Queensland Floods Commission of Inquiry

Statement of Andrew Stuart Brier

(Moranbah CSG Project)

September 2011

QFCI

Date: 8/11/11 JM

Exhibit Number: 924

QUEENSLAND FLOODS COMMISSION OF INQUIRY

STATEMENT OF ANDREW STUART BRIER

WITH RESPECT TO THE MORANBAH CSG SITE

I, **ANDREW STUART BRIER** of c/- 400 George Street Brisbane in the State of Queensland, General Manager Strategic Implementation, Coal & CSG Operations, Regional Service Delivery, Operations and Environmental Regulator, Department of Environment and Resource Management (DERM), solemnly and sincerely affirm and declare:

Requirement from Queensland Floods Commission of Inquiry

1. I have seen a copy of a letter dated 13 September 2011, which is attachment **ASB-01**, from the Commissioner, Queensland Floods Commission of Inquiry to me requiring a written statement under oath or affirmation, and which details the topics my statement should cover.

Role

2. I am currently the General Manager Strategic Implementation, Coal and Coal Seam Gas Operations within the Regional Service Delivery Division in the Department of Environment and Resource Management. I have held this position since 21 February 2011 although I was involved in the management of flood related issues surrounding coal mines from the 10 January 2011 onwards.

3. Between 2010 and 2011 my roles were as follows:
   - 25/12/2009 to 05/08/2010 - Regional Manager GABSI & Major Projects
   - 06/08/2010 to 02/01/2011 - Regional Manager CSG Activities
   - 03/01/2011 to 20/02/2011 - Director LNG Enforcement Unit
   - 21/02/2011 onwards - General Manager Coal & CSG Operation

Item 1: Department of Environment and Resource Management's activities in respect of each mine's flood preparedness in advance of the 2010/2011 wet season, including whether any particular activities were undertaken as a response to the forecast of an above-average rainfall wet season.

4. Environmental authorities include requirements for companies to prepare Water Management Plans that outline the overall mine water management strategy for their site. The environmental authorities require an annual review of these plans to ensure learnings from past wet season performance are incorporated into forward plans and preparations for future wet seasons.

5. Environmental authorities for mine sites also include dam structural design, construction and operation requirements that are commensurate with flood risks given a mines location, including:

a. certified hazard assessment required for all dams;
b. must be designed to prevent floodwaters from entering the dam, wall failure and overtopping up to and including a specified flood event based on AEP;
c. certified design plans, high risk dams reviewed by DERM technical experts;
d. having a marked "mandatory reporting level" above which DERM must be notified immediately, and actions put in place to prevent or minimise environmental harm;
e. ensuring that dams are inspected by a suitably qualified and experienced person;
f. undertaking reviews annually about the effectiveness of the dam during the preceding wet season and modifying the water management system accordingly;
g. monitoring of water quality within the dam prior to the wet season;
h. maintaining a register of dams and relevant information.

6. Arrow Energy (as CH4 Pty Ltd) holds a number of petroleum tenements in the Moranbah area for extraction and processing of coal seam gas (CSG). Arrow undertakes these activities under EA PEN100015907 **(ASB-MCSG01-01)**.

7. The site is located about 2.5 km from the Moranbah township and is divided by the Isaac River which flows through it.

8. The EA in place at the time allowed for the release of reverse osmosis (RO) treated CSG water to Isaac River subject to limits on quality and the available flow in the river.

9. Arrow did not have an operating RO plant or other required infrastructure to conduct releases, as allowed by its EA at this time.

10. Prior to the 2010/2011 wet season a total of 10 operating dams were present on PL191 and PL196.

11. Dams 1, 2 and 10 were the major dams providing approximately 90% of the total storage capacity for CSG water.

12. Other much smaller dams were used for moving water between groups of remote wells and the major dams. Dam 3 was mainly used for brine storage.

13. Dam 11, a major part of Arrow's future water management plans, was being constructed at the time and was not capable of having water stored in it or transferred to it during the 2010/2011 wet season.

14. The construction of dam 11 was delayed by rains in October and November 2010, which prevented it from being completed as scheduled during 2010.

15. DERM did not undertake a pre wet season compliance inspection of this site. As detailed below DERM was already dealing with Arrow Energy in regards to

water management concerns at the Moranbah site prior to the wet season.

Item 2: the water management sections of the environmental authority applicable at the mine during the 2010/2011 wet season, including:

a) **Any concerns held by him or the Department of Environment and Resource Management (DERM) regarding its terms and the ability of the mine operator to comply with it**
b) **Any terms that the mine operator has indicated it is unable to comply with, or breached**
c) **Any terms that had to be amended from the Fitzroy model conditions because the model terms were unsuitable for this mine site**
d) **Any terms that he or DERM consider do not adequately promote environmental protection and dam safety**

a) **Any concerns held by him or the Department of Environment and Resource Management (DERM) regarding its terms and the ability of the mine operator to comply with it**

16. Under its EA Arrow were required to notify DERM and take actions to prevent dams exceeding the DSA or if unable to prevent, to minimise any actual or potential environmental harm caused by the dam exceeding its DSA.

17. On 26 October 2010 Arrow wrote to DERM **(ASB-MCSG02-01)** advising it had exceeded the DSA in dam 1 due to recent rainfall. Arrow advised that it had taken actions to ensure that net evaporation was higher than net inputs by reducing the production of gas and water from wells. No discharge occurred or was threatened by dam 1 exceeding its DSA.

18. On 27 October 2010 DERM emailed Arrow **(ASB-MCSG02-02)** seeking information, including information about distances to sensitive receptors from the Dam.

19. On 29 October 2010 Arrow wrote to DERM **(ASB-MCSG02-03)** advising they were in the process of transferring water to other storages at the site and that they would be within DSA in a week. In regards to water management conditions Arrow had not breached its EA at this time.

20. On 20 November 2010 Arrow wrote to DERM **(ASB-MCSG02-04)** advising that following additional recent rainfall the DSA for several dams was now exceeded. Arrow advised that it would not have sufficient storage in the event of heavy or prolonged rainfall over the wet season. No issues relating to the structural integrity of any dams was raised. No discharge occurred or was threatened by the dams exceeding DSA's.

21. On 24 November 2010 DERM wrote to Arrow **(ASB-MCSG02-05)** warning them to take all reasonable and practicable measures to ensure compliance with its EA. DERM also sought additional information about water management

measures at the site to assist in quantifying potential risks should discharges or overtopping events occur at a later date.

b) Any terms that the mine operator has indicated it is unable to comply with, or breached.

22. On 3 December 2010 Arrow submitted a program notice (**ASB-MCSG02-06**) outlining water management concerns at the Moranbah site and stating that if forecast heavy rain occurred a discharge might be required from dams on site to prevent overtopping. No discharge had occurred, however Arrow advised DERM of the potential for discharges to occur. Arrow did not specify any concerns with the structural integrity of any dams on site.

23. Arrow stated that until dam 11 was completed they would not have sufficient water storage to manage water at the site, without a discharge. Arrow advised it would apply for a TEP for an authorised discharge over the wet season.

24. A meeting was scheduled for 14 December with Arrow, DERM and Queensland Health to discuss Arrows water management and the potential that Arrow would apply for a TEP to release CSG water to the Isaac River.

25. On 13 December 2010 Arrow advised DERM via phone that they had received significant rainfall, that some dams were approaching MRL and that they had formed a view that pond 2 was in danger of suffering structural failure, which would lead to the overland flow of CSG water.

26. Arrow further advised they would commence releasing CSG water via a pipe over the wall of pond 2, due to the concerns about the possible structural failure of pond 2.

27. Arrow was unable to provide any engineering advice in regards to the concerns held. DERM was not aware of any concerns detected during the annual inspection of Arrow's dams in October 2010.

28. Between 13 and 14 December 2010 Arrow released 2.6ML of CSG water in breach of the conditions of its EA (**ASB-MCSG02-07**). At the time of the releases Arrow were not able to provide a full suite of analysis to demonstrate the water quality being released.

29. On 20 December after further rain at the site Arrow commenced releasing CSG water to keep levels within pond 2 at levels its engineers advised was safe and to prevent other dams overtopping. This release continued until 6 January 2011 During this period Arrow released 34ML of CSG water in breach of the conditions of its EA (**ASB-MCSG02-09**).

c) Any terms that had to be amended from the Fitzroy model conditions because the model terms were unsuitable for this mine site.

30. Site specific conditions were in place at Arrow's site. The Fitzroy model conditions were developed for use in coal mines in the Fitzroy Basin and are therefore not applicable to this site.

d) Any terms that he or DERM consider do not adequately promote environmental protection and dam safety.

31. To the best of my knowledge the Arrow EA does not contain terms that do not adequately promote environmental protection and dam safety.

32. At the time of the 2010/2011 wet season Arrow's water storage on site was not sufficient. Arrow has since completed dam 11, which provides an additional 400ML storage. If Dam 11 had of been constructed prior to the wet season it would have prevented Arrow from discharging.

33. In July 2011 Arrow submitted its Coal Seam Water Management Plan (**ASB-MCSG02-08**) which outlines its water management at the Moranbah site.

34. DERM has assessed this plan and requested further details from Arrow relating to a number of issues. The information is due to be submitted by 30 September 2011 **ASB-MCSG02-10.**

Item 3: any transitional environmental program (TEP) issued or refused or any emergency direction (ED) given or considered regarding either mine during the period 1 October 2010 to 30 July 2011 related to water management, and for each, the following:

- **a) Information received from the mine operator**
- **b) Any relevant dam safety issues**
- **c) Relevant correspondence with the mine operator and other stakeholders**
- **d) Whether and, if so, how DERM consulted with stakeholders**
- **e) What considerations DERM took into account in making the decision**
- **f) Whether, and if so, how DERM balanced environmental considerations and economic consequences of mines being non-operational**
- **g) Whether, and if so how, DERM took account of downstream effects, including cumulative effects**
- **h) The terms of the TEP issued or ED given**
- **i) What actions were taken by DERM to advise emergency management personnel, including local and regional disaster management groups and local residents downstream of the dam about the TEP and any discharges or effects**
- **j) Reasons for the decision given to the mine operator**
- **k) Any breaches of the TEP or ED by the mine operator and DERM's response**

a) Information received from the mine operator

35. On 23 December 2010 Arrow submitted a TEP for assessment by DERM (**ASB-MCSG03-01**).

36. On 24 December 2010 Arrow submitted an engineering assessment of pond 2 in support of its TEP application (**ASB-MCSG03-02**).

37. On 31 December 2010 Arrow provided an amended TEP for assessment, in response to questions from DERM and QLD Health (**ASB-MCSG03-03**).

38. A further amended TEP with the required water quality information was submitted on 4 February 2011 and was approved on 4 February 2011 (**ASB-MCSG03-04**).

39. A notice approving the TEP was provided to Arrow with the approved TEP. (**ASB-MCSG03-05**).

40. On 4 April 2011 DERM extended the time for allowing a discharge under the TEP to 31 March to 13 May 2011. No other aspects of the TEP were amended and the TEP's final completion date for reporting did not change. (**ASB-MCSG03-06**).

41. On 6 June 2011 Arrow submitted a final report on the TEP (**ASB-MCSG03-09**).

b) Any relevant dam safety issues

42. As stated above, Arrow advised DERM on 13 December 2010 that it had formed a view that pond 2 was in danger of suffering structural failure, which would lead to the overland flow of CSG water. On 24 December 2010 Arrow submitted an engineering assessment of pond 2 in support of its TEP application (**ASB-MCSG03-02**).

43. The engineers report recommended that pond 2 be kept at a level 4m below its DSA.

44. Arrow's Coal Seam Gas Water Management Plan (**ASB-MCSG02-08**) submitted to DERM in July 2011 states that pond 2 is now active.

c) Relevant correspondence with the mine operator and other stakeholders

45. There was a significant level of correspondence with many mines in relation to TEPs assessed as a result of the 10/11 wet season within the dates specified. This correspondence is held in a number of regional offices and in the email accounts of a significant number of DERM staff. It is estimated that there are several thousand correspondence items across all mines within this period of time and, as such, DERM was unable to search all the potential sources of correspondence within the timeframe allowed for submission of this statement. I was not comfortable with attaching correspondence items to this statement at this time due to the potential for errors, omissions or inaccuracies due to the high number of documents that would need to be searched in a short period of time. If the Commission wishes copies of particular items of correspondence then I am more

than willing to provide these if requested. Additionally, if the Commission wishes copies of all correspondence these can be provided if time is allowed.

46. QLD Health were liaised directly with and involved in meetings and provided advice on appropriate water quality for any release approved under the TEP. **(ASB-MCSG03-07 and ASB-MCSG03-08).**

47. The Mayors of the relevant local governments was spoken with personally at the time of discharges.

d) Whether and, if so, how DERM consulted with stakeholders

48. DERM liaised with QLD Health and sought its advice in regards to water quality of discharges that occurred and the final TEP approved. QLD Health Officers attended meetings with DERM and Arrow in regards to the releases at the site.

49. DERM verbally advised the Mayor's of both Isaac and Fitzroy Regional Council's of all discharges conducted by Arrow and of the final approved TEP.

50. DERM contacted landholders immediately downstream of the Arrow site and advised them of all discharges conducted by Arrow and of the final approved TEP.

51. DERM also consulted with the Fitzroy Water Quality Advisory Group (FWQAG) on three occasions during the dates specified. This consultation was in broad terms in context of all mine discharges that were occurring during the wet season and formed part of the agenda at meetings of the FWQAG held in Rockhampton on 16 December 2010, 4 February 2011 and 7 April 2011.

52. The FWQAG is made up of a number of stakeholders including the mining industry, community groups, conservation groups, local government and DERM. One of the key roles of the group is to provide advice to State Government agencies relating to water quality management in the Fitzroy River Basin.

e) What considerations DERM took into account in making the decision

53. Transitional environmental programs (TEPs) are specific programs that, when complied with, achieve compliance with the Environmental Protection Act 1994 (EP Act) for an activity by reducing environmental harm, detailing the transition of the activity to an environmental standard or detailing the transition of the activity to comply with a condition of a development approval, an environmental authority or code of environmental compliance. The requirements for TEPs and the process for assessing and approving them is set out in chapter 7, part 3 of the EP Act **(ASB-M03-e00a).**

54. Draft TEPs may be submitted voluntarily by a mine operator, or DERM may require an operator to submit a draft TEP if it is satisfied that an activity or proposed activity is or may cause unlawful environmental harm. In either case, the draft TEP is prepared by the operator. DERM's role is to assess the draft TEP

against the requirements of the EP Act and either approve the TEP, approve the TEP with conditions, or refuse to approve the TEP.

55. Section 338 of the EP Act **(ASB-M03-e00b)** provides the framework for considerations that the administering authority must make in deciding whether to approve or refuse a draft TEP or the conditions (if any) of the approval. In making its decision it:
    - must comply with any relevant regulatory requirement and
    - subject to the above, must also consider the following:
        - the standard criteria
        - additional information given in relation to the draft TEP and
        - the views expressed at a conference held in relation to the draft TEP.

56. DERM has produced guidance material to support regional officers and delegated decision makers in assessing draft TEPs. A two part procedural guide; Part 1-Notice requiring a draft TEP **(ASB-M03-e01)** and Part 2-Considering and making a decision about a draft TEP **(ASB-M03-e02)** is attached. Supplementing the guidelines are two correlating assessment report templates Part 1 Assessment Report **(ASB-M03-e03)** to assist officers to record the information considered by DERM when deciding to issue a notice requiring a TEP and Part 2 – Assessment Report **(ASB-M03-e04)** to assist users to evaluate the content of a draft TEP and make a decision to either approve (with or without conditions) or refuse a draft TEP. Prior to the procedural guides and assessment reports coming into effect, a draft Administrative Practice Note **(ASB-E03-e04a)** and a Request for Statutory Approval template **(ASB-E03-e04b)** was utilised by regional officers to assist with the TEP assessment process.

57. In the case of the Arrow discharge and TEP, DERM considered a number of issues such as:
    - The potential for uncontrolled discharges and associated environmental harm, should dams overtop and discharge undiluted CSG water, if Arrow were instructed to cease unapproved releases or if the TEP was not approved;
    - Discharges of up to 7.5ML/day CSG water with EC of up to 13000uS/cm into the Isaac River;
    - The base flood levels of the Isaac River before discharge would be allowed and the levels of dilution (more than 1:400) that would be achieved during any discharge;
    - The background water quality parameters in the Isaac River being mindful of the DRAFT environmental values and water quality objectives for the river;
    - Water users located downstream of the site;
    - The economic impacts to Arrow of shutting further wells to further reduce the production of water at the site; and
    - Advice from QLD Health on appropriate water quality information to be obtained.

f) Whether, and if so, how DERM balanced environmental considerations and economic consequences of mines being non-operational

58. The EP Act and subordinate legislation governs the responsibilities of DERM in the environmental regulation of mining activities in Queensland. The objective of the EP Act is to protect Queensland's environment while allowing for development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends. This is referred to as ecologically sustainable development (ESD). Accordingly, DERM is required to balance environmental, economic, social and equity considerations when making decisions.

59. When making any decision under the EP Act, including whether to approve a draft TEP, DERM must consider the "Standard Criteria" (**ASB-M03-f01**) as specified in Schedule 4 of the EP Act. The standard criteria specifically require environmental and economic considerations to be balanced and considered. Part 2- Considering and making a decision about a draft TEP procedural guide (**ASB-M03-e02**) provides further guidance on some of the principles on evaluating ESD. In addition further direction is provided on other considerations of the standard criteria, relevantly the financial implications for an applicant in complying with a TEP (and any conditions that may have been imposed) and the character, resilience and values of the receiving environment.

60. Furthermore, part 2 and 3 of the Environmental Protection Regulation 2008 (EP Reg) (**ASB-M03-f02**) stipulate requirements for all environmental management decisions and additional regulatory considerations with respect to imposing conditions relating to a wide ambit of environmental and economic considerations including but not limited to monitoring, and releases to waters or land. Decisions must also consider any relevant Environmental Protection Policies (EPP) such as the Environmental Protection (Water) Policy 2009 which sets out to achieve the objective of the EP Act with respect to Queensland waters. It does this by identifying environmental values and management goals and providing a framework for making consistent, equitable and informed decisions about Queensland waters.

61. In its TEP application Arrow advised DERM that in an effort to manage water storage constraints, it had shut in a large number of wells, targeting the wells with high water to gas ratios to minimise the production of coal seam water associated with operations.

62. Arrow also advised that whilst shutting in some high water producing wells had reduced coal seam water production, shutting in further wells would yield limited benefits in terms of water reduction but would cause significant reduction in gas output.

63. While the economic impacts of requiring Arrow to shut in further wells was considered in granting a TEP, the actual conditioning of the TEP primarily related to managing risks to the environment by ensuring the discharge occurred in a controlled manner, with a minimum base flow and dilution in place.

g) Whether, and if so how, DERM took account of downstream effects, including cumulative effects

64. Within DERM internal advice was sought from the Aquatic Ecosystem Risk & Decision Support unit, who provided site specific advice in regards to appropriate release limits and dilution levels required to minimise impacts in the Isaac River to aquatic values.

65. When assessing the Arrow TEP DERM took into consideration the downstream impacts of the proposed releases to the Isaac River by ensuring the conditions of the TEP required adequate dilution to achieve downstream EC targets. These targets included drinking water quality guidelines and aquatic ecosystem guidelines to ensure the protection of waterholes in the Isaacs River.

66. DERM also took into account releases from other mines into the system along with background water quality parameters to ensure cumulative impacts were minimised and downstream water users were adequately protected. DERM also took these other releases into account to ensure other mines were afforded the opportunity to releases water where required under similar programs.

67. The Arrow TEP was approved with a condition that required them to cease releases if directed to do so by DERM.

h) The terms of the TEP issued or ED given

68. Refer to (a) in item 3 above for terms of TEPs issued.

69. No Emergency Direction was issued to Arrow.

i) What actions were taken by DERM to advise emergency management personnel, including local and regional disaster management groups and local residents downstream of the dam about the TEP and any discharges or effects

70. DERM advised the Mayor's of both Isaac and Fitzroy Regional Council's of all discharges conducted by Arrow and of the final approved TEP.

71. DERM contacted landholders immediately downstream of the Arrow site and advised them of all discharges conducted by Arrow and of the final approved TEP.

72. Given the relatively minor nature of the volume of CSG water released by Arrow (less than 100L/second at the maximum of 7.5ML/day), and the fact that the release was unlikely to cause any significant issues to downstream landholders or the environment, it was not considered necessary to formally notify local and regional disaster management groups or landholders other than those immediately adjacent to the discharge.

j) Reasons for the decision given to the mine operator

73. No reasons were given to Arrow in regards to the final decision to approve the TEP.

74. Arrow was communicated with throughout the TEP negotiations and was advised as to the appropriate level of information requirements required before DERM would approve any TEP to discharge. Arrow were initially unable to provide DERM with appropriate water quality information, due to a range of reasons including wet weather access, laboratory delays and the closure of its Brisbane Office due to the Brisbane River flooding in January 2011.

k) Any breaches of the TEP or ED by the mine operator and DERM's response

75. Arrow did not breach any conditions of its TEP in regards to the water quality discharged, the base flows in the Isaac River required during discharge or the level of dilution required.

76. Arrow did however fail to comply with conditions relating to the submission of water quality monitoring, however this appeared to be as a result of the laboratory used at that time and not a deliberate act on behalf of the company.

77. At no stage was Arrow directed to cease the release under the TEP.

Item 4: the effects on the environment, drinking water quality and public health downstream of each of the mine sites (as far as the Great Barrier Reef Marine Park) as a result of discharges of water under a TEP or ED.

78. The potential effects of releases of water from mine sites are assessed prior to the grant of environmental authorities or transitional environmental programs. In applying to receive approval to discharge to a surface water, applicants must prepare information to support the application which identifies the environmental values, water quality objectives and management intent (that is, the goals to be achieved in terms of meeting water quality objectives and protecting environmental values) of the surface water. This framework is provided in the EPP Water (**ASB-MCSG04-01**). Applications must be able to demonstrate that the management intent for the receiving water will be met despite the discharge occurring.

79. All applications for environmental authorities and TEPs submitted for the approval of discharge to surface waters must be assessed by DERM against the requirements of the EP Act which includes the EPP Water, including an impact assessment to ensure that environmental values of any surface water will be protected. In conducting these regulatory assessments, DERM has developed a number of decision support tools including the guideline "Protecting Environmental Values from CSG Water Discharged to Surface Waters" (2010, **ASB-MCSG04-02**) Conditions for Coal Mines in the Fitzroy Basin – Approach to Discharge Licensing (June 2010) and the Operational Policy "Waste water discharge to Queensland Waters" (2007, **ASB-MCSG04-03**) and associated

procedural information (**ASB-MCSG04-04** and **ASB-MCSG04-05**). DERM has also prepared an "Interim Decision Support Matrix Release of water produced in association with Coal Seam Gas activities to surface waterways" (2010, **ASB-MCSG04-06**) which informs assessments and resultant authority conditions

80. The approach used by DERM throughout the 2010-2011 wet season aimed to be consistent with state/national water quality guidelines e.g. The Queensland Water Quality Guidelines (2006), ANZECC/ARMCANZ Guidelines for Fresh and Marine Water Quality 2000, the Australian Drinking Water Quality Guidelines and the October 2010 released Draft for Consultation – Establishing Environmental Values, Water Quality Guidelines and Water Quality Objectives for Fitzroy Basin Waters. .

81. Controls and limitations are placed on authorities as conditions such as limits upon the volumes discharged, timing of discharge and required dilution and mixing zones for discharges. Conditions also include comprehensive contaminant monitoring programs for discharge quality which is supplemented by detailed receiving environment monitoring programs.

82. Releases of water from a dam at a mine site can be authorised by the conditions of an environmental authority or via specific permission under a transitional environmental program. Regardless of the statutory instrument, for releases of water from a dam at a mine site to be authorised, the assessment procedure described above would apply.

83. The EP Act and the subordinate Environmental Protection (Water) Policy 2009 (EPP Water) provides for drinking water values for Queensland waters. Accordingly, the protection of these values must be demonstrated prior to any authority being granted authorising a contaminant release to surface waters. Conditions of the environmental authority or TEP will provide quality limits and environmental monitoring to ensure that discharge quality is sufficient to protect drinking water values.

84. During the 10/11 wet season, DERM staff liaised with Queensland Health on a regular basis to ensure that any authorised or un-authorised discharges from mine sites were managed to ensure the protection of drinking water quality.

85. TEPs issued during or as a result of the 10/11 wet season also considered the effects of any mine site release on drinking water and were conditioned to ensure that the discharge was managed in such a way as to ensure the protection of drinking water supplies.

86. Arrow conducted monitoring of unapproved discharges prior to TEP approval (referred to in Item 2 part b above) in accordance with either the monitoring requirements of its EA or the monitoring requirements of the draft TEP which it later submitted to DERM.

87. The TEP required that monitoring occur at the discharge point, upstream of the discharge and 500m downstream of the discharge.

88. Arrow were required to monitor daily during release for Electrical conductivity (uS/cm), pH, Turbidity (NTU) and BTEX.

89. Arrow were required to monitor at the commencement of a release and then weekly thereafter for a suite of metal, TPH and Flouride.

90. There is no evidence to suggest that the discharges from Arrow had any environmental impacts upon the Isaac River.

Item 5: details of how the new Fitzroy Model Conditions negotiated during 2011, or any other discussions with DERM, will resolve any issue raised above 1, 2, 3, or 4

91. Arrow have completed dam 11, providing an additional 400ML of storage on the site. Given these changes to water storage, Arrow would not need to discharge if the same wet season events occurred in the future. As mentioned previously, the Fitzroy Model Water Conditions for Coal Mines do not apply to this site.

Item 6: an explanation as to whether the new Fitzroy Model Conditions negotiated during 2011 are advantageous or disadvantageous to the mine operator in the management of water at the mine, the downstream environment and safety issues.

92. The conditions on Arrow's EA are site specific and do not use the new Fitzroy Model conditions.

Item 7: any briefing (written or oral) given to any Minister or Director-General regarding a TEP or ED related to water management or non-compliance with an environmental authority at the mine and the reason for that briefing

93. Incident alerts in regards to the water management situation at the Arrow site were prepared during December2010 (**ASB-MCSG07-01 and ASB-MCSG07-02**).

94. To the best of my knowledge, there were no further specific written briefings provided to any Minister or Director General in relation to this CSG site. A number of general briefings were provided in relation to mines/CSG activities and the 10/11 wet season and these are attached as items **ASB-D07-03** to **ASB-D07-06**. A weekly report on TEPs was provided via email to key departmental and ministerial staff during the time period requested and a copy of the latest report provided prior to 20 July 2011 is attached as item **ASB-D07-07 (A and B)**. It is possible that there were other written briefing material provided during this period but this is the best information DERM staff were able to gather within the timeframe permitted for submission of this statement

95. There were a significant number of oral briefings provided to the Minister for Climate Change and Sustainability and the Director General of DERM in relation

to TEPs during the wet season period of which there are no written records. In general, these were primarily in relation to the mining/CSG industry as a whole and the number of TEPs issued or currently being assessed. Individual mines and CSG sites were discussed at several of these briefings but I am unable to provide an accurate transcript or meeting notes from these briefings.

Item 8: DERM's opinion as to whether the mine operator should be managing water at the Mine other than by storing it in dams or ponds, including by using desalination plants, purification procedures or any other means

96. Arrow's Coal Seam Gas water management plan details its strategy for water management at this site which includes the construction of further dams, the construction and operation of an RO water treatment plant to allow the discharge RO treated CSG water at 2ML/day under its current EA, the beneficial use of CSG water by both industry (coal washing) and agriculture.

97. Arrow is required by both the conditions of its EA and the EP Act to review its water management.

98. Arrow is required under conditions of its EA to develop and implement a water release reduction strategy and to report to DERM annually on progress.

99. In addition to this EA condition Arrow are also required by s316A of the Environmental Protection Act to submit with its annual return an evaluation of the effectiveness of the management of coal seam gas water under the criteria mentioned in section 310D(5)(e) for carrying out each relevant CSG activity.

Item 9: an explanation of that which is involved in managing water at the Mine other than by storing it in dams or ponds, including by using desalination plants, purification Procedures or any other means

100. At the time of the 2010/2011 wet season Arrow primarily relied upon evaporation of CSG water in dams as the main means of disposing of its CSG water. Whilst its EA allowed for a discharge of RO treated CSG water of 2ML/day, Arrow did not have an RO plant at the site and was not able to discharge.

101. Arrow has plans in place to provide a nearby coal mine with up to 500ML/year of CSG water for coal washing.

102. Arrow has commenced the construction of an RO plant to treat and release up to 2ML/day of RO treated CSG water under its EA.

103. As stated in item 8 above, Arrow is required under both its EA and the EP Act to review its management of CSG water on an annual basis.

Item 12: a description of any concerns regarding the potential for pond overtopping at the site between 1 October 2010 and 30 July 2011

104.This is dealt with at item 3 part b above. Arrow advised DERM on 13 December 2010 that it had formed a view that pond 2 was in danger of suffering structural failure, which would lead to the overland flow of CSG water. On Arrow submitted an engineering assessment of pond 2 in support of its TEP application which recommended that pond 2 be kept at a level 4m below its DSA.

105.Older dams at the Arrow site did not have spillways in place and any overtopping of these dams may have put the structures at risk.

106.Arrow did not have sufficient water storage on site for the 2010/2011 wet season as it had not finalised the construction of dam 11, which provided an additional 400ML of storage.

107.Dam 11 is now constructed and fully operational.

Item 13: an explanation of how the risks to the environment, drinking water quality and public health posed by the discharge of water from coal seam gas operations are different to those risks posed by the discharge of water from coal, gold or copper mining

108.The process of extracting coal seam gas requires dewatering of the coal seam and as a result, large quantity of CSG water is generated, with the typical contaminant of concern being salts. The rate of generation of water and its quality depends on the location of the wells.

109.Salt was the limiting contaminant for Arrow's discharge, with CSG water on site being discharged at an electrical conductivity below 13 000 uS/cm.

110.The main difference between Arrows discharge and that of coal mines in the catchment, was that coal mines in general discharged large volumes (several hundred to several thousand megalitres) of mine affected water with an electrical conductivity generally ranging between 1200 to 4000 uS/cm.

111.In contrast Arrow discharged relatively small volumes (less than 60ML from December 2010 to March 2011) of CSG water at conductivities approaching 13000 uS/cm

112.A discharge from a copper or gold mine would typically be limited by the presence of heavy metals and not salt.

Item 14: an explanation of how the process of DERM assessing and deciding whether to grant a TEP is different for coal seam gas projects as compared to mines

113.Whilst the exact same assessment process would be followed for a coal seam gas release compared to one proposed for a coal, gold or copper mine, different site specific and process specific considerations would be considered.

Item 15: an explanation of how consideration taken into account by DERM in assessing and deciding whether to grant TEP or ED is different for coal seam gas projects as compared to mines

114. As stated in item 14 above the exact same assessment process would be followed for a coal seam gas release compared to one proposed for a coal, gold or copper mine, however different site specific and process specific considerations would be considered.

115. These considerations would include the differences in the key limiting contaminants (electrical conductivity for coal and CSG discharge; heavy metals for gold or copper) and the impacts of those contaminants in the receiving environment.

I make this solemn declaration conscientiously believing the same to be true, and by virtue of the provisions of the *Oaths Act 1867.*

Signed [redacted] ......
Andrew Stuart Brier

Taken and declared before me, at Brisbane this day of September 2011

.. [redacted] ....
Solicitor/~~Barrister/Justice of the Peace/Commissioner for Declarations~~

Our ref: Doc 1712526

13 September 2011

Mr Paul Lack
Assistant Crown Solicitor
Crown Law
GPO Box 5221
BRISBANE QLD 4001

Dear Mr Lack

Department of Environment and Resources – Mining Dams

Please find enclosed a Requirement to Provide Statement to the Commission addressed to the following:

1. Mr Andrew Brier, General Manager, Strategic Implementation, Coal & CSG Operations, Regional Service Delivery, Operations and Environmental Regulator, directed to the regulation by the Department of Environment and Resource Management of Hail Creek Mine, Dawson Mine, Callide Power Station, Rolleston Coal Mine and Moranbah CSG Project.
2. Mr Rob Lawrence, Director, Environmental Services (North Region), Regional Service Delivery, Operations and Environmental Regulator, directed to the regulation by the Department of Environment and Resource Management of Century Mine

The material from Mr Brier and Mr Lawrence is returnable to the Commission no later than 5 pm, Monday, 26 September 2011.

If you require further information or assistance, please contact Ms Susan Hedge on telephone [redacted].

We thank you for your assistance.

Yours sincerely

[redacted]

Jane Moynihan
Executive Director

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Telephone **1300 309 634**
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Our ref: Doc 1712484

13 September 2011

Mr Andrew Brier
General Manager, Strategic Implementation, Coal & CSG Operations,
Regional Service Delivery, Operations and Environmental Regulator
Department of Environment and Resource Management
Level 13, 400 George Street
BRISBANE QLD 4001

REQUIREMENT TO PROVIDE STATEMENT TO COMMISSION OF INQUIRY

I, Justice Catherine E Holmes, Commissioner of Inquiry, pursuant to section 5(1)(d) of the *Commissions of Inquiry Act 1950* (Qld), require Mr Andrew Brier of the Department of Environment and Resource Management to provide a written statement, under oath or affirmation, to the Queensland Floods Commission of Inquiry, in which the said Mr Brier gives an account of the following topics.

