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Dear Mr Summerhayes

Thank you for the opportunity to review and provide comment on the above document sent to the Environment Protection Authority (EPA) on 17 February 2012, by the Department of Trade, Investment, Regional Infrastructure & Services (DTIRIS). This document is a Review of Environmental Factors (REF) for the AGL Energy Limited Irrigation proposal to be located at the Tiedman property, 3km north east of Stratford, NSW. This document also includes the Water Management Plan for the Tiedman Irrigation Program that was provided by AGL Energy Limited on 8th March 2012.

Both the EPA and Office of Environment and Heritage (OEH) have reviewed the document and this letter is a consolidated response providing comments and advice to DTIRIS for their consideration. Please note the EPA and OEH in this instance are not identified determining authorities under Part 5 of the Environmental Planning and Assessment (EP&A) Act 1979. For ease of reading EPA and OEH from hereon in will be referred to as EPA.

Details about the proposal

The proposal is referred to as a trial however the purpose and objectives of the proposal is unclear. The EPA recommends that DTIRIS requires the proponent to specifically define the purpose and objectives of the trial and to develop an evaluation program relative to these objectives.

Water and Soil

The EPA recommends DTIRIS requires the proponent to provide the following information to adequately assess the likely impacts of the proposal on groundwater, surface water and in relation to soil sustainability.

- adequate information on soils to enable an assessment of likely impacts on soil structure and crop uptake;
- A revised water balance and salt balance modelling (including quantifying irrigation water losses to groundwater and surface water, taking into account water crop uptake factors and any anticipated reduced water uptake based on cumulative effects of salinity and sodicity on crop productivity);
- A range of site specific trigger levels for soil and irrigation water quality and management responses to these triggers (including possible cessation of the trial) to provide confidence that such a high risk operation can be undertaken without significant effects on soil structure, soil chemistry, salinity, erosion and surface and groundwater impacts. These triggers are important as the effects of salinity and sodicity are likely to be cumulative as irrigation proceeds; and
- a suitable monitoring program to support management responses at the trigger points established above.

Attachment A contains comments further detailing what information the EPA recommend DTIRIS requires of the proponent in order to adequately assess the proposal.

Biodiversity

Site Habitat and species assessment - As detailed in section 5.4 of the REF, the report's flora and fauna assessment is derived largely from existing reports prepared for the site. Specifically, the vegetation communities described in Lucas Energy (2007) were used to describe / extrapolate the vegetation communities which occur on the proposed extended irrigation area. Although OEHL does not object to previous studies/surveys being utilised, they must have been conducted in accordance with the EPA's 'survey and assessment guidelines' (DEC 2004a) and generally must not be greater than five years old. If previous studies are to be considered, they must conform to current guideline standards / methodologies and adequate justification must be provided for their inclusion.

The EPA recommends DTIRIS require a copy of all previous ecological studies/surveys to compare against the OEHL guidelines.

The EPA also recommends DTIRIS require the report to include a comprehensive list of all fauna and flora species identified in the assessment to adequately assess the project area for potential habitat for the 36 flora and 10 fauna species identified by the Threatened Species Conservation Act as occurring in the vicinity of the project site.

Limited information has been provided in the REF to adequately assess impacts to threatened species. As such the EPA recommends that DTIRIS requires that the REF provides the following information:

- document all the known and likely threatened species, their habitats, populations and ecological communities of the site / study area (including any adjacent areas that may be indirectly impacted upon by the proposal).
- detail what surveys have been undertaken (including targeted searches) on the site and within the study area, as well as details of methodologies utilised.
- provide a detailed assessment (including 'assessments of significance' for all potential threatened species) of the direct and indirect impacts of the proposal, including any impacts associated with ancillary activities, on such species, habitats, populations and ecological communities;
- detail the actions that will be taken to avoid or mitigate impacts on threatened species, their habitats, populations and ecological communities; and in instances where impacts can not be avoided provide appropriate details on offset / compensatory habitat packages or strategies.

Impacts to species from irrigation – frogs are sensitive to increased salinity, and so this proposal could cause harm to local threatened frog species. The EPA recommends that DTIRIS requires further information in order to fully undertake this assessment.

