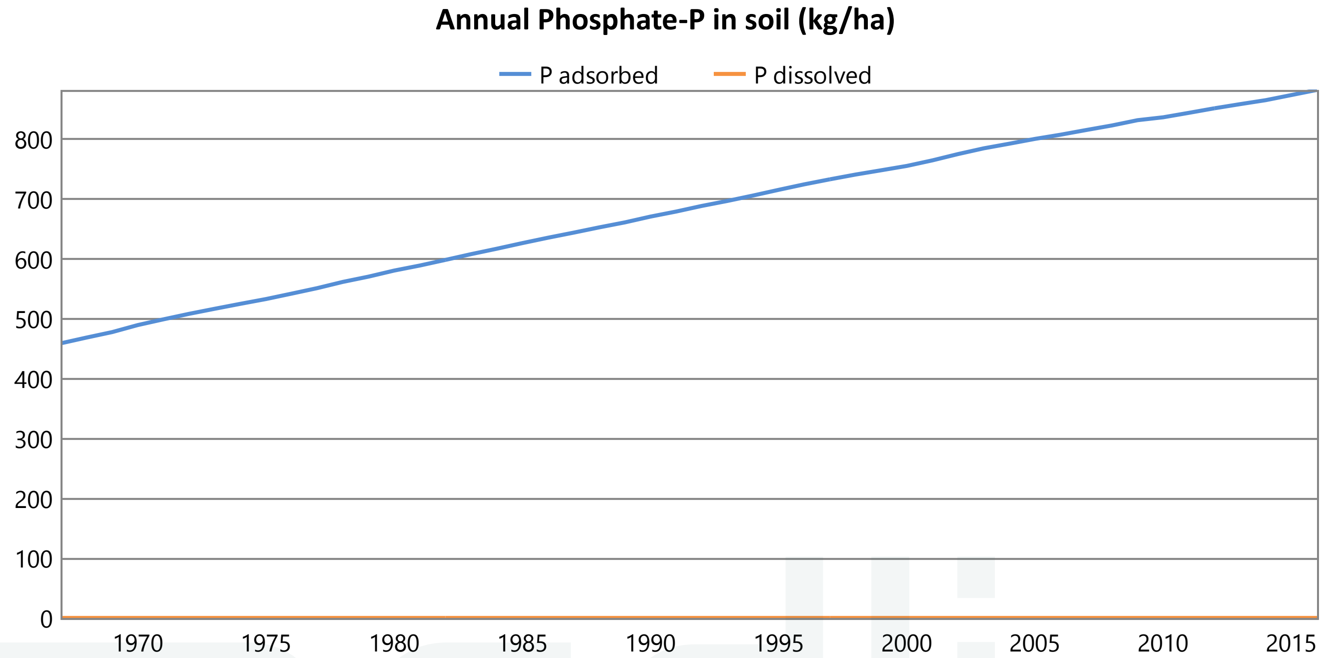
DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Land: New Paddock: 56 ha

Irrigation: Fixed Sprinkler with 0.2% ammonium loss during irrigation





DIAGNOSTICS

Sustainability Diagnostics: Kur World

Paddock Plant Performance: New Paddock: 56 ha

Average Plant Performance (Minimum - Maximum): Continuous Coastal Couch Grass (Cynodon dactylon) Pasture_mod golf, kick started

Average annual shoot dry matter yield (kg/ha/year)	16889.68 (13401.90 - 22243.78)
Average monthly plant (green) cover (fraction)	1.00 (0.99 - 1.00)
Average monthly crop factor (fraction)	0.80 (0.79 - 0.80)
Total plant cover (both green and dead) left after harvest (fraction)	1.00
Average monthly root depth (mm)	799.36 (792.32 - 800.00)
Average number of normal harvests per year (no./year)	11.80 (9.00 - 16.00)
Average number of normal harvests for last five years only (no./year)	10.80
Average number of crop deaths per year (no./year)	0.00 (0.00 - 0.00)
Average number of crop deaths for last five years only (no./year)	0.00
Average annual nitrogen deficiency index (0 = no stress, 1 = full stress) (coefficient)	0.28 (0.03 - 0.43)
Average January temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.02 (0.00 - 0.07)
Average July temperature stress index (0 = no stress, 1 = full stress) (coefficient)	0.20 (0.00 - 0.41)
Average monthly water stress index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.01)
Average monthly waterlogging index (0 = no stress, 1 = full stress) (coefficient)	0.00 (0.00 - 0.00)
No. days without crop/year (days)	0.00

Soil Salinity - Plant salinity tolerance: Tolerant

Assumes 1.0 dS/m Electrical Conductivity = 640 mg/L Total Dissolved Salts
All values based on 10 year running averages

Salinity of infiltrated water (Average salinity of rainwater = 0.03 dS/m) (dS/m)	0.35
Salt added by rainfall (kg/ha/year)	263.53
Average annual effluent salt added & leached at steady state (kg/ha/year)	4975.98
Average leaching fraction based on 10 year running averages (fraction)	0.52
Average water-uptake-weighted rootzone salinity sat. ext. (dS/m)	0.31
Salinity of the soil solution (at drained upper limit) at base of rootzone (dS/m)	1.09
Relative crop yield expected due to salinity (fraction)	1.00
Proportion of years that crop yields would be expected to fall below 90% of potential due to salinity (fraction)	0.00

DIAGNOSTICS

Run Messages

Messages generated when the scenario was run:

Full run chosen

NRA

Environmental Approval & Compliance Solutions

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P: 61 7 4034 5300 **F:** 61 7 4034 5301

Townsville Office:
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P: 61 7 4796 9444 **F:** 61 7 4796 9410

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