Guide
ORG-ARW-HSM-GUI-00152

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Arrow Energy - Treated Sewage Effluent and Greywater Management

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Contents

1. Purpose and application

The purpose of this Guide is to provide guidance on the discharge to land, by way of irrigation, of treated effluent and/or greywater from temporary camps with sewage treatment plants (STP) with a capacity up to 150 Equivalent Persons (EP). As an alternative, effluent can be disposed by removal under normal regulated waste requirements should irrigation be ceased. The Guide outlines actions and management measures required to ensure lawful discharge of treated effluent or greywater to land on Arrow tenures under Arrow Energy's Environmental Authorities (EA).

For STPs associated with permanent facilities such as on-plot infrastructure and larger capacity STPs (over 150EP), details of design and outputs may vary and hence are not addressed in this Guide. Requirements for permanent facilities and larger capacity STPs (over 150EP), must be discussed with the Environment team prior to discharge or use.

The use of treated effluent or greywater for construction purposes and/or dust suppression is permitted under some Arrow Energy EAs and is subject to meeting additional criteria. Any instance where this is proposed must be discussed with the environmental team to ensure it is permitted under the Arrow Energy EA and a site-specific management plan be developed prior to commencement of such an activity.

This guideline can be used to comply with Arrow's Waste Standard and Waste Management Procedure (ORG-ARW-HSM-PRO-00066).

2. Roles and responsibilities

Table 1 - Roles and Responsibilities

Role	Responsibilities
All employees and contractors	• Follow this guideline and subordinate documents • Comply with reasonable directions from Arrow representatives • Report any non-compliance to supervisor
Manager Well Operations	• Accountable for compliance with Arrow Energy EA conditions relating to STP and effluent and implementation of this Guide
Well Operations Superintendent	• Ensure Rig Contractors provide all relevant records per Section 7 of this Guide to Arrow for reporting purposes • Ensure this Guide is implemented and activities are compliant with the Arrow Energy EAs through assurance activities and completion of the Well Delivery Camp Assurance Checklist • Ensure that all non-compliances with Arrow Energy EAs and/or this Guide are reported to the appropriate stakeholders and managed in accordance with Arrow's HSE Incident Management Procedure (ORG-ARW-HSM-PRO-00089) • Coordinate incident response and investigation and the implementation of corrective and preventative actions where relevant
Standards, Compliance & Contract Holder Support	• Ensure the Rig Contractor is aware of their responsibilities and accountabilities under the relevant Arrow Energy EA, AAP and this Guide • Support incident response and investigation and close out actions
Rig Contractor or Direct Mobile Camp Contractor	• Responsible for compliance of camp STPs with Arrow Energy EAs and this Guide • Ensure the effluent discharge area is selected, sized, fenced and signed in accordance with Section 5 this Guide. Provide planning records in accordance with Section 7 to Arrow Energy prior to discharge commencing

Role	Responsibilities
	• Undertake management and maintenance of the STPs and irrigation areas and provide a report to Arrow Energy in accordance with Section 7 • Undertake sampling and analyse the results against the discharge criteria in this Guide (Section 4). Provide the sampling analysis results and a summary of STP management report to Arrow Energy in accordance with Section 7 of this Guide • Implement corrective actions in accordance with this Guide when effluent does not meet discharge release levels • Report any non-compliances with Arrow Energy EAs and/or this Guide to Arrow Energy in accordance with Arrow's HSE Schedule Mode 2 (ORG-ARW-HSM-SCH-00012)
Environment Team (HSE)	• Provide technical support and advice to Well Operations Superintendent regarding release of treated effluent and greywater • Provide technical support to owners of incidents involving non-compliance with Arrow Energy EAs and/or this guide • Support incident owners with reporting to the environmental regulator when non-compliances with an Arrow Energy EA occur in accordance with Arrow's HSE Incident Management Procedure (ORG-ARW-HSM-PRO-00089)
Access Integration Team Lead	• Ensure Arrow Energy EA requirements in relation to siting temporary camps and associated STP infrastructure and discharge areas are identified and provided in the Access and Approval Package

3. Regulatory Requirements

The Arrow Energy EA conditions govern whether treated sewage effluent or greywater is permitted for use or release to land. In most cases, Arrow Energy EAs for petroleum lease tenures are based on the Department of Environment, Science & Innovation's (DESI) Streamlined model conditions for petroleum activities Guideline ESR/2016/1989 v2.0, 5 May 2016.