With respect to the Hail Creek Mine, Dawson Mine, Callide Power Station, Rolleston Coal Mine and Moranbah CSG Project:

1. Department of Environment and Resource Management (DERM) activities in respect of each mine's flood preparedness in advance of the 2010/2011 wet season, including whether any particular activities were undertaken as a response to the forecast of an above-average rainfall wet season

2. the water management sections of the environmental authority applicable at the mines during the 2010/2011 wet season, including:
   a. any concerns held by him or DERM regarding its terms and the ability of the mine operator to comply with it
   b. any terms that the mine operator has indicated it is unable to comply with, or breached
   c. any terms that had to be amended from the Fitzroy model conditions because the model terms were unsuitable for this mine site
   d. any terms that he or DERM consider do not adequately promote environmental protection and dam safety

3. any transitional environmental program (TEP) issued or refused or any emergency direction (ED) given or considered regarding any of the mines during the period 1 October 2010 to 30 July 2011 related to water management, and for each, the following:
   a. information received from the mine operator

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b. any relevant dam safety issues
c. relevant correspondence with the mine operator and other stakeholders
d. whether and, if so how, DERM consulted with stakeholders
e. what considerations DERM took into account in making the decision
f. whether, and if so how, DERM balanced environmental considerations and economic consequences of mines being non-operational
g. whether, and if so how, DERM took account of downstream effects, including cumulative effects
h. the terms of the TEP issued or ED given
i. what actions were taken by DERM to advise emergency management personnel, including local and regional disaster management groups and local residents downstream of the dam about the TEP and any discharges or effects
j. reasons for the decision given to the mine operator
k. any breaches of the TEP or ED by the mine operator and DERM's response

4. the effects on the environment, drinking water quality and public health downstream of each of the mine sites (as far as the Great Barrier Reef Marine Park) as a result of discharges of water under a TEP or ED

5. details of how the new Fitzroy Model Conditions negotiated during 2011, or any other discussions with DERM, will resolve any issue raised above in 1, 2, 3, or 4

6. an explanation as to whether the new Fitzroy Model Conditions negotiated during 2011 are advantageous or disadvantageous to the mine operator in the management of water at the mines, the downstream environment and safety issues

7. any briefing (written or oral) given to any Minister or Director-General regarding a TEP or ED related to water management or non-compliance with an environmental authority at the mine and the reason for that briefing

8. DERM's opinion as to whether the mine operator should be managing water at the Mine other than by storing it in dams or ponds, including by using desalination plants, purification procedures or any other means

9. an explanation of that which is involved in managing water at the Mine other than by storing it in dams or ponds, including by using desalination plants, purification procedures or any other means

With respect to the Callide Power Station only:

10. to the knowledge of DERM, the effects on the environment, drinking water quality and public health downstream of each of the Power Station sites (as far as the Great Barrier Reef Marine Park) as a result of discharges from Ash Dam B between 1 October 2010 and 30 July 2011

11. a description of the concerns surrounding Ash Dam B during the period 1 October 2010 to 30 July 2011, including:
    a. water level

b. dam safety
c. uncontrolled discharge
d. contaminants and hazardous waste in the contents of the dam

With respect to the Moranbah CSG Project only:

12. a description of any concerns regarding the potential for pond overtopping at the site between 1 October 2010 and 30 July 2011

13. an explanation of how the risks to the environment, drinking water quality and public health posed by the discharge of water from coal seam gas operations are different to those risks posed by the discharge of water from coal, gold or copper mining

14. an explanation of how the process of DERM assessing and deciding whether to grant a TEP is different for coal seam gas projects as compared to mines

15. an explanation of how consideration taken into account by DERM in assessing and deciding whether to grant TEP or ED is different for coal seam gas projects as compared to mines

Mr Brier should attach to his statement:

- the water management sections of the environmental authority in force during the 2010/2011 wet season for the mines
- all relevant TEP or ED documentation, including internal working documents, assessment report, policy documents used, expert reports, notes of any conference, meeting or teleconference, reasons given to mine operators, notice of decision, correspondence with the mine operator and other stakeholders
- any new environmental authority issued in response to the 2011 amendments to the Fitzroy Model Conditions
- any internal reports regarding the Ensham Coal Mine de-watering between 2008 and 2011

In addressing these matters, Mr Brier is to:

- provide all information in his possession and identify the source or sources of that information;
- make commentary and provide opinions he is qualified to give as to the appropriateness of particular actions or decisions and the basis of that commentary or opinion.

Mr Brier may also address other topics relevant to the Terms of Reference of the Commission in the statement, if he wishes.

The statement is to be provided to the Queensland Floods Commission of Inquiry by 5 pm, Monday 26 September 2011.

The statement can be provided by post, email or by arranging delivery to the Commission by emailing info@floodcommission.qld.gov.au.

C. Holmes

Commissioner
Justice C E Holmes

Our ref: Doc 1712531

13 September 2011

Mr Rob Lawrence
Director, Environmental Services (North Region), Regional Service Delivery, Operations and Environmental Regulator
Department of Environment and Resource Management
Level 13, 400 George Street
BRISBANE QLD 4001

REQUIREMENT TO PROVIDE STATEMENT TO COMMISSION OF INQUIRY

I, Justice Catherine E Holmes, Commissioner of Inquiry, pursuant to section 5(1)(d) of the *Commissions of Inquiry Act 1950* (Qld), require Mr Rob Lawrence of the Department of Environment and Resource Management to provide a written statement, under oath or affirmation, to the Queensland Floods Commission of Inquiry, in which the said Mr Lawrence gives an account of the following topics.

With respect to the Century Mine:

1. Department of Environment and Resource Management (DERM) activities in respect of the mine's flood preparedness in advance of the 2010/2011 wet season, including whether any particular activities were undertaken as a response to the forecast of an above-average rainfall wet season

2. the water management sections of the environmental authority applicable at the mine during the 2010/2011 wet season, including:
    a. any concerns held by him or the Department of Environment and Resource Management (DERM) regarding its terms and the ability of the mine operator to comply with it
    b. any terms that the mine operator has indicated it is unable to comply with, or breached
    c. any terms that had to be amended from the Fitzroy model conditions because the model terms were unsuitable for this mine site
    d. any terms that he or DERM consider do not adequately promote environmental protection and dam safety

3. any transitional environmental program (TEP) issued or refused or any emergency direction (ED) given or considered regarding either mine during the period 1 October 2010 to 30 July 2011 related to water management, and for each, the following:
    a. information received from the mine operator

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b. any relevant dam safety issues
c. relevant correspondence with the mine operator and other stakeholders
d. whether and, if so how, DERM consulted with stakeholders
e. what considerations DERM took into account in making the decision
f. whether, and if so how, DERM balanced environmental considerations and economic consequences of mines being non-operational
g. whether, and if so how, DERM took account of downstream effects, including cumulative effects
h. the terms of the TEP issued or ED given
i. what actions were taken by DERM to advise emergency management personnel, including local and regional disaster management groups and local residents downstream of the dam about the TEP and any discharges or effects
j. reasons for the decision given to the mine operator
k. any breaches of the TEP or ED by the mine operator and DERM's response

4. the effects on the environment, drinking water quality and public health downstream of each of the mine sites (as far as the Great Barrier Reef Marine Park) as a result of discharges of water from the mine during the period 1 October 2010 to 30 July 2011

5. any actions taken by DERM in response to any effect of discharges from the mine falling into 4, above, during the period 1 October 2010 to 30 July 2011

6. any briefing (written or oral) given to any Minister or Director-General regarding a TEP or ED related to water management or non-compliance with the water management provisions of the environmental authority at the mine and the reason for that briefing

7. details of any flood preparedness activities planned to precede the 2011/2012 wet season

8. details of how the new Fitzroy Model Conditions negotiated during 2011, or any other discussions with DERM, will resolve any issue raised above in 1, 2, 3, or 4

9. an explanation as to whether the new Fitzroy Model Conditions negotiated during 2011 are advantageous or disadvantageous to the mine operator in the management of water at the mine, the downstream environment and safety issues

10. DERM's opinion as to whether the mine operator should be managing water at the Mine other than by storing it in dams or ponds, including by using desalination plants, purification procedures or any other means

11. An explanation of that which is involved in managing water at the Mine other than by storing it in dams or ponds, including by using desalination plants, purification procedures or any other means

Mr Lawrence should attach to his statement:

- the water management sections of the environmental authority in force during the 2010/2011 wet season for the mine

- all relevant TEP or ED documentation, including internal working documents, assessment report, policy documents used, expert reports, notes of any conference, meeting or teleconference, reasons given to the mine operator, notice of decision, correspondence with the mine operator and other stakeholders
- any new environmental authority issued in response to the 2011 amendments to the Fitzroy Model Conditions

In addressing these matters, Mr Lawrence is to:

- provide all information in his possession and identify the source or sources of that information;
- make commentary and provide opinions he is qualified to give as to the appropriateness of particular actions or decisions and the basis of that commentary or opinion.

Mr Lawrence may also address other topics relevant to the Terms of Reference of the Commission in the statement, if he wishes.

The statement is to be provided to the Queensland Floods Commission of Inquiry by 5 pm, Monday 26 September 2011.

The statement can be provided by post, email or by arranging delivery to the Commission by emailing info@floodcommission.qld.gov.au.

P. Holmes

Commissioner
Justice C E Holmes

Queensland

Environmental Protection Act 1994

Environmental Protection (Water) Policy 2009

Reprinted as in force on 16 July 2010

Reprint No. 1B

**This reprint is prepared by
the Office of the Queensland Parliamentary Counsel
Warning—This reprint is not an authorised copy**

Information about this reprint

This policy is reprinted as at 16 July 2010. The reprint—

- shows the law as amended by all amendments that commenced on or before that day (Reprints Act 1992 s 5(c))
- incorporates all necessary consequential amendments, whether of punctuation, numbering or another kind (Reprints Act 1992 s 5(d)).

The reprint includes a reference to the law by which each amendment was made—see list of legislation and list of annotations in endnotes. Also see list of legislation for any uncommenced amendments.

This page is specific to this reprint. See previous reprints for information about earlier changes made under the Reprints Act 1992. A table of reprints is included in the endnotes.

Also see endnotes for information about—

- **when provisions commenced**
- **editorial changes made in earlier reprints.**

Spelling

The spelling of certain words or phrases may be inconsistent in this reprint or with other reprints because of changes made in various editions of the Macquarie Dictionary (for example, in the dictionary, 'lodgement' has replaced 'lodgment'). Variations of spelling will be updated in the next authorised reprint.

Dates shown on reprints

Reprints dated at last amendment All reprints produced on or after 1 July 2002, authorised (that is, hard copy) and unauthorised (that is, electronic), are dated as at the last date of amendment. Previously reprints were dated as at the date of publication. If an authorised reprint is dated earlier than an unauthorised version published before 1 July 2002, it means the legislation was not further amended and the reprint date is the commencement of the last amendment.

If the date of an authorised reprint is the same as the date shown for an unauthorised version previously published, it merely means that the unauthorised version was published before the authorised version. Also, any revised edition of the previously published unauthorised version will have the same date as that version.

Replacement reprint date If the date of an authorised reprint is the same as the date shown on another authorised reprint it means that one is the replacement of the other.

Queensland

Environmental Protection (Water) Policy 2009

Contents

Environmental Protection (Water) Policy 2009

[as amended by all amendments that commenced on or before 16 July 2010]

Part 1 Preliminary

1 Short title

This policy may be cited as the *Environmental Protection (Water) Policy 2009*.

2 Definitions

The dictionary in schedule 2 defines particular words used in this policy.

Part 2 Application and purpose of policy

3 Application of policy

This policy applies to all Queensland waters.

4 Purpose of policy

The purpose of this policy is to achieve the object of the Act in relation to Queensland waters.

Note—

See section 3 of the Act.

5 How purpose of policy is achieved

The purpose of this policy is achieved by—

(a) identifying environmental values and management goals for Queensland waters; and

(b) stating water quality guidelines and water quality objectives to enhance or protect the environmental values; and

(c) providing a framework for making consistent, equitable and informed decisions about Queensland waters; and

(d) monitoring and reporting on the condition of Queensland waters.

Part 3 Basic concepts

6 Environmental values to be enhanced or protected

(1) The environmental values of waters to be enhanced or protected under this policy are—

(a) for water mentioned in schedule 1, column 1—the environmental values stated in the document opposite the water in schedule 1, column 2; or

(b) for other water—the environmental values stated in subsection (2).

(2) For subsection (1)(b), the environmental values are as follows—

(a) for high ecological value waters—the biological integrity of an aquatic ecosystem that is effectively unmodified or highly valued;

(b) for slightly disturbed waters—the biological integrity of an aquatic ecosystem that has effectively unmodified biological indicators, but slightly modified physical, chemical or other indicators;

(c) for moderately disturbed waters—the biological integrity of an aquatic ecosystem that is adversely affected by human activity to a relatively small but measurable degree;

(d) for highly disturbed waters—the biological integrity of an aquatic ecosystem that is measurably degraded and of lower ecological value than waters mentioned in paragraphs (a) to (c);

(e) for waters that may be used for producing aquatic foods for human consumption—the suitability of the water for producing the foods for human consumption;

(f) for waters that may be used for aquaculture—the suitability of the water for aquacultural use;

(g) for waters that may be used for agricultural purposes—the suitability of the water for agricultural purposes;

(h) for waters that may be used for recreation or aesthetic purposes, the suitability of the water for—

(i) primary recreational use; or

(ii) secondary recreational use; or

(iii) visual recreational use;

(i) for waters that may be used for drinking water—the suitability of the water for supply as drinking water;

(j) for waters that may be used for industrial purposes—the suitability of the water for industrial use;

(k) the cultural and spiritual values of the water.

(3) In this section—

cultural and spiritual values, of water, means its aesthetic, historical, scientific, social or other significance, to the present generation or past or future generations.

primary recreational use, of water, means full body contact with the water, including, for example, diving, swimming, surfing, waterskiing and windsurfing.

secondary recreational use, of water, means contact other than full body contact with the water, including, for example, boating and fishing.

visual recreational use, of water, means viewing the water without contact with it.

7 Indicators and water quality guidelines for environmental values

(1) An ***indicator*** for an environmental value is a physical, chemical, biological or other property that can be measured or decided in a quantitative way.

Examples—

- The concentration of nutrients and pH value are types of chemical indicators.
- Secchi disc clarity is a type of physical indicator.
- Seagrass depth range, macro-invertebrate family richness and percentage of exotic fish are types of biological indicators.

(2) ***Water quality guidelines*** are quantitative measures or statements for indicators, including contaminant concentration or sustainable load measures of water, that protect a stated environmental value.

(3) For particular water, the indicators and water quality guidelines for an environmental value are—

(a) decided using the following documents—

(i) site specific documents for the water;

(ii) the QWQ guidelines;

(iii) the AWQ guidelines;

(iv) other relevant documents published by a recognised entity; and

(b) for water mentioned in schedule 1, column 1—the indicators stated in the document opposite the water in schedule 1, column 2.

(4) To the extent of any inconsistency between the documents mentioned in subsection (3)(a) for a particular water quality guideline, the documents are to be used in the order in which they are listed in that subsection.

(5) In this section—

sustainable load measure, of water, means the maximum concentration of contaminants the water can accommodate while achieving the water quality objectives for the water.

8 When environmental values are protected

For this policy, the environmental values for particular water are protected if the measures for all indicators do not exceed the water quality guidelines stated for the indicators.

Part 4 Management goals and water quality objectives for waters

9 Management goals

The management goals for water mentioned in schedule 1, column 1 are the goals, if any, stated in the document opposite the water in schedule 1, column 2.

Examples of management goals—

- to maintain an area, composition and condition of seagrass beds, reefs or mangroves
- to maintain a stated level of diversity of fish species

10 Water quality objectives

(1) The water quality objectives for water mentioned in schedule 1, column 1 are—

(a) the objectives stated in the document opposite the water in schedule 1, column 2; or

(b) if water quality objectives for the water are not stated in the document—the set of water quality guidelines that will protect all environmental values stated in the document.

(2) The water quality objectives for water not mentioned in schedule 1, column 1 are the set of water quality guidelines for all indicators that will protect all environmental values for the water.

(3) However, water quality objectives do not apply to—

(a) water in swimming pools; and

(b) drinking water in a domestic water supply system, including, for example, water in a local government or privately owned water supply system; and

(c) waste water in a storage including, for example, a sewage lagoon, mine tailings dam, irrigation tailwater dam and piggery or dairy waste water pond; and

(d) water in a pond used for aquaculture; and

(e) water in a stormwater treatment system.

11 Identifying environmental values etc. for waters

(1) This section applies to water not mentioned in schedule 1, column 1.

(2) For developing a document about particular water for inclusion in schedule 1, the chief executive may, in cooperation with the chief executive (fisheries), identify—

(a) the environmental values to be protected for the water; and

(b) the water quality objectives for the water; and

(c) ways to improve the quality of the water.

(3) In identifying the matters mentioned in subsection (2), the chief executive must ensure there has been—

(a) consultation with the community, including industry and commerce sectors; and

(b) consideration of the economic and social impacts of protecting environmental values for the water.

(4) Also, the chief executive may identify water quality objectives for the water that provide a lower level of protection of the environmental values for the water than the water quality guidelines mentioned in section 10(2) only if—

(a) the adoption of the water quality guidelines would involve unacceptable economic or social impacts on the community; and

(b) the water quality objectives are an improvement on existing water quality.

12 Amending waters in sch 1

(1) The chief executive may replace a document stated in schedule 1, column 2 for particular water only if—

(a) there has been consultation with the community, including industry and commerce sectors; and

(b) the chief executive has considered the economic and social impacts of protecting environmental values for the water.

(2) However, subsection (1) does not apply to a replacement document if—

(a) the purpose of the replacement is only to correct a minor error, or make another change that is not a change of substance; or

(b) the document being replaced states that an amendment of a stated type may be made to the document under this subsection, and the purpose of the replacement is only to make an amendment of the stated type.

Part 5 Management of activities

13 Management hierarchy for surface or ground water

(1) This section states the management hierarchy for an activity that may affect water.

Note—

See the *Environmental Protection Regulation 2008*, section 51.

(2) To the extent it is reasonable to do so, release of waste water or contaminants to waters must be dealt with using the following hierarchy of preferred procedures—

(a) step 1—evaluate water conservation measures to reduce the use of water and the production of waste water or contaminants;

(b) step 2—evaluate waste prevention options and implement appropriate waste prevention measures;

(c) step 3—if waste prevention does not, or is not likely to, eliminate the release of waste water or contaminants to waters, evaluate treatment and recycling options and implement appropriate treatment and recycling;

(d) step 4—if treatment and recycling does not, or is not likely to, eliminate the release of waste water or contaminants to waters, evaluate the following options for waste water or contaminants, in the order in which they are listed—

(i) appropriate treatment and release to a waste facility or sewer;

(ii) appropriate treatment and release to land;

(iii) appropriate treatment and release to surface waters or ground waters.

(3) In this section—

appropriate treatment, of waste water or contaminants, means—

(a) for release to a sewerage service provider's waste facility or sewer—treatment that meets the service provider's requirements for the release to the waste facility or sewer; or

(b) for release to land—treatment that ensures the release to land is ecologically sustainable; or

(c) for release to surface waters or ground waters—treatment that ensures the release will not affect the environmental values for the waters.

waste facility means a facility for the recycling, reprocessing, treatment, storage, incineration, conversion to energy or disposal of waste.

14 Management intent for waters

(1) This section states the management intent for waters subject to an activity that involves the release of waste water or contaminants to the waters.

Note—

See the *Environmental Protection Regulation 2008*, section 51.

(2) It is the management intent for the waters that the decision to release the waste water or contaminant must ensure the following—

(a) for high ecological value waters—the measures for the indicators for all environmental values are maintained;

(b) for slightly disturbed waters—the measures for the slightly modified physical or chemical indicators are progressively improved to achieve the water quality objectives for high ecological value water;

(c) for moderately disturbed waters—

(i) if the measures for indicators of the environmental values achieve the water quality objectives for the water—the measures for the indicators are maintained at levels that achieve the water quality objectives for the water; or

(ii) if the measures for indicators of the environmental values do not achieve the water quality objectives for the water—the measures for indicators of the environmental values are improved to achieve the water quality objectives for the water;

(d) for highly disturbed waters—the measures for the indicators of all environmental values are progressively improved to achieve the water quality objectives for the water.

Part 6 Environmental plans

Division 1 Preliminary

15 Purpose of policy to be considered

In developing and implementing an environmental plan under this part, a local government or sewerage service provider must consider the purpose of this policy and how the purpose is to be achieved.

Notes—

See sections 4 (Purpose of policy) and 5 (How purpose of policy is achieved).

See also section 358 (When order may be issued) of the Act for when the administering authority may issue an environmental protection order to secure compliance with this policy.

16 Development and implementation of environmental plans

(1) If, under this part, a local government or sewerage service provider must develop and implement an environmental plan about trade waste management, it must develop and start implementing the plan within 1 year after the commencement of this policy.

(2) If, under this part, a local government must develop and implement an environmental plan other than a plan about trade waste management, it must develop and start implementing the plan—

(a) for a distributor-retailer's participating local government—before 1 July 2012; or

(b) for a large local government, other than a distributor-retailer's participating local government—before 1 July 2013; or

(c) for another local government—before 1 July 2014.

(3) In this section—

large local government means a local government having a local government area with a population of more than 50000.

17 Reporting and review of environmental plans

(1) The local government or sewerage service provider must—

(a) after an environmental plan has been developed, and certified and endorsed under section 23—publish the plan on its website; and

(b) within 4 years after the plan is published under paragraph (a)—give the chief executive a report on the plan's implementation; and

(c) within 5 years after the plan is published under paragraph (a)—review and update the plan.

(2) The chief executive may at any time require a local government or sewerage service provider to review and amend its environmental plans.

18 Compliance with part

A local government may comply with a requirement under this part to develop and implement an environmental plan by using and implementing a plan prepared by it that complies with this policy, even though the plan was not originally prepared for this policy.

Division 2 Environmental plans—local governments and sewerage service providers

19 Total water cycle management—general

(1) A following local government must develop and implement an environmental plan about water cycle management for its local government area (a ***total water cycle management plan***)—

(a) a distributor-retailer's participating local government;

(b) a local government, other than a distributor-retailer's participating local government, if its local government area has a population of at least 25000;

(c) another local government if the chief executive requires it to develop and implement a total water cycle management plan, having regard to the water management requirements for the local government's area, including any results of ambient monitoring carried out under section 26.

Note—

In making a water netserv plan under the *South-East Queensland Water (Distribution and Retail Restructuring) Act 2009*, a distributor-retailer must, under section 99BQ(1)(c) of that Act, have regard to each of its participating local governments' total water cycle management plans.

(2) A local government's total water cycle management plan must include provisions about—

(a) the collection, treatment and recycling of waste water, stormwater, ground water and other water sources; and

(b) the integration of water use in its area.

(3) In developing and implementing the plan, the local government must have regard to—

(a) any guidelines published by the department about water cycle management; and

(b) any regional water security program made under the *Water Act 2000*, section 360M applying to its local government area; and

(c) any regional water supply strategy applying to its local government area; and

(d) for a local government within the SEQ region, each of the following plans, to the extent the plan applies to its local government area—

(i) SEQ regional plan;

(ii) any sub-regional total water cycle management plan under the SEQ regional plan.

(4) The local government must consider including in the plan—

(a) a strategy for demand management for water in its local government area; and

(b) ways to increase recycling of waste water and stormwater for purposes including, for example, industrial or agricultural purposes; and

(c) ways to use recycled waste water; and

(d) opportunities for stormwater harvesting for use as a water source; and

(e) the impacts of existing and future land use in the area on water cycle management, including the following—

(i) impacts of the use on the natural flow of waters;

(ii) impacts of the use on water quality objectives for waters;

(iii) the risks to drinking water supplies caused by the use; and

(f) a forecast of the water supply requirements for the area.

Note—

For other matters that must be included in the plan, see sections 20 to 22.

(5) If, under subsection (1)(b), the chief executive requires a local government to develop and implement a total water cycle management plan, the chief executive must advise the local government about the requirement in writing.

(6) In this section—

demand management, for water, see the *Water Supply (Safety and Reliability) Act 2008*, schedule 3.

regional water supply strategy means a document about short-term and long-term water supply security for particular regions, published by the department.

Note—

Regional water supply strategies are available on the department's website at <www.derm.qld.gov.au>.

SEQ regional plan means the regional plan for the SEQ region under the Planning Act.

20 Total water cycle management—sewage management

(1) A local government's total water cycle management plan must include provisions about the following for each waste water treatment plant in its local government area—

(a) effluent management;

(b) waste water recycling;

(c) sewerage system overflows;

(d) biosolids management.

(2) The local government must consider including in the plan provisions about—

(a) ways of improving effluent quality, reducing effluent contaminant loads and toxicity and increasing waste water recycling for the waste water treatment plant; and

(b) for water into which waste water may be released—

(i) the water quality objectives for the water; and

(ii) monitoring and reporting of releases of waste water; and

(iii) ambient monitoring of the water; and

(c) the maintenance of acceptable health risks; and

(d) ways of reducing infiltration to sewers; and

(e) minimising sewerage system overflows in a way that is consistent with the AWQ guidelines; and

(f) if the local government's area includes a boat harbour, marina or mooring, the management of sewage collected from vessels at the boat harbour, marina or mooring; and

(g) the management of biosolids in a way that is consistent with the document called 'Management for beneficial re-use of biosolids for sewage treatment plants July 2006', published by the department; and

(h) the health and safety of people working on the sewerage service.

21 Total water cycle management—urban stormwater quality management

(1) A local government's total water cycle management plan must include provisions about its stormwater quality management to improve the quality and flow of stormwater in ways that protect the environmental values of waters affected by the local government's urban stormwater system.

(2) The local government must consider including in the plan provisions about—

(a) identifying urban stormwater quality management needs for developed and developing areas that are consistent with the local government's priority infrastructure plan under the Planning Act; and

(b) the opportunities for stormwater harvesting, recycling or re-use; and

(c) incorporating water sensitive urban design in developed areas within a stated period; and

(d) managing urban stormwater quality and flows for development in the local government's area, having regard to the following documents—

(i) any site specific documents;

(ii) the QWQ guidelines;

(iii) relevant guidelines published by the department about stormwater quality; and

(e) monitoring and reporting processes for stormwater quality management.

22 Trade waste management

(1) This section applies to a local government or other entity that is a sewerage service provider, if the local government or entity permits trade waste to enter its sewerage services.

Note—

However, see the *South-East Queensland Water (Distribution and Retail Restructuring) Act 2009*, section 100A for how this section applies to a distributor-retailer under that Act.

(2) The local government or entity must develop and implement an environmental plan about trade waste management to control trade waste entering its sewerage services.

(3) The local government or other entity must consider including in the plan—

(a) requirements for waste prevention, treatment and recycling before the release of trade waste to a sewer may be authorised; and

(b) provisions about the effect of trade waste on—

(i) the receiving environment into which the trade waste is released; and

(ii) the end use of waters to which trade waste is being released; and

(iii) the materials used to construct the local government's or entity's sewerage service; and

(iv) the health and safety of people working on the sewerage service; and

(v) the treatment capabilities of waste water treatment plants; and

(c) a process for carrying out regular reviews of the quantity and content of trade waste entering the sewerage service.

(4) If a local government is required under section 19 to develop and implement a total water cycle management plan, the local government's plan about trade waste management must be included in its total water cycle management plan.

23 Certification and endorsement of plans

(1) This section applies to the following—

(a) a plan to which section 18 applies;

(b) a total water cycle management plan;

(c) a management plan about trade waste management.

(2) Each plan must—

(a) be independently certified by a registered professional engineer under the *Professional Engineers Act 2002* as complying with this policy; and

(b) if the plan is developed and implemented by a distributor-retailer's participating local government—be endorsed by the distributor-retailer.

(3) The certification must include the engineer's name and registration details.

Division 3 Other environmental plans

24 Healthy waters management plans

(1) The chief executive may, in cooperation with the chief executive (fisheries), develop and implement an environmental plan about water (a ***healthy waters management plan***) to decide ways to improve the quality of the water.

(2) Also, a recognised entity, in cooperation with the chief executive, may develop and implement a healthy waters management plan.

(3) A healthy waters management plan for water must—

(a) describe the water to which the plan applies; and

(b) include an assessment of the following for the water—

(i) any threats to water-dependent ecosystems;

(ii) any matters that may adversely affect the use of the water as a supply of drinking water;

(iii) any matters that may adversely affect the natural flows of the water; and

(c) if environmental values and water quality objectives for the water are stated in a document mentioned in schedule 1, column 2—include the environmental values and water quality objectives; and

(d) if environmental values and water quality objectives have not been established for the water—include proposed environmental values, management goals and water quality guidelines for the water; and

(e) if a water resource plan under the *Water Act 2000* applies to the water—include the environmental flow objectives for the plan and ecological outcomes stated in the plan for the water; and

(f) identify ways to protect the environmental values for the water, and to monitor and assess the effectiveness of the protection.

(4) In developing and implementing the plan, the chief executive or entity must have regard to any guidelines published by the department about healthy waters management plans.

Part 7 Functions of chief executive

25 Community awareness and involvement

(1) This section applies if the chief executive decides to develop and implement a plan to—

(a) raise community awareness of issues about water quality; and

(b) involve the community in water quality management.

(2) The chief executive must consider including in the plan—

(a) a description of the issues about water quality; and

(b) ways to raise community awareness and understanding about water quality policy, planning and management; and

(c) ways to improve levels of community consultation in relation to water quality management, including consultation carried out under this policy; and

(d) ways to better inform the community of issues about water quality management.

26 Ambient monitoring

(1) If the chief executive carries out a program of ambient monitoring of waters to assess the state of Queensland waters, the chief executive must—

(a) carry out the monitoring under—

(i) the document called ‘Monitoring and Sampling Manual 2009’ published by the department; and

(ii) the AWQ guidelines; and

Editor’s note—

The document called ‘Monitoring and Sampling Manual 2009’ may be inspected at the department’s office at level 3, 400 George Street, Brisbane and on the department’s website at <www.derm.qld.gov.au>.

(b) publish the results of the monitoring on the department’s website; and

(c) prepare a report about the results of the monitoring.

(2) To the extent of any inconsistency between the documents mentioned in subsection (1)(a), the document mentioned in subsection (1)(a)(i) prevails.

(3) If practicable, a comparison of ambient monitoring results with the water quality objectives for, and freshwater flows to, the water during the time of the monitoring must be included in the report.

(4) For a report prepared under this section, if the measure of an indicator does not comply with a water quality guideline because of a natural property of the water, the measure of the indicator is taken to comply with the water quality guideline.

(5) If the results of monitoring show the water quality objectives for the water have not been met, the chief executive may investigate the reasons why the water fails to meet the water quality objectives.

Part 8 Miscellaneous

27 Operation of sch 1

The boundaries of water mentioned in schedule 1, column 1 are the boundaries identified in the document stated opposite the water in schedule 1, column 2.

Editor's note—

A document mentioned in schedule 1 may be inspected at the department's office at level 3, 400 George Street, Brisbane and on the department's website at <www.derm.qld.gov.au>.

Part 9 Repeal and transitional provisions

Division 1 Repeal provision

28 Repeal

The Environmental Protection (Water) Policy 1997, SL No. 136 is repealed.

Division 2 Transitional provisions

29 Definitions for div 2

In this division—

commencement means the day this section commences.

repealed policy means the repealed *Environmental Protection (Water) Policy 1997*.

30 Effect of particular environmental plans

(1) This section applies if—

(a) a local government must, under this policy, develop and implement a total water cycle management plan; and

(b) on the commencement, the local government has any of the following plans developed under the repealed policy—

(i) an environmental plan about sewage management;

(ii) an environmental plan about stormwater quality management; and

(c) the plans mentioned in paragraph (b) comply with the requirements under this policy for a part of a total water cycle management plan.

(2) The local government's plan developed under the repealed policy is taken to be a plan to which section 18 applies.

31 Effect of trade waste management plan

(1) This section applies if—

(a) a local government must, under this policy, develop and implement an environmental plan about trade waste management; and

(b) on the commencement, the local government has an environmental plan about trade waste management developed under the repealed policy; and

(c) the plan mentioned in paragraph (b) complies with the requirements of this policy for an environmental plan about trade waste management.

(2) The local government's plan about trade waste management developed under the repealed policy is taken to be a plan about trade waste management under section 22.

32 Application of ss 16 and 17 to particular local governments

(1) This section applies to a local government required to develop and implement a total water cycle management plan under 19(1)(b).

(2) Sections 16 and 17 apply to the local government as if the references in the sections to the commencement of this policy were a reference to the day the local government was advised by the chief executive about the requirement under section 19(5).

33 References to repealed policy

In an Act or document, a reference to the repealed policy may, if the context permits, be taken as a reference to this policy.

Schedule 1 Environmental values and water quality objectives for waters

sections 6 and 10

Column 1 Water		Column 2 Document
Name	**Description**	
Albert River, including all tributaries of the river	part of basin 145	Albert River Environmental Values and Water Quality Objectives, published by the department in July 2010
Bloomfield River, including all tributaries of the river	part of basin 108	Bloomfield River Environmental Values and Water Quality Objectives, published by the department in July 2010
Bremer River, including all tributaries of the river	part of basin 143	Bremer River Environmental Values and Water Quality Objectives, published by the department in July 2010
Brisbane River, including all tributaries of the Brisbane River other than Bremer River, Lockyer Creek, Oxley Creek and Stanley River	part of basin 143	Brisbane River Environmental Values and Water Quality Objectives, published by the department in July 2010

Column 1 Water		Column 2 Document
Name	**Description**	
Brisbane creeks—Bramble Bay, including Bald Hills, Cabbage Tree, Downfall, Kedron Brook, Nudgee and Nundah creeks	part of basin 142	Brisbane Creeks—Bramble Bay Environmental Values and Water Quality Objectives, published by the department in July 2010
Broadwater, including— • Biggera and Loders creeks • the Broadwater and all creeks of the Broadwater catchment • Runaway Bay	part of basin 146	Broadwater Environmental Values and Water Quality Objectives, published by the department in July 2010
Burrum, Gregory, Isis, Cherwell and Elliott rivers, including all Hervey Bay coastal rivers and creeks	basin 137	Burrum, Gregory, Isis, Cherwell and Elliott Rivers Environmental Values and Water Quality Objectives, published by the department in July 2010
Caboolture River, including all tributaries of the river	part of basin 142	Caboolture River Environmental Values and Water Quality Objectives, published by the department in July 2010

Column 1 Water		Column 2 Document
Name	**Description**	
Coomera River, including all tributaries of the river	part of basin 146	Coomera River Environmental Values and Water Quality Objectives, published by the department in July 2010
Currumbin and Tallebudgera creeks and Pacific Beaches, including— • all tributaries of Currumbin and Tallebudgera creeks • all creeks of the Pacific Beaches catchment	part of basin 146	Currumbin and Tallebudgera Creeks Environmental Values and Water Quality Objectives, published by the department in July 2010
Daintree River, including all tributaries of the river	part of basin 108	Daintree River Environmental Values and Water Quality Objectives, published by the department in July 2010
Douglas central coastal creeks, including all coastal creeks between Mowbray River and Mossman River	part of basin 109	Douglas Central Coastal Creeks Environmental Values and Water Quality Objectives, published by the department in July 2010
Douglas coastal waters	adjacent to basins 108 and 109	Douglas Coastal Waters Environmental Values and Water Quality Objectives, published by the department in July 2010

Column 1 Water		Column 2 Document
Name	**Description**	
Douglas northern coastal creeks, including all coastal creeks north of Daintree River and east of Bloomfield River	part of basin 108	Douglas Northern Coastal Creeks Environmental Values and Water Quality Objectives, published by the department in July 2010
Douglas southern coastal creeks, including all coastal creeks between Mowbray River and Simpson Point	part of basin 109	Douglas Southern Coastal Creeks Environmental Values and Water Quality Objectives, published by the department in July 2010
Fraser Island waters	basin 139	Fraser Island Environmental Values and Water Quality Objectives, published by the department in July 2010
Great Sandy Strait and coastal creeks	part of basin 140 and adjacent to basins 137, 138 and 139	Great Sandy Strait and Coastal Creeks Environmental Values and Water Quality Objectives, published by the department in July 2010
Hervey Bay	adjacent to basins 137 and 139	Hervey Bay Environmental Values and Water Quality Objectives, published by the department in July 2010
Lockyer Creek, including all tributaries of the creek	part of basin 143	Lockyer Creek Environmental Values and Water Quality Objectives, published by the department in July 2010

Column 1 Water		Column 2 Document
Name	**Description**	
Logan River, including all tributaries of the river	part of basin 145	Logan River Environmental Values and Water Quality Objectives, published by the department in July 2010
Maroochy River, including all tributaries of the river	part of basin 141	Maroochy River Environmental Values and Water Quality Objectives, published by the department in July 2010
Mary River, including all tributaries of the river	basin 138	Mary River Environmental Values and Water Quality Objectives, published by the department in July 2010
Mooloolah River, including all tributaries of the river	part of basin 141	Mooloolah River Environmental Values and Water Quality Objectives, published by the department in July 2010
Moreton Bay	basin 144 and adjacent to basins 141 to 143, 145 and 146	Moreton Bay, North Stradbroke, South Stradbroke, Moreton and Moreton Bay Islands Environmental Values and Water Quality Objectives, published by the department in July 2010
Mossman River, including all tributaries of the river	part of basin 109	Mossman River Environmental Values and Water Quality Objectives, published by the department in July 2010
Mowbray River, including all tributaries of the river	part of basin 109	Mowbray River Environmental Values and Water Quality Objectives, published by the department in July 2010

Column 1 Water		Column 2 Document
Name	**Description**	
Nerang River, including all tributaries of the river	part of basin 146	Nerang River Environmental Values and Water Quality Objectives, published by the department in July 2010
Noosa River, including— • Kin Kin creek • Teewah coastal creeks • lakes Cooroibah, Cootharaba, Doonella and Weyba	part of basin 140	Noosa River Environmental Values and Water Quality Objectives, published by the department in July 2010
Oxley Creek, including all tributaries of the creek	part of basin 143	Oxley Creek Environmental Values and Water Quality Objectives, published by the department in July 2010
Pimpama River, including— • Behm and McCoys creeks • southern Moreton Bay coastal creeks	part of basin 146	Pimpama River Environmental Values and Water Quality Objectives, published by the department in July 2010

Column 1 Water		Column 2 Document
Name	**Description**	
Pine rivers and Redcliffe creeks, including— • Hays Inlet • all tributaries of the North Pine and South Pine rivers	part of basin 142	Pine Rivers and Redcliffe Creeks Environmental Values and Water Quality Objectives, published by the department in July 2010
Pumicestone Passage, including— • waters of Bribie Island • Bells, Coochin, Dux, Elimbah, Mellum, Ningi and Tibrogargan creeks	part of basin 141	Pumicestone Passage Environmental Values and Water Quality Objectives, published by the department in July 2010
Redland creeks, including Coolnwynpin, Eprapah, Hilliards, Lota, Moogurrapum, Tarradarrapin, Tingalpa and Wynnum creeks	part of basin 145	Redland Creeks Environmental Values and Water Quality Objectives, published by the department in July 2010
Saltwater Creek, including all tributaries of the creek	part of basin 108	Saltwater Creek Environmental Values and Water Quality Objectives, published by the department in July 2010

Column 1 Water		Column 2 Document
Name	**Description**	
Sandy, Six Mile, Wolston, Woogaroo and Goodna creeks including all tributaries of the creeks	part of basin 143	Sandy, Six Mile, Wolston, Woogaroo and Goodna Creeks Environmental Values and Water Quality Objectives, published by the department in July 2010
Stanley River, including all tributaries of the river	part of basin 143	Stanley River Environmental Values and Water Quality Objectives, published by the department in July 2010
Trinity Inlet	part of basin 111	Trinity Inlet Environmental Values and Water Quality Objectives, published by the department in July 2010

Editor's note—

A copy of each plan may be inspected on the department's website at <www.derm.qld.gov.au>.