Recent surveys for threatened species and their habitat undertaken in the general area by Duralie Mine have identified Giant Barred Frog (*Mixophyes iteratus*) populations within The Glen Nature Reserve. The Glen Nature Reserve is located approximately 5 km south east of the subject site, and Dog Trap Creek runs from The Glen Nature Reserve, along the site boundary, into the Avon River to the west of the site.

Based on the habitat requirements of the Giant Barred Frog, sections of Dog Trap Creek downstream of The Glen Nature Reserve, specifically areas with appropriate riparian vegetation, may also provide suitable habitat for this species. Although database searches, including Atlas of NSW Wildlife, do not identify any Giant Barred Frog records within Dog Trap Creek, the area has not been well studied and recent identification of The Glen Nature Reserve populations and habitat suitability of Dog Trap Creek make the waterway and riparian vegetation potential habitat for this species.

Accordingly, targeted surveys both upstream and downstream of the site are required to determine the presence or likely occurrence of any Giant Barred Frog populations or individuals. The targeted surveys should be conducted in accordance with the guideline '*Threatened Species Survey and Assessment*

Guidelines: Field Survey Methods for Fauna – Amphibians' (DECC 2009). The guideline specifically notes survey requirements for the Giant Barred Frog.

Should you have any enquiries regarding this matter or require further assistance, please contact Jessica Creed by telephoning (02) 6773 7000.

Yours sincerely



2-4-2012.

CARMEN DWYER
Special Project Manager – Coal Seam Gas
Environment Protection Authority

ATTACHMENT A

Further comments about water and soil issues for AGL Energy Ltd Gloucester Operations Irrigation Proposal REF

Water and Salt Balance modelling:

To adequately assess the proposal the EPA recommends DTIRIS require the proponent:

- Develop a water balance that clearly sets out the volumes of water expected to be used in crop evapotranspiration and lost to groundwater and surface water;
- Revise the water balance to address the crop uptake rates and blending water volumes required to meet assumptions for water quality in the crop uptake rates;
- Develop a suitable irrigation soil monitoring program to support decisions for irrigation scheduling (both volume and timing); and
- Should this trial proceed, regular updating of the the water balance and irrigation schedule in the water management plan based on actual crop uptake rates at the site.

Soil Impact Assessment:

There is inadequate soils information to properly assess the likely impacts of the proposal on soil structure and crop uptake (and thereby water balance). Extracts only from one of the soil reports were provided, not full reports whilst the soil survey methodology, sampling protocols and sampling locations are unclear. Grid references for the site were also not included so that comparative analysis with existing reports and data could be undertaken.

Soil descriptions are poor and incomplete and describe the soil in depth intervals (0-10cm, 10-20 cm, 20-30cm), not the natural soil horizons and not to an adequate depth. In addition to these it was found that the REF:

- Had inconsistencies in the soil results presented in the *Irrigation and drainage Management Plan* (IDMP); and
- The presentation of soil testing results appears inconsistent, with physical parameter test results presented for some soil samples and chemical parameter testing results presented for other soil samples, but the chemical and physical test results for the same soil samples are not presented. This limits the ability to make any assessment of the effect of saline irrigation water on the soil conditions.

The soil information has not been used effectively in an integrated assessment of critical issues related to the irrigation of high salinity and sodicity waters to highly sodic soils. It is therefore not possible to confidently determine the suitability of the site for irrigation of the wastewater and the likely impacts on soil sustainability.

It is recommended that DTIRIS require the proponent to:

- prepare a single table which presents all of the results from the soil testing, describes how samples were bulked, and the sampling locations (such as a grid reference or location on a map);
- provide data on soil texture and soil properties to a depth of approximately 1 metre;
- separate the assessment of baseline results from post irrigation results in 2009, and present a justified assessment of impacts from this previous irrigation;
- determine irrigation water quality (and dilutions needed to achieve this quality) that would protect the soil in the irrigation area from dispersion and reduced infiltration, using appropriate guidelines such as ANZECC 2000 (see Table 9.2.6 for SAR).