The SMC that apply are:

- Waste 11. Treated sewage effluent or greywater can be released to land provided it:
  a) meets or exceeds secondary treated class B standards for a treatment system with a daily peak design capacity of between 150EP and 1,500EP; or
  b) meets or exceeds secondary treated class C standards for a treatment system with a daily peak design capacity of less than 150EP.
- Waste 12. The release of treated sewage effluent or greywater authorised in condition (Waste 11) must:
  a) be to a fenced and signed contaminant release area(s)
  b) not result in pooling or run-off or aerosols or spray drift or vegetation die-off; and
  c) be to a contaminant release area(s) that is kept vegetated with groundcover, that is:
     I. not a declared pest species
     II. kept in a viable state for transpiration and nutrient uptake; and
     III. grazed or harvested and removed from the contaminant release area not less than every three months.

- Waste 14. Sewage pump stations must be fitted with a:
  a) stand-by pump; and
  b) high level alarm to warn of imminent pump station overflow that operates without mains power or with a back-up power source that starts automatically in the event of a power failure.

Prior to undertaking any treated sewage effluent or greywater release to land, individual Arrow Energy EAs and AAPs should be reviewed to confirm if the activity is permitted and conditions that apply.

4. Discharge criteria

Greywater and treated effluent water quality that is discharged to land must be sampled and analysed upon commissioning of the STP and then, at a minimum, on a 3-monthly basis[1] and when equipment faults and/or is restarted to verify that the quality is suitable for discharge.

Should discharge criteria not be met, irrigation must cease, and effluent must be collected and disposed of at an approved regulated waste facility by a licensed waste transporter.

For STP operating up to 150EP, the treated sewage effluent and greywater must comply with the secondary treated class C standard defined in Department of Environment, Science & Innovation's Streamlined model conditions for petroleum activities Guideline ESR/2016/1989 v2.0, 5 May 2016 provided in Table 2 **or** the relevant Arrow Energy EA discharge criteria for release to ground, whichever is the most stringent.

Table 2 - Discharge criteria

Analyte	Unit		Limit
Total Phosphorus as P	mg/L	max	20
Total Nitrogen as N	mg/L	max	30
5-day biochemical oxygen demand (inhibited)	mg/L	max	20
Suspended solids	mg/L	max	30
pH	mg/L	max	6.0-8.5
e-Coli	cfu per 100mL	80th percentile# and	10,000
		max	100,000

80th percentile based on at least 5 samples with no less than 30 minutes between samples

For STPs operating over 150EP additional restrictions apply. The scope of this Guide does not include STPs operating over 150EP and for these, the Environment team must be consulted during the planning stage and thus prior to the discharge of treated effluent or greywater to land.

[1] Department of Environment and Heritage Protection (QLD) ESR/2015/1710, V2, 15 August 2016. Eligibility criteria and standard conditions for sewage treatment works (ERA 63)

All samples are to be collected and managed by a suitably qualified person[2] and analysed by a NATA accredited laboratory. All sampling must be completed in accordance with the Department of Environment and Science Monitoring and Sampling Manual *Environmental Protection (Water) Policy 2009* (2018).

5. Planning and design

The following criteria is to be met by the Rig Contractor in planning and design of all irrigation areas, where discharge to land associated with a temporary camp has been approved as part of the AAP.