Schedule 2 Dictionary

section 2

ambient monitoring, of water, includes assessing, analysing, examining, inspecting, measuring or reporting on the following—

(a) the quantity, quality and characteristics of water;

(b) the effectiveness of control, remedial or rehabilitation measures on the matters mentioned in paragraph (a).

aquatic ecosystem means a community of organisms living within or adjacent to water, including riparian or foreshore areas.

AWQ guidelines means the national guidelines made by the Commonwealth under the program known as the National Water Quality Management Strategy, published by the Natural Resource Management Ministerial Council.

basin, followed by a number, means the river basin of that number described in 'Australia's River Basins 1997', 3rd edition, published by Geoscience Australia, Commonwealth of Australia, in 2004.

Editor's note—

A map showing the river basins in Queensland can also be viewed on the department's website at <www.derm.qld.gov.au>.

biological integrity, of water, means the water's ability to support and maintain a balanced, integrative, adaptive community of organisms having a species composition, diversity and functional organisation comparable to that of the natural habitat of the locality in which the water is situated.

Examples—

The following are examples of biological integrity of water—

(a) the intrinsic value of an aquatic ecosystem that is effectively unmodified or highly valued;

(b) its ability to support associated wildlife;

(c) its ability to produce food for human consumption.

chief executive (fisheries) means the chief executive of the department in which the *Fisheries Act 1994* is administered.

commencement see section 29.

contaminated stormwater means stormwater that contains a contaminant.

distributor-retailer see the *South-East Queensland Water (Distribution and Retail Restructuring) Act 2009*, schedule.

environmental values means the environmental values mentioned in section 6.

ground water means water that occurs naturally in, or is introduced artificially into, an aquifer.

healthy waters management plan see section 24(1).

high ecological value waters means waters in which the biological integrity of the water is effectively unmodified or highly valued.

highly disturbed waters means waters that are significantly degraded by human activity and have lower ecological value than high ecological value waters or slightly or moderately disturbed waters.

indicator see section 7(1).

moderately disturbed waters means waters in which the biological integrity of the water is adversely affected by human activity to a relatively small but measurable degree.

participating local governments, for a distributor-retailer, see the *South-East Queensland Water (Distribution and Retail Restructuring) Act 2009*, section 5.

Queensland regional NRM body means a Queensland regional natural resource management body under the Commonwealth program known as 'Caring for Our Country'.

QWQ guidelines means the document called 'Queensland water quality guidelines 2009' published by the department.

Editor's note—

A copy of the guidelines may be inspected at the department's office at level 3, 400 George Street, Brisbane and on the department's website at <www.derm.qld.gov.au>.

recognised entity means—

(a) a local government; or

(b) a public sector unit; or

(c) an agency of the Commonwealth or another State, however called, with similar functions to the functions of the chief executive under this policy; or

(d) a ministerial council established by the Council of Australian Governments; or

(e) the Commonwealth Scientific and Industrial Research Organisation; or

(f) a research centre completely or partly funded by the Commonwealth; or

(g) an Australian university; or

(h) a Queensland regional NRM body; or

(i) Healthy Waterways Limited ACN 137 943 554.

recycling, of waste water, means—

(a) re-using the waste water in the process that generated it; or

(b) re-processing the waste water to develop a new product; or

(c) using the waste water (whether on or off the site where it is generated).

repealed policy see section 29.

sewerage service means—

(a) sewage treatment; or

(b) the collection and transmission of sewage through infrastructure; or

(c) the disposal of sewage or effluent.

sewerage service provider see the *Water Supply (Safety and Reliability) Act 2008*, schedule 3.

site specific document means a document that—

(a) contains specific information about a water, or part of a water; and

(b) is recognised by the chief executive as having appropriate scientific authority.

slightly disturbed waters means waters that have the biological integrity of high ecological value waters with slightly modified physical or chemical indicators but effectively unmodified biological indicators.

stormwater treatment system means a system used for managing stormwater quality, quantity and flows.

surface waters means waters other than ground waters.

total water cycle management plan see section 19(1).

trade waste see the *Water Supply (Safety and Reliability) Act 2008*, schedule 3.

waste prevention means the adoption of practices or processes that avoid generating waste or reduce the quantity of waste requiring subsequent treatment, recycling or disposal.

waste water means aqueous waste, and includes contaminated stormwater.

waste water treatment plant includes a sewage treatment plant, advanced waste water treatment plant, water reclamation plant, industrial waste water treatment system and any other plant whose primary function is to treat waste water.

water quality guidelines see section 7(2).

water quality objectives, for water, are the objectives identified under section 10 for protecting the environmental values for the water.

waters includes the bed and banks of waters.

water sensitive urban design means urban planning or design that integrates water cycle management.

Endnotes

1 Index to endnotes

2 Date to which amendments incorporated

This is the reprint date mentioned in the Reprints Act 1992, section 5(c). Accordingly, this reprint includes all amendments that commenced operation on or before 16 July 2010. Future amendments of the Environmental Protection (Water) Policy 2009 may be made in accordance with this reprint under the Reprints Act 1992, section 49.

3 Key

Key to abbreviations in list of legislation and annotations

Key		Explanation	Key		Explanation
AIA	=	**Acts Interpretation Act 1954**	**(prev)**	=	**previously**
amd	=	**amended**	**proc**	=	**proclamation**
amdt	=	**amendment**	**prov**	=	**provision**
ch	=	**chapter**	**pt**	=	**part**
def	=	**definition**	**pubd**	=	**published**
div	=	**division**	**R[X]**	=	**Reprint No. [X]**
exp	=	**expires/expired**	**RA**	=	**Reprints Act 1992**
gaz	=	**gazette**	**reloc**	=	**relocated**
hdg	=	**heading**	**renum**	=	**renumbered**
ins	=	**inserted**	**rep**	=	**repealed**
lap	=	**lapsed**	**(retro)**	=	**retrospectively**
notfd	=	**notified**	**rv**	=	**revised edition**
num	=	**numbered**	**s**	=	**section**
o in c	=	**order in council**	**sch**	=	**schedule**
om	=	**omitted**	**sdiv**	=	**subdivision**
orig	=	**original**	**SIA**	=	**Statutory Instruments Act 1992**
p	=	**page**	**SIR**	=	**Statutory Instruments Regulation 2002**
para	=	**paragraph**	**SL**	=	**subordinate legislation**
prec	=	**preceding**	**sub**	=	**substituted**
pres	=	**present**	**unnum**	=	**unnumbered**
prev	=	**previous**			

4 Table of reprints

Reprints are issued for both future and past effective dates. For the most up-to-date table of reprints, see the reprint with the latest effective date.

If a reprint number includes a letter of the alphabet, the reprint was released in unauthorised, electronic form only.

Reprint No.	Amendments included	Effective	Notes
1	none	28 August 2009	
1A	2009 SL No. 280	18 December 2009	
1B	2010 SL No. 185	16 July 2010	

5 List of legislation

Environmental Protection (Water) Policy 2009 SL No. 178

made by the Minister for Climate Change and Sustainability on 18 August 2009
notfd gaz 28 August 2009 pp 1491–6
commenced on date of notification
exp 1 September 2019 (see SIA s 54)
Notes—(1) The expiry date may have changed since this reprint was published. See the latest reprint of the SIR for any change.
(2) An explanatory note was prepared.

amending legislation—

Sustainable Planning Regulation 2009 SL No. 280 ss 1–2, pt 9 div 9

notfd gaz 27 November 2009 pp 1001–6
ss 1–2 commenced on date of notification
remaining provisions commenced 18 December 2009 (see s 2)

Environmental Protection (Water) Amendment Policy (No. 1) 2010 SL No. 185

notfd gaz 16 July 2010 pp 1142–3
commenced on date of notification

6 List of annotations

Environmental values to be enhanced or protected
s 6 amd 2010 SL No. 185 s 3

Development and implementation of environmental plans
s 16 sub 2010 SL No. 185 s 4

Reporting and review of environmental plans
s 17 amd 2010 SL No. 185 s 5

Total water cycle management—general
s 19 amd 2010 SL No. 185 s 6

Total water cycle management—urban stormwater quality management
s 21 amd 2009 SL No. 280 s 74

Trade waste management
s 22 amd 2010 SL No. 185 s 7

Certification and endorsement of plans
prov hdg amd 2010 SL No. 185 s 8(1)
s 23 amd 2010 SL No. 185 s 8(2)

SCHEDULE 1—ENVIRONMENTAL VALUES AND WATER QUALITY OBJECTIVES FOR WATERS
amd 2010 SL No. 185 s 9

SCHEDULE 2—DICTIONARY
def **"distributor-retailer"** ins 2010 SL No. 185 s 10
def **"participating local governments"** ins 2010 SL No. 185 s 10

Guideline

Protecting Environmental Values from Coal Seam Gas Water Discharged to Waters

Water and Ecosystem Outcomes Division, Water Quality and Accounting

Version 1.4

28 October 2010

Guideline

Protecting Environmental Values from Coal Seam Gas Water Discharged to Waters

Version Number: 1.4

SIGN OFF BY DELEGATED OFFICER:

1. Operationally capable of being implemented			
Endorsed by:	**Position:** Director, Healthy Waters Policy	**Signature:**	
	Date:		
2. Meets business policy and legislative needs			
Endorsed by:	**Position:** General Manager, Water Quality and Accounting	**Signature:**	
	Date:		
3.			
Endorsed by:	**Position:** DDG, Water Division	**Signature:**	
	Date:		
4.			
Endorsed by:	**Position:** DG, DERM	**Signature:**	
	Date:		

Metadata

Item	Details
File No.	
WQA Subject leader	[redacted] Principal Policy Officer
Location	
Review trigger	Annual: Next Scheduled Review Date:

Version History

Version Number	Date	Changed by	Nature of amendment
1.0	20/08/10	[redacted]	Document created following internal consultation
1.1	02/09/10		Document review to incorporate internal comments
1.2	24/09/10		Document review to incorporate internal comments
1.3	04/10/10		Title change as per EMG CSG Sub-Committee comments: Interim Policy to Guideline
1.4	28/10/10		Document review to incorporate UWP&M comments

1. Purpose

The purpose of this document is to provide guidance to decision makers and information on the existing legislative framework to ensure that the disposal of Coal Seam Gas (CSG) water to Queensland waters, including surface and ground waters, is managed to avoid or minimise environmental harm. This includes the scenarios where CSG water is:

- Considered as waste water and disposed of to Queensland waters (including surface waters, and groundwaters via aquifer re-injection or re-charge); or

- Approved for re-use and is being transported and/or stored in waters or returned to waters via overland flow or aquifer recharge.

CSG water under the EP Act s310D (7) means underground water brought to the surface of the earth or moved underground in connection with exploring for or producing coal seam gas. The 'Coal Seam Gas Water Management Policy' provides information on the activity and the department's position with regard to the preferred options for the management of CSG water. The options for disposal of CSG water currently include injection into natural underground reservoirs or aquifers of equal or lesser water quality, direct use of treated CSG water and/or discharge of CSG water to surface waters. The disposal of CSG water directly to surface waters is not a preferred management option. Where injection is technically and economically feasible, operators should inject treated water into aquifers that are under developmental stress and/or are at risk of adverse impact from CSG activity, as a first priority for the use of treated CSG water.

2. Scope

This document is a guideline which outlines, and provides some interpretation of the broad statutory requirements, guidelines and supporting documents as they are relevant to the management of CSG water to protect environmental values. Future versions of this guideline document will include additional reference to the following areas:

- Monitoring and reporting standards;
- Approach to cumulative impacts; and
- Mapping the Department of Environment and Resource Management's roles and responsibilities.

3. Statutory Requirements and Supporting Documents

The statutory bases for managing CSG water discharged to Queensland waters along with supporting documents linked to these statutes are primarily as follows:

<u>State Legislation</u>

- *Environmental Protection Act 1994* (EP Act). The object of the EP Act is to 'protect Queensland's environment while allowing for development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends (*ecologically sustainable development- ESD)'*. Chapter 5A of the EP Act provides for environmental authorities for petroleum activities which includes CSG activities. The supporting documents include:
  - Coal Seam Gas Water Management Policy

- Guideline: Preparing an Environmental Management Plan for Coal Seam Gas activities
- Guideline: Model conditions for level 1 environmental authorities for coal seam gas activities
- Operational Policy: Waste water discharge to Queensland Waters

- *Environmental Protection Regulation 2008* (EP Reg). This is subordinate legislation made under the EP Act to regulate the protection of the environment.

- *Environmental Protection (Water) Policy 2009* (EPP Water). The purpose of the EPP Water is to 'achieve the object of the EP Act in relation to Queensland waters'. Environmental values and water quality objectives are scheduled in this policy. The supporting documents include:
  - Monitoring and Sampling Manual 2009
  - Queensland Water Quality Guidelines 2009

- *Environmental Protection (Waste Management) Policy 2000*. The object of this policy is to achieve the object of the EP Act in relation to waste management. The policy provides a waste management hierarchy to be applied to the management of CSG water, and principle for identifying environmental protection commitments, objectives and control strategies. The supporting documents include:
  - Guideline: Approval of coal seam gas water for beneficial use

- *Water Act 2000*. To advance sustainable management and efficient use of water and other resources by establishing a system for the planning, allocation and use of water. Water Resource Plans (WRPs) and Resource Operation Plans (ROPs) are developed under the Act.

<u>Commonwealth Legislation</u>

- *Environmental Protection and Biodiversity Conservation Act 1999 (Cth)*. This Commonwealth Act provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places - matters of national environmental significance. DERM is not the administering authority for this legislation.

- Murray Darling Basin Agreement - Schedule 1 of the *Water Act 2007 (Cth)*. The purpose of the agreement is to 'promote and co-ordinate effective planning and management for the equitable, efficient and sustainable use of the water and other natural resources of the Murray-Darling Basin, including by implementing arrangements agreed between the Contracting Governments to give effect to the Basin Plan, the *Water Act* and State water entitlements.' DERM is not the administering authority for this legislation.

4. DERM as an Administering Authority

Proponents will be required to meet all relevant statutory requirements as identified in the State and Commonwealth legislation. However, DERM is the administering authority when assessing and conditioning an environmental authority (EA) under the EP Act for discharging CSG water to Queensland waters. The administering authority must comply with any relevant regulatory requirement; consider standard criteria; and any additional information. The EP Reg s5 establishes a range of matters to be considered for environmental management decisions. S51 (1) (a) states that:

(1) The administering authority must, for making an environmental management decision relating to an activity, consider the following matters—

(a) each of the following under any relevant environmental protection policies—

(i) the management hierarchy;

(ii) environmental values;

(iii) quality objectives;

(iv) the management intent;

Section 13 of the *Environmental Protection (Water) Policy 2009* (EPP Water 2009) states the management hierarchy for an activity that may affect a water. The release of waste water or contaminants must be dealt with according to the stated hierarchy of preferred procedures under section 13 (2) (a) to (d).

Environmental values and water quality objectives for waters are addressed under Part 5 of this Guideline.

Section 14 of the EPP Water 2009 states the management intent for waters subject to an activity that involves the release of waste water or contaminants to the waters. The management intent depends on the level of aquatic ecosystem protection for the waters.

In order to protect the environment it is necessary to define any related impact. Under the EP Act, environmental harm is defined as any adverse effect, or potential adverse effect (whether temporary or permanent and of whatever magnitude, duration or frequency) on an environmental value, and includes environmental nuisance (s14). CSG activities are classified as either Level 1 or 2 activities (defined in Schedule 5 of the EP Reg) based on the risk of environmental harm being caused by the activities. Assessment processes for Level 1 activities are more comprehensive and may require the completion of an environmental impact statement (EIS).

An EA application for a Level 1 CSG activity must be accompanied by an environmental management plan (EM Plan) to demonstrate that the applicant has considered all potential impacts of the proposed petroleum activities. EM Plans must be prepared in accordance with s310D of the EP Act. The department has developed the guideline 'Preparing an environmental management plan for coal seam gas activities' to provide information to proponents on EM Plan preparation. The EM Plan as it refers to environmental values must among other things:

(b) describe each of the following—

(iv) the environmental values likely to be affected by the activities;

(v) the potential adverse and beneficial impacts of the activities on the environmental values; and

(c) state the environmental protection commitments the applicant proposes for the activities to protect or enhance the environmental values under best practice environmental management; and

(d) contain enough other information to allow the administering authority to decide the application and conditions to be imposed on

the environmental authority (chapter 5A activities); and

The guideline document ‘Model conditions for level 1 environmental authorities for coal seam gas activities’ provides a set of model conditions that can form the basis of environmental protection commitments given in the EM Plan and EA.

5. Environmental Values

Environmental values are defined in EP Act s9. For Queensland waters they are the aquatic ecosystem and human use values in s6 (2) of the EPP Water—

(a) for high ecological value waters—the biological integrity of an aquatic ecosystem that is effectively unmodified or highly valued;

(b) for slightly disturbed waters—the biological integrity of an aquatic ecosystem that has effectively unmodified biological indicators, but slightly modified physical, chemical or other indicators;

(c) for moderately disturbed waters—the biological integrity of an aquatic ecosystem that is adversely affected by human activity to a relatively small but measurable degree;

(d) for highly disturbed waters—the biological integrity of an aquatic ecosystem that is measurably degraded and of lower ecological value than waters mentioned in paragraphs (a) to (c);

(e) for waters that may be used in primary industry or for agricultural purposes, the suitability of the water for—
(i) agricultural use; or
(ii) aquacultural use; or
(iii) producing aquatic foods for human consumption;

(f) for waters that may be used for recreation or aesthetic purposes, the suitability of the water for—
(i) primary recreational use; or
(ii) secondary recreational use;

(g) for waters that may be used for drinking water—the suitability of the water for supply as drinking water;

(h) for waters that may be used for industrial purposes—the suitability of the water for industrial use;

(i) the cultural and spiritual values of the water.

If an environmental value for particular water has not been scheduled in Schedule 1 of the EPP Water then s7 states the following:

(3) For particular water, the indicators and water quality guidelines for an environmental value are—
(a) decided using the following documents—
(i) site specific documents for the water;
(ii) the Queensland Water Quality guidelines;

(iii) the Australian Water Quality guidelines;

(iv) other relevant documents published by a recognised entity;

For the management of ground waters, documents that would be identified under s(3) (iv) above include the National Water Quality Management Strategy (NWQMS) Australian Guidelines for Water Recycling: Managing Health and Environmental Risks (Phase 2): Managed Aquifer Recharge. While it is recognised that this guideline does not specifically deal with injection of CSG water, there are a number of elements that may apply to injection of brine and treated and untreated CSG water. Therefore wherever applicable, this NWQMS guideline may be considered the basis for assessment of injection proposals.

In establishing and scheduling environmental values (EVs) for waters in the EPP Water, and the subsequent derivation of water quality objectives (WQOs) to protect the values, the process is independent of any release to receiving waters. In other words the environmental values are determined before any release to waters is considered, and is a completely independent process. Under s 8 of the EPP Water, the environmental values for a particular water are protected if the measures for all indicators do not exceed the water quality guidelines stated for the indicators. This encompasses a commonly used range of some 20 water quality guidelines but also extends to all measures for all indicators to protect the environmental values. The EPP Water defines water quality guidelines as ‘quantitative measures or statements for indicators, including contaminant concentration or sustainable load measures of water, that protect a stated environmental value’. If the environmental values for an area have not been scheduled the ecological assets included in WRPs, which are developed under the Water Act, may also provide information. WRPs are recognised as other relevant documents as per s7 (3) (iv) of the EP Act.

6. Environmental Authorities

There are two key areas of risk to aquatic ecosystem and human use environmental values from the discharge of CSG water to Queensland waters that require management to ensure their protection:

1. Changes to water quality (including physical, chemical and biological characteristics); and
2. Changes to in-stream and groundwater hydrology (including associated ecosystem impacts due to the volume and timing of discharges).

A precautionary and adaptive management approach is advocated to address these areas of risk, which is consistent with the objectives of the EP Act and the EPP Water.

EAs are required under chapter 5A of the EP Act for environmentally relevant activities, including for petroleum activities. The administering authority may impose the conditions on the environmental authority (chapter 5A activities) it considers are necessary or desirable (s309z). For an EA to discharge CSG water to waters conditions to meet specified water quality and hydrological requirements to protect environmental values would be included.

6.1 Water Quality

<u>*Background*</u>

CSG water at all stages of the process should be fully characterised, this includes the quantity and quality of the water before and after production and treatment and at the point of discharge. This is consistent with the risk-based approach adopted in the National Water Quality Management Strategy (NWQMS). The NWQMS Guidelines for Fresh and Marine Water Quality, EPP Water and the Qld Water Quality Guidelines 2009 state that locally applicable guidelines for indicators should be used in preference to less specific regional and national guidelines. This requires a detailed risk assessment to be undertaken, and indicators of concern to be identified. The indicator for an environmental value is a 'physical, chemical, biological or other property that can be measured or decided in a quantitative way' (EPP Water s7(1)). Indicators are then conditioned in the EA (EP Act Ch 5) for the activity. If detailed characterisation is not undertaken, conditioning in the EA will be necessarily more stringent. This is consistent with the precautionary approach.

The general characterisation of CSG water quality as reported in the literature has identified a range of possible risks to environmental values. These values for aquatic ecosystems and human use (including suitability of the waters used for primary industry or agricultural purposes, primary and secondary recreation, drinking water, industrial purposes and cultural and spiritual values) are enhanced or protected by maintaining the water quality objectives (WQOs) for the receiving waters. To provide for appropriate environmental management, WQOs are identified to protect environmental values and are then scheduled in the EPP Water. In the absence of scheduled WQOs, water quality guidelines for all indicators that will protect environmental values for the water are used. To achieve this legislative requirement, any release of CSG water to receiving waters must be conditioned in accordance with s51 (1) (a) of the EP Reg.

Implementation

The required water quality for CSG water discharged to Queensland waters will be conditioned through an EA issued under the EP Act and in accordance with section 51 of the EP Reg (see Attachment 1).

As previously stated, under the EPP Water, the environmental values (values for aquatic ecosystem and human use) for particular water are protected if the measures for all indicators do not exceed the water quality guidelines stated for the indicators. To achieve this outcome, any proposed release is required to be assessed, in part with s51 of the EP Reg. Monitoring, reporting and incident management requirements will also be identified in the EA. A detailed risk assessment is to be undertaken using appropriate CSG water characterisation data. This will allow for parameters of concern to be identified and then included in the EA conditions for the activity.

To protect environmental values the quality of CSG water discharged to waters will need to be within an acceptable upper and/or lower bounds to ensure the WQOs required to protect the aquatic ecosystem health and relevant human use environmental values are achieved. This is of particular importance in the likely scenario of CSG water being treated with reverse osmosis and then discharged to ephemeral systems where at times CSG water is likely to flush and / or fill natural waterholes and make-up 100% of the flow. Attachment 2 discusses potential issues associated with discharging large quantities of CSG water to waters.

If CSG water is to be reinjected to an aquifer there are some key components of the injection proposal risk assessment to protect the environmental values and the groundwater resource values associated with the water quality impact zone and hydraulic impact zone where fluid is proposed to be injected. These components include:

a) the establishment of baseline data and hydrogeological conceptualisation of the aquifer;
b) the identification of potential hazards of re-injection and related activities and their inherent risk; and
c) the identification of injection standards (including proposed limits for contaminants of concern), requirements, preventative measures and residual risk.

Risk assessments of proposed discharges of CSG water to waters must be sufficient to demonstrate that the regulatory requirements of section 63(2) of the *Environmental Protection Regulation 2008* will be met. A guiding framework for risk assessments is provided in relevant NWQMS guidelines.

The requirements for monitoring programs and reporting should be included in the conditions of the EA for the activity. The monitoring programs and reporting should be designed to ensure EA conditions are being met and that strategic data collection to enhance the understanding of cumulative impacts is undertaken. The collection of this data will ensure that adaptive management to protect environmental values occurs. Specific monitoring programs include:

- Baseline conditions of the receiving environment: For surface waters ambient monitoring in accordance with the *Queensland Water Quality Guidelines (2009)*;
- Quality of the CSG water discharged; and
- Receiving environment impacts: This should include assessment of the impact of the release on the receiving waters with a requirement to implement a multiple before-after control impact design to assess changes as per the Australia New Zealand Guidelines for Fresh and Marine Water Quality (2000).

These requirements are further outlined in Schedule I of the guideline 'Model conditions for coal seam gas activities'. Specific requirements of the Receiving Environment Monitoring Program (REMP) are found in Appendix 1 (BA15-BA18) of the same document. Monitoring should be undertaken in line with the EPP Sampling Manual.

Implementation to align with Water Safety (Supply and Reliability) Act 2008 requirements

Legislative reforms to the *Water Safety (Supply and Reliability) Act 2008* (WS (S&R) Act) are proposed to provide purpose built rigorous requirements for CSG water which has a material impact on town drinking water supply sources, in order to protect public health. In the scenario where CSG water directly or in-directly augments a town drinking water supply source and there is a material impact on the supply source, the proposed reforms in the WS (S&R) Act will require the development of a Recycled Water Management Plan (RWMP). The regulated entity will be required to prove that the treatment process and supporting management arrangements will consistently deliver water of the quality required. Where there is direct supply of treated CSG water to a drinking water service provider for the use in a town drinking water supply source, then the drinking water service provider will also require a Drinking Water Quality Management Plan.

CSG water quality standards will be prescribed by Queensland Health (QH) under the *Public Health Regulation 2005*. This is currently being developed and in the interim, the regulator will set the water quality standard as part of the RWMP consistent with the standard prepared by QH.

If there is no material impact on a town's drinking water supply source, then there may be an exclusion from the requirement for a RWMP (for defined circumstances in a regulation for discharges into an aquifer or if these are not applicable, then through a regulator's exclusion decision and attached conditions).

The process under the EP Act, EP Reg and EPP Water to protect environmental values (including the suitability of the water for supply as drinking water) through conditions in the EA for the activity will also apply. This means that there will be co-regulation of the activity – both under the EP Act and the WS (S&R) Act. Consequently standards may be imposed under the EP Act as well as under the WS (S&R) Act. If there are different values for a particular indicator, then the holder of the EA/RWMP will need to meet the most stringent of the requirements. To make certain that there are no inadvertent conflicts in the EA conditions and RWMP conditions, DERM Project Managers will ensure that a detailed risk assessment and adaptive management process is undertaken, and that through feedback processes any inconsistencies are identified early and addressed. See Attachment 2. for a discussion on these issues. Conditions in the EA and RWMP will require notification to the relevant administrator of each Act, if the particular values in the EA or RWMP are triggered.

Until the new regulatory framework under the *Water Supply (Safety and Reliability) Act 2008* commences, the regulatory requirements under the EP Act, will be used to regulate CSG water which impacts on town drinking water supply sources.

6.2 Hydrology

Background

Discharge of water to a watercourse is not by default an environmental benefit, as ephemeral streams naturally have periods of dryness as well as periods of wetness. WRPs, under the *Water Act 2000*, are fundamentally designed for sustainable allocation and management of the water resources in the catchment. The management rules in the plan are tailored to minimise the impact of water extraction on the flow patterns that are of most importance to a WRP's ecological assets.

The environmental flow indicators of the WRP are primarily designed to determine how much water could be extracted from the watercourse. In assessing for the protection of the environmental value for aquatic ecosystems, it is not enough to assess if Environmental Flow Objectives (EFO) in Water Resource Plans (WRP) are met. This is because the EFOs are designed as a reference check when allocating water for extraction (which is a 'drying' action) and are not designed as a reference check when approving a discharge (which is a 'wetting' action).

Releases to receiving surface waters need to be regulated to protect environmental values. A water's flow supplemented with CSG water may be at most equivalent to but not in excess of a DERM approved pre-development flow regime. An example of this would be that wetting of the flow regime beyond 'naturalness' for an ephemeral stream would not be acceptable. It is critical that key ecological assets and aquatic ecosystem values are protected from artificial discharges to waters.

The underlying intent of maintaining or moving towards the natural flow regime in surface waters is to:

- Avoid localised erosion of bed and banks (including re-suspension of sediments and riparian zone erosion) and impacts on riparian ecosystems;
- Maintain natural variability in the flow regime. A single release rate will reduce the small scale variability patterns which contribute to maintaining the biological integrity

of a system such as stream habitat, wetting on macrophyte beds, inducing fish movement, entraining organic matter, scouring and primary production;
- Mimic natural seasonality (timing), frequency and duration of events of different magnitudes that support and trigger natural ecosystem processes (eg. nutrient cycling, migration and spawning cues, etc.); and
- Follow natural attenuation patterns, avoid bank slumping, maintain macroinvertebrate communities and minimise fish stranding, etc.

Implementation

The discharge strategy for CSG water discharged to waterways will be conditioned through the EA issued under the EP Act.

If the CSG discharge proposal is part of a beneficial re-use (as defined in *Environmental Protection (Waste Management) Policy 2000*) scheme, an amendment to the applicable resource operations plan may be required (e.g. water sharing rules, dam operating rules) to ensure there are no impacts on other entitlements.

CSG water discharges need to be managed to mimic seasonal flow volumes and allow for periods of low and no flow. A simplified example of this would see the discharge of larger volumes of CSG water during periods of higher natural flow and lower or nil discharges during naturally low and no flow periods. CSG water discharges should meet these variable flow requirements with the conditions incorporated in the environmental authority. These conditions may include volumetric release limits over time periods including per day or season, with modelling of pre-development flows using the Integrated Quality and Quantity Model as a guide in their calculation, and including the key ecological assets identified in the WRP process for the waters.

When CSG water is discharged to waters as part of a Water Supply Scheme or beneficial use approval, it is still necessary that the environmental values are protected.

7.0 Adaptive Management and Cumulative Impacts

To ensure that the conditions included in the EA are appropriate to protect the environmental values of the receiving waters, proponents will be required to undertake adequate monitoring of the implementation and effectiveness of the EA conditions. This includes assessing the effectiveness and reliability of any water treatment process (i.e. reverse osmosis), monitoring for changes in receiving water quality and aquatic ecosystem health, and for any other impacts to environmental values. If new impacts to environmental values are identified, future EAs will include conditions to adequately manage them.

To effectively protect waters from the as-yet unquantified cumulative impacts of CSG water discharged to waters, an adaptive approach will be used. Through this process, information collected through both monitoring and research, can be used to inform both new EAs and future management frameworks.