Proposed Soil Amelioration

The proposed soil amelioration techniques may be effective in reducing impacts but it is not possible to assess without soil data >40 cm. Large volumes of soil treatment products are proposed for use at the site. If the proposal proceeds, the proponent should install appropriate bunding of storage areas for these soil treatment products. It should also be noted that some soil treatment products can increase salinity impacts.

Irrigation Water Quality:

Salinity:

The REF has not specifically considered the effect of salinity on crop yields in potential water uptake considerations. Details of plant salt tolerances should be assessed and related to any reduce yield and any associated reductions in water uptake.

While salt concentrations can be managed through dilution, without treatment the total salt load will remain the same. The salt load applied during irrigation will either accumulate in the soil profile, be leached to groundwater and/or runoff to surface water. There will be therefore a cumulative effect of these salt loads on the irrigation area and/or other water users and environmental values. Consequently, unless there is some treatment, it is unlikely that the long term irrigation of this water will be a sustainable proposition.

The salinity of the proposed irrigation water is 3000 $\mu\text{S}/\text{cm}$. OEH's *Environmental Guidelines: Use of Effluent by Irrigation* classify water above about 1800 $\mu\text{S}/\text{cm}$ as high strength effluent (DEC 2004) indicating that this is a high risk activity. These guidelines also mandate runoff controls that should be incorporated into the proposal for runoff controls.

Sodicity:

ANZECC & ARMCANZ (2000) encourages an integrated approach to sodicity assessment taking account of source water, soil characteristics and other site specific factors.

The primary sustainability indicator for sodicity is ESP usually measured at depths of 0–10 cm and 50–60 cm (or base of root zone). Soils on the site are naturally sodic (Henderson, 2000) with Stage 1 irrigation area soils having an ESP of 15-19% which is strongly sodic. The OEH's *Environmental Guidelines: Use of Effluent by Irrigation* (Table 2.2) indicates that an ESP >10 at 0-40 cm presents a severe limitation for effluent irrigation and that sites with these properties are unlikely to be suitable for irrigation of some or all effluent products.

OEH's *Environmental Guidelines: Use of Effluent by Irrigation* states that soil aeration permeability and aeration problems can occur when soil is irrigated with water with a SAR above 6. ANZECC & ARMCANZ (2000) also recognises that soil texture and clay mineralogy are important factors to consider for SAR of irrigation waters and presents a table of suitable SAR levels according to soil texture and clay content (see Table 9.2.6 ANZECC).

The REF states that the produced water has a SAR of 30 to 78, which is clearly too high when compared with OEH guidelines or ANZECC and therefore presents risks soil structure. However the proponent has not used these guidelines to develop a suitable SAR level for the water to be irrigated.

Overall there is inadequate information on and an inconsistent assessment of sodicity impacts of the proposal and a SAR of 30 as proposed in the REF is too high for irrigation of high clay content soils even with elevated salinity.

Bicarbonate:

The bicarbonate alkalinity levels presented in the REF for this proposal are >395 mg/L in the south dam and >872 mg/L in the north dam (Table 5-4 REF). ANZECC & ARMCANZ (2000) does not include a trigger value for bicarbonate in irrigation waters. However, the Queensland Government has adopted a bicarbonate limit for beneficial reuse of coal seam gas waters of 100 mg/L (Queensland Department of Environment and Resource Management (DERM) *Guideline Environmental Protection (Waste Management) Regulation 2000 – Approval of Coal Seam Water for Beneficial Reuse*).

It is unclear from the REF what bicarbonate levels would be achieved after blending although with a dilution of 1:3 it is unlikely to achieve a level similar to the limits imposed by the Queensland Government regulations. Certainly the unblended water for stage 1 of the trial will exceed this Queensland Government benchmark.

The EPA recommends that DTIRIS requires the proponent to determine and justify a suitable bicarbonate level for the irrigation waters for short term use using an appropriate guideline such as ANZECC/ARMCANZ (2000) which factors in soil texture/clay content of the irrigation area. Dilution rates to achieve a suitable SAR may need to be further adjusted as bicarbonates can exacerbate sodicity risk.

Sodium

Trigger values for prevention of foliar injury due to sodium in irrigation water from sprinkler application are provided in table 4.2.8 of ANZECC & ARMCANZ (2000). Trigger values for specific toxicity effects are provided in table 4.2.9. The REF appears to have assessed only foliar injury aspects but has not related the criteria to the plant species grown. Toxicity impacts should also be assessed for the relevant plant species to be irrigated, as crop survival and health is clearly important for maintaining the water balance.

Groundwater:

The proponent has not adequately assessed potential groundwater impacts from the proposal in the following areas:

- The baseline groundwater quality has not been established. As this is a proposed trial baseline conditions should be established in order to clearly identify what, if any, impacts have resulted from the trial;
- The seepage of produce water from dams has not been assessed. The monitoring bore results at the TMB 04 and 05 show high EC levels (8300 and 8770 $\mu\text{S}/\text{cm}$) which may indicate a problem with the already existing storage dams; and
- The impact of irrigation water losses to groundwater has not been assessed. The information provided in the REF indicates that the alluvial aquifer associated with the Avon River extends under the proposed irrigation area and that there are known 'soaks' located on the premises. The depth to the alluvial aquifer, water quality of the aquifer and existing users of the aquifer is not assessed in detail and therefore the risks and likely impacts of the proposed irrigation scheme have not been fully determined. OEH's *Environmental Guidelines: Use of Effluent by Irrigation* suggests that effluent should generally not be applied to land where the depth to groundwater is less than 10 metres.

Monitoring Program:

Soil Monitoring

The proposed soil monitoring program has not been specifically set out for the trial and irrigation proposal. It relies on the proponents methods used in 2009 and 2010 and as section 2.2 indicates there are a range of problems with these methodologies and quality control. A clear program of indicators, locations, depths and methodologies should be developed with supporting values that will trigger a defined management response. Management responses should include cessation of the trial where no mitigation measures can be identified that would reduce soil conditions below the trigger levels.

Irrigation Water Monitoring:

An Irrigation water quality monitoring program should be developed to ensure that the quality remains consistent with the information included in the assessment.

Stage 1B – 20ML unblended irrigation:

The Water Management Plan (WMP) states that it replaces all the initial monitoring and contingency plans outlined in the REF. However, the irrigation scheme in the REF describes the 20 ML of unblended irrigation across 8.6 ha of the previously used irrigation areas (p15) over the first 5 months of the trial, and the WMP describes 20 ML of non-blended irrigation across 21ha at a low intensity during spring and summer (p 5-7). It is unclear which irrigation scheme is now being proposed for the unblended trial. This is a critical point as the water balance would be quite different for each scheme.

While there is inadequate soils information and water quality impact assessment in the REF, EPA has concerns based on the information provided that there is likely to be soil and water impacts from this component of the trial including:

- an increase in sodicity which may cause soil erosion and associated surface water quality impacts;
- an increase in soil salinity which may reduce crop water uptake, and therefore lead to either excessive losses to groundwater or increased surface water runoff,

- potential for clays to surface seal under irrigation of the proposed water (texture particle size data indicates a large percentage of clay), and
- potential for a reduction of hydraulic conductivity of surface soil.

Stage 1A – 50ML Blended Irrigation:

There is insufficient information provided about the dilution rates that will be achieved for EPA to adequately assess potential impacts. EPA has noted however:

- the range of salinity levels (1500-2000 reported in the REF) means the irrigation water is equivalent to high strength effluent under OEH's *Environmental Guidelines: Use of Effluent by Irrigation* indicating that this is a high risk activity;
- bicarbonate levels are likely to remain above the Queensland Government's benchmark of 100 mg/L (Queensland Department of Environment and Resource Management (DERM) *Guideline Environmental Protection (Waste Management) Regulation 2000 – Approval of Coal Seam Water for Beneficial Reuse*); and
- SAR levels up to 30 would be unsuitable for irrigation particularly on the sodic soils present at the proposed site. As stated earlier, OEH's *Environmental Guidelines: Use of Effluent by Irrigation* states that soil aeration permeability and aeration problems can occur when soil is irrigated with water with a SAR above 6.