5.1 Selecting the site

a) Soil suitability

It is recommended that a visual or desktop assessment of soil type is undertaken when selecting a suitable discharge site, and consider whether the discharged effluent is likely to pool or soak into the soil, or cause potential impacts to soil during irrigation. These impacts must be managed to ensure compliance with Arrow Energy EA conditions.

b) Land form

When selecting a site for effluent and/or greywater discharge, it is fundamental to consider the compatibility of surrounding land uses as well as the suitability of land for effluent and/or greywater discharge, effluent and/or greywater storage and transport and other management requirements.

Effluent and/or greywater discharge areas should be preferentially located in areas:

- With slope <5%
- Outside flood prone areas that have flood recurrence intervals (Average Rainfall Intensity) of greater than five years.
- With no crests, drainage lines or incised channels
- With no or little surface rock or outcropping present
- Where groundwater is greater then 3m below the surface at any time of year

Established vegetative cover (eg. crops, perennial native or exotic grass cover) must be present where irrigation is proposed to occur. Where groundcover is not already present, effluent and/or greywater discharge should not occur until groundcover is well established. Vegetation from contaminant release areas must be grazed or harvested and removed from the contaminant release area not less than every 3 months.

[2] Suitably Qualified Person - means a person who has professional qualifications, training or skills or experience relevant to the nominated subject matters and can give authoritative assessment, advice and analysis about performance relevant to the subject matters using relevant protocols, standards, methods or literature. Arrow Energy HSE Competence and Induction Procedure (ORG-ARW-HSM-PRO-00024)

c) Buffer Distances

The following precautionary buffer distances between effluent and/or greywater discharge areas and sensitive landscape feature have been developed from Queensland government guidelines and codes.

Table 3 - Buffer distances

Sensitive Landscape feature	Buffer (m)
Dwellings, recreation areas	10[1](from edge of irrigated wet area)
Property boundaries, pedestrian paths and walkways	2[1](from edge of irrigated wet area)
Domestic water bore	250[2]
Town Water Bore	1000[2]
Designated precinct in a strategic environmental area as defined in the *Regional Planning Interests Regulation 2014* or regional plan	0[2,4]
Wetland, watercourse or spring	100[2]
Outer bank of water course	100[3]
Category A environmentally sensitive areas	300[3]
Category B environmentally sensitive areas	300[3]
Category C environmentally sensitive areas that are 'nature refuges' or 'koala habitat'	200[3]
Category C environmentally sensitive areas that are 'essential habitat', 'essential regrowth habitat', or 'of concern' regional ecosystems	200[3]
Category C environmentally sensitive areas that are 'regional parks' (previously known as 'resources reserves')	200[3]
Category C environmentally sensitive areas that are 'state forests' or 'timber reserves'	0[3,4]
Areas of vegetation that are 'critically limited'	200[3]

[1] Queensland Government, V1.0, 2019: Queensland Plumbing and Wastewater Code

[2] Department of Environment and Heritage Protection (QLD) ESR/2015/1710, V2, 15 August 2016. Eligibility criteria and standard conditions for sewage treatment works (ERA 63)

[3] Department of Environment and Science (QLD) ESR/2016/1989 V2.0, 5 May 2016. Streamlined model conditions for petroleum activities Guideline

[4] There is no buffer, however the activity cannot take place within the location itself

5.2 Size of the area for effluent release

The minimum land required for Irrigation areas for discharge of treated effluent and/or greywater from temporary camps with a STP with a capacity up to 150EP is per Table 3. A Medli report is not required. Site size relates to the volume and quality of effluent requiring discharge, the equipment used to irrigate (flow rates) and soil type (eg. how fast will effluent soak into ground). Treated water must be distributed evenly and sufficient area must be allowed such that release of treated effluent or greywater must not result in pooling, runoff, aerosols, spray drift or vegetation die-off as per the Arrow Energy EA conditions. Area must also allow for regular maintenance (ie harvesting, slashing or cropping of vegetation). A healthy crop must be maintained to maximise the rate of evapotranspiration and nutrient uptake. In certain situations, fertilisers and pest