8.0 Definitions

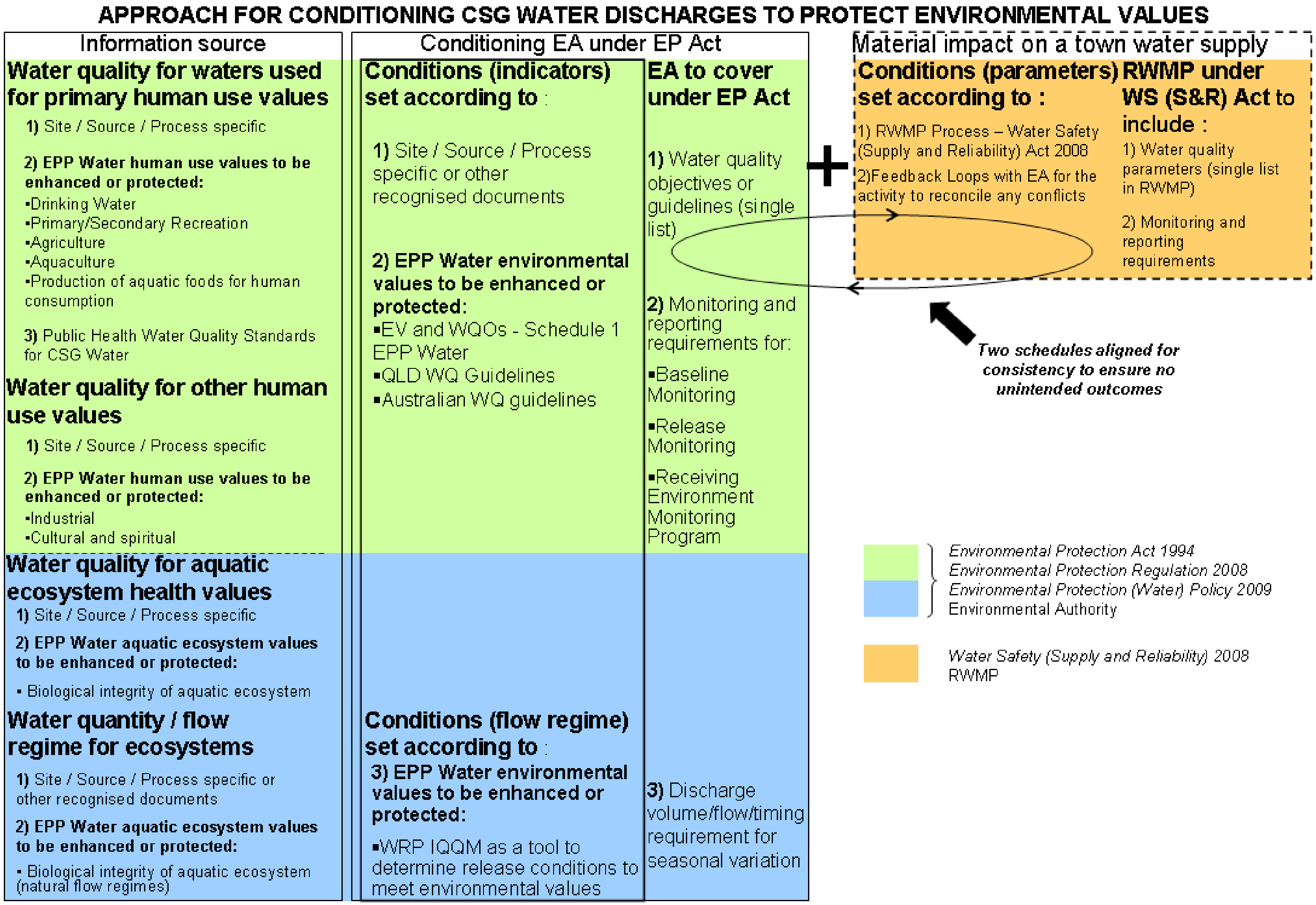
Note: Where a term is not defined in this guideline, the definition in the *Environmental Protection Act 1994*, its regulations and Environmental Protection Policies must be used.

Disclaimer:

While this document has been prepared with care it contains general information and does not profess to offer legal, professional or commercial advice. The Queensland Government accepts no liability for any external decisions or actions taken on the basis of this document. Persons external to the Department of Environment and Resource Management should satisfy themselves independently by consulting their own professional advisors before embarking on any proposed course of action.

Attachment 1.

Approach for Conditioning CSG Water Discharges to Protect Environmental Values



Attachment 2.

Review of Interim Public Health Water Quality Standards and Potential Impacts to Aquatic Ecosystem Values from Coal Seam Gas Water (CSG)

Acknowledgements: Water Quality & Aquatic Ecosystem Health Scientists, Environment & Resource Sciences Division

Background

Under the *Environmental Protection Act 1994* (EP Act), and its subordinate legislation, there is a process for identifying the environmental values of waters. In the scenario where a proponent is proposing to undertake an environmentally relevant activity in Queensland, including discharge of CSG water to waters, an environmental authority (EA) must be issued by the administrative authority - the Department of Environment and Resource Management (DERM). If an EA is issued, it must include conditions to manage any impacts to the identified environmental values of the waters from the activity. These conditions may include indicators for water quality with a set of guidelines / release limits for the discharge. The proposed regulatory reforms to the *Water Supply (Safety and Reliability) Act 2008* and the associated RWMP process will apply along with the process under the EP Act, EP Reg and EPP Water to protect environmental values (including the suitability of the water for supply as drinking water) through conditions in the EA for the activity. This means that there will be co-regulation of the activity – both under the EP Act and the WS (S&R) Act. Consequently standards may be imposed under the EP Act as well as under the WS (S&R) Act. If there are different values for a particular indicator, then the holder of the EA/RWMP will need to meet the most stringent of the requirements. To make certain that there are no inadvertent conflicts in the EA conditions and RWMP conditions, DERM Project Managers will ensure that a detailed risk assessment and adaptive management process is undertaken, and that through feedback processes any inconsistencies are identified early and addressed. This document aims to reconcile any potential conflicts. It also considers other issues for aquatic ecosystem health related to the discharge of CSG water to waters.

Interim Public Health Water Quality Standards under the WS (S&R) Act

Interim Public Health Water Quality Standards have been developed by Queensland Health for use where CSG water will impact on an urban community's drinking water supply source. These standards will be included in the Recycled Water Management Plan (RWMP) that will be required under the WS (S&R) Act. These standards will be prescribed under the *Public Health Regulation 2005.* The levels are set to allow for ingestion by humans of two litres per day for a lifetime. Existing water quality data for CSG water was examined, including Australian and overseas data, to inform the development of these standards. The standards are focused on coal associated compounds of health concern, or any hazards that may be added during treatment, storage or transport of the CSG water. The standards will be amended as more specific information on CSG source water quality in Queensland and associated treatment, storage and transport processes becomes available. It should be noted that this proposed schedule of standards is not intended to represent the ongoing monitoring program for CSG companies, it simply prescribes the health related standard if a particular compound is detected during monitoring.

Scientific Assessment

The following provides a comparison between the Interim Public Health Water Quality Standards (WQS) proposed for CSG and the toxicant trigger guidelines for protection of aquatic ecosystems. The purpose of this review is to determine potential conflicts between the Interim Public Health WQS and other guidelines. Note that the aquatic ecosystem guidelines are based on biological effects data and are meant to be trigger values. Where exceeded in the environment, background levels should be assessed and the triggers modified to reflect the risk involved.

In general, the review indicates the following:

- There are no obvious conflicts between the list of Public Health WQS and other guidelines for CSG;
- The list of indicators is substantial and it is likely that it could be reduced through source characterisation and associated risk assessment processes;
- For Reverse Osmosis (RO) treated CSG water, many of the indicators are unlikely to be relevant, even in the source water – see the table below;
- Areas of potential conflict where Public Health WQS are listed in an approval (or required to be monitored) and the limit listed is significantly higher than guidelines for aquatic ecosystem health protection. This is shown for 17 indicators in the table below. The major problem here is that a false impression may be given to proponents in terms of satisfactory standard for discharge if the standards in the RWMP are less stringent then those required to meet environmental values. Where these contaminants are of concern, they should be listed with appropriate limits in the EA, with the proponent meeting the most stringent ; and
- Note that such a review could also be done for primary industry guidelines such as irrigation. Similar conclusions from the comparison with aquatic ecosystem guidelines are expected.

For the discharge of 'good quality' RO treated CSG water, the potential risks to receiving water should be relatively small. The major issues that should be assessed on a case by case basis include:

1. The potential deficiency of cations/anions such as calcium that could have a detrimental effect on aquatic ecosystem biota. The proposed management action would be to dose the water to achieve appropriate cation/anion concentrations. Release limits for Sodium Adsorption Ratio, calcium, magnesium etc would generally be applied.
2. The potential change to flow regimes. This risk is potentially greatest for significant continuous releases to ephemeral streams. In most cases, this requires an assessment of key aquatic habitats and the potential extent of effect from the release. In many cases, sandy substrates may mean the water may have a limited extent of effect on surface waters. Alternative discharge locations may need to be considered and ongoing monitoring may be required during operation where potential risks exist.
3. Boron is not generally removed from the RO process and is often elevated in the discharge water. An assessment should be carried out on the potential effect on all downstream environmental values including aquatic ecosystem and irrigation. The levels are not typically high enough to be of major concern and there are limited management actions available to address this issue.
4. Given the water is very clear and the systems receiving the water are generally very turbid, there is potential for the water to impact on aquatic environments. The action risk from this effect is currently unknown and needs further research. In general, management as per issue 2 will also address this issue if it exists.

Table 1. Comparison of the Public Health WQS to Aquatic Ecosystem Toxicant Triggers and typically levels found in CSG Water.

Chemical Compounds/ Parameters of concern	CAS Number	Interim Release Limits (µg/L)	Aquatic Ecosystem TTV*	TOXNET Hazardous Substances Data Bank	Found in CSG source water?	Comments
1,2 Dichloroethane (DI)	107-06-2	3	ID	EV	NNS	Industrial solvent - chlorination of water does not appear to contribute to 1,2-dichloroethane in drinking water - Ethane is a constituent in the paraffin fraction of crude oil and natural gas - **may be produced inadvertently by chlorination reactions which take place during the disinfection of wastewater effluents or drinking water sources**
1,1 Dichloroethene (DI)	75-35-4	30	-	EV	NNS	Used in polymers and organic synthesis - Ethene is a natural product emitted by fruits, flowers, leaves, roots, and tubers, and is released to the atmosphere from biomass combustion and volcanos, and photodegradation of dissolved organic material - **may be produced inadvertently by chlorination reactions which take place during the disinfection of wastewater effluents or drinking water sources**.
1,2 Dichloroethene	540-59-0	60	ID	NHTV	NNS	
1, 2 Dichlorobenzene (DI)	106-46-7	1500	160	EV	NNS	Used as a chemical intermediate for the manufacture of dyes - **may be produced inadvertently by chlorination reactions which take place during the disinfection of wastewater effluents or drinking water sources**
1,4 Dichlorobenzene (DI)	106-46-7	40	60	EV	NNS	
2,2 Dichloropropionic Acid (DI) (DPA)	75-99-0	500	-	EV	NNS	Herbicide

Chemical Compounds/ Parameters of concern	CAS Number	Interim Release Limits (µg/L)	Aquatic Ecosystem TTV*	TOXNET Hazardous Substances Data Bank	Found in CSG source water?	Comments
2,4,5-Trichlorophenol	95-95-4	350	ID	EV	NNS	Chlorophenols - used as a biocide, disinfectant for the home, hospital, and farm, an antiseptic, manufacture of the insecticide profenofos, in the synthesis of the fungicides dichlorophen and triadimefon, in the synthesis of the cholesterol-reducing drug, denaturant for alcohol, and selective solvent in refining mineral oil and in organic syntheses of dyes - **may be produced inadvertently by chlorination reactions which take place during the disinfection of wastewater effluents or drinking water sources**
2,4,6-Trichlorophenol	88-06-2	20	3	EV	NNS	
2,4-Dichlorophenol (DI)	120-83-2	200	120	NHTV	NNS	
2-Chlorophenol (DI)	95-57-8	300	340	EV	NNS	
4-Chlorophenol (DI)	106-48-9	10	220	EV	NNS	
4-Methylphenol (p-cresol)	106-44-5	600	-	EV	NA	Cresols, including p-cresol, are a group of widely distributed natural compounds formed as metabolites of microbial activity and excreted in the urine of mammals. Cresols occur in various plant lipid constituents, including oils from jasmine, cassia and camphor. Oils from conifers, oaks, and sandalwood trees also contain cresols.
4-Nitrophenol	100-02-7	30	ID	EV	NNS	Used in the manufacture of pesticides, dyestuffs as well as a leather treatment agent. It is a photooxidation product of nitrobenzene in air and aromatic hydrocarbons such as benzene, toluene, and phenanthrene with nitric oxide in air. It is emitted in vehicular exhaust from both gasoline and diesel engines. 4-Nitrophenol is also a degradation product of parathion and an impurity in the parathion formulation Thiophos and, therefore, will be released

Chemical Compounds/ Parameters of concern	CAS Number	Interim Release Limits (µg/L)	Aquatic Ecosystem TTV*	TOXNET Hazardous Substances Data Bank	Found in CSG source water?	Comments
						during the application of the insecticide
4-Nonylphenol	104-40-5	500	-	NHTV	NNS	Routinely used as a co-stabilizer with mixed-metal stabilizers for heat stabilization during plastic production; used as starting material for the production of phenolic resins.
Acenaphthene	83-32-9	20	SED	EV	Yes	A natural component of crude oil and coal tar, and is also a product of combustion and can be released to the environment via natural fires associated with lightening, volcanic activity, and spontaneous combustion.
Acenaphthylene	208-96-8	0.014	SED	NHTV	Yes	
Acrylamide	79-06-1	0.2	-	EV	Unlikely	Used in the production of polyacrylamide and amide monomers.
Aluminium		200	55			
Ammonia		500	900			
Anthracene	120-12-7	150	ID - SED	EV	Yes	Anthracene occurs in fossil fuels.
Antimony		3	ID - SED			
Arsenic		7	-			
Arsenic III			24			
Arsenic V			13			
Barium		700				
Benzene	71-43-2	1	950	EV	Yes	Benzene is found naturally in the environment from volcanoes, as a natural constituent of crude oil, from forest fires and as a plant volatile.
Benzo(a)pyrene	50-32-8	0.01	ID - SED	EV	Yes	Occurs naturally in crude oils, shale oils, and coal tars, and is emitted with gases and fly

Chemical Compounds/ Parameters of concern	CAS Number	Interim Release Limits (µg/L)	Aquatic Ecosystem TTV*	TOXNET Hazardous Substances Data Bank	Found in CSG source water?	Comments
						ash from active volcanoes. There is some evidence for biosynthesis by plants, bacteria and algae. Emissions of polycyclic aromatic hydrocarbons, including benzo(a)pyrene, are a product of incomplete combustion of organic matter.
Bisphenol A	80-05-7	200	-	EV	NNS	Used as an intermediate in manufacture of epoxy, polycarbonate, phenoxy, polysulfone and certain polyester resins, rubber chemicals, flame retardants and in food packaging and coatings
Boron		4000	370			
Bromate	NA	20	-	EE	Unlikely	Bromate is a drinking water disinfection by-product formed during the ozonation of source water containing bromide.
Bromide	NA	7000	-			
Bromine	7726-95-6	7000	-	EV	Unlikely	Bromine does not exist in nature in its elemental state, molecular bromine (Br_2).
Bromochloroacetic acid (DI)	5589-96-8	0.014	-	NHTE	NNS	Formed as a chemical by-product of chlorination and chloramination of drinking water.
Bromochloroacetonitrile (DI)	83463-62-1	0.7	-	NHTE	NNS	Formed during the chlorination of water. In experiments bromochloroacetonitrile was found in water treated with chlorine, chlorine with bromide, chlorine with ozone and chloramination with bromide.
Bromochloromethane (DI)	74-97-5	40	-	NHTV	Unlikely	Bromochloromethane was found in remote ocean areas along with other naturally occurring bromo or chloro methanes produced by algae. Although it is possible

Chemical Compounds/ Parameters of concern	CAS Number	Interim Release Limits (µg/L)	Aquatic Ecosystem TTV*	TOXNET Hazardous Substances Data Bank	Found in CSG source water?	Comments
						that bromochloromethane was produced by this natural source, the author suggested that it may be due to long range transport from anthropogenic sources. Bromochloromethane was released from cultivated species of the brown algae, Phaeophyta. This may be a major source of biogenic emissions of bromochloromethane from oceans. Bromochloromethane's production and use as a fire extinguisher fluid, especially in aircraft and portable units.
Bromodichloromethane (DI)	75-27-4	6	-	EV	Unlikely	Bromodichloromethane is biosynthesized and emitted to seawater (and eventually to the atmosphere) by various species of marine macroalgae which are abundant in the various locations of the world's oceans. Ice macroalgae from McMurdo Sound, Antarctic were found to contain and release to sea water bromodichloromethane. Bromodichloromethane's production and use in organic synthesis and as a solvent may result in its release to the environment through various waste streams. However, bromodichloromethane is not produced or used on a large commercial-scale indicating that large releases do not occur from these practices. **The predominant environmental release of bromodichloromethane results from its inadvertent formation during chlorination treatment processes of drinking, waste, and cooling waters**. The amount of bromodichloromethane which may

Chemical Compounds/ Parameters of concern	CAS Number	Interim Release Limits (µg/L)	Aquatic Ecosystem TTV*	TOXNET Hazardous Substances Data Bank	Found in CSG source water?	Comments
						be produced during chlorination processes depends upon a variety of parameters which include temperature, pH, bromide ion concenntration of the water, fulvic and humic substance concentration, and actual chlorination treatment practices.
Bromoform (DI)	75-25-2	100		EV	Unlikely	Bromoform is produced by macroalgae and microalgae.
Cadmium		2	0.2			
Chlorate	NA	0.8mg/L	-	EV	Unlikely	The chlorite ion (ClO_2^-) is a **major degradation product resulting from the reaction of chlorine dioxide with inorganic and organic constituents in the water**. When free chlorine is used after the application of chlorine dioxide in the treatment process, chlorite is oxidized to chlorate. This conversion will continue over time as the water travels through the distribution system. Chlorate ion is also formed by photodecomposition of chlorine dioxide when treated water is exposed to bright sunlight in open basins. The rate at which chlorate forms affects the amount of chlorine dioxide or chlorite that remain in the finished drinking water.
Chlorine (DI)	7782-50-5	5 000	3	EV	Unlikely	The most important manmade emissions of chlorine are from processes involving the production, transportation, and use of chlorine.
Chlorine dioxide (DI)	10049-04-4	1000	-	EV	Unlikely	Chlorine dioxide is used as a disinfectant in water treatment plants in the USA.

Chemical Compounds/ Parameters of concern	**CAS Number**	**Interim Release Limits (µg/L)**	**Aquatic Ecosystem TTV***	**TOXNET Hazardous Substances Data Bank**	**Found in CSG source water?**	**Comments**
Chlorite (DI)	NA	300	-	EE	Unlikely	Chlorite ion (ClO_2^-) is present in drinking water and there are two possible ways it ends up in the drinking water: 1) chlorine dioxide is produced via sodium chlorite used as a starting material and incomplete conversion of sodium chlorite into chlorine dioxide leaves residual chlorite ion in water and 2) the chlorite ion is a major degradation product resulting from the reaction of chlorine dioxide with inorganic and organic constituents in the water. When free chlorine is used after the application of chlorine dioxide in the treatment process, chlorite is oxidized to chlorate. This conversion will continue over time as the water travels through the distribution system. Chlorate ion is also formed by **photodecomposition of chlorine dioxide when treated water is exposed to bright sunlight in open basins**. The rate at which chlorate forms affects the amount of chlorine dioxide or chlorite that remain in the finished drinking water.
Chloroacetic acid (DI)	79-11-8	150	-	EV	Unlikely	Chloroacetic acid's formation as a **chemical by-product of chlorination and chloramination of drinking water**, and its use as a herbicide and in the manufacture of various dyes and other organic chemicals.
Chlorobenzene (DI)	108-90-7	300	ID	EV	Possible	Chlorobenzene's production and use as a chemical intermediate, solvent, and heat transfer medium.
Chloroform (Trichloromethane) (DI)	67-66-3	200	ID	EV		Chloroform is produced by tropical red algae, and by red seaweed and has been reported

Chemical Compounds/ Parameters of concern	CAS Number	Interim Release Limits (µg/L)	Aquatic Ecosystem TTV*	TOXNET Hazardous Substances Data Bank	Found in CSG source water?	Comments
						to be produced by micro algae, in peat bogs, was produced in spruce forest soil and was found in wood degrading areas. Chloroform's production and use in the synthesis of hydrochlorofluorocarbon 22 (HCFC-22), use as an extractant or solvent, chemical intermediate, dry cleaning agent, fumigant ingredient, synthetic rubber production. Its indirect production in the manufacture of ethylene dichloride and as a **disinfection by-product in the chlorination of drinking water**, municipal sewage, cooling water in electric power generating plants. Chloroform is produced during the atmospheric photodegradation of trichloroethylenes and is produced from auto exhaust.
Chromium III			ID			
Chromium VI		50	1.0			
Copper		2000	1.4			
Cyanide		80	7			
Dibromoacetic acid (DI)	631-64-1	0.014	-	EV	Unlikely	Dibromoacetic acid's formation as a **chemical by-product of chlorination and chloramination of drinking water**.
Dibromochloromethane (DI)	124-48-1	100	-	EV	Unlikely	Chlorodibromomethane is produced naturally by various marine macroalgae and is present naturally in seawater.

Chemical Compounds/ Parameters of concern	CAS Number	Interim Release Limits (µg/L)	Aquatic Ecosystem TTV*	TOXNET Hazardous Substances Data Bank	Found in CSG source water?	Comments
						Chlorodibromomethane's inadvertently formed during **chlorination treatment processes of drinking, waste, and cooling waters**; it is also used as a chemical intermediate.
Dichloroacetic acid (DI)	79-43-6	100	-	EV	Unlikely	Dichloroacetic acid's formation as a **chemical by-product of chlorination and chloramination of drinking water**, and its production and use as a chemical intermediate, in pharmaceuticals and medicine.
Dichloroacetonitrile (DI)	3018-12-0	2	-	EV	Unlikely	Dichloroacetonitrile formation as a **by-product of the chlorination of humic substances, algae and amino acids contained in drinking water** and pulp bleaching processes. Dichloroacetonitrile is a by-product of the chlorination of humic substances, algae and amino acids, such as when humic and fulvic acids from natural waters are chlorinated with sodium hypochlorite.
Ethylbenzene	100-41-4	300	ID	EV	Yes	Ethylbenzene's production and use as an intermediate for the manufacture of styrene and use as a resin solvent, intermediate for the production of diethylbenzene and acetophenone, and its use as a component of automotive and aviation fuels. Ethylbenzene is present in coke-oven tars.
Fluoride		1500	-			
Hydrazine	302-01-2	10 (ng/L)	-	EV	Unlikely	Hydrazine has been found to be a primary product of nitrogen fixation by *Azotobacter*

Chemical Compounds/ Parameters of concern	CAS Number	Interim Release Limits (µg/L)	Aquatic Ecosystem TTV*	TOXNET Hazardous Substances Data Bank	Found in CSG source water?	Comments
						agile. Used as a chemical intermediate, reducing agent, as rocket fuel and as a boiler water treatment agent- **may be produced inadvertently by chlorination reactions which take place during the disinfection of wastewater effluents or drinking water sources**
1,2-diphenylhydrazine	122-66-7		ID	EV	Unlikely	1,2-Diphenylhydrazine's production and use as a chemical intermediate. It also may be produced in wastewater receiving azobenzene where conditions are reducing. This drug is primarily used as a veterinary medication.
Iodide		100	-			
Iodine		60	-			
Iron		300	300**			
Lead		10	3.4			
Manganese		500	1900			
Mercury		1	0.06			
Molybdenum		50	34**			
Monochloramine (DI)	10599-90-3	3000	-	EV	NNS	Chloramine is used as a chemical intermediate in the synthesis of various amines and hydrazine and as a disinfectant in drinking water for systems in which free chlorine radicals are difficult to maintain. Chloramine can be formed in situ by the combination of ammonia and chlorine

Chemical Compounds/ Parameters of concern	CAS Number	Interim Release Limits (µg/L)	Aquatic Ecosystem TTV*	TOXNET Hazardous Substances Data Bank	Found in CSG source water?	Comments
						containing agents under basic conditions.
Nickel		20	11			
Nitrate – as N		50000	7200			
Nitrite		3000	-			
N-Nitrosodiethylamine (DI) (NDEA)	55-18-5	0.01	-	NHTE	Unlikely	Formed by the action of nitrate-reducing bacteria. N-Nitrosodiethylamine's production and use as a gasoline and lubricant additive, antioxidant and stabilizer may result in its release to the environment through various waste streams.
N-Nitrosodimethylamine (DI) (NDMA)	62-75-9	0.01	-	EV	Unlikely	Formation of DMN ... can occur by reaction of nitrites with dimethylamine produced by intestinal bacteria. Formed by the interaction of nitrite with dimethylamine and by the action of nitrate-reducing bacteria. One group that found N-nitrosodimethylamine in tap water concluded that the N-nitrosodimethylamine may have formed from the reaction of low concentrations of nitrite, an oxidizing agent (possibly chlorine), and secondary amines. Another researcher concluded that extensive nitrosamine formation in natural waters is not likely because of low nitrite concentrations, low levels of nitrosatable amines, and expected third order kinetics.
Phenanthrene	85-01-8	150	ID	EV	Likely	Phenanthrene occurs in fossil fuels.

Chemical Compounds/ Parameters of concern	CAS Number	Interim Release Limits (µg/L)	Aquatic Ecosystem TTV*	TOXNET Hazardous Substances Data Bank	Found in CSG source water?	Comments
						Phenanthrene was detected in spruce needles, tree leaves and grass and plants.
Phenol	108-95-2	150	320	EV	Yes	Phenol is present in animal, leaf litter and other organic wastes as a result of decomposition. The level of phenol present in poultry manure has been shown to increase in time as degradation proceeds. Phenol is obtained from coal tar. Phenol's production and use as a chemical intermediate in the production of bisphenol-A, phenolic resins, caprolactam, aniline, alkylphenols and other chemicals, as well as its use as a disinfectant and antiseptic may result in phenol being released to the environment as emissions and in wastewater as a result of its production and use. Wood smoke from fireplaces and wood stoves contain high conc'ns of phenol. Phenol is found in gasoline and diesel engine exhaust, and emissions from refuse combustion, brewing, foundries, wood pulping, plastics mfg, lacquer mfg, and glass fibre mfg. Laboratory tests indicate that phenol would be found in leachate from tires. It is also released from some plastics when heated. Phenol is a photooxidation product of benzene, and would be produced in the atmosphere from benzene emissions.
Pyrene	129-00-0	150	SED	EV	Yes	Pyrene has been isolated in crude oil, coal

Chemical Compounds/ Parameters of concern	CAS Number	Interim Release Limits (µg/L)	Aquatic Ecosystem TTV*	TOXNET Hazardous Substances Data Bank	Found in CSG source water?	Comments
						tar and fossil fuels.
Radiological Compounds		0.5 mSv/year				
Selenium		10	5			
Silver		100	0.05			
Strontium (Stable)(Total)		4000	-			
Sulfate		500 000	-			
Thallium (Stable)(Total)		Detection limit	0.03**			
Titanium (Total)		Detection limit	-			
Toluene	108-88-3	800	ID	EV	Yes	Toluene occurs in nature in natural gas deposits and has been detected in emissions from volcanos, forest fires and crude oil. Toluene is released into the atmosphere principally from the volatilization of petroleum fuels and toluene-based solvents and thinners and from motor vehicle exhaust. Toluene's production and use as an intermediate in the production of benzoic acid, benzaldehyde, explosives, dyes and many other organic compounds may also result in its release to the environment through various waste streams.
Total Petroleum Hydrocarbons (reported as separate fractions)		(Total) 200	-			
Trichloroacetic acid (DI)	76-03-9	100	-	EV	Unlikely	Trichloroacetic acid is produced photoxidatively when chlorinated ethenes and ethanes are converted to trichloroacetylchloride and finally hydrolyzed

Chemical Compounds/ Parameters of concern	CAS Number	Interim Release Limits (µg/L)	Aquatic Ecosystem TTV*	TOXNET Hazardous Substances Data Bank	Found in CSG source water?	Comments
						to the acid ... can also be formed during anthropogenically induced combustion processes if chloride and redox-sensitive elements such as Fe or Cu are present, e.g. forest fires, wood burning, waste incineration, etc. ... **also one of the main disinfection by-products during drinking water chlorination**.
Uranium		20	0.5**			
Vanadium		50	6**			
Xylenes	1330-20-7	600	-	EV	Yes	Common naturally occurring sources of xylenes are petroleum, forest fires, and volatiles of plants. Mixed xylenes are present in petroleum stocks and natural gas in small quantities. Commercial xylene's production and use in petroleum products and as a chemical solvent and intermediate may result in its release to the environment through various waste streams. Xylene use as an aquatic herbicide will result in its direct release to the environment. Xylenes are components of gasoline. Xylenes may be released to the environment through emissions from petroleum refining, coal tar and coal gas distillation, through emissions from the transport and storage of gasoline and from carburetors, and through leaks and evaporation losses during the transport and storage of gasoline and other fuels.
o-xylene	95-47-6		350	EV	Yes	

Chemical Compounds/ Parameters of concern	CAS Number	Interim Release Limits (µg/L)	Aquatic Ecosystem TTV*	TOXNET Hazardous Substances Data Bank	Found in CSG source water?	Comments
Zinc		3000	8			

DI indicates the parameter is a disinfection by-product and is not included in monitoring of active wells.

* TTV – 95% species protection toxicant trigger values taken from ANZECC/ARMCANZ (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality.

** low reliability trigger

SED Appears in ANZECC/ARMCANZ (2000) as a sediment trigger value only

EE Ecotoxicity Excerpts are available in the Hazardous Substances Data Bank

EV Ecotoxicological Values or data are available in the Hazardous Substances Data Bank

NHTE Non-human Toxicity Excerpts are available in the Hazardous Substances Data Bank

NHTV Non-human Toxicity Values are available in the Hazardous Substances Data Bank

NNS – No natural sources

ID – Insufficient Data

Highlighted values are significantly below Public Health WQS

Conditions for Coal Mines in the Fitzroy Basin

Approach to Discharge Licensing

1. Introduction

This document describes the proposed approach for deriving consistent and appropriate limits and conditions for Coal mine discharges and supports the draft Conditions for Coal Mines in the Fitzroy Basin. The proposed approach aims to minimise the risk of discharges on downstream environmental values of receiving waters and be consistent with current legislation, departmental policy and State/National water quality guidelines. This includes the department's Policy for wastewater discharges to Queensland waters (http://www.epa.qld.gov.au/publications?id=2272), the Queensland Water Quality Guidelines (2006) and the ANZECC/ARMCANZ Fresh and Marine Water Guidelines 2000.

2. Managing and Characterising Discharges

The first step in assessing a licence proposing a wastewater discharges is to demonstrate the unavoidable need for that discharge. Water is a resource and most mines require substantial amounts of water even if for coal washing and/or dust suppression. A well planned and effective water management system is essential for having sufficient water for the mine during dry times but also having sufficient available storage/free-board to ensure discharges are infrequent and only associated with major storm events. Effective water management requires separate storage of water with varying water quality (such as storage of process water/groundwater, surface water runoff), appropriate infrastructure to accommodate sufficient water storage and appropriate flood design and control.

Where the need for a discharge is demonstrated, the next step is to characterise the wastewater and identify the potential contaminants or associated hazards that may exist. This may require an understanding of historical wastewater quality and/or information on local groundwater quality, geology types, the process/treatment systems involved and the broader water management strategies to be adopted. Currently, salinity (measured as electrical conductivity) and suspended sediment (and pH to a lesser extent) are known to be major water quality issues that require regulation. However, for other characteristics such as metals/metalloids, a legitimate need for regulation it is likely to vary from case to case. However, in the majority of cases there is currently a lack of data. Further information needs to be collected on both wastewater and natural waters. An interim approach is required for setting discharge conditions where water quality data insufficient or not currently available.

3. Environmental Values and Ephemeral Streams

After characterising the discharge, the next step requires environmental values and water quality objectives for waterways potentially affected by the discharge to be assessed. Depending on the risks from the discharge (based on its volume, contaminant concentrations, duration and location), this step will need to be done to a lesser or greater spatial extent. With greater risk, environmental values and potential impacts will need to be considered further a field. Environmental values and water quality objectives specified in the Environmental Protection (Water) Policy 1997 must be considered for assessment of all waterways including ephemeral streams. Environmental values for drinking water, stock watering, irrigation, recreation, industrial use and aquaculture may exist downstream of the discharge depending on the discharge location. The guidelines for these environmental values will form the basis of default water quality objectives and will typically not differ between permanent and temporary flowing streams. Various published guideline values are shown in Tables 1 to 6.

Many coal mines are situated in areas of ephemeral/intermittent streams. Current reference-based water quality guidelines for aquatic ecosystem protection (for example, in the Queensland Water Quality Guidelines, 2006) are available only for permanent flowing streams. Nonetheless, it is proposed that these guidelines be used for impact assessment and licensing discharges to ephemeral streams until local reference information becomes available. In addition, in mining areas it is common that background concentrations may be elevated as a result of historical anthropogenic activities and/or natural causes (certainly the case for some metals). Deriving local guidelines and background data is ideally needed but requires sufficient reliable data from monitoring of appropriate sites. Monitoring of ephemeral streams can be challenging given the infrequent and unpredictable nature of flow and the logistical issues involved with accessing and taking event related sampling. There is currently insufficient information for some contaminants as to how levels change with rainfall and flow. For electrical conductivity (EC) it is unlikely that high EC is associated with high flows in contrast to suspended sediment solids or turbidity which is typically elevated during rainfall-associated events.

For many sites there will be an absence of suitable monitoring data. In this case, reference-based guidelines from permanent flowing streams can be used for deriving end-of-pipe limits or trigger values in a precautionary sense, although consideration needs to be given to the above points. Where good local referenced data has been collected, this could be used to derive local reference-based guidelines (typically 75th percentiles for median EC, 80th percentiles for other reference-based water quality indicators such as pH, turbidity and suspended sediment). Typically at least 18 data points would be required and collected over at least 3 rain events. This may require 2 years of data but is dependant on rainfall frequency. Data from multiple reference sites could be amalgamated in most situations. The Queensland Water Quality Guidelines propose that this approach also be used for metals/metalloids where local reference conditions may be elevated.

4. Potential Water Quality Impacts

Effects of Salinity on Aquatic Organisms

Salinity has the potential to cause both acute and chronic toxicological effects in aquatic organisms. There is currently no nationally published toxicity trigger for salinity effects in freshwater environments although there is published information on the effects of salinity on fish, macroinvertebrates and other biota. Thus the recommended approach is to consider the ambient reference-based guidelines as discussed in Section 7. Generally, setting EC limits based on reference-based conditions will address potential concerns with toxicity given that discharge levels will typically be below toxicity thresholds. However, for situations where the stream has assimilative capacity for salinity, it may be possible to have discharge levels at or above toxicity thresholds and through dilution, still meet reference-based guidelines in-stream within a short distance downstream. The general policy position in this case is that the discharge should not result in any toxicity within the initial mixing zone.

Based on the comments by Hart (2008) in a recent review of water quality in the Fitzroy Basin, EC values of less than 1500 µS/cm are unlikely to affect adult fish although salinity around 1000-1500 µS/cm may effect early life stages of fish. Macroinvertebrates are unlikely to be affected at below around 1000µS/cm. However, for those species adapted to quite low salinity (200-300µS/cm) such as in the south of the Fitzroy Basin, permitting ambient EC concentrations to reach 1000-1500 µS/cm would adversely affect the community structure, especially at a species level. A conservative trigger used in the ANZECC guidelines (1992) was Total Dissolved Solids (TDS) of 1000 mg/L (this converts to an EC of approximately 1500µS/cm) which receiving waters should not exceed.

5. Monitoring of Metals/Metalloids

Metals/metalloids have the potential to cause both acute and chronic toxic effects in the short-term and bioaccumulate to have similar effects in the long-term. The comments on measuring EC in receiving waters are also relevant to applying limits to metals/metalloids in receiving waters. There are few examples of where metals/metalloid limits have been applied end-of-pipe at this stage for coal mines and in most cases, further review of data is required for this to be done. Ascertaining end-of-pipe total and dissolved metal concentrations is recommended. Trigger values for receiving environment monitoring can be applied. Trigger values should be based on relevant environmental values. Conservative trigger values are shown in Tables 5 and 6. For aquatic ecosystem protection (Table 5), the default trigger values are for slightly-to-moderately disturbed (SMD) systems protecting 95% of species. For highly disturbed systems (HDS), ANZECC/ARMCANZ (2000) guidelines recommend adopting SMD levels in the first instance but if there are known high levels naturally occurring, lower lesser level of species protection (such as 90% or even 80%) can be adopted. In some situations such as may occur in highly mineralised mining catchments, natural or historical effects have resulted in even higher background levels for some specific metals/metalloids. Guideline adjustment for metals such as aluminium, copper, iron and zinc is sometimes required. If this is the case, relevant reference data should be assessed to develop locally-relevant guidelines. Where reference data is not available, the use of upstream background could be negotiated as a surrogate where it can be demonstrated that the site has not been influenced by upstream mine or other industry-related activities that are likely to affect metal/metalloid concentrations. Guideline values for long-term medians can be developed from 80th percentiles of relevant reference data.

For aquatic ecosystems, the metals/metalloid limits could be applied to total (i.e. unfiltered) concentrations. If this is the case and the total concentration exceeds the trigger value, a hardness correction can be applied for some metals (cadmium, chromium III, copper, lead and nickel) up to a salinity of 2500 mg/L. See Table 3.4.3 of ANZECC/ARMCANZ (2000) Guidelines as to how to modify the trigger values for hardness for these metals. However, if exceedances still occur or are likely to occur then dissolved (i.e. filtered) metals/metalloid concentrations should also be measured and compared to the limits. Also note that speciation of some metals/metalloids is usually required for aquatic ecosystem protection (e.g. arsenic and chromium). For event-based sampling, measurement of dissolved metals/metalloids will be more problematic and logistically difficult. Samples need to be filtered, refrigerated and analysed within short time frames and this may not always be possible. However, at this stage it is proposed that for protection of aquatic ecosystem, metals are measured for dissolved metals/metalloids given the likelihood for exceedance of the guidelines. On the other hand, given the potential addition costs of speciated metals, it is proposed that all samples be analysis for dissolved total species (i.e. all species of the metal/metalloid, or 'total' species) for licensing. Where risks are identified, further assessment of speciated components may be required. For other environmental values, assessment of total metals/metalloids is needed to compare to guidelines but only for those that are specified in the guidelines. Where there is an absence of other information on potential sources or levels of metals/metalloids, a standard set of metals/metalloids is recommended until such information is made available. This might include characterising of the wastewater in dams or potential sources of wastewater (such as groundwater, waste characterisation or geological analysis).

6. Monitoring Receiving Waters

Water Quality Monitoring

Where data is available, background receiving water quality typically does not meet reference-base guidelines for all indicators. This may be due to both differences in natural conditions and from anthropogenic pressures. For this reason, application of guidelines to receiving waters as regulatory limits is likely to result in frequent non-compliance, regardless of whether the mine is discharging or not.

Therefore, receiving water assessments using water quality guidelines should only be used for triggering reporting (or investigation purposes) and not as a primary mechanism for regulation. This could include reporting of long-term medians of data (reference-based guidelines) or reporting against 95th percentiles (biological effect data). Maximum trigger values for certain indicators such as EC and pH may be adopted for some near-field monitoring sites as an additional trigger limit.

Reporting against guidelines for environmental values other than aquatic ecosystem protection should also be done where present. Monitoring should be done when the stream is flowing (this flow trigger would preferably be below the discharge flow trigger) and should ideally be done both when the discharge is and is not occurring. Reporting of the receiving environment monitoring program (REMP) could be done.

Water quality measurements of permanent water holes or other specific downstream environmental values are also appropriate where risks of potential impact are identified. For ephemeral streams, the current science suggests that the permanent and semi-permanent water holes need to be protected as a high priority. The concentrations of some water quality characteristics can increase significantly in water holes with time due to evaporation and no flow conditions whilst others decrease in concentration due to changes in water chemistry. Recent mine discharges have resulted in significant changes to salinity profiles within some downstream drinking water reservoirs and therefore impoundments, storages, weirs, dams, etc. should also be monitored given the potential for impacts.

Biological Monitoring

Biological monitoring (e.g. macroinvertebrate sampling) will generally only be required when the discharge quality and circumstances are such that they are considered to pose a significant risk to the affected receiving waters and associated habitat(s). For instance, this situation might arise when end-of-pipe EC levels are above 1000 μS/cm and there is a potential for discharge during times of low flow when limited dilution will be occurring. Having said that, biological monitoring should generally be limited to permanent and semi-permanent water bodies that could be potentially impacted by the discharge (for example, within 50km of the discharge), although this will depend on the quantity and duration of discharge. Note that specific ecosystem-type considerations must be taken into account, for example, in some areas of the catchment even short-term wetting of stream beds can play an extremely important role in the ecological cycle of the system and therefore may warrant biological monitoring.

Monitoring of macroinvertebrates must be carefully designed and interpreted in accordance with (i) the Queensland Australian River Assessment System (AusRivAS) Sampling and Processing Manual (August, 2001) and (ii) Chessman (2003), SIGNAL 2 – A Scoring System for Macro-invertebrate ('Water Bugs') in Australian Rivers, Monitoring River Heath Initiative Technical Report no. 31, Commonwealth of Australia, Canberra. Monitoring should be undertaken at both impact and control sites. (For further advice on this issue, contact Neil Tripodi on 3896 9241)

Sediment Sampling

Sediment sampling for toxicants such as metals and metalloids will generally only be required when the discharge quality and circumstances are such that they pose a significant risk to the receiving waters. This may be the case where end-of-pipe metals/metalloid concentrations are significantly above both background/guideline concentrations, discharge has occurred for extended periods of low flow and ANZECC/ARMCANZ (2000) water quality guideline values and background water quality concentrations are exceeded.

Sediment monitoring should be limited to permanent water bodies (such as weirs, water holes etc) that could be potentially impacted by the discharge and that possess the environment where muds (sediment) can accumulate. Sediment monitoring locations may be of similar nature to macroinvertebrate sampling sites (where required).

8. Setting End-of-pipe Limits and Links to Natural Flow

Discharging linked to natural flow in ephemeral streams is an essential mechanism for ensuring any discharge has reduced risk of impact on downstream environmental values. The specification of upstream monitoring sites and start/stop discharge triggers based in the environmental flow is also needed to ensure that this occurs. Large dilutions factors (e.g. 1 to 10 or 1 to 20) would generally result in reduced risk of both water quality and flow impacts, assuming the monitoring of the stream and discharge flow are closely linked and controlled.

The proponent should provide adequate data and modelling of the flow in their part of the catchment to determine the most suitable environmental flow trigger under which a discharge of certain maximum volume and flow rate should occur. The frequency or percentage of wet weather days that this will be possible should be assessed under a range of rainfall scenarios.

As part of the approval, the following will be required:

- A minimum natural receiving environment flow (m^3/s) should be defined at which wastewater discharge can take place – both commencement and cessation. It should be based on historical measurements of upstream natural flow and be designed to avoid times of poor mixing and permit significant post-discharge flushing (such as <20th percentile flow). Ongoing access to data from a suitably situated gauging station will be required.
- The maximum discharge rate should be set so that it does not exceed 20% of the minimum natural receiving environment flow rate (i.e. 1:4 – 1 part discharge wastewater : 4 parts natural flow).
- Daily discharge in cumecs (m^3/s) should be reliably measured and recorded.

An interim approach is required when no background receiving environment monitoring data is available. In this case, the dilution factors are not considered in setting limits as background water quality may exceed guidelines (i.e. there would be no assimilative capacity for any contaminant), although a 20 percent dilution with receiving waters will still be required.

Where discharge cannot be linked to sufficient natural flow, more detailed risk assessment should be undertaken for the waterways potentially affected by the discharge as the likelihood of impact is significantly increased. Any permanent water bodies (e.g. weirs or water holes) or locations of other environmental values potentially affected by the discharge should be identified. For such situations, more stringent water quality limits would typically be required such that it meets ambient or background water quality levels. Long-term continuous discharges in ephemeral streams should be generally discouraged. In the case of some mines in upper catchment areas, an interim approach may be adopted where discharge is permitted with flow measurements downstream. This will ensure that potential impacts are limited to near-field. Such an approach may be suitable for a transitional environmental program (TEP) or where the potential effects are considered low risk.

Monitoring of relevant physical chemical and toxicant indicators in Tables 1 to 6 should be undertaken end-of-pipe when a discharge is occurring, ideally coinciding with receiving environment monitoring. The limits/triggers are derived from ambient water quality data of permanent flowing streams in the Fitzroy and from drinking water guidelines. It is proposed that the EC discharge limit should vary depending on geographical location and whether a drinking water reservoir is located downstream of the discharge. Other issues that should be considered in setting end-of-pipe indicators and limits/triggers include laboratory detection limits and the relevance of the indicators to the activity and the risks involved.

End-of-pipe limits are required for EC and pH. The information is not currently available to set maximum values based on acute toxicity. A conservative approach would be to ensure discharge limits for EC end-of-pipe do not exceed 1500 µS/cm. Under certain circumstances, a higher end-of-pipe limit may be applicable where large mixing ratios are achieved and discharge is only for smaller durations/volumes. In these cases, the end-of-pipe limit may be increase up to 2250 µS/cm. The need for this would need to be demonstrated. The pH limits would ideally be between 6.5 and 8.5 when linked to 1:4 dilutions. Higher pH limits (say ≤9.0) end-of-pipe may be negotiated where appropriate dilution will be achieved. Limits for suspended solids concentrations can be negotiated with mines for sediment based on expected sediment removal from settling. Turbidity levels should be measured with the view of setting a relevant limit when sufficient background data is obtained.

In terms of metals/metalloid measurements end-of-pipe, it is recommended that no compliance limit be applied to this end-of-pipe monitoring unless adequate receiving environment data is collected and reviewed. However, trigger limits can be proposed for those metals/metalloids that currently have ANZECC/ARMCANZ (2000) trigger values for freshwater. Such trigger limits, if triggered, would firstly require a comparison of down stream water quality to trigger values, if exceeded, and then a comparison should be made to reference site data. If values are within local reference levels, no further action should be required.

There is a range of other indicators that may be monitored and regulated end-of-pipe (and in receiving waters). These include nutrients (ammonia, nitrate, total nitrogen, total phosphorus, filterable reactive phosphorus, phosphate, chlorophyll-a), sulphate, total hydrocarbons, fluoride and pathogens to mention only a few. Nutrients should be monitored where these are likely to be high in the discharge as a result of the activity, for example, where a sewage treatment plant is adopted or where there is a source of nutrients in the process. Ammonia and nitrate are potential toxicants (with toxicant trigger values) while total nitrogen, total phosphorus, ammonia, organic nitrogen, oxidised nitrogen, and filterable reactive phosphorus are indicators relating to potential eutrophication effects (and have related ambient water quality guidelines). Sulphate is currently regulated as a result of potential effects on drinking water (human and stock). Sulphate has no aquatic ecosystem trigger value although can change the interactions of other water quality contaminants. There are also no aquatic ecosystem guidelines for total petroleum hydrocarbons (TPHs) or polycyclic aromatic hydrocarbons (PAHs) other than naphthalene but this may be required to be monitored where mechanical workshops or petroleum-based chemicals/fuels are used on site.

9. Receiving Environment (RE) Monitoring and Triggers

Monitoring of all indicators listed for relevant environmental values in Tables 1 to 6 should be undertaken in the receiving waters at upstream and receiving environment monitoring points. Metals/metalloids as shown in Table 5 (and Table 6 if relevant) should also be monitored at upstream and downstream receiving environment monitoring points, at least until time where sufficient data is available to revise suitable monitoring indicators. Ideally, both total and dissolved metals should be monitored in the receiving environment relevant to the environmental value that the indicator relates to, e.g. total arsenic is required for assessment against drinking water guidelines.

Ideally, any associated local receiving environment monitoring program should include at least one far-field monitoring point situated much further downstream to represent post-mixing water quality. Note that the far-field monitoring point may be off the mining lease but should remain located within the nearest major flowing stream – this monitoring point should not be assessed for compliance purposes (or maximum triggers). A reference site un-impacted by mining activities (e.g. no mines within 20km upstream) should be identified and monitored for the sub-catchment. In situations where this is not possible, the least affected site, or unaffected site from another nearby sub-catchment should be identified for the purpose of collecting reference or "background" data. Collaborative monitoring programs involving more than one mining company may be applicable for monitoring such sites for local creek catchments.

Upstream and downstream receiving environment monitoring should occur during all flow events, not just during periods when discharges are taking place. This requirement is necessary for a number of reasons:

- To allow for condition assessment of these waterways
- To allow for potential assessing of impacts before and after discharge
- To allow assessment of background to assist with limit setting

Where end of pipe compliance limits apply for physical chemical indicators and are considered low risk, receiving environment monitoring and reporting should be based on long term assessment of consecutive measurements over a twelve month period and compared to ambient water quality objectives in the Queensland Water Quality Guidelines (2006) and background water quality.

Where end-of-pipe limits are considered to pose some potential risk to receiving waters, trigger values can be applied to sites immediately downstream from the discharge. The trigger values would generally be more stringent than end-of-pipe conditions but be achievable. For example, based on available information a receiving environment maximum trigger of 1000 µS/cm EC is proposed for near-field monitoring sites. Trigger values for metals/metalloids would typically be ANZECC/ARMCANZ (2000) toxicant trigger values for slightly moderately disturbed systems until sufficient reference data becomes available to review these limits.

Exceedance of these trigger values during discharge should require an in accordance with the ANZECC and ARMCANZ 2000 methodology. Where downstream water quality is within reference data, no further action should be required.

10. Modifying Limits and Triggers

Changes to compliance limits and trigger values may be appropriate where adequate and relevant reference monitoring data is made available and assessed as per the allowance in ANZECC/ARMCANZ (2000) and additional information. A reference site can be defined as a site without mine impacts (e.g. no mines within 20km upstream) for the sub-catchment with other requirements as per Appendix C in the QWQG (2006). In some cases it may be the least impacted site, or an unaffected site from another adjacent sub-catchment. An adequate number of valid data points are required to provide a reasonable confidence limit around the percentile based trigger values/guidelines. For example to develop an 80^{th} percentile guideline, a minimum of 18 samples is required to provide a 95% confidence level. Ideally, samples should be taken from multiple (minimum 3) flow events over at least a one to two year period.

The objective of water sampling for meta/metalloid concentrations discussed above is to help form an acceptable data set to allow site specific license limits or trigger values to be set for end-of-pipe and receiving waters. Elevated background levels of some metals such as aluminium, zinc, iron and chromium have been observed in the Fitzroy Basin.

Where assimilative capacity has been identified as part of monitoring, additional allowance may be incorporated into discharge limits.

Definitions

Background – In terms of water quality, background would typically be obtained by sampling upstream of the mining activity in times of natural flow. Background should not include times of discharges from other mines upstream or times of no flow.

Reference - A reference site is a site whose condition is considered to be a suitable baseline or benchmark for assessment and management of sites in similar waterbodies. The condition of the site is reference condition and values of individual indicators at that site are the reference values. Most commonly, reference condition refers to sites that are subject to minimal/limited disturbance. The key criteria quoted in the Queensland Water Quality that is applicable for most mining areas in the Fitzroy is that there is no major extractive industry (current of historical) within 20km upstream. Monitoring must occur when the stream is flowing.

Adequate Data – The Queensland Guidelines recommend a minimum of 18 samples collected over at least 12 months for estimates of 20th or 80th percentiles at a site. For 50th percentiles a smaller minimum number of samples (~ 10–12) would generally be adequate. For ephemeral streams, more than one sample should be taken for each flow event and all flow events in the period should be sampled.

Table 1. Reference-based EC guidelines for the protection of aquatic ecosystems in the Fitzroy Catchment (Qld Guidelines 2007). Units in µS/cm.

Sub catchment	**95th Percentile Guideline**	**90th Percentile Guideline**	**75th Percentile Guideline***
Fitzroy North	1400	1250	720
Fitzroy South	650	510	340

* guideline should be compared to median of long term data set.

Table 2. Guideline Values for EC for other values

	TDS (mg/L)	EC* (µS/cm)
Drinking Water	500	750
Irrigation**		1100
Stockwater***	2400	3600

* using theoretical conversion mg/L TDS = 0.67 x µS/cm EC;
** most stringent field/grass croop trigger - for corn in clay (depends on crop and soil types);
*** for dairy cattle, poultry trigger of 2000mg/L TDS

Table 3. Aquatic Ecosystem Guideline Values (for comparison against long term medians of 10-12 data points)

Parameter	Guideline (lowland)	Guideline (upland)
Ammonia N (ug/L)	20	10
Oxidised N (ug/L)	60	15
Organic N (ug/L)	420	225
Total N (ug/L)	500	250
Filtered Reactive Phosphorus (ug/L)	20	15
Total P (ug/L)	30	10
Chlorophyll-a (ug/L)	5.0	-
Dissolved Oxygen (% saturation)	85 to 110	90 to 110
Turbidity (NTU)	50	25
Suspended Solids (mg/L)	10	-
pH	6.5 to 7.5	6.5 to 8.0

Table 4. Selected Guideline Values for Stock, Crop and Drinking water (units in mg/L).

Parameter	Stock Drinking	Crop Irrigation	Drinking/ Household
Sulfate	1000		250
Chloride		350	
Calcium	1000		
Nitrate	400		
Nitrite	30		

Table 5. Aquatic Ecosystem Protection Toxicant Guideline Values

Parameter	ANZECC Guideline for slightly-moderately disturbed environ. (µg/L)	Comment
Aluminium	55	Trigger value for pH > 6.5
Ammonia	900	Based on a pH of 8
Antimony	9	Low reliability trigger
Arsenic (As III)	24	
Arsenic (As V)	13	
Beryllium	0.13	Low reliability trigger
Boron	370	See Note 1
Cadmium	0.2	
Chromium (Cr VI)	1	See Note 1
Copper	1.4	
Iron	300	Low reliability trigger
Lead	3.4	
Manganese	1900	See Note 1
Mercury (inorganic)	0.06	99% PL as can bioaccumulate
Molybdenum	34	Low reliability trigger.
Nickel	11	
Selenium (Total Speciated)	5	99% PL as can bioaccumulate
Silver	0.05	
Uranium	0.5	Low reliability trigger
Vanadium	6	Low reliability trigger
Zinc	8	See Note 1

Note 1: May not protect key species from chronic toxicity**.**

Table 6. Metal Guideline Values for Stock, Crops and Drinking Water (units in mg/L)

Parameter	Stock Drinking	Crop Irrigation	Drinking/ Household
Total Aluminium	5	200	0.2
Total Arsenic	0.5	0.1	0.007
Total Boron	5	0.5	4
Total Cadmium	0.01	0.01	0.002
Total Chromium (DW should be Cr (VI)	1	0.1	0.05
Total Cobalt	1		
Total Copper	1	200	1
Total Iron		0.2	0.3
Total Lead	0.1	2	0.01
Total Manganese		0.2	0.1
Total Mercury	0.002	0.001	0.001
Total Molybdenum	0.15	0.01	0.05
Total Nickel	1	0.2	0.02
Total Selenium	0.02	0.02	0.01
Total Zinc	20	2	3

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Operational policy

Licensing

Waste water discharge to Queensland waters

Operational policies provide a framework for consistent application and interpretation of legislation by the Environmental Protection Agency, which incorporates the Queensland Parks and Wildlife Service. Operational policies will not be applied inflexibly to all circumstances. Individual circumstances may require an alternative application of policy.

This operational policy[1] provides both policy advice and technical information for officers assessing development applications or environmental authority applications under the Environmental Protection Act 1994*,* Environmental Protection (Water) Policy 1997*,* Integrated Planning Act 1997 *and* State Development and Public Works Organisation Act 1971 *for environmentally relevant activities discharging residual waste water to Queensland waters, including to waters of high ecological value. The operational policy includes the consideration of mixing zones, assimilative capacity, environmental offsets and environmental values and water quality objectives in assessing and deciding applications. It also informs applicants in preparing applications.*

Table of contents

[1] This operational policy supersedes the EPA Procedural guide *Licensing discharges to aquatic environments* and is informed by the EPA Procedural Guide *Procedural information for the operational policy Waste water discharge to Queensland waters*. (The latter document will remain draft and the subject of consultation until finalised late in the first quarter of calendar 2008.)

Environmental Protection Agency
www.epa.qld.gov.au ABN 87 221 158 786

Queensland Government
Environmental Protection Agency
Queensland Parks and Wildlife Service

1. Operational policy overview

1.0 Policy subject

This document summarises and explains the policies that apply when assessing applications under the *Environmental Protection Act 1994* (the EP Act) that may involve discharge of waste water[2] to Queensland waters[3], including to waters of high ecological value (HEV). It also applies when assessing applications under other Acts that involve environmental values (EVs) of water or water quality objectives (WQOs), decisions made under the *State Coastal Management Plan 2001* and Regional Coastal Management Plans.

1.1 Key legislation and policy frameworks

The operational policy is based primarily on the EP Act and the *Environmental Protection (Water) Policy 1997* (the EPP Water). The object of the EP Act is "to protect Queensland's environment while allowing for development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends (ecologically sustainable development)" (from Section 3 of the EP Act). The explanatory notes to Section 5 of the EP Act (Obligations of persons to achieve object of Act) require "all people who are given power under this Act, to use that power to protect the Queensland environment and do so consistent with the principles of ESD".

The current EPP Water includes statements of policy about assessment and decision making that resulted from consultation on the Regulatory Impact Statement for the *Environmental Protection (Water) Amendment Policy No 1 2006* (the EPP (Water) AP). These are described in the corresponding explanatory notes. This operational policy provides further information on the implications of 'scheduling' EVs and WQOs under the EPP Water for residual waste water discharge. Refer also to the EPA information sheet *Scheduling environmental values and water quality objectives.*

The operational policy also informs officers and applicants on key provisions of the EPP Water, the *Queensland Water Quality Guidelines 2006* and the ANZECC Water Quality Guidelines.

The environmental offsets policy at Section 2.5 is to be used in conjunction with the Queensland Government Environmental Offsets Policy.

Relevant legislation, intergovernmental agreements and other EPA Operational policies are listed at Section 4.

1.2 Application of policy

This operational policy applies when assessing or deciding applications (hereinafter referred to as development applications) relating to activities that are proposing to discharge residual waste water to waters, such as:

- development approvals under the *Integrated Planning Act 1997* (IPA) for EP Act chapter 4 activities (non-mining and non-petroleum environmentally relevant activities (ERAs)) prescribed under the *Environmental Protection Regulation 1998*;
- environmental authorities under the EP Act for mining and petroleum activities;
- the assessment of *Environmental Impact Statements* prepared under the EP Act chapter 3 or the *Environmental Protection and Biodiversity Conservation Act 1999* (the EPBC Act);
- projects declared to be significant projects by the Coordinator General under the *State Development and Public Works Organisation Act 1971* (the SDPWO Act);

[2] Under the EPP Water, waste water means liquid waste and includes contaminated stormwater.
[3] Queensland waters means all waters that are within the limits of the State and includes all tidal (coastal and estuarine) and non-tidal (riverine) waters, groundwaters and wetlands (see the definition in the *Acts Interpretation Act 1954*).

- development that is the subject of designation of land for community infrastructure under the *Integrated Planning Act 1997*;
- when assessing transitional environmental programs or environmental evaluations under the EP Act; and
- when making environmental management decisions under the EPP Water involving waste water release on land, waste water recycling and the release of contaminated stormwater that may impact on surface waters or groundwaters.

In assessing development applications for EP Act chapter 4 activities the administering authority must comply with any relevant Environmental Protection Policy requirement and must consider the standard criteria of schedule 3 of the EP Act (see Glossary of Terms) and additional information given in relation to the application.

If the application seeks an increase in the scale or intensity, the administering authority must assess the application having regard to the proposed activity, the existing activity and the potential environmental harm the proposed activity and the existing activity may cause. Refer to section 73AA of the EP Act for applications in a wild rivers area.

Subject to IPA, the administering authority may impose **conditions on the development approval** it considers are necessary or desirable, and must include any condition the authority is required to impose under an Environmental Protection Policy requirement. For other conditions that may be imposed, refer to section 73B (3) and (4) of the EP Act.

In assessing and deciding applications for environmental authority (mining activity) for level 1 mining projects the administering authority may in granting the application impose the conditions on the environmental authority it considers necessary or desirable.

In deciding whether to grant or refuse the application or to impose a condition the authority must:

(a) comply with any relevant Environmental Protection Policy requirement; and

(b) subject to paragraph (a), consider - application documents for the application, the standard criteria, the wild river declaration for the area—to the extent the application relates to mining activities in a wild river area, any suitability report obtained for the application and the status of any application under the *Mineral Resources Act 1989* for each relevant mining tenement.

The operational policy also informs the application of EVs and WQOs in the assessment of non-ERA development applications, including under the *State Coastal Management Plan 2001* and Regional Coastal Management Plans (State Planning Policies under IPA). Information on Implementing the State Coastal Management Plan includes the Planning Scheme Guideline and Development Assessment Guideline. These guidelines provide advice on reflecting the relevant policies of the State and Regional Coastal Management Plans into Local Government planning schemes and for development assessment. Relevant policies include 2.4.1 Water quality management, 2.4.4 Stormwater management and 2.4.5 Groundwater.

A glossary of terms is at Appendix 6.1.

2. Policy/technical issues determination

2.0 Policy statements

The statements of policy informing assessment and decision making on applications for ERAs discharging residual waste water to Queensland waters are at Explanatory notes for EPP (Water) AP and summarized as follows. The policy context is considered with respect to receiving waters that have the biological integrity of:

a. Effectively unmodified (high ecological value) aquatic ecosystems

"The management intent for high ecological value aquatic ecosystems is to maintain the natural values; including the physico-chemical, biological, habitat and flow attributes. For any new ERA a decision to release waste water to high ecological value surface waters, or groundwater, is the least preferred option. Under the waste management evaluation procedure of section 15 of the Environmental Protection (Water) Policy 1997 (the waste management evaluation procedure), the management hierarchy requires the sequential evaluation of waste water prevention and waste water treatment and recycling before the evaluation of the release of waste water to land, sewer or surface water.

In addition, the activity must be carried out in accordance with best practice environmental management for the activity.

However if some release of waste water from the activity to high ecological value surface water is environmentally acceptable after consideration of the waste evaluation procedure, and there are no practicable alternative surface water discharge locations, the ERA would need to demonstrate:

- *an equivalent outcome of no, or negligible, change[4] to the physico-chemical, biological, habitat and flow attributes beyond natural variation of the waters, excepting, in limited circumstances, within a defined initial mixing zone measured near the waste water release outfall location. The intent is that beyond the mixing zone boundaries, current environmental quality is maintained and the aquatic ecosystem is conservatively protected over time, taking into account the precautionary principle;*
- *some environmental assimilative capacity[5] is preserved for future ecologically sustainable development;*
- *the proposal is in the public interest[6] and provides outstanding net benefits to the region, or State as a whole[7];*
- *where practicable, the proposal includes a like kind environmental offset[8]; and*
- *compliance with State Government obligations under intergovernmental agreements which include the management and protection of world heritage areas under the UNESCO Convention[9]; the management and conservation of wetlands under the Ramsar Convention on Wetlands[10]; and the management and protection of migratory birds and their environment under JAMBA and CAMBA[11]"*; or

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[4] The method of assessing 'no change' to the physico-chemical, biological, habitat and flow ecosystem attributes of high ecological waters is given in the Queensland Water Quality Guidelines 2006 (Appendix D Compliance assessment protocols.)
[5] The environmental assimilative capacity is broadly the capacity of the environment to receive some human induced input of contaminants or alteration, without causing unacceptable change.
[6] Refer to the standard criteria listed under Section 3 of the *Environmental Protection Act 1994*.
[7] Refer to the Terms and abbreviations section of the *State Coastal Management Plan 2001*.
[8] To be of a 'like-kind' the environmental offset would need to be based on the same contaminant and preferably in the same water. However the environmental offset proposal would be considered by the administering authority on a case-by-case basis; seeking to deliver a net environmental gain to the water as a whole.
[9] The *Convention Concerning the Protection of the World Cultural and Natural Heritage (UNESCO) 1972.*
[10] *RAMSAR Convention on Wetlands, Iran 1971*.
[11] Japan Australia Migratory Bird Agreement and China Australia Migratory Bird Agreement. Australian Treaty Series, respectively 1981 No.6 and 1988 No.22. Department of Foreign Affairs and Trade. Canberra.

b. Slightly to moderately disturbed aquatic ecosystems

"*The management intent for the release of waste water to surface waters having the biological integrity of slightly to moderately disturbed aquatic ecosystems is considered with respect to the existing water quality.*

For any new ERA, if after consideration of the waste evaluation procedure the release of contaminants to surface water is environmentally acceptable, the management intent is summarised below:

- *where the existing water quality is better than the scheduled water quality objectives, the management intent is to maintain the current water quality; while allowing in some circumstances the use of some of the remaining assimilative capacity for future development and population growth; and*
- *where the existing water quality corresponds to the scheduled water quality objectives, the management intent is to maintain the water quality; and*
- *where the existing water quality is of a lower quality than the scheduled water quality objectives, the management intent is to improve the water quality and prevent further degradation. Attainment of the scheduled water quality objectives will be sought through continual improvement over time and, depending on existing water quality, may be a long-term goal. Environmental offsets of a 'like kind' may be considered by the administering authority where there are no feasible alternatives to the release of waste water.*

In addition, the activity must be carried out in accordance with best practice environmental management for the activity. For existing ERAs the continuous improvement requirement of development conditions applies…'; or

c. Highly disturbed aquatic ecosystems

"The management intent for the release of waste water to surface waters having the biological integrity of highly disturbed aquatic ecosystems is to halt the decline and reverse the trend in water quality.

For any new ERA, if after consideration of the waste evaluation procedure the release of contaminants to surface water is environmentally acceptable, the management intent is to halt the decline and reverse the trend in existing water quality. However it is recognised that attainment of scheduled water quality objectives is a long-term goal.

In addition, the activity must be carried out in accordance with best practice environmental management for the activity. For existing environmentally relevant activities the continuous improvement requirement of development conditions also applies.

Environmental offsets of a 'like kind' may be considered by the administering authority where there are no feasible alternatives to the release of waste water."

The above statements of policy are considered in the following sections 2.1 to 2.5, in conjunction with the Queensland and ANZECC Water Quality Guidelines and the role of EVs and WQOs in water quality assessment. An overall assessment flowchart is at Figure 1, the corresponding task list for assessing the discharge of residual waste water is at Table 1. A glossary of terms is at Appendix 6.1.

Figure 1 — Assessment flowchart

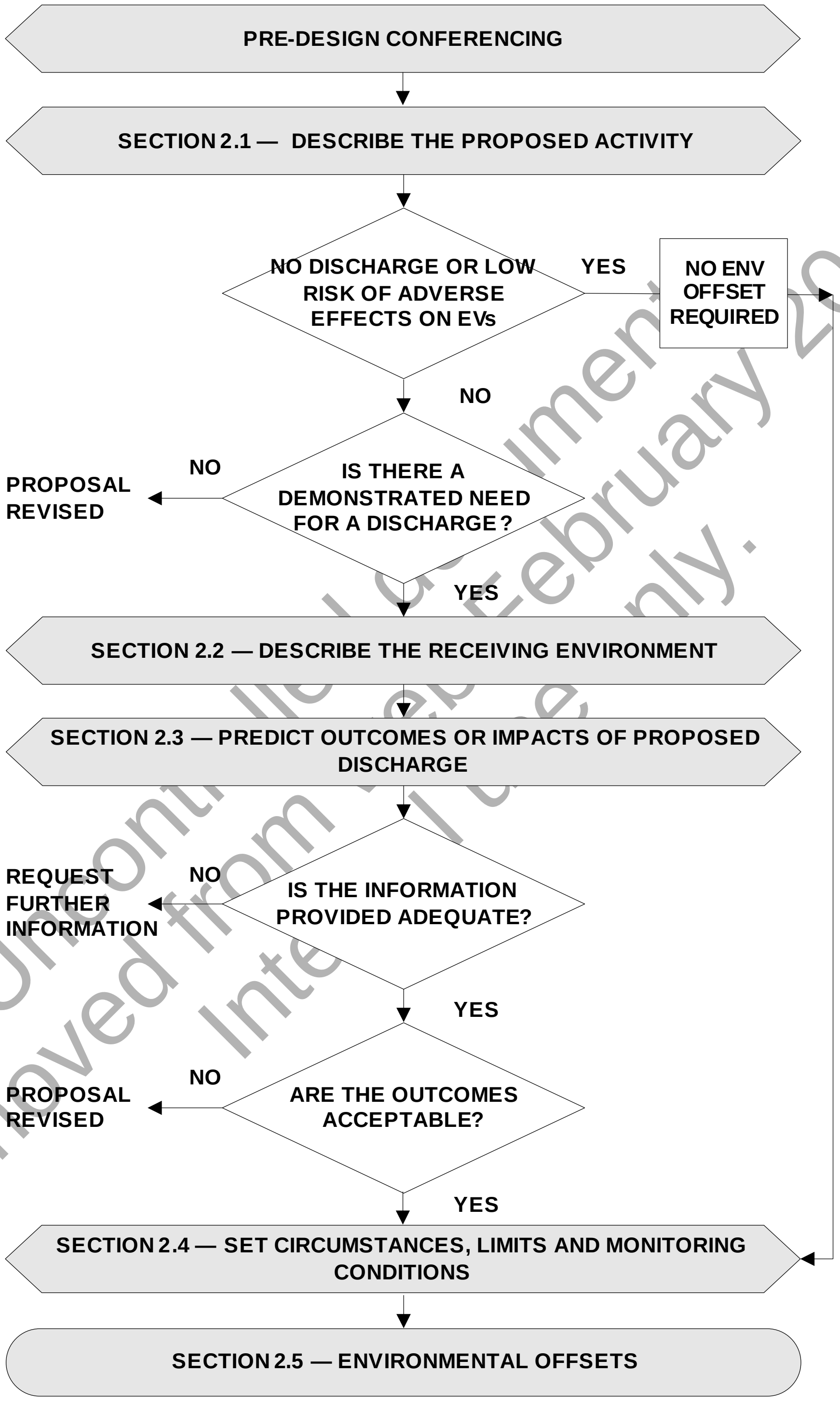


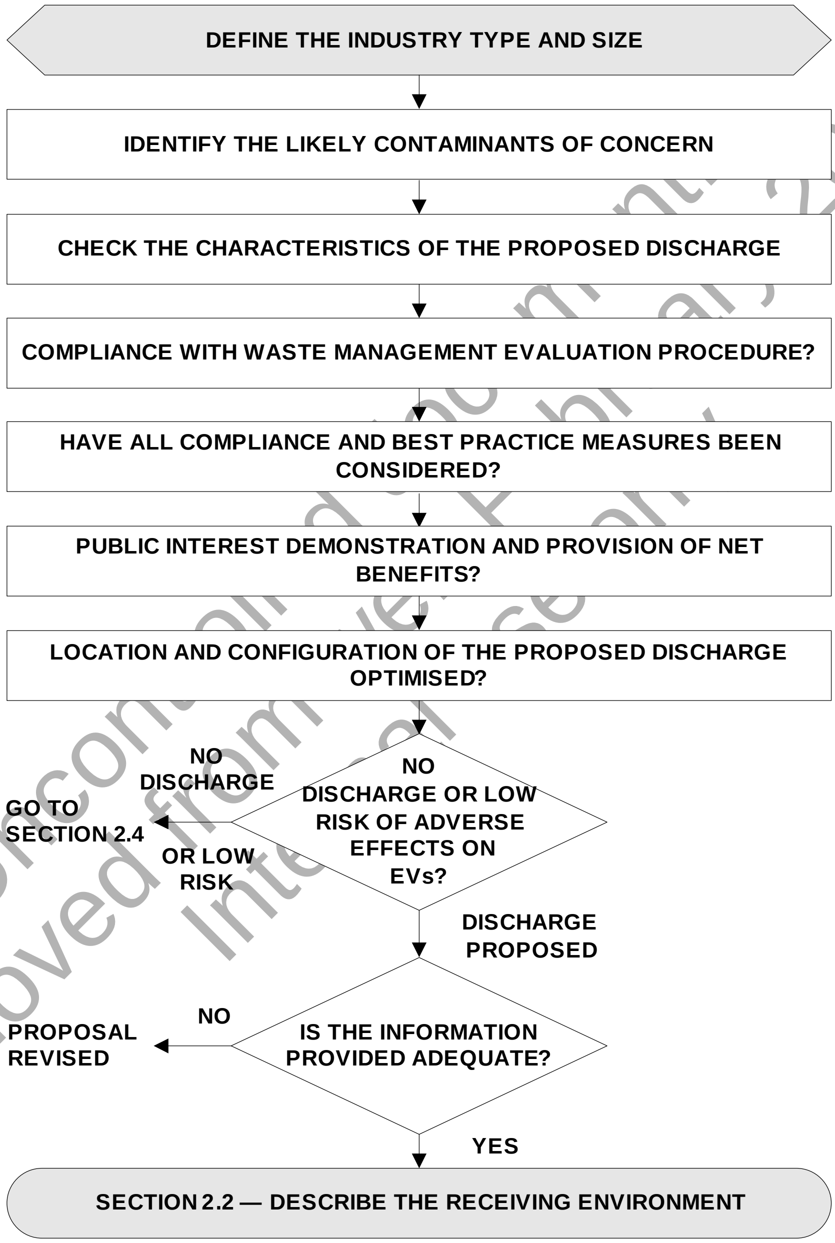
Table 1 — Task list for assessing the discharge of residual waste water

Section	Activity	Tasks list
2.1	Describe the proposed activity	Define the industry type and size (proposed production). Is a residual waste water discharge proposed, or is the discharge assessed as low risk of having an adverse effect on an environmental value? Identify the potential contaminants of concern in the proposed discharge. Check the characteristics of the proposed discharge (quality/quantity/variability). Check the location and configuration of the proposed discharge. Have all reasonable and practicable measures been used to avoid or minimise the discharge (for example best practice, source reduction, recycling)?
2.2	Describe the receiving environment	Identify water bodies potentially affected by the proposed discharge. For each water body, what are the sustainable loads for key contaminants? What proportion of the sustainable load is used by this proposal? Check government planning requirements that apply to these water bodies (e.g. Ramsar, EPA Referable Wetlands, National Parks and Fish Habitat Areas). Has relevant information on the receiving environment been provided? Is it adequately described given the contaminants and risks associated with the proposed discharge? Are the EVs and WQOs for these waters listed in the EPP Water Schedule 1? (If not EVs and WQOs from the *Queensland Water Quality Guidelines 2006* and ANZECC Water Quality Guidelines apply). Have other sources and loads of contaminants in the catchment, including future loads, and previous history, been considered?
2.3	Predict outcomes of the proposed activity	Identify the need for predicting outcomes of the proposed activity (i.e. is modelling required?) and what predictive methods/models were used. Were the predictive methods used appropriately? If a mixing zone is proposed; check the EPP Water (Section 18) and ANZECC Water Quality Guidelines. For receiving water bodies, are WQOs met and EVs protected? If not, does the activity contribute to achieving them in the future? Determine the need for consideration of environmental offsets.
2.4	Set limits, circumstances and monitoring conditions	Specify any circumstances (for example limitations or timing issues) related to the approved discharge. Derive end-of-pipe limits from approved discharge loads/characteristics. Include compliance monitoring for the end-of-pipe/receiving environment Include reporting requirements for the approved activity. As required, condition the execution of an environmental offset agreement.

2.1 Describe the proposed activity and discharge

This section involves the assessment of information provided by the applicant on the description of the proposed activity, as shown in Figure 2 below and summarised in the following text.

Figure 2 — Activity description and assessment



2.1.1 Define the industry type and size (estimated production)

The industry type and scale will help to classify the potential environmental risk from the proposed activity and discharge of residual waste water. The scale of the activity can be specified in production quantities such as area of production for aquaculture farms, tonnes of throughput for processing industries or equivalent persons in the case of sewage treatment.

2.1.2 Identify the potential contaminants of concern in the discharge from the proposed activity

The first step in assessing the discharge of residual waste water from the proposed activity is identifying the source waste streams and potential contaminants of concern. Contaminants can be a gas, liquid or solid, an odour, an organism, energy (as in a thermal discharge) or a combination of contaminants. Common industry point source discharges and their likely effects are summarised in Table 2.

Note that some industries/ERAs are commonly associated with particular classes of aquatic contamination; for example Waste Water Treatment Plants and nutrients. The National Pollutant Inventory emission estimation technique manuals list 90 priority substances on the basis of health and environmental risk, by industry sector, and the USA EPA Toxic Release Inventory lists 313 priority substances.

These inventories may assist in identifying other key contaminants by industry/ERA. The information can be used as a guide to check information in the application. A search of the academic literature and the internet would be undertaken for more information on specific activities not mentioned. Contaminants are related to process inputs and outputs and can transfer from media other than water (for example leach from solids, scrubber effluent, etc). Contaminants in residual waste water may also occur as unintended by-products of processes (for example dioxins and metal compounds).

Depending on the character and resilience of the receiving environment, and the degree of risk, direct toxicity assessment may be required on any available laboratory or pilot plant samples to complement literature evaluation of the additive toxicity of contaminants in the proposed discharge. Such analysis more closely resembles the situation in the natural environment than single chemical testing approach. Refer to the ANZECC Water Quality Guidelines — volume 2, Section 8.3.6.

Table 2 — Potential issues of concern and water quality contaminants

Point source discharges	Potential issues	Water quality contaminants
Sewage effluent	Asphyxiation of aquatic animal life (e.g. low dissolved oxygen levels leading to fish kills), algal blooms, smothering of flora and fauna, impairment of ecosystem structure and function, and public health risks.	Carbonaceous material, nutrients, pathogens, suspended solids, toxicants (metals/metalloids, pesticides, residual disinfectants and pharmaceuticals).
Abattoir effluent	Asphyxiation of aquatic animal life (e.g. low dissolved oxygen levels leading to fish kills), algal blooms, smothering of flora and fauna, impairment of ecosystem structure and function, and public health risks.	Carbonaceous material, suspended solids, nutrients, pathogens, residual disinfectants and toxicants.
Mine discharges	Toxicity of sulphate, acid/alkaline solutions and metals/metalloids. Increased availability of metals due to pH changes, smothering of flora and fauna impairment of ecosystem structure and function, and salinisation. May affect stock and irrigation water.	pH, sulphate, temperature, suspended solids, turbidity, salinity, toxicants (metals/ metalloids and other chemicals, including fluoride).
Aquaculture discharges	Asphyxiation of aquatic animal life (e.g. low dissolved oxygen levels leading to fish kills), algal blooms, smothering of flora and fauna, impairment of ecosystem structure and function, diseases and introduced species.	Carbonaceous material, suspended solids, nutrients and toxicants. Diseased organisms and antibiotics may be an issue in some operations.

Point source discharges	Potential issues	Water quality contaminants
Sugar mill cooling waters	Low dissolved oxygen levels leading to fish kills, elevated temperatures may lead to fish kills and other effects on fauna and flora.	Carbonaceous material, temperature and antifouling agents.
Chemical processing plants	Toxicity of acids, alkalis, metals or industrial chemicals. Increased availability of metals from pH changes, smothering of flora and fauna, algal blooms and low dissolved oxygen levels leading to fish kills.	pH, sulphate, toxicants (ammonia, metals/metal compounds (including sulphides)/metalloids, pesticides, and other chemicals), suspended solids, carbonaceous material, temperature, nutrients and by-products.
Power stations - blowdown water	Toxicity of metals and metalloids. Smothering of flora and fauna. Elevated temperatures and salinisation.	Suspended solids, toxicants (metals, metalloids and chemicals), temperature and dissolved salts.

2.1.3 Check the characteristics of the discharge from the proposed activity

The quality and quantity of the discharge from the proposed activity should be clearly characterised. This must include concentrations, typically averages and worst-case values of all potential contaminants of concern, assuming the treatment technology is working effectively. The quantity of the discharge must be similarly expressed for volumes and resulting contaminant loads. The expected variability with time is a further important consideration and percentiles may be used to express this. Wet weather influences must be considered and separate wet weather discharge characteristics defined where applicable.

The method used to estimate these characteristics must be clearly defined and realistically achievable from practical and economic viewpoints. This may be demonstrated with reference to guidelines, pilot plant results or previous applications of the adopted waste water treatment technology. Alternatively, process models may be used to predict these characteristics.

2.1.4 Have all best practice measures been used to avoid or minimise the discharge? Have all compliance matters been addressed?

The mandatory waste management evaluation assessment consideration is required under the EPP Water and the *Environmental Protection (Waste Management) Policy 2000* (EPP Waste). Assessment usually involves benchmarking against waste management principles, relevant best practice environmental management (BPEM) and evaluation of discharge alternatives. A range of processing options for the proposed activity are usually available to the applicant to prevent, abate or mitigate the waste water discharge and its impacts. These measures include segregating waste streams, source reduction, substitution of chemicals used, cleaning and processing with minimal water, recycling, reuse and best practice treatment and disposal alternatives.

a. Best practice environmental management for the proposed activity

The application should demonstrate that the management of the proposed activity will achieve an on-going minimisation of the activity's environmental harm through cost effective measures assessed against the measures currently used nationally and internationally for the activity. Best practice environmental management technology standards are industry and contaminant specific. Guidance is available from sources including environmental guidelines, research organisations, equipment manufacturers and performance records of industry sector leaders. A technology based standard using best practice environmental management would comprise a benchmark to satisfy the EPP Water waste minimisation provisions.

b. Compliance with the Environmental Protection Policies — waste management evaluation

The application must demonstrate that the proposed activity complies with the EPP Water provisions, including Sections 14 to 24, the EPP Waste provisions, including Sections 10 to 13 and 15 to 17 (as relevant) and consider the *Queensland Water Recycling Guidelines 2005* and the National Water Quality Management Strategy's *Australian Guidelines for Water Recycling: Managing Health and Environmental Risks 2006*.

The latter guidelines provide the framework to encourage the adoption of sustainable water recycling to better manage water resources, and to support economic growth while protecting the environment and safeguarding public health. For industrial waste streams it should also be demonstrated that a release of effluent to sewer, subject to Local Government conditions, is not an acceptable option. A letter from the relevant Local Government advising that discharge to sewer would not be permitted is the common way that this may be demonstrated.

c. Some discharge of residual waste water shown to be unavoidable and environmentally acceptable

Waste water discharge to receiving waters is the least preferred option. The application must demonstrate that waste management evaluation procedures have been addressed and best practice environmental management measures have been used to avoid or minimise the residual discharge to water, and there are no alternate discharge locations or other residual waste water treatment, reuse or disposal options that cause less harm to the environment.

Environmentally acceptable in the context of this paragraph means incorporating all best practice and practicable waste minimization measures.

d. Compliance with State Government obligations under Intergovernmental Agreements and other statutory instruments

The application must comply with, and assessment and approval processes must address matters of State interest, including relevant State Government obligations under inter-government agreements including:

- *Intergovernmental Agreement on the Environment;*
- Agreement under the *Council of Australian Governments* (COAG) *Water Reform Framework;*
- *Convention on Wetlands (Ramsar, Iran, 1971);*
- *UNESCO World Heritage Convention 1972;* and
- International Agreements Relating to Migratory Birds and Wetlands (the Japan-Australia Migratory Bird Agreement (JAMBA), the China-Australia Migratory Bird Agreement (CAMBA) and the Directory of Important Wetlands Australia).

Inter-government agreements contain a range of State obligations. Examples include the promotion the sustainable use and conservation of Ramsar wetlands, protecting world heritage areas and adopting ecologically sustainable development in natural resource decision-making and approval processes. State obligations under COAG include the implementation of the *National Water Quality Management Strategy*.

Matters the subject of the agreements may be of national environmental significance under the EPBC Act and trigger Commonwealth assessment and approval processes. The applicant is responsible for self-assessment and referral to the Australian Government for impact assessment on a matter of national environmental significance. For further information refer to the Department of Environment and Heritage website, EPBC Act Policy Statements — Significant Impact Guidelines/Matters of National Environmental Significance.

Relevant statutory instruments having the effect of State planning policies include the *State Coastal Management Plan 2001,* Regional Coastal Management Plans (Wet Tropical Coast, Cardwell - Hinchinbrook, Curtis Coast, South-east Queensland) and the *South East Queensland Regional Plan 2005 – 2026.* **State planning policies** include SPP 2/02 (Planning and Managing Development involving Acid Sulphate Soils) and SPP 2/07 (Protection of Extractive Resources) that identifies those extractive resources of State or regional significance where extractive industry development is appropriate in principle, and aims to protect those resources from developments that might prevent or severely constrain current or future extraction when the need for use of the resource arises.

EPA Referable Wetlands datasets are available to State and Local Government through the Queensland Government *Infolink* and development triggers for land in or near are at Assessable development under *Integrated Planning Regulation 1998*.

e. ***For HEV waters — is the proposal in the public interest and does it provide outstanding net benefits to the region, or State as a whole?***

Public interest under the standard criteria of Schedule 3 of the EP Act may be ascribed as meaning the interest of the public as distinct from the interest of the individual(s).

Net benefits to the region, or the State as a whole, has the meaning under the *State Coastal Management Plan 2001.*

These matters may be addressed if, for example:

- the proposal provides a public service such as municipal sewage disposal or provides goods or services to the Queensland community to meet an identified demand and there is no alternative option that is capable of meeting that demand; and
- the potential environmental, economic and social impacts of the project (whether beneficial and adverse) have been assessed at a regional or State level, depending on the project scale; and strongly supports the proposal.

Note the public interest and applicable environmental impact studies, assessments or reports are a part of the standard criteria under Schedule 3 of the EP Act that must be considered in assessing all applications.

2.1.5 Check the location and configuration of the discharge from the proposed activity

The location of the proposed discharge is important as it determines the receiving waters potentially affected. Further, the potential impacts of the proposed discharge are influenced by the configuration under which it is operated (for example some discharges may only occur in the wet season or under slack water, or flood or ebb-tide conditions). A further consideration is the diffuser or outfall configuration. A diffuser may be used to provide better mixing in the initial zone. Outfalls may be submerged to promote mixing or achieve aesthetic goals. The application should explain the rationale behind the proposed discharge location and configuration. Similarly, the rationale for rejecting alternatives to discharge should be explained.

It would typically be necessary and desirable for a discharge pipe to be submerged below low water spring datum, except in cases of denser than ambient waste waters where submergence may exacerbate adverse environmental effects.

2.1.6 ERAs with low assessed risk or no discharge of residual waste water

If the proposed ERA does not involve a direct or indirect discharge of residual waste water to waters, then conditions prohibiting waste water discharge would be included. If the ERA includes a discharge, but represents a low risk of having an adverse effect on an environmental value, then further detailed steps may not be required. Subject to addressing the matters in Section 2.1, and checking for any matters in Section 2.2 that would preclude the discharge, the assessment should proceed to Section 2.4.

A low risk of having an adverse effect on an environmental value would generally occur when pollutant loads are decreasing and are a relatively minor contribution to the receiving water, and when toxicant concentrations in the discharge are below trigger values listed in Section 3.4 of the ANZECC Water Quality Guidelines.

Another case may be a relatively infrequent discharge such as overtopping of waste water storage during flood conditions.

Where no toxicant trigger values are available but published information suggests a chemical may be of concern, direct toxicity assessment may be required on any available laboratory or pilot plant samples to ensure risks are low. Refer to the ANZECC Water Quality Guidelines — volume 2, Section 8.3.6 and Appendix 6.2 of this operational policy.

Development applications involving contaminants found to be low risk or involving no discharge of waste water require no further receiving water quality assessment.

Development conditions would require monitoring and reporting to annually confirm the absence of adverse effects on environmental values or would prohibit waste water discharge (in development applications where no discharge was proposed). Development conditions would also typically specify the nature of the permitted discharge and require monitoring of discharge volume and quality to ensure the activity was carried out as described in the application. In most cases, conditions also typically prohibit discharge of contaminated stormwater. For some activities, stormwater treated to render it less hazardous may comprise a waste water stream that is permitted to be discharged subject to conditions.

Summary

Is there a demonstrated need for a discharge of residual waste water? Are relevant EPP and other compliance issues addressed?

Note that in deciding whether to grant or refuse an application the administering authority must comply with any relevant EPP requirement and must consider the standard criteria of Schedule 3 of the EP Act.

Applications must demonstrate that the discharge of residual waste water from the proposed activity is unavoidable and environmentally acceptable, and other EPP requirements and other compliance requirements are addressed.

If not demonstrated the application should be revised following an information request.

Applicants are encouraged to discuss the above requirements at pre-design conferencing.

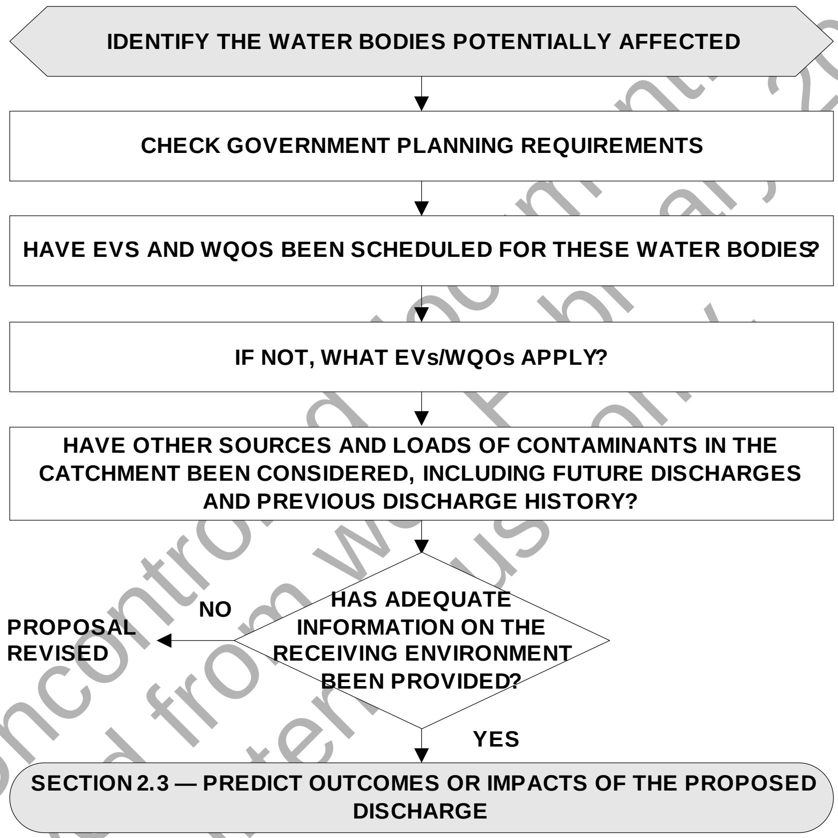
Pre-design conferencing is offered by the EPA to all prospective applicants seeking direction and advice on development applications; including on the preparation of development applications and the necessary documentation to ensure that lodged applications are supported by the requisite information to enable the administering authority to make a decision. Applicants are encouraged to compile information for pre-design conferencing of concepts and plans.

2.2 Describe the receiving environment

This section involves the assessment of information provided by the applicant on the description of the receiving environment, as shown in Figure 3 below and summarised in the following text.

For the receiving waters potentially affected by the proposed discharge, the applicant should identify the EVs and WQOs and provide a description of the existing character, resilience and environmental values of the receiving environment. Refer Appendix 6.1 for the glossary of terms.

Figure 3 — Description of receiving environment

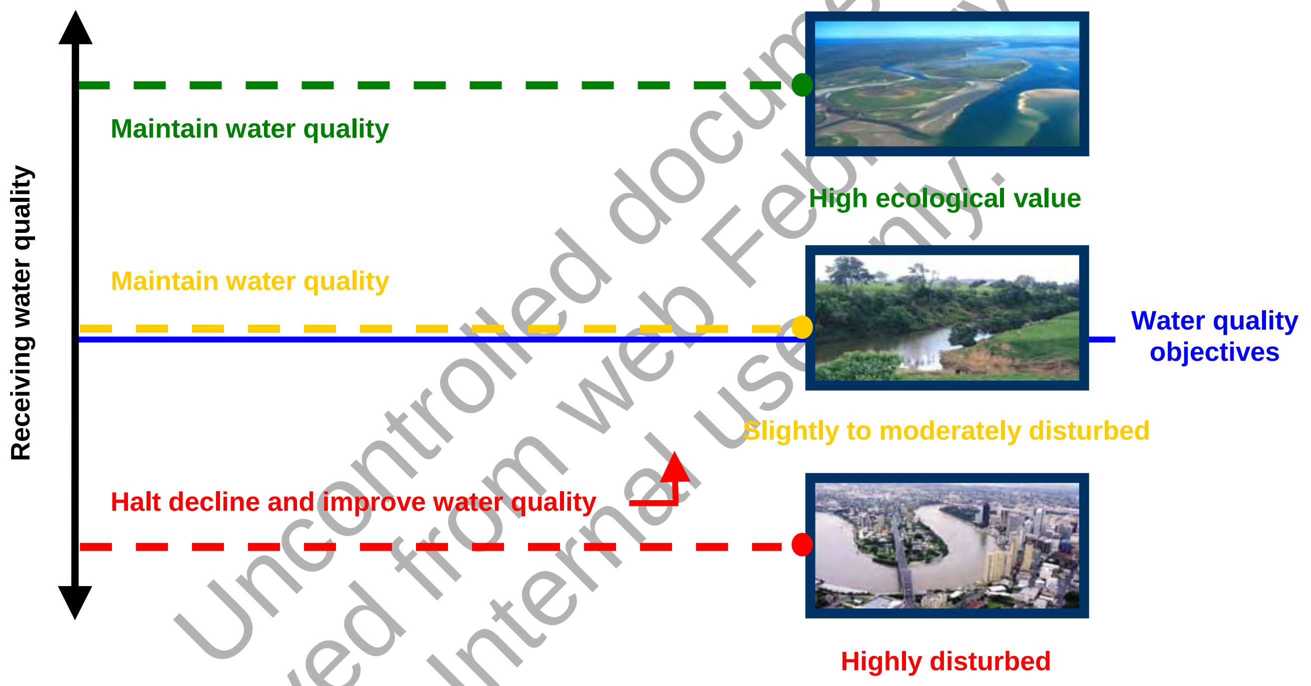


2.2.1 Identify the water bodies potentially affected by the proposed discharge

The intent is to characterize the receiving waters including EVs, WQOs and levels of ecosystem protection. Key information sources are the EPP Water (Schedule 1) and the *Queensland Water Quality Guidelines 2006,* for waters not listed under Schedule 1. As in Section 2.2.2, other State and regional planning documents may also be relevant.

It is important to determine what receiving water ecological health monitoring data is available and how it compares with the relevant water quality objectives and the policy intent (refer Figure 4 below, Section 2.2.3 and Section 2.3).

Figure 4 — Receiving water quality, water quality objectives and management intent



EVs relevant to the receiving waters should be used for the assessment of development applications. For example the affected water body might be a bay, an estuary or riverine waters, and different EVs and WQOs will apply to different parts of the water body. This information is either contained in the documents referenced in Schedule 1 of the EPP Water (accessible via the EPA website) or from the *Queensland Water Quality Guidelines 2006.* Local information may need to be obtained if the latter does not adequately characterise the receiving waters, refer Section 2.2.5.

Further, the levels of aquatic ecosystem protection need to be determined as either high ecological value (HEV) or slightly-to-moderately disturbed (SMD) or highly disturbed (HD). Levels of aquatic ecosystems protection may be available from a number of sources including the EPP Water, State and Regional Coastal Management Plans (Areas of State Significance (Natural Resources)), the Directory of Important Wetlands Australia and Marine Parks and National Parks designations for waters in areas of protected estate. Further guidance in assigning the level of aquatic ecosystem protection is given in Table 3, Section 2.2.2 and the ANZECC Water Quality Guidelines (Section 3.1.3).

2.2.2 Check applicable government plans or requirements

Environmental management objectives, levels of aquatic ecosystem protection and other relevant matters are often specified in applicable planning designations. These matters are a part of the standard criteria of Schedule 3 of the EP Act that must be considered by the administering authority in deciding the application. Examples of Commonwealth requirements include matters of national environmental significance, such as Ramsar listed wetlands and World Heritage Areas, threatened species, as well as Great Barrier Reef Marine Park requirements. Examples of State requirements include the State and Regional Coastal Management Plans, Marine Park zoning plans, Water Resource Plans, Fisheries Habitat Areas, National Parks, EPA Referable Wetlands (refer Section 2.1.4 *d*) and the Great Barrier Reef Water Quality Protection Plan. Local Government information may also include relevant designations in Local Government planning schemes.

2.2.3 Check applicable environmental impact studies, assessments or reports

Relevant information may be available through Commonwealth and State Government Agencies and Authorities, Non-Government Agencies and Local Government web sites, and internet and library searches; or required by the applicant.

2.2.4 Has relevant information on the receiving environment been provided? Is it adequately described given the contaminants and risks associated with the proposed discharge?

It is essential that ecosystem health and catchment information is obtained to assess the outcomes of the proposed activity. Information must be provided on both the character and resilience of the receiving environment to address the standard criteria of Schedule 3 of the EP Act and would include current local ecosystem health and water quality information, potential catchment pollutant sources and local catchment issues**.** This information may already exist; however it must be current and adequately address temporal and spatial variations to be representative of current conditions. The information may need to be established as part of special investigations prior to lodging the development application. **Pre-design conferencing to address these issues is strongly encouraged.**

Local or regional ecological health monitoring data may be available for the receiving waters (for example from EPA, Department of Natural Resources and Water (DRNW), regional natural resource management bodies or Local Government). The information will be required for comparing the existing water quality of the receiving waters with the WQOs, and must relate to the specific contaminants and assessed risks associated with the proposed residual discharge of waste water to the receiving waters. Current ecological health information may also be required for calibration of predictive models, refer Section 2.3 and Appendix 6.3.

In considering the proposed discharge of residual waste water, the policy intent relates to the level of ecosystem protection and the existing receiving water quality, as shown in Figure 4 and summarised in Table 3.

There may be reports, environmental studies or monitoring results that assist in characterising the receiving environment from sources such as the EPA, the DNRW, the Department of Primary Industries and Fisheries (DPIF), other State Government departments, Local Government, universities, external research organisations and industry groups. This information is a valid consideration under the standard criteria of Schedule 3 of the EP Act.

Note that the precautionary principle must be considered where EVs for waters are threatened and information on the resilience of the system is unknown or limited.

Table 3 — Levels of aquatic ecosystem protection, policy intent and environmental management decisions

High ecological value
The policy intent for high ecological value waters is to afford a high degree of protection of the EVs by ensuring no measurable change to water quality, biological diversity or flow condition. Applications proposing residual waste water discharge to HEV waters should be accompanied by local reference data and local biological effects data. Where practicable the proposal should include a 'like kind' environmental offset, seeking to deliver a net environmental gain to the water. For toxicants listed in Section 3.4 of the ANZECC Water Quality Guidelines, environmental management decisions would include trigger values for toxicants[12] to protect 99 percent of species in the affected water. HEV waters may include fish habitat areas, dugong protection areas, Marine Parks, National Parks and Areas of State Significance (Natural Resources) under State and Regional Coastal Management Plans. Additional HEV waters may be identified through State or regional strategies, ecological studies or stakeholder consultation.
Slightly to moderately disturbed
The policy intent for slightly to moderately disturbed waters is dependent upon current water quality. If the current water quality is better than the WQOs, the intent is to maintain current water quality — using some assimilative capacity. If the current water quality is worse than the WQOs, the intent is to prevent further degradation and improve water quality over time. Environmental offsets of a 'like kind' may be considered by the administering authority where there are no feasible alternatives to discharge of residual waste water. For toxicants listed in Section 3.4 of the ANZECC Water Quality Guidelines, environmental management decisions would include trigger values for toxicants[13] to protect 95 or 99 percent of species in the affected water. The applicant may also use risk analysis techniques, including direct toxicity assessment; all supporting documentation should be supplied with the development application. EPAofficers should request assistance from the Environmental Sciences Division in assessing the validity of the data.
Highly disturbed
The policy intent for highly disturbed waters is that receiving water quality should: a) improve towards achieving the WQOs to protect the EVs, over time; and b) not measurably deteriorate as a result of the proposed discharge. For toxicants listed in Section 3.4 of the ANZECC Water Quality Guidelines, environmental management decisions would include trigger values for toxicants for slightly to moderately ecosystems would be adopted first, although lower levels of protection (for example 90 percent of species) may apply in some cases. An application for a discharge into HD waters should be supported by reference to local monitoring data. Environmental offsets of a 'like kind' may be considered by the administering authority where there are no feasible alternatives to the discharge of residual waste water.

[12] See Table 3.4.2 of the ANZECC Water Quality Guidelines.
[13] Refer above.

2.2.5 Have EVs and WQOs for the waters been listed in Schedule 1 of the EPP Water?

EVs and WQOs for waters listed under Schedule 1 of the EPP Water must be adopted and considered in assessing development applications.

2.2.6 If EVs and WQOs are not listed under Schedule 1 of the EPP Water, what EVs/WQOs apply?

Where EVs and WQOs for the waters have not been specifically set in Schedule 1 of the EPP Water then, under Section 11(2) of the EPP Water, the WQOs are the set of water quality guidelines that will protect all EVs for the waters, including the Queensland and ANZECC Water Quality Guidelines.

Where the default guideline values are inappropriate for the receiving environment, for example due to non–anthropogenic reasons such as high organic carbon, WQOs would be based on water quality guidelines derived from data collected at appropriate local reference sites — refer Section 3.1.

Table 4 lists EVs for waters, refer also to Appendix 6.1. The EPA guideline *Establishing draft environmental values and water quality objectives* sets out the process for establishing EVs and WQOs under the EPP Water.

Table 4 — Environmental values for waters

EVs of water	Examples of suitability for use
Aquatic ecosystems EVs The level of aquatic ecosystems protection that the WQOs are intended to protect includes: • High ecological value ecosystems • Slightly to moderately ecosystems • Highly disturbed ecosystems	Maintain or improve the biological integrity of the respective aquatic ecosystems condition (HEV, SMD, HD). Total to partial complement of aquatic and adjacent terrestrial habitat and biota diversity and abundance (depending on the level of protection), including water associated wildlife.
Human use EVs include:	
• Recreation and aesthetics	Primary contact recreation (e.g. swimming). Secondary contact recreation (e.g. boating). Visual recreation (e.g. natural landscape).
• Drinking water	Water sources used for drinking water.
• Primary industries	Irrigation, general agricultural use and stock watering. Stock watering. Human consumption of aquatic foods (fish, crustacean and mollusks) — commercial and recreational sources. Aquaculture.
• Industrial	Generic processes (heating and cooling). Specific industries (textile, chemical, paper and pulp). Power generation (hydro-electric).
• Cultural and spiritual	Protection of cultural resources — places or objects of historic or indigenous significance or value.

2.2.7 Have other sources and loads of contaminants in the catchment been considered, including future discharges and previous discharge history?

For some contaminants such as nutrients and sediment it is necessary to consider other catchment sources and loads, and if the activity will be contributing to these loads. Considering catchments loads is particularly important where WQOs are not currently being achieved in receiving waters potentially affected by the discharge and multiple discharge sources exist.

It should be noted that the EPP Water also requires discharge of waste water from future developments to be considered in the decision making process. Possible sources of information include development applications, Local Government sewerage planning strategies, the EPA Point Source Database and the Department of Infrastructure and Planning. This aspect is important because the administering authority would not allocate all available assimilative capacity to a single application, and an application should not seek the discharge of a contaminant where the proposed load was a significant proportion of the sustainable load; i.e. the contaminant load consistent with the maintenance of the WQOs for the receiving waters. The concept of sustainable load including consideration of assimilative capacity is addressed further under Section 2.3.4.

The sustainable load can be determined by studies of aquatic ecosystem health and modelling to predict the effect of natural catchment and anthropogenic loads (diffuse and point source) on the water quality objectives of the receiving water. This process is generally undertaken in collaboration with regional natural resource management bodies and other relevant stakeholders.

For some receiving waters, previous management actions have resulted in the reduction of contaminant loads in order to achieve water quality objectives. The administering authority would consider it important that improved environmental outcomes be maintained, rather than re-establish discharge loads. Load history may also give insight into the likely effect of certain levels of discharge on water quality. Environmental offsets may be considered by the administering authority for SMD and HD waters with no assimilative capacity for the contaminant, and where there are no feasible alternatives to the discharge of residual waste water.

Summary

Has adequate information been provided to describe the character, resilience and environmental values of the receiving environment? Have applicable government plans, requirements, environmental impact studies, assessments or reports been considered?

Note that the above relates only to part of the standard criteria of Schedule 3 of the EP Act. All the standard criteria and other prescribed matters must be considered by the administering authority in deciding whether to grant or refuse the application.

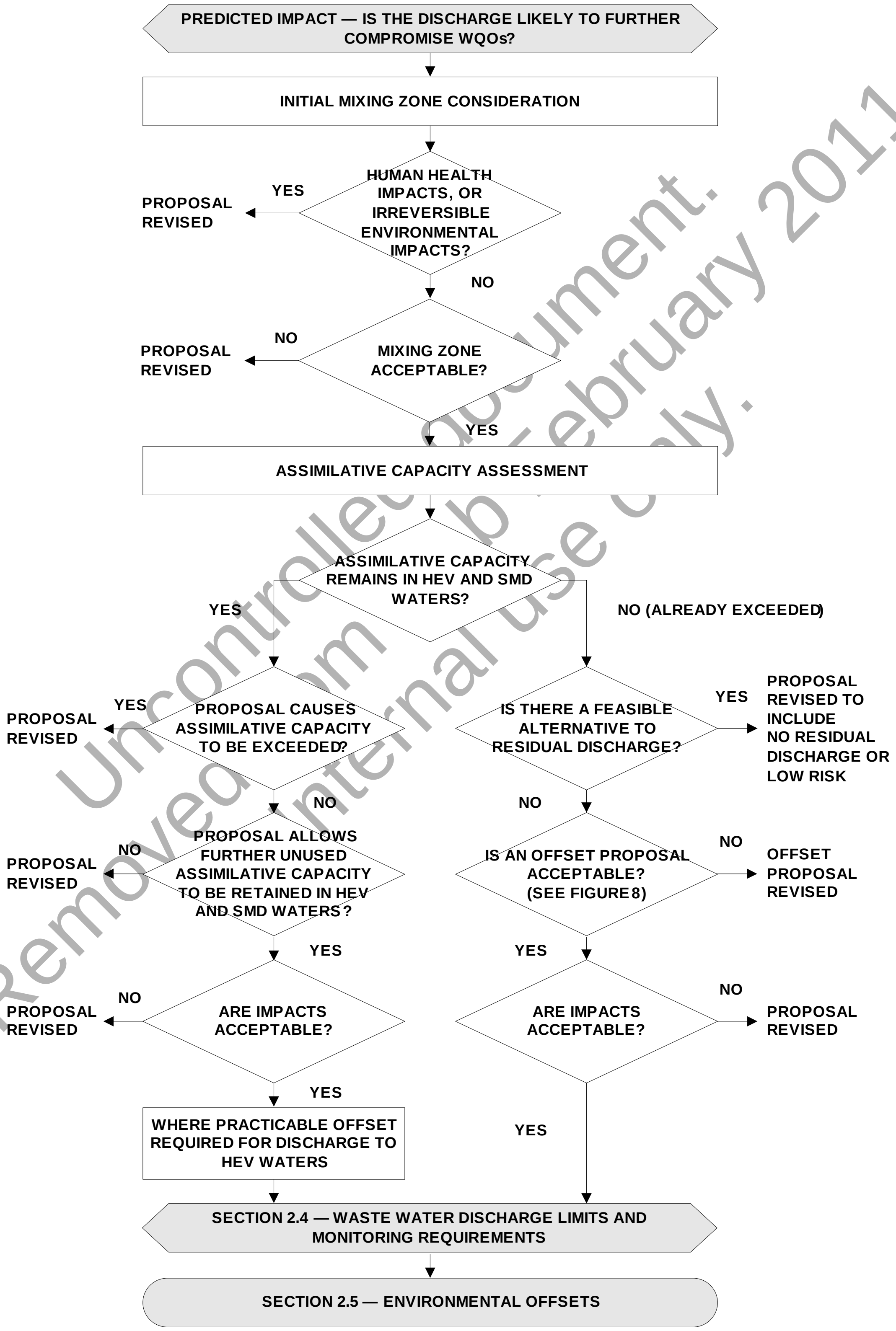
If not demonstrated, the application should be revised following an information request.

Applicants are encouraged to discuss the above requirements at pre-design conferencing.

2.3 Predict outcomes or impacts of the proposed discharge

This section involves the assessment of information provided by the applicant on the predicted outcomes or impacts of the proposed discharge, as summarised in the following text and shown in Figure 5 below.

Figure 5 – Prediction of impacts of proposed discharge



2.3.1 Predicted impact of the proposed discharge of residual waste water on the EVs and WQOs of the receiving waters

Prediction of the environmental outcomes or impacts that would result from the proposed ERA requires the completion of quantitative assessments which may involve numerical modelling procedures to estimate contaminant loads, changes to receiving waters contaminant concentrations and the effects of mitigation actions. Refer to Appendix 6.3 — *Numerical modelling of environmental impacts and mitigation actions*.

Prediction of the impact of the proposed discharge of residual waste water on receiving water quality should be compared to the WQOs — in the context of the policy intent at Section 2.0, which is summarised below and shown at Figure 4. Existing receiving water quality should be the baseline comparison for impact assessment.

a. For the discharge of residual waste water to high ecological value (HEV) receiving waters

The policy intent in considering an application to discharge residual waste water into high ecological value receiving waters is to maintain the natural values; including the physico-chemical, biological, habitat and flow attributes.

b. For the discharge of residual waste water to slightly to moderately disturbed (SMD) receiving waters

The policy intent in considering an application to discharge residual waste water into slightly to moderately disturbed receiving waters is considered with respect to the existing water quality — either maintain (use some assimilative capacity) or improve (over time).

c. For the discharge of residual waste water to highly disturbed (HD) receiving waters

The policy intent in considering an application to discharge residual waste water into highly disturbed receiving waters is to halt the decline and reverse the adverse trend in water quality. Highly disturbed receiving waters do not have any assimilative capacity. It is recognised that attainment of WQOs for highly disturbed receiving waters is a long-term goal.

2.3.2 Where WQOs are not currently being achieved, is the discharge likely to further reduce receiving water quality?

If the WQOs of the receiving waters that are potentially affected by the proposed discharge are not currently being achieved, a significant environment risk is associated with the proposed discharge as further environmental harm is likely to occur. In this case the EVs will not be protected and pre-design conferencing with the applicant should consider alternatives. Where the discharge of residual waste water from the proposed ERA may not otherwise be avoided, reused, recycled or other disposal alternatives adopted; further considerations by the administering authority should include environmental offsets where there are no feasible alternatives to the discharge of residual waste water — refer to Section 2.5.

2.3.3 Initial mixing zone

Mixing zones are a mandatory consideration under the EPP Water and applications must:

- comply with Section 18 of the EPP Water (waste water releases to surface water);
- consider the ANZECC Water Quality Guidelines for mixing zones;
- include the results of the baseline water quality monitoring in the area of the proposed mixing zone; and
- for HEV waters — provide predictive modelling results that demonstrate no or negligible change to the ecological attributes beyond the mixing zone, refer to Appendix 6.2.

A mixing zone is a permitted zone of non-compliance with the receiving WQOs and is primarily for managing soluble toxicants where concentrations in the discharge are above toxicant trigger values in Section 3.4 of the

ANZECC Water Quality Guidelines. Where this is the case, further risk assessment including direct toxicity assessment (DTA) for biological effects, should be considered prior to mixing zone assessment.

Refer to the ANZECC Water Quality Guidelines — volume 2, Section 8.3.6. Where the toxicant concentrations in the discharge are found to not cause toxicity, mixing zone assessment may not be required. Results of DTA will also be used to assess the actual dimensions of the mixing zone.

Various predictive models are available for estimating initial mixing zones, evaluating outfall diffuser designs and defining areas around the outfall where concentrations may exceed WQOs; refer Appendices 6.2 and 6.3.

The administering authority would not approve a mixing zone if inclusion would be likely to result in human health impacts, irreversible environmental impacts, unacceptable impacts to biota or where the discharge of residual waste water was characterised by a lack of effluent plume dispersion.

Mixing zone considerations include:

- only one mixing zone, minimised to the greatest practicable extent in accordance with the waste management hierarchy, is permitted for an ERA;
- spatially defining the mixing zone based on compliance with estimated receiving environment concentrations using mean flows and maximum expected toxicant concentrations for the discharge against chronic toxicant concentration (refer Appendix 6.2). The diameter (as depicted in Figure 6) should be measured from the diffuser port and should be defined by considering the maximum extent from a range of tidal conditions in tidal areas covering at least slack tides and mid-tide conditions for all toxicants present in the discharge. In non-tidal streams, the minimum consecutive seven day average flow with a 10-year recurrence interval is recommended as a guide to minimum dilution conditions;
- ensuring the mixing zone would not provide a barrier to the migration of aquatic fauna in riverine and estuarine waters, i.e. not take up the width of the stream. As a general rule, the maximum lateral dimension should be the lesser of 50m diameter or 30 percent of the waterway width for riverine and estuarine waters and a radius not exceeding 100m from the diffuser port for coastal/marine waters;
- avoiding overlap of mixing zones from neighboring discharges. It is recommended that the edges of the mixing zones be at least 200m apart. The combined affect should be assessed;
- not impinging on the shore line; for example, based on the mean on the low water spring tide (Mean Low Spring Tide);
- the use of mixing zones is not appropriate for managing the discharge of nutrients, bio-accumulatory or particulate substances. For nutrients, see discussion below for management using reference based assessment;
- mixing zones are typically not applicable to waters with significant and regular use for primary contact recreation, existing aquaculture development approvals, areas allocated to aquaculture under planning frameworks, waters of high ecological value, conservation significance or scientific importance or near potable water intakes;
- the discharge limits should be set such that within the mixing zone the residual waste water discharge does not cause odours, surface discolouration, visible floating foam, oils, grease, scum, litter or other objectionable matter;
- contaminant concentrations in the mixing zone must not be acutely toxic to fish, other aquatic vertebrates, commercial species or endangered wildlife, cause significant irreversible harm including objectionable bottom deposits, the growth of undesirable aquatic life or the dominance of nuisance species (such as algal blooms). The use of toxicity-based guidelines or site-specific biological effects

data is usually required to define the boundary of the mixing zone (refer Figure 6 and Appendix 6.3); and

- for large flowing freshwater streams where effluent discharges are unlikely to have significant density difference to the receiving waters, the effluent plume may extend a considerable distance downstream. The applicant would need to confirm the proposed discharge did not violate the WQOs of the receiving waters after full lateral mixing.

When assessing thermal discharges and oxygen demanding substances, acute effects should not occur anywhere in the receiving waters, for example no harmful dissolved oxygen sags are caused. In these cases, maximum concentrations and loads should be modeled and assessed to assess potential impacts. Predicted environmental concentrations and levels should be compared to known acute effect levels.

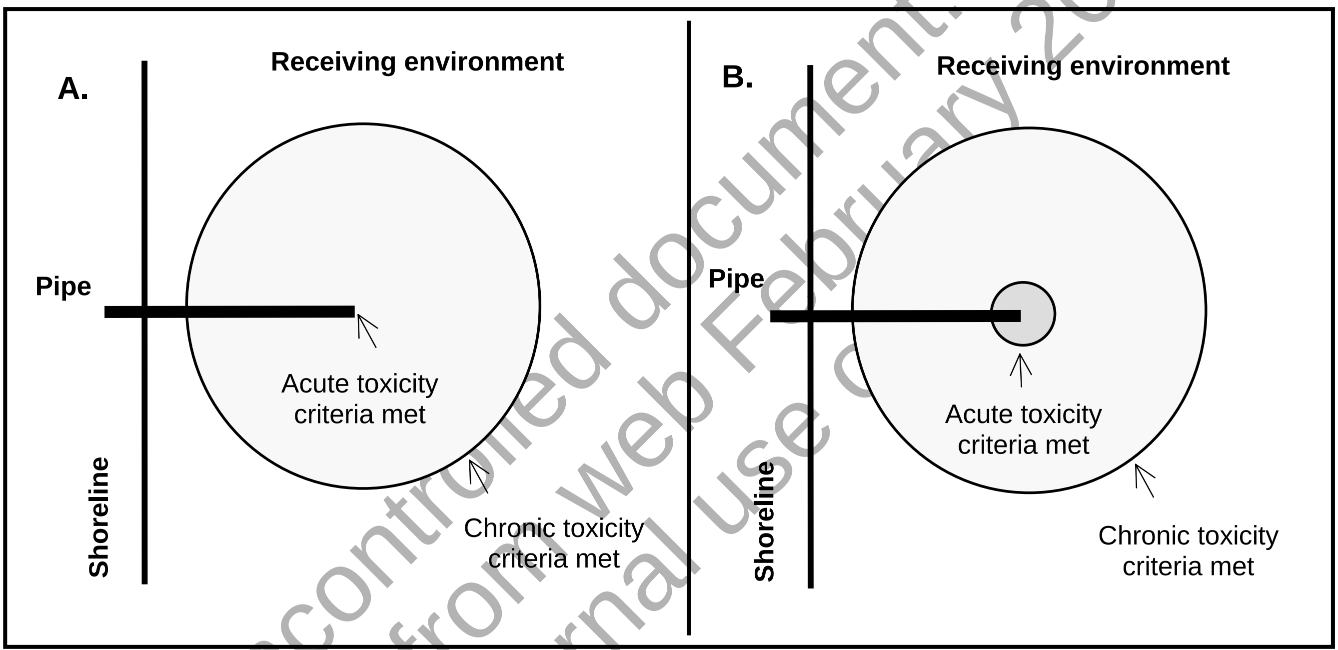


Figure 6 — Spatially defining an initial mixing zone.

A. Low risk configuration where acute toxicity levels are met end-of-pipe.

B. Configuration that involves a small zone within the mixing zone where acute toxicity criteria may not be met but have a low risk of causing acute toxicity.

When assessing effects of contaminants that are based primarily on a reference condition rather than direct effects, for example nitrogen and phosphorus concentrations, assessment typically requires water quality objectives to be met on a percentile basis (for example median concentration). It is not necessary that such concentrations are met directly at the discharge point as effects of dilution, assimilation and average receiving environment conditions should be considered. Prediction of effects of these discharges is typically a far-field issue and needs to consider the assimilative capacity of the waters (see Section 2.3.4).

Monitoring of effects of discharges in these cases is typically undertaken in the centre of waterway channel at various distances from the discharge point. Compliance with reference criteria should be met within 3 stream widths or 300m, whichever is the smaller as a general guide. Approval of zones with exceeded water ambient quality objectives greater than this size may be granted in specific cases where social and economic considerations support the discharge of residual waste water and there are no other feasible alternatives. Regardless, localised environmental harm should not occur, for example smothering of corals with benthic algae from nutrients.

For discharges involving contaminants that are not directly toxic, diffusers are still desirable and may also be required to achieve good initial dilution and avoid undesirable effects such as visible plumes or slicks and biological effects such as avoidance behavior. Modeling may be required to design the diffusers to optimize dilution and location. For example, it would generally be desirable to achieve at least a 1:50 dilution within 100m in any direction from the discharge point of the release. Discharges from pipes should also be located so that they are submerged under all tidal conditions, unless the discharge is denser than ambient. Discharges to poorly mixed waterways should be discouraged, for example upper estuaries, below barrages and small waterways with limited tidal exchange.

In cases where a mixing zone was permitted, development conditions would require the applicant to install measures such as diffusers on which the predictions were based and require a compliance monitoring program to verify that the minimum dilution ratios and concentrations predicted for mixing zone were achieved at the modelled or DTA determined mixing zone boundary.

Specific considerations include**:**

- Loss of aesthetic enjoyment or generation of an objectionable odour;
- **Public notification**. As the environmental values for waters may be prejudiced by the inclusion of a mixing zone, impact assessable development applications proposing a mixing zone should become public knowledge through the public notification stage of the application. Development conditions may require signage to identify the location of the adjacent mixing zone;
- **The precautionary principle** must be applied where environmental values are threatened and information on the resilience of the system is limited. Consequently the administering authority must, in considering the application and assessing risks to the ecological health of waters outside the mixing zone, adopt the precautionary principle to ensure that the current environmental quality is maintained beyond the mixing zone boundaries and that human health and aquatic ecosystems are conservatively protected within the mixing zone; and
- For HEV waters **peer review assessment** of the mixing zone proposal is required, including the demonstration of the lack of impacts beyond the mixing zone boundaries, and must be submitted with the development application. The EPA can advise of potential peer reviewers.

2.3 4 Assimilative capacity and sustainable load

a. Policy issues

Refer to Section 2.0.

Assimilative capacity is the capacity of the receiving waters to receive some human induced input of contaminants, or alteration, while still achieving the water quality objectives.

b. Release of assimilative capacity in HEV and SMD waters for discharge of residual waste water

Decisions about the use of assimilative capacity in HEV and SMD receiving waters for the discharge of residual waste water must be considered after all options to manage the waste water have been assessed and managed by the administering authority in the context of sustainable and efficient use of scarce resources — see also sub-section *d* below, *Assimilative capacity of HEV water not to be exceeded by discharge of residual waste water.*

A development application should demonstrate that the assimilative capacity of the receiving waters is not exceeded and that some assimilative capacity is preserved for future ecologically sustainable development - the proportion proposed to be consumed should be determined.

As a guide, the majority proportion of the assimilative capacity should be retained for future ecologically sustainable development.

The administering authority may consider the role of market-based instruments in managing these issues (for example flexible or incentives based mechanisms). For HEV waters the policy intent is that, where practicable, the application includes an environmental offset proposal seeking to deliver a net environmental gain to the water as a whole, see Section 2.5.

c. What are the sustainable loads for key contaminants?

The sustainable load of a particular contaminant is the maximum amount that a water body can receive without failing to meet the WQOs and therefore adversely affecting EVs. The concept of sustainable load is particularly important for oxygen demanding substances, nutrients, sediments and toxicants. It should be noted that toxicants are generally a near-field issue[14] and that suspended sediments can have an adsorbed toxicant load which can adversely affect pelagic species and benthic fauna and flora directly, as well as indirectly through contamination of food sources (for example, seagrass and organic detritus)..

d. Assimilative capacity of HEV water not to be exceeded by discharge of residual waste water

The demonstration of 'no or negligible change' to the ecological indicators beyond the mixing zone boundaries also demonstrates that the HEV water assimilative capacity is not exceeded. Refer to Appendix 6.2.

e. Where assimilative capacity is exceeded — prior to assessment

In some SMD waters the assimilative capacity for specific contaminants may already be exceeded. This may be evident from ecological health monitoring and remedial programs may be underway to restore ecological health by reducing loads of specific contaminants.

Where the current receiving water quality does not meet the WQOs, the policy intent for slightly-to-moderately disturbed (SMD) waters is to prevent further degradation and improve water quality over time.

Highly disturbed (HD) waters do not have any assimilative capacity. The policy intent is to halt the decline and reverse the trend in water quality, recognising the attainment of receiving WQOs is a long term goal.

For ERAs seeking to discharge residual waste water to receiving waters without assimilative capacity, alternatives to the discharge and alternate discharge locations should be re-evaluated before undertaking an assessment of how worse water quality will become. If there are no feasible alternatives to prevent, control or abate the discharge of residual waste water or to mitigate the impacts through alternative discharge strategies, then environmental offsets may be considered by the administering authority — see Section 2.5.

For waters with no assimilative capacity, achieving the receiving WQOs would be sought on a catchment wide basis involving all ERAs discharging waste water to the receiving waters through continual improvement over time, and additionally considering diffuse source (urban and rural) emissions. Depending on the existing receiving water quality, achievement of the WQOs may be a long-term goal. The EPA *Strategic compliance management program* typically includes area/sub-catchment, industry sector and licensed activity inspections that seek, amongst other things, to improve receiving water quality on a catchment basis. The program may involve all activities discharging to a particular water body.

In the case of an existing industry that is a key contributor to the impaired water quality in SMD or HD waters, reductions in discharge loads would be considered for any application to increase scale or intensity, or as part of the above EPA program to restore waterway health.

[14] Sustainable loads should relate to an area of influence based on the issues of concern. For example, effects from sediment bound toxicants on benthic communities may be a localised issue.

The public interest consideration and other considerations under the standard criteria of Schedule 3 of the EP Act may be important in the assessment of applications proposing the discharge of residual waste water to SMD or HD receiving waters, where assimilative capacity is exceeded.

Relevant considerations may include:

- the proposal provides a public service such as municipal sewage disposal or provides goods or services to the Queensland community to meet an identified demand and there is no alternative option that is capable of meeting that demand; and
- applicable environmental impact studies, assessments or reports.

Summary

Is the information provided adequate?

Is sufficient information provided about the proposed activity that addresses the above matters? If necessary, further information should be requested.

Are the outcomes/impacts acceptable?

Further information may also be required to address deficiencies or achieve better environmental outcomes, for example using alternative technologies, management practices, discharge locations. Pre-design conferencing is important in raising issues and exploring options at the earliest possible time, and in seeking advice and direction on documentation, plans and information requirements.

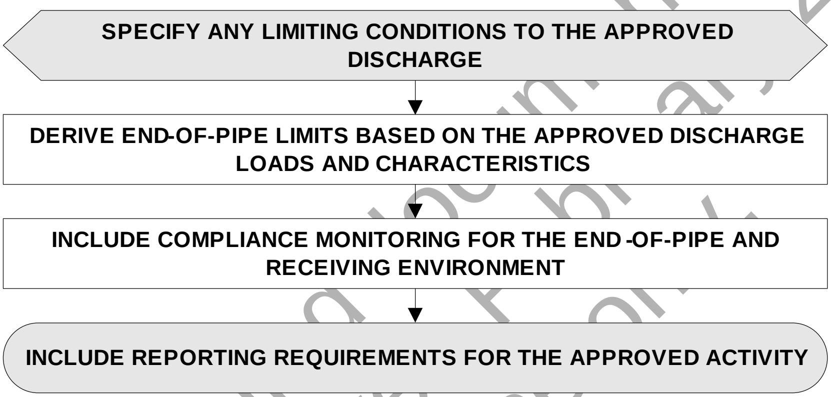
Pre-design conferencing is encouraged to address the prediction of impacts of the discharge on receiving waters, mixing zone and assimilative capacity requirements.

2.4 Set residual waste water discharge limits, discharge and impact monitoring requirements

Once the outcomes of the proposed activity are deemed acceptable, it is necessary to determine the appropriate residual waste water discharge limits and monitoring requirements, the latter in compliance with Sections 26 and 27 of the EPP Water, for inclusion in the development conditions. The derived development conditions, including discharge characteristics, limits, release (discharge) and impact monitoring requirements should reflect the inputs used in predictions.

Other factors for consideration include the environmental risk of the industry type and the use of best practice environmental management for the activity. Appropriate discharge limits and performance monitoring can be decided upon by undertaking the following steps that are summarised at Figure 7.

Figure 7 — Consideration of specific development conditions



2.4.1 Specify any circumstances related to the approved discharge

Approval to discharge must be constrained to the residual waste water, after waste minimisation measures have been implemented. The conditions must state that only approved waste water may be discharged. The location of the discharge, including any need for submergence or a diffuser, should be specified. Certain limitations or timing issues may also be conditional to the approval. For example, the discharge may only be permitted at outgoing tides (ebb-tide release), certain months of the year or only during wet weather flows exceeding a stated level. Outfall submergence below local low water to avoid visual impacts and enhance mixing is generally required, unless the discharge is not buoyant. Other precautions such as signage may be desirable depending upon the nature and the location of the discharge.

The protocols for monitoring must comply with Section 10 of the EPP Water and be in accordance with the EPA Water Quality Sampling Manual and the ANZECC Water Quality Guidelines. Compliance assessment protocols for different levels of aquatic ecosystems protection (HEV, SMD and HD waters) are at the Queensland Water Quality Guidelines.

2.4.2 Derive discharge limits based on the approved discharge loads and characteristics

WQOs would not normally be used directly for regulatory purposes and therefore discharge limits for the end-of-pipe need to be derived that will achieve these WQOs. The process of deriving the limits can be divided into selecting the indicator (for example dissolved oxygen concentration), determining the relevant limit type (for example minimum) and choosing the limit and units (for example 6mg/L). General guidance for setting limits is shown in Table 5. Derived information would be used in conditioning development approvals, environmental authorities, transitional environmental programs and environment protection orders.

a. ***Indicators***

Limits should be placed on any indicators that can be practically measured at the end-of-pipe and are relevant to the discharge quality. These might include toxicants, nutrients, oxygen-consuming substances, suspended solids, dissolved oxygen, pH and pathogen indicators such as *Enteroccocus spp*. The discharge loads proposed for the activity and assessed in the above processes would be used as a basis for setting these limits. For waste streams that may vary over time, for example municipal sewage may receive varied trade waste inputs, an additional qualitative condition that requires that the release must not have any other properties nor contain any other organisms or other contaminants which are capable of causing environmental harm is recommended to address this issue.

b. ***Discharge volume limits***

Maximum volumes permitted for discharge on any one day would be considered, including wet weather flows for waste water treatment plants (WWTPs),

c. ***Percentiles and frequency***

Development conditions may include limits combining percentiles (for example the 80th percentile) and must include maximum values (or minimum values in cases such as dissolved oxygen discharge of very cold water where adverse effects are related to low values rather than high values). Maximum values are particularly important for toxicants that have an acute impact on the environment (refer Table 3 and Table 3.4.2 ANZECC Water Quality Guidelines for trigger values for toxicants to protect 99, 95 and 90 percent of species). In addition, maximum values can be applied for compliance monitoring to a single sampling event whereas percentiles can only be applied over a number of sampling events. Maximum values also ensure a proper standard of treatment applies at all times. Percentiles may be employed when relevant to treatment technology and when percentile performance is used in impact assessment studies to evaluate medium to long term environmental outcomes, for example nutrient loads and risks of nutrient enrichment.

Table 5 — Guidance for setting limits for indicator types

Contaminant type	Limit type/s	Guidance for limits
Toxicants	Maximum No observed effect level (NOEL)	No acute toxicity in initial mixing zone (i.e. end-of-pipe). No chronic effects outside initial mixing zone. Additional multiplying factors may be used in the case of bio-accumulating and bio-concentrating contaminants. No build-up in sediments, exceeding relevant trigger levels. No build-up in seafood species (Food Standards Code). Irrigation, stockwater and drinking water protected where these are relevant values.
Nutrients	50th percentile Maximum Mass loads	50th percentile to achieve mass load (and prevent local impacts). Maximums to prevent local impacts (generally three times limit for 50th percentile). Mass loads based on systems sustainable load or capacity.
Sediments	Maximum	Use levels achievable by BPEM (e.g. 50 mg/L)
Salinity	Maximum	Maximum to prevent local impacts.
Pathogenic indicators	Maximum Median 4 out of 5	Limits based on 2005 National Health and Medical Research Council (NHMRC) Water Guidelines (e.g. for faecal coliforms, *Enterococcus spp.* and pathogenic protozoa).

Contaminant type	Limit type/s	Guidance for limits
Temperature	Maximum Minimum	Maximum temperature elevation based on receiving waters.
Residual disinfectant	Maximum Minimum	Maximum based on likely decay time and effects on biota.
Dissolved oxygen concentration	Minimum	Best practice environmental management.
Oxygen demand and suspended solids	Mass loads 80th percentile Maximum	Mass loads based on systems sustainable load or capacity. 80th percentile to achieve mass load (and prevent local impacts). Maximums to prevent local impacts (generally three times limit for 80th percentile).

Minimum values are necessary for dissolved oxygen concentration levels and pH in discharges. Percentiles are important as they encompass ongoing high quality treatment in the longer term, whilst allowing reasonable fluctuation in the treatment process. Note that percentiles are not suitable for some characteristics (for example residual chlorine) and should not be applied without relevant maxima or minima.

Activities with substantial discharges such as large WWTPs would typically be required to meet a long-term percentile (annual), short-term percentile (six week) and maximum limits. As this involves significant sampling effort (for example weekly), this may not be appropriate for a small-scale discharge such as that from a small caravan park's WWTP. In this case, monthly monitoring against maximum limits and annual percentile would be more reasonable. The method of determining maximums and percentiles should incorporate expected and acceptable fluctuations in concentrations and loads consistent with best practice.

Typically loads are implicitly conditioned through a combination of both concentration and volume limits. In some cases, load-based limits may be set (for example daily, weekly or annually).

This is done by setting a limit on the mass of a particular contaminant discharged per day, calculated by multiplying the volume released that day by the most recent monitoring result for the contaminant. Percentile load limits are expressed as the proportion of a number of consecutive daily loads that must meet the relevant limit (for example five out of 10 consecutive daily loads must not exceed a stated mass).

Where loads are used to quantify discharge limits, concentrations should also be included. This prevents the discharge of a smaller volume of very poorly treated effluent that would meet a load limit.

d. ***Limits and units***

Limits need to be set for each quality characteristic in appropriate units based on potential effects and available analytical methods (refer Table 5). Analytical methods are given in the *EPA Water Quality Sampling Manual*. Scientific experts should be consulted where required.

2.4.3 Include requirements for discharge monitoring and receiving environment impact monitoring

The administering authority must consider requiring the applicant to monitor waste water releases and to carry out impact monitoring of the effect of the waste water releases. Compliance monitoring decisions, monitoring frequency and indicators must be in accordance with the provisions of sections 26 and 27 of the EPP Water. Compliance monitoring may be applied to a combination of end-of-pipe, the local receiving environment and the regional receiving environment.

Further information on setting up monitoring programs can be obtained from the *Australian Guidelines for Water Quality Monitoring and Reporting (2000) Australian and New Zealand Environment and Conservation Council (ANZECC) and Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ)*. Refer also to Appendix 6.4 for the application of Multiple Before-After Control-Impact monitoring program for HEV water assessment.

Discharge or end-of-pipe monitoring should relate to the criteria and limits decided above. This type of monitoring is a direct measure of the performance of the activity and is necessary to assess compliance with a condition of a development approval, environmental authority, or transitional environmental program or environment protection order. It may also be required to determine whether a system is working true to its design specifications to avoid environmental harm. End-of-pipe monitoring does not provide direct information on the impact of the discharge on the receiving environment.

Impact or ambient monitoring within the local receiving environment should focus on protecting the EVs of the receiving waters through comparison of monitoring data with the WQOs. The ambient monitoring program may also be designed to monitor those locations near known discharges or other inputs into the waterway, where water quality objectives are most likely not be met (for example mixing zones). Ambient monitoring data may be used for performance assessment and for calibrating water quality models.

As the WQOs for the receiving waters may be affected by other activities in the catchment, non-compliance with WQOs may not be solely attributed to the performance of a particular point source discharge. This is particularly the case where impacts occur over time in tidal estuaries. An example of where ambient monitoring may more immediately relate to effects of an activity is measurement of sediment plumes downstream of a dredging operation and comparing it to up-current conditions. Other reasons for requiring ambient monitoring may be to monitor mixing zone characteristics, verify conclusions of an environmental impact assessment, study or report, to decide future disposal strategies or if there is concern about the levels of a particular contaminant in waters.

Ambient monitoring can provide information on regional ecosystem health and other relevant water quality information required to assess EVs. Such programs may be coordinated through regional partnerships comprising groups of stakeholders involved in the catchment. A contribution by the applicant to existing regional ecological health monitoring programs may be an alternate to applicant monitoring.

Compliance monitoring of residual waste water discharge and the receiving environment would normally commence when the approved activity commences, however baseline ecological health monitoring of receiving waters may be required by the applicant to characterise the receiving environment in the preparation of the development application. For further details refer to the Queensland Water Quality Guidelines Appendix C, Table C3 — Data for stand alone use in developing local guidelines (a minimum of 18 data values, over 12 months at two reference sites.)

2.4.4 Include reporting requirements for discharge and impact monitoring

The provision of monitoring data and reports to the administering authority should be set out as development conditions. Requirements should include reporting performance against development approval, environmental authority, transitional environmental program or environment protection order conditions, prompt notification of breaches of development conditions and other incidents likely to cause environmental harm; and the assessment of impact monitoring of the effect of waste water releases. The EPA has a database to receive electronic data from licensees. This is currently available for WWTPs.

Summary

The administering authority must consider requiring the applicant to monitor the discharge of residual waste water against approval conditions and to carry out impact monitoring of the effect of the residual waste water releases.

Pre-design conferencing is encouraged, including addressing any requirement for baseline ecological health monitoring of the receiving waters prior to lodging an application.

2.5 Environmental offsets

a. Policy issues

Refer to Section 2.0 for detail. The policy intent is that for:

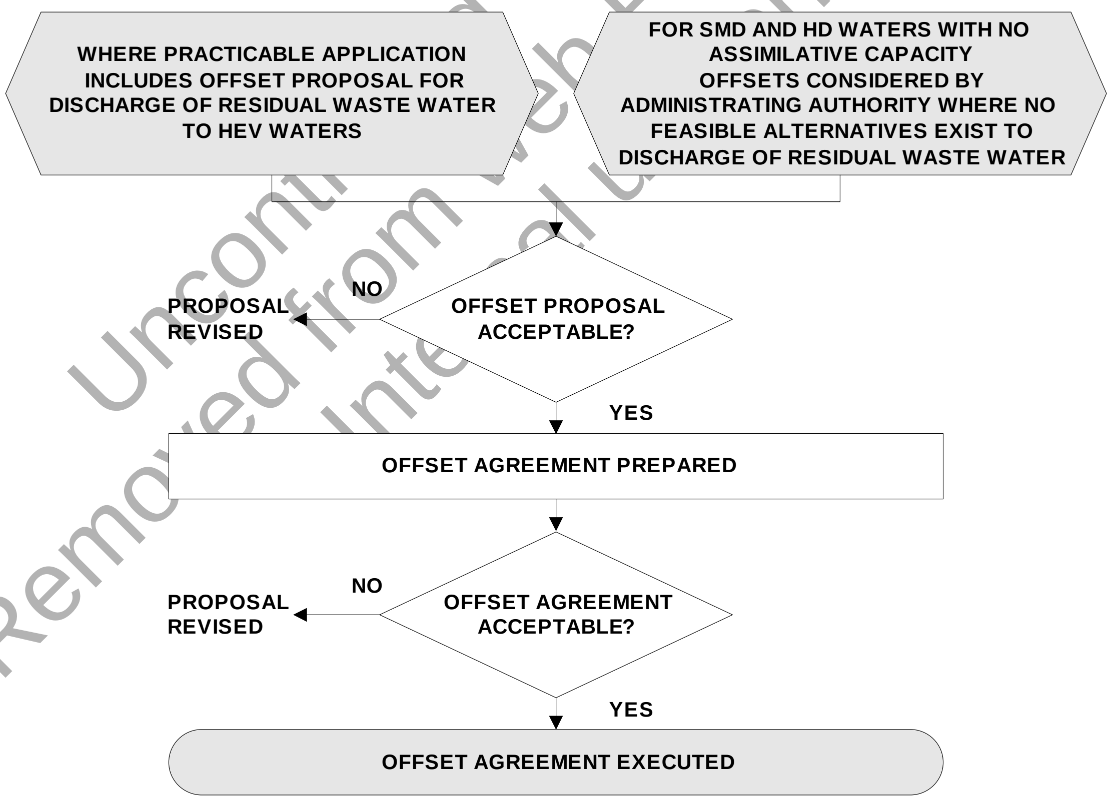
- HEV waters, where practicable the application includes a like kind environmental offset proposal - counterbalancing the discharge of residual waste water (the discharge) from the proposed ERA[15]; and
- SMD and HD waters with no assimilative capacity, environmental offsets (offsets) may be considered by the administering authority where there are no feasible alternatives to residual waste water discharge.

For the purposes of the EPA operational policy, environmental offsets will not apply to SMD waters where assimilative capacity exists. Refer to Section 2.3.4. By definition HD waters have no assimilative capacity.