[3] Department of Environment and Heritage Protection (QLD) ESR/2015/1710, V2, 15 August 2016. Eligibility criteria and standard conditions for sewage treatment works (ERA 63)

and disease control may be required. Periodic removal of harvested biomass from the irrigation site is essential to remove nutrients and maintain the nutrient balance of the site[4]

Table 4 – Irrigation area requirements

Rainfall	Maximum irrigation rate	Minimum land required (m2)
<600 mm/year	3 mm/day	335m^2 per m^3 of treated effluent irrigated
>600mm/year to 1000 mm/year	2mm/day	500m^2 per m^3 of treated effluent irrigated
>1000mm/year	1mm/day	1000m^2 per m^3 of treated effluent irrigated

5.3 Fence off site and sign

Effluent and/or greywater discharge must be to a fenced and signed “Contaminant release area”. If treated effluent or greywater discharge is to occur where stock is present, fencing should be of a standard that will exclude stock effectively (e.g. cattle panels or electric tape). If stock are not present on site, flagging/hazard tape may be sufficient. Access and approval conditions should be reviewed to ensure any landholder requirements in relation to fencing are met.

6. Monitoring, maintenance and corrective actions

The irrigation area and STP must be monitored and maintained to achieve the regulatory requirements outlined in Section 3 and the requirements in Section 5.

Should the regulatory requirements of Arrow Energy EAs or the discharge criteria (Section 4) not be met, irrigation must cease and effluent collected and disposed of at an approved regulated waste facility by a licensed waste transporter. Irrigation cannot recommence until the cause has been identified and rectified and sampling and analysis indicates the effluent meets the discharge criteria.

In the event of an actual or potential non-compliance with an Arrow Energy EA and/or this Guide the Well Operations Superintendent and Environment Team are to be advised immediately. The incident process including reporting to the Environmental Regulator if required, will be followed in accordance with Arrow’s HSE Incident Management Procedure (ORG-ARW-HSM-PRO-00089).

7. Record keeping and reporting

Treated sewage effluent and greywater management records and reports must be kept by the Rig Contractor or Direct Mobile Camp Operator and provided to Arrow Energy as required by this Guide to demonstrate compliance with Arrow Energy EAs, AAPs and this Guide. The required records include those listed in Table 5.

[4] Department of Environment and Science (QLD), June 2020; Disposal of effluent using irrigation – Technical Guideline

Table 5 – Record keeping and reporting

Record	Frequency and timing of provision to Arrow
Site planning (incl. selection/location, sizing calculations, site preparation, fencing and signage	Prior to initial discharge and within one week of subsequent changes
Discharge records (incl. dates and periods of discharge to land, volume of discharge to land, analysis of sampling results against discharge criteria)	Upon commissioning and then on a 3-monthly basis and when equipment faults and/or is restarted
Site and STP management and maintenance reports (incl. general observations, observations of pooling, runoff, vegetation die-off, vegetation management, STP issues/servicing and any corrective actions or changes made)	On a 3-monthly basis with the discharge records
Incident and non-compliance reporting	Immediately an incident or non-compliance occurs in accordance with Arrow's HSE Schedule Mode 2 (ORG-ARW-HSM-SCH-00012)

8. Compliance and assurance

The Well Operations Superintendent will ensure the *Well Delivery Mobile Camp Compliance Audit* is completed on a 3-monthly basis during effluent and/or greywater discharge to land. The waste water management section of the *Well Delivery Mobile Camp Compliance Audit* has been developed based on the compliance checklist template in Appendix A.

Compliance with the requirements established in this Guide will be reviewed as part of Arrow Energy's assurance activities.

9. References

Department of Environment and Heritage Protection (Qld) ESR/2015/1710, V2, 15 August 2016. Eligibility criteria and standard conditions for sewage treatment works (ERA 63)

Department of Environment and Science (Qld), 2020; Disposal of effluent using irrigation – Technical Guideline

Department of Environment and Science (Qld), 2018; Monitoring and Sampling Manual *Environmental Protection (Water) Policy 2009*

Department of Environment and Science (Qld) ESR/2016/1989 V2.0, 5 May 2016. Streamlined model conditions for petroleum activities Guideline

Queensland Government, V1.0, 2019: Queensland Plumbing and Wastewater Code

10. Document Administration

Revision history

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1.0	06/06/2019	IFU	Leanne Stevens
2.0	July 2022	Minor updates and additional references to monitoring and compliance requirements	Morgan Gersekowski
3.0	May 2024	Issued For Use	Georgina Rowe

Related documents

Document Number	Document title
ORG-ARW-HSM-PRO-00066	Arrow Energy – Waste Management Procedure
ORG-ARW-HSM-PLA-00152	Arrow Energy – Environmental Management Plan

Acceptance and release

Author

Position	Incumbent	Release Date
Senior Environment Advisor	Daniel Blunt	October 2010

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Position	Incumbent	Review Date
Manager, Environmental Compliance & Assurance	Georgina Rowe	February 2024
Manager, Environment & Carbon	Kelsey Bawden	March 2024
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Well Operations Superintendent	Leith Kay	April 2024
Access Integration Team Lead	Lindsay Rooke	April 2024
Standards, Compliance & Contract Holder Support	Keith Williams	April 2024
Environment Advisor	Morgan Gersekowski	April 2024
Environment Advisor	Julie Kil	April 2024

Approver(s)

Position	Incumbent	Approval Date
Manager, Environment & Carbon	Kelsey Bawden Kelsey Bawden (May 15, 2024 11:23 GMT+10)	15/05/2024

Appendix A Treated Sewage Effluent and Greywater Management Checklist

Contractor/Department Name:		**Site Name:**	
Completed by:		**Position:**	
Signature:		**Date:**	

This form is for the monitoring of temporary sewage treatment systems of daily peak design capacity <150EP that are discharging treated effluent or greywater to land.

If a response of 'No' is recorded against any item, corrective actions should be generated and tracked to completion.
If a response of N/A is recorded justification for this must be recorded in the comments.

No.	Item	Yes	No	N/A	Comments
1.0	**Siting requirements**				
1.1	Is release of treated effluent/greywater permitted under the AAP?				
1.2	Is release of treated sewage effluent/greywater being undertaken within the approved disturbance footprint for the relevant AAP?				
1.3	Are any additional conditions imposed by the landholder for release of treated sewage effluent/greywater as documented in the AAP being met?				
2.0	**Monitoring and management requirements**				
2.1	Has the rig contractor provided Arrow with analysis of water quality results against the discharge criteria as stipulated in the Guide (ORG-ARW-HSM-GUI-00152)?				
2.2	Has the rig contractor provided Arrow with a quarterly summary of STP management including records of any maintenance undertaken?				
2.3	Do the records provided by the rig contractor indicate that the quality of discharge meets the water quality criteria?				
2.4	Where water quality has not been met, has the rig contractor identified and implemented the identified corrective actions?				
2.5	Do the records kept by the rig contractor reflect the record keeping requirement stipulated in the guide (ORG-ARW-HSM-GUI-00152)?				
3.0	**Receiving environment**				
3.1	Is the contaminant release area adequately fenced to exclude cattle?				
3.2	Is there adequate signage to clearly identify the contaminant release area (eg. treated effluent release area)?				
3.3	Is there any evidence of pooling or runoff?				
3.4	Is there any aerosols or spray drift evident?				

3.5	Is there any vegetation die-off evident in or around the area?				
3.6	is the contaminant release area kept vegetated with groundcover that is not a declared pest species?				
3.7	Is groundcover within the contaminant release area kept in a viable state for transpiration and nutrient uptake (ie. living and growing)?				
3.8	Is groundcover within and around the contaminant release area being grazed or harvested and removed from the area as needed (but not less than every 3 months) to minimise fire risk and other risks associated with overgrown vegetation?				

Corrective Actions	**Responsible Person**	**Due Date**