In accordance with the above, and consistent with the overarching principles of the discussion paper[16] on the proposed Queensland Government Environmental Offsets Policy, the aim of providing environmental offsets is:

- to maintain the biological integrity of HEV waters, by counterbalancing the discharge of residual waste water (the discharge) from the proposed ERA with a like kind environmental offset; and
- to improve the water quality of SMD and HD waters by providing an offset that both counterbalances the proposed residual waste water discharge and provides additional assimilative capacity.

Figure 8 — Environmental offsets



Further to the above policy intent, where it is practicable and the discharge is suitable for management via offsets the application should include a like kind environmental offset proposal (offset proposal) that would be

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15 The Australian Government is considering environmental offsets as approval conditions under the EPBC Act when a proposed development impacts on a matter of national environmental significance. When finalised, EPBC Act requirements should be considered in conjunction with this operational policy.

16 Subject to the finalisation of the proposed Queensland Government Environmental Offsets Policy in 2008, any inconsistencies will be addressed by further review of this operational policy.

considered by the administering authority on a case-by-case basis seeking to deliver a net environmental gain to the receiving waters as a whole.

The consideration of offsets must only occur after all options to avoid, reuse, recycle or adopt other disposal alternatives have been addressed in accordance with the waste management evaluation procedure under the EPP Water, and the discharge is demonstrated to be unavoidable and environmentally acceptable.

Figure 8 above depicts the matters that are detailed in the following sections.

b. Like kind offsets

To be of a 'like kind' offsets must be of the same contaminant and chemical form and preferably a point source emission impacting on the same waters as the proposed ERA discharge. To avoid further impairment of waters that have no assimilative capacity for the proposed ERA contaminants, offsets should impact on the same waters as the proposed ERA discharge. Where this is not practicable, offsets to waters in the same catchment would be considered by the administering authority.

Where it is not practicable to secure point source offsets, then diffuse urban offsets (from new and existing urban development) or diffuse rural offsets would be considered by the administering authority. The priority and spatial location of diffuse offsets would be advised by the administering authority during pre-design conferencing, reflecting catchment priorities established under planning processes completed by recognised entities under the EPP Water. Offset proposals must reduce contaminant discharges to a level below individual load limits for point sources and beyond minimum performance standards for diffuse sources.

c. Net environmental gain

The offset quantity should seek to deliver a net environmental gain to the water as a whole. Net environmental gain for a water, the subject of discharge from the proposed ERA, is based on a 'nil net discharge' and additionally takes account of the environmental risk and uncertainty and the policy intent for the waters (maintaining natural values or the lack of assimilative capacity and water quality objectives not being met- respectively for HEV and SMD/HD waters.)

d. Equivalence ratios

Offset sources are assigned a quantity equivalence (or offset) ratio accounting for:

- environmental risk and uncertainty resulting from the effects of separation distance, attenuation, the nature of the offset (point or diffuse source), performance variation over time, delayed onset time, different chemical forms and bioavailability; and
- the maintenance of the biological integrity of HEV waters and to prevent further degradation and reverse the trend in water quality of SMD and HD waters. The latter aspect would be considered by the administering authority in the context of the whole catchment assessment and the contribution from point source discharges.

For like kind point source offsets emitting to the same water type and effective from the time of the proposed ERA discharge, an equivalence ratio greater than 1 is required.

Equivalence is less likely:

- with increased distance from the proposed ERA discharge location;
- where the offset load reduction is effected in different water types in the same catchment;
- where urban or rural diffuse source offsets are involved; or
- where the timing of offset reductions is delayed from the project commencement date.

Consequently higher quantity offset ratios would be assigned in these circumstances reflecting the increased risk of delivering a net environmental gain, quantified over the project life.

If diffuse rural offsets are included in the offset proposal, the offset should rehabilitate or restore degraded riparian or wetland habitats according to priority locations advised by the administering authority. Other land use management actions that reduce rural diffuse emissions may be considered by the administrating authority. Proposals to include urban diffuse offsets from either new or existing urban development should also be according the priorities advised by the administering authority.

The EPA procedural guide *Procedural information for the operational policy waste water discharge to Queensland waters*, provides guidance in determining environmental equivalence through minimum default offset ratios and determining riparian and wetland buffer widths.

e. Discharge contaminants must be suitable for management by offsets

Discharge contaminants that are potentially suitable for management by offsets include nutrients (nitrogen and phosphorus), sediment (TSS and TDS), organic carbon, contaminated stormwater or other contaminants where the scientific basis can be demonstrated and the contaminants do not have human health impacts, irreversible environmental impacts or unacceptable biota impacts.

f. Development application to include an offset proposal

Where required the development application must include an offsets proposal that meets the acceptability requirements listed below. The onus is on the applicant to provide sufficient information to allow the administering authority to consider whether the offset proposal is acceptable.

g. Acceptability of offset proposal

At pre-design conferencing the administering authority would advise on the requirements for an acceptable offset proposal, that must:

- meet statutory, regulatory and planning requirements and be enforceable—through development conditions, covenants or contracts;
- be additional to the consideration of EPP and EP Act provisions, as summarised in Sections 2.1 to 2.4;
- be enduring--offset the impact of the development from commencement and for the period that the impact occurs. Where onset is delayed, offsets must balance any initial shortfall over the project life;
- be suitable and targeted--contaminants must be suitable for management by offsets, be of the same contaminant and chemical form;
- be capable of being supplied and secured by the applicant or authorised agent;
- be appropriately located--apply to the same waters impacted by the proposed residual waste water discharge, or to other water types in the same catchment;
- initially consider point source offsets and then diffuse urban offsets or diffuse rural offsets (involving the restoration of degraded riparian or wetlands buffers) in accordance with catchment priorities as advised by the administering authority;
- seek to achieve a net environmental gain to the receiving waters;
- demonstrate compliance through emissions monitoring and reporting to the administering authority;
- be compatible with any flexible or incentive based mechanisms such as nutrient trading; and,
- address other elements, pending case by case assessment by the administering authority.

h. Offset agreement

If the offset proposal is acceptable to the administering authority and the application is approved, the administering authority must include development conditions that require the applicant:

- to secure the offsets proposal through an agreement between the applicant and the administering authority; and
- to execute the agreement before the commencement of site works, that:
  - includes a memorandum of agreement if the offset proposal involves either the State or a Local Government;
  - includes a deed of agreement for private developers; and generally use a financial guarantee, refundable on demonstrated offset establishment;
  - requires rural diffuse offsets to be legally secured with covenants or conservation agreements and addresses the on-going management and maintenance of offset sites, where relevant; and
  - requires the offset to be recorded on the appropriate register.

Other elements may need to be considered, pending case by case assessment by the administering authority.

i. Financial contribution

The discussion paper on a proposed Queensland Government Environmental Offsets Policy (QGEOP) provides for financial contributions to be made to meet offset requirements in certain circumstances. The discussion paper outlines several principles that must be complied with for a financial contribution to be acceptable. The use of financial contributions under the operational policy will be considered further upon the implementation of the QGEOP.

Summary

Pre-design conferencing is encouraged to address environmental offset requirements

3. Additional information

3.0 Process for using default EVs and WQOs

Where EVs for the waters have not been specifically set in Schedule 1 of the EPP Water, then, under Section 11(2) of the EPP Water, the WQOs are the set of water quality guidelines (the *Queensland Water Quality Guidelines 2006* and the ANZECC Water Quality Guidelines) that will protect all EVs for the waters.

Where the above guideline values are considered inappropriate for the receiving environment the following provides information on default EVs and WQOs based on water quality guidelines derived from data collected at appropriate local reference sites.

a. ***Define default EVs***

Information on existing and possible future EVs should be obtained from maps, site inspections, surveys, local knowledge, water abstraction licences, planning documents, scientific studies and monitoring data. It is recommended that any changes to default EVs be agreed upon through consultation with key stakeholders, such as representatives of government, community, and industry groups.

EVs may be discounted if sufficient information can be obtained to justify that this value does not currently exist and is unlikely to exist in the future. It should be noted that the protection of the aquatic ecosystems and visual aesthetics should always be included as an environmental value of any water body. However, the level of aquatic ecosystem protection can vary between water bodies or zones of water bodies.

b. ***Define default environmental goals***

Locally specific information on EVs can be used to propose environmental goals. These goals define in more detail what needs to be protected and represent major subdivisions of EVs. Examples of typical environmental goals for EVs include protection of specific habitats (such as seagrass beds), protection of specific aquatic species (such as wallum frogs), minimisation of algal blooms, and maintenance of biodiversity or protection of the public during swimming activities.

c. ***Define default water quality indicators***

The next step involves determining the water quality indicators and concentrations required to protect the identified EVs. This is a technical process to be conducted by the applicant and involves reference to water quality data and guidelines. The indicators and concentrations determined in this step will become the WQOs for the next step of the process.

Water quality indicators may include physical-chemical, biological or toxicant measures applying to a combination of water, sediment and biota. Some sources of information to determine suitable indicators for protection of EVs are included in Table 6 below.

d. ***Define default WQOs***

To determine default WQOs, trigger values can be taken from published guidelines (for all values) or from local reference data (for aquatic ecosystem protection only). Once the numerical criteria are determined, they should be listed in a matrix of water quality indicators versus EVs for each geographical zone that has different EVs. For some indicators in a particular zone, different guideline numbers may be quoted to protect more than one EV or goal. In these cases, the more stringent guideline should be adopted as the default water quality objective for that indicator.

Reference data for Queensland waterways can be obtained from the EPA, or as listed in Table 6. Guidelines for biological, toxicants and sediment indicators and for primary industry, recreational water quality and drinking water values can be obtained from the ANZECC Water Quality Guidelines. Local reference information may be particularly important in determining the water quality characteristics required to protect local aquatic ecosystems. This would be the case if there are known unique species, such as acid frogs that require low pH conditions.

Determining default WQOs to protect aquatic ecosystems often requires significant technical input and should be considered as trigger values, below which a very low risk to the environment from that pollutant may be assumed. Default WQOs may depend on the levels of aquatic protection assigned for each zone. Further information on how to determine levels of aquatic ecosystem protection is provided in Table 3.

The *Queensland Water Quality Guidelines 2006* will become a repository for such sub-regional and local information for Queensland waters as it becomes available, and should be referenced for the default WQOs. The ANZECC Water Quality Guidelines will remain important for a range of indicators (for example toxicants and pathogens).

3.1 Use of local reference data

The *Queensland Water Quality Guidelines 2006* and ANZECC Water Quality Guidelines recommend using data from local reference sites to derive WQOs. The three main steps in the process are to establish a suitable reference site, collect sufficient data and calculate typical reference ranges and objectives. For further detail refer to Section 7.4.4 of the ANZECC Water Quality Guidelines (Volume 1.)

Table 6 — Guideline and reference information for determining WQOs

EVs of Water	Sources of guideline and reference information
Aquatic ecosystem	EPA website for the Queensland Water Quality Guidelines and physical-chemical reference data. National water targets online for nutrients, turbidity and salinity. National Water Quality Management Strategy website for biological, toxicant and sediment guidelines. Fact sheets on biological indicators and groundwater are at the above site.
Recreation and aesthetics	National Water Quality Management Strategy website. National water targets online for nutrients, turbidity and salinity. World Health Organisation Guidelines.
Drinking water	Australian Drinking Water Guidelines (NHMRC 2004).
Primary industries	National Water Quality Management Strategy website.
Industrial	National Water Quality Management Strategy website.
Cultural and spiritual	EIS assessments and other site specific information where relevant. Refer also the State Coastal Management Plan.

Reference sites are used to define the condition of a stream without impacts from discharges. They should ideally be in the same stream, a short distance upstream of the proposed discharge being assessed. If monitoring is possible before the discharge commences, a site downstream of the proposed discharge may be appropriate (note that it is not appropriate to use the same waterway to develop water quality criteria if it receives waste discharges or its quality is materially affected by non-point source runoff). If no suitable sites are identified in the stream, sites may be chosen in another local stream with similar hydrological, geological and ecological characteristics.

A list of reference sites for riverine, estuarine and coastal waters is included in the *Queensland Water Quality Guidelines 2006*.

For physical and chemical indicators and toxicants, the ANZECC Water Quality Guidelines recommend a minimum of two years of monthly data to define reference conditions. If objectives are derived from less data, they may be unreliable. Established Queensland or ANZECC Water Quality Guidelines reference conditions are preferred in this case. It is also crucial in researching reference conditions that appropriate quality assurance measures are applied to sample collection, preservation and analysis (refer to the EPA Water Quality Sampling Manual).

Once sufficient data have been collected, WQOs can be determined from the reference range of the data. This is the range from the 20th percentile to the 80th percentile of data and represents the typical range that would be expected for that indicator in the absence of the discharge. Most physical, chemical and toxicant indicators only require an upper water quality objective derived from the 80th percentile. For pH and dissolved oxygen where low values are also undesirable, lower WQOs are also derived from the 20th percentile.

3.2 Temporary streams

Temporary streams are defined as streams that do not flow continuously all year round. They include ephemeral streams, which only flow after significant rainfall, as well as intermittent streams, which only stop flowing during extended dry periods. Temporary streams go through a series of hydrological stages, from a wetting stage following rain (including the first flush), through a recessional stage, to a pooled stage or completely dry stage.

Discharge of waste water to temporary streams requires special consideration due to their unique hydrological and ecological characteristics. Such emissions are likely to disrupt the natural ecology and impact the aquatic ecosystem. Continuous or semi-continuous discharges during naturally dry stages should be avoided, and wet weather discharges occur when receiving water flows are sufficient, from a risk based assessment, to achieve the receiving water quality objectives. The nearest upstream gauging station should be used to determine the release period. Feasible alternatives should be investigated such as minimizing the production of waste water, reuse and retention to discharge during wet conditions. Specific mine water disposal issues of a 'one-off' nature would be considered on a case-by-case basis with the administering authority.

Receiving water quality objectives should be based on the most appropriate local reference data collected in the same stream above the discharge or in a similar stream in the area that is not affected by the discharge. Monitoring data should ideally cover the wetting stage as well as recessional or pool stages. In the absence of suitable reference data, default values from the Queensland and ANZECC Water Quality Guidelines should be adopted.

3.3 Hydrological impacts

The discharge of waste water may have adverse impacts on the hydrology of temporary and permanent surface receiving waters. The impacts relate to the volume and velocity of discharge relative to natural flows, and may include bed and bank erosion and changes to the particle size distribution of sediments. Other effects may occur on biota where there is insufficient time to complete life cycles due to changed flow regime. As a general guide, modelling of flow characteristics should be considered where the waste water flow would exceed 10 percent of the natural minimum flow of the waterway.

3.4 Riparian habitat impacts

Discharge of waste water may adversely affect riparian vegetation. For example, nutrient rich discharges may lead to weed infestation of habitats where vegetation is adapted to a low nutrient regime. Visual recreation is a declared environmental value of a water that likely to be adversely affected if a water way becomes weed infested. Similarly saline groundwater discharged into a freshwater stream or clearing may adversely affect riparian vegetation.

3.5 Public health impacts

Protection of public health usually requires that multiple barriers between effluent and drinking water or contact water be in place. The monitoring for typical water quality indicators such as *Enterococcus spp.* is not for pathogenic organisms, but indicators of possible contamination and hence does not necessarily guarantee safe levels. Apart from effluent treatment trains, barriers usually include dilution and significant distances between outfalls and places where potential exposure and water use occurs.

In some cases these barriers may not be present, for example where:

- the effluent is not substantially diluted by a watercourse/ocean prior to public access; and
- persons may come in contact with the effluent (for example, a beach or recreational area); or
- the waters are essentially fresh, which may encourage children to ingest the waters;

then alternative discharge locations should be evaluated, or more specialised public health assessment approaches adopted. Refer to the Guidelines for Managing Risk in Recreational Waters (NHMRC 2006) for further information on assessing suitability of recreational water quality.

3.6 Groundwater impacts

Additional considerations exist when applying the guidelines to groundwater, or to water bodies directly or indirectly affected by groundwater. An example of a direct impact is where the groundwater is suitable for drinking. In this case, the guideline values should be applied directly to the groundwater. An example of an indirect impact is where the groundwater is not directly used but the movement of the groundwater impacts on a secondary water body with defined values. In this case it is necessary to consider the values to be protected, as well as the effects of the attenuation zone, the flux rate of the groundwater and any dilution achieved.

4. Relevant legislation, intergovernmental agreements and EPA operational policies

Relevant legislation, intergovernmental agreements and EPA operational policies include:

- *Environmental Protection Act 1994*;
- *Environmental Protection (Water) Amendment Policy No 1 2006* — Subordinate Legislation No. 30 of 2006 and its explanatory notes;
- *Environmental Protection (Water) Policy 1997* — Subordinate Legislation No. 136 of 1997, including Sections 15–19 and Schedule 1, and the explanatory notes;
- *Environmental Protection (Waste Management) Policy 2000,* including Part 3 Waste management hierarchy and Part 4 Environmental management decisions concerning waste;
- *Queensland Water Quality Guidelines 2006*;
- *Queensland Water Recycling Guidelines 2005*;
- *State Coastal Management Plan — Queensland's Coastal Plan 2001*;
- *Integrated Planning Act 1997*;
- *State Development and Public Works Organisation Act 1971*;
- *Environment Protection and Biodiversity Conservation Act 2000*;
- *National Water Quality Management Strategy,* including the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2000* (the ANZECC Water Quality Guidelines) and the *Australian Guidelines for Water Recycling: Managing Health and Environmental Risks (Phase 1) 2006*;
- Intergovernmental Agreement on the Environment;

- Guidelines for Managing Risks in Recreational Water Quality (NHMRC 2005);
- Agreement under the Council of Australian of Australian Governments Water Reform Agenda;
- International agreements relating to migratory birds and wetlands (Japan-Australia Migratory Bird Agreement (JAMBA) and the China-Australia Migratory Bird Agreement (CAMBA));
- Directory of Important Wetlands Australia;
- *Australian and New Zealand Guidelines for Fresh and Marine Waters 2000* (Volume 2. Appendix 1 Mixing zones adjacent to effluent outfalls);
- EPA operational policy *Licensing waste water releases from existing marine prawn farms in Queensland*;
- EPA operational policy *Approval of sewage treatment plants including options for use of reclaimed water*;
- EPA Information sheet *Case study 1 — Licensing discharges from sewage treatment plants*; and
- EPA Information sheet *Case study 2 — Licensing discharges from sewage treatment plants*.

5. Further information

For further information please contact the EPA Ecoaccess Customer Service Unit on:

Ph. 1300 368 326
Fax. (07) 3115 9600
Email eco.access@epa.qld.gov.au

Approved by
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6. Appendices

Appendix 6.1: Glossary of terms

Administering authority means the administering authority under the EP Act, and will be the chief executive of the Environmental Protection Agency or the Local Government's chief executive officer.

The chief executive of the DPIF has delegated authority for ERAs 3 and 4 (i.e. cattle feedlotting and pig farming). These ERAs have been delegated to the DPIF.

Applicant means the applicant for a development approval or environmental authority application. In the context of this operational policy it may also mean employees of organisations contracted by the applicant to assist in the preparation of the application.

Aquatic ecosystems is defined in the ANZECC Water Quality Guidelines as the animals, plants and micro-organisms that live in water, and the physical and chemical environment and climatic regime in which they interact. It is predominantly the physical components (for example light, temperature, mixing, flow, and habitat) and chemical components (for example organic and inorganic carbon, oxygen, nutrients) of an ecosystem that determine what lives and breeds in it, and therefore the structure of the food web. Biological interactions (for example grazing and predation) can also play a part in structuring many aquatic ecosystems.

Assessable development means development specified under Part 1, Schedule 8 of IPA and includes the carrying out of a chapter 4 activity, other than an activity (or part of an activity) for which a code of environmental compliance has been approved.

Assessment manager for an application for a development approval means the Local Government or the entity prescribed under the *Integrated Planning Regulation 1998*.

Assimilative capacity means the capacity of the receiving waters to receive some human induced input of contaminants, or alteration, without causing the water quality to deteriorate so the water quality objectives are no longer met.

Basin means the major hydrological drainage basins in the national spatial database provided by Geoscience Australia. Australia is divided into drainage divisions which are sub-divided into water regions which are in-turn sub-divided into river basins. The data, which includes the name and number of each Queensland drainage division, region and river basin, is available at the Australian Government Geoscience Australia website.

Best practice environmental management is defined in the EP Act as the management of the activity to achieve an on-going minimisation of the activity's environmental harm through cost effective measures assessed against the measures currently used nationally and internationally for the activity. Section 21(2) lists measures to be regarded in deciding best practice environmental management of an activity. These measures include, but are not limited to, strategic planning, systems and training, product and process design, public consultation, waste prevention/treatment and disposal.

Biological integrity of a water is defined in the EPP Water as the water's ability to support and maintain a balanced, integrative, adaptive community of organisms having a species composition, diversity and functional organisation comparable to the natural habitat of the locality in which the water is situated.

Catchment means the total watershed draining into a river, creek, reservoir or other body of water. The limits of a given catchment are the heights of land (such as hills or mountains) separating it from neighbouring catchments. Catchments can be made up of smaller sub-catchments.

Character, resilience and environmental values of the receiving environment – see **Resilience.**

Code of environmental compliance is a document that contains standard environmental conditions for an ERA, or part of an ERA.

Complete mixing means, with reference to mixing zone considerations, the effluent is completely dispersed through the receiving waters.

Compliance monitoring means the activity of monitoring the approved discharge and comparing against the specified development conditions. This will generally occur at the discharge pipe. Monitoring can also be required for the receiving environment. Compliance should not be based on the receiving environment monitoring results alone, particularly where other factors in the catchment may contribute to non-compliance.

Concurrence agency for an application for a development approval under IPA means an entity prescribed under a regulation as a concurrence agency for the application.

Contaminant is defined in Section 11 of the EP Act as a liquid, gas, solid or other forms, that is released into the environment.

Cultural resources is defined in the *State Coastal Management Plan 2001* as places or objects that have anthropological, archaeological, historic, scientific, spiritual, visual or ecological significance or value.

Development application means an application for a development approval or environmental authority under the EP Act and subordinate EPP Water, IPA or the SDPWO Act for ERAs proposing to discharge of residual waste water to Queensland waters.

Decision notice means the written notice issued under IPA by the assessment manager to notify an applicant of the decision for their application in relation to a development approval.

Development condition means a condition of a development approval imposed by the assessment manager or concurrence agency under IPA.

Direct toxicity assessment (DTA) means the assessment of the combined effects of a number of compounds of unknown identity and concentration in an effluent. DTA provides an integrated measure of the aggregate/additive toxicity of chemicals and accounts for interactions between compounds. The DTA approach has been adapted from conventional toxicity testing approaches using the same methods, species selection and extrapolation to receiving waters (refer to ANZECC Water Quality Guidelines Volume 2, Section 8.3.6).

Ecological health is defined in the ANZECC Water Quality Guidelines as the health or condition of an ecosystem. It is the ability of an ecosystem to support and maintain key ecological processes and organisms so that their species compositions, diversity and functional organisations are as comparable as possible to those occurring in natural habitats within a region (also termed ecological integrity). The concept of ecological health is applicable to all complex ecosystems and sustainability is a key element of the concept.

Ecologically sustainable development (ESD) is defined in the EP Act as the protection of Queensland's environment while allowing for development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends. The principles for ESD as published in the *National Strategy for Ecologically Sustainable Development 1992* are a part of the standard criteria of Schedule 3 of the EP Act and include the precautionary principle. They must be considered when making decisions to grant or refuse an application.

Environmental authority application means an application under the EP Act for an environmental authority.

Environmental offsets in the context of this operational policy means the positive measures taken to counterbalance the adverse environmental impacts of the development resulting from the residual waste water discharge that cannot be avoided, reused, recycled or otherwise disposed in accordance with the waste management evaluation procedure under the EPP Water. An offset is to be of a like-kind (i.e. the same contaminant and chemical form), is located outside the development site and seek to deliver a net environmental gain to the waters.

Environmentally relevant activity (ERA) means a mining activity or an activity prescribed under a regulation as an ERA (where a contaminant will or may be released into the environment when the activity is carried out and the release will or may cause environmental harm). Schedule 1 of the *Environmental Protection Regulation 1998* lists the non-mining ERAs and section 39 (1) lists the ERAs devolved to Local Government.

Environmental values (EVs) is defined in the EPP Water as the qualities of a water that make it suitable for supporting aquatic ecosystems and human water uses (refer also Section 9 of the EP Act). EVs need to be protected from the effects of pollution, waste discharges and deposits to ensure healthy aquatic ecosystems and waterways that are safe for community use. Particular waters may have different EVs. The list of EVs and the waters they can potentially apply to, are tabulated below.

Environmental value	Potentially applicable to:	
	Tidal waters	Fresh (non-tidal) waters
Protection of aquatic ecosystems (**Aquatic ecosystem EV**) Protection of aquatic ecosystems, under three possible levels of protection relating to the following three ecosystem conditions: • High ecological value waters; • Slightly to moderately disturbed waters; and • Highly disturbed waters. (suitability for seagrass has also been specifically identified for some waters as a component of this EV)	✓	✓
EVs other than aquatic ecosystem EV (called human use EVs)		
Suitability for human consumers of wild or stocked fish, shellfish or crustaceans (suitability for oystering has also been specifically identified for some waters)	✓	✓
Suitability for primary contact recreation (for example swimming)	✓	✓
Suitability for secondary contact recreation (for example boating)	✓	✓
Suitability for visual (no contact) recreation	✓	✓
Protection of cultural and spiritual values	✓	✓
Suitability for industrial use (including manufacturing plants, power generation)	✓	✓
Suitability for aquaculture (for example red claw, barramundi)	✓	✓
Suitability for drinking water supplies		✓
Suitability for crop irrigation		✓
Suitability for stock watering		✓
Suitability for farm use		✓

Far-field waters means, in the context of an initial mixing zone, the waters beyond the specified boundaries of the mixing zone.

General environmental duty means the duty that applies to all persons in Queensland to take all reasonable and practicable measures to prevent or minimise environmental harm when carrying out an activity that causes, or is likely to cause, environmental harm. It is defined in Section 319 of the EP Act.

High ecological value (HEV) waters is defined in the *Queensland Water Quality Guidelines 2006*, as amended, as waters that have the biological integrity of effectively unmodified (intact) ecosystems or waters that are highly valued.

Information request means the additional information given about an application that is supplied by the applicant, at the request of the assessment manager or concurrence agency under IPA. It includes an EIS supplement.

Intergovernmental Agreement on the Environment means the agreement made on 1 May 1992 between the Commonwealth, the States, the Australian Capital Territory, the Northern Territory and the Australian Local Government Association.

Level of protection (for aquatic ecosystems) is defined in the *Queensland Water Quality Guidelines 2006*, as amended, as the level of aquatic ecosystem condition that the water quality objectives for that water are intended to achieve. The levels of aquatic ecosystem protection are:

- Level 1 High ecological/conservation value aquatic ecosystems — effectively unmodified or other highly valued systems;
- Level 2 Slightly to moderately disturbed aquatic ecosystems — ecosystems in which aquatic biological diversity may have been adversely affected to a relatively small but measurable degree by human activity; and
- Level 3 Highly disturbed aquatic ecosystems — measurably degraded ecosystems of lower ecological value.

Like kind environmental offsets means the offsetting load reductions from other point source and diffuse source emissions of the same contaminant (and chemical form).

Mixing zone (or initial mixing zone) is defined in the EPP Water as an area where residual waste water mixes rapidly with surface water because of the momentum or buoyancy of the waste water and turbulence of the surface water. Within the initial mixing zone dilution of the effluent contaminants takes place, water quality degradation occurs and certain water quality objectives may be exceeded.

Multiple Before-After, Control-Impact (MBACI) means water quality assessment studies that are designed to assess change to the water body from a particular input or disturbance. Such water quality assessments give the greatest confidence that any observed differences between control and impacted sites are not simply a result of natural variation between places or times.

Near-field waters means, in the context of an initial mixing zone, the waters immediately adjacent to the specified boundaries of the mixing zone.

Net environmental gain for a water the subject of residual waste water discharge from the proposed ERA, means the counterbalancing environmental offsets produce a net environmental outcome -- based on a **'**nil net discharge' and additionally accounting for the environmental risk/uncertainty and the lack of assimilative capacity and water quality objectives not being met.

Offsets agreement means the agreement between an applicant and the EPA, Local Government or other party that secures the offsets proposal.

Offsets proposal means the proposal acceptable to the administering authority that quantitatively offsets, for the life of the proposed development, the discharge of residual waste water from the ERA to achieve a net environmental gain to the receiving waters.

Peer review or expert peer review means the commissioning, by the applicant, of a nationally or internationally recognised expert in the relevant discipline, to provide independent expert written assessment of the technical/scientific work of either the applicant, or the applicant's consultant for inclusion in the application.

Precautionary principle is defined in the *National Strategy for Ecologically Sustainable Development 1992* as where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In application of the precautionary principle, public and private decisions should be guided by careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment and an assessment of the risk-weighted consequences of various options. Decisions to grant or refuse an application must consider the precautionary principle as part of the standard criteria of Schedule 3 of the EP Act.

Public interest may be ascribed as meaning the interest of the public as distinct from the interest of the individual(s).

Queensland Water Quality Guidelines means the *Queensland Water Quality Guidelines 2006,* as amended*,* prepared by the EPA.

Queensland waters is defined in the *Acts Interpretation Act 1954* as all waters that are within the limits of the State or coastal waters of the State.

Resilience of the receiving environment means the ability of an ecosystem to adjust or respond to progressive impacts **and** the ability to recover following cessation of the natural or anthropogenic disturbance. Information on both the recovery and response phases is required to **characterise resilience and the sensitivity of the receiving environment.** In particular, information on the recovery phase is crucial because it is the indicator of reversibility or irreversibility of the impact.

Standard criteria is defined in Schedule 3 of the EP Act as:

(a) the principles of ecologically sustainable development as set out in the 'National Strategy for Ecologically Sustainable Development'; and

(b) any applicable environmental protection policy; and

(c) any applicable Commonwealth, State or Local Government plans, standards, agreements or requirements; and

(d) any applicable environmental impact study, assessment or report; and

(e) the character, resilience and values of the receiving environment; and

(f) all submissions made by the applicant and submitters; and

(g) the best practice environmental management for activities under any relevant instrument, or proposed instrument, as follows—

  (i) an environmental authority;

  (ii) a transitional environmental program;

  (iii) an environmental protection order;

  (iv) a disposal permit; and

  (v) a development approval; and

(h) the financial implications of the requirements under an instrument, or proposed instrument, mentioned in paragraph (g) as they would relate to the type of activity or industry carried out, or proposed to be carried out, under the instrument; and

(i) the public interest; and

(j) any applicable site management plan; and

(k) any relevant integrated environmental management system or proposed integrated environmental management system; and

(l) any other matter prescribed under a regulation.

Stream order is a standard means of describing streams. The smallest streams in a drainage network have no tributary streams. These are called first order streams. Two first order streams unite to form a second order stream. Second order streams only have first-order streams as tributaries. Third order streams only have second and first order streams as tributaries, etc. As the order of the stream increases, the discharge increases, the gradient decreases, the velocity increases, and the channel dimensions (width and depth) increase to accommodate the increased discharge.

Sustainable load of a particular contaminant means the maximum amount of the contaminant that a water body can receive without exceeding the related WQOs, and therefore adversely affecting EVs.

Trigger values means the numerical criteria that if exceeded require further investigation for the pollutant of concern. If not exceeded, a low risk of environmental harm can be assumed.

Waste management evaluation procedure in making environmental management decisions about the release of residual waste water from an ERA means, under the EPP Water, the assessment processes for prioritising waste management practices (waste management hierarchy) to achieve the best environmental outcome.

Waste water treatment plants (WWTPs) means sewage treatment plants, advanced waste water treatment plants, water reclamation plants and all other synonyms for treatment plants whose primary function is to treat a water based waste stream.

Waste water means, under Schedule 2 of the EPP Water, a liquid waste and includes contaminated stormwater.

Water means the whole or any part of surface water or groundwater, tidal or non-tidal, and including any river, stream, lake, lagoon, swamp, wetland, unconfined surface water, natural or artificial watercourse, dam, tidal waters (estuarine, coastal and marine waters to the limit of Queensland waters) and underground or artesian water.

Water quality indicator (for an EV) is defined in the EPP Water as a property that can be measured or decided in a quantitative way. Examples of water quality indicators include physical indicators (for example temperature), chemical indicators (for example nitrogen, phosphorus, metals) and biological indicators (for example macroinvertebrates, seagrass and fish).

Water quality objectives (WQOs) are, the WQOs specified in Schedule 1 of the EPP Water to protect the EVs for waters. WQOs are long term goals for water quality management. They are numerical concentration limits or narrative statements established for receiving waters to support and protect the designated EVs for those waters. They are based on scientific criteria or water quality guidelines, but may be modified by other inputs (for example social, cultural, and economic).

Water types means waters with similar characteristics. The water types covered by this document are based on water types established in the *Queensland Water Quality Guidelines 2006*. Water types include coastal waters (open and enclosed), estuarine waters (lower, middle and upper), tidal canals, constructed estuaries, marinas and boat harbours, freshwaters (lowland, upland and dams/reservoirs), wetlands and ground waters. WQOs applying to different water types are outlined in the documents under Schedule 1 of the EPP Water.

Appendix 6.2: Mixing zone determination

Matters to be addressed in the development application must include:

a. Use of Direct Toxicity Assessment

The development application must demonstrate that the contaminants in the proposed residual waste water discharge are not acutely toxic to aquatic organisms inside the mixing zone or exceed the No Observed Effect Level, or equivalent (for example, the No Observed Adverse Effect Concentration) outside the mixing zone.

Where the proposed residual waste water discharge includes a contaminant(s) for which there is a lack of environmental effects data the development application must include the results of Direct Toxicity Assessment (DTA). Testing may be based on samples from demonstration plant, pilot plant or laboratory scale to complement a literature review.

This information is relevant to DTA of discharged effluent, whether required prior to licensing approval or as part of post-approval monitoring. DTA of effluent is also referred to as Whole of Effluent Toxicity testing.

DTA of an effluent is applicable to discharges that pose a potentially acute toxic exposure risk to aquatic fauna in the receiving environment. Typically, this involves cases where the concentrations of multiple chemical and/or elemental substances in the effluent exceed, or are likely to exceed, the known Toxicant Trigger Values presented in the ANZECC Water Quality Guidelines. The potential for synergistic toxicological effect can also be demonstrated through the use of DTAs. DTA of effluent would generally apply to residual waste water treatment plants that have the potential to receive commercial or industrial effluent as part of the trade waste system, or Advanced Waste water Treatment Plants (AWTPs) that produce a Reverse Osmosis Concentrate (ROC), or other similarly concentrated waste streams.

Specific requirements may include:

- The proponent should submit a DTA program and Toxicity Identification Evaluation (TIE) program for review and approval by the QLD EPA prior to commencement of the DTA program;
- DTA should be conducted on the effluent as it would be deliver to the end-of-pipe;
- The use of toxicity testing for licensing requirements should preferably employ cellular-based (mode of action) methods over whole organism tests where a QLD EPA and National Association of Testing Authorities (NATA) approved method for those tests exist[17]. This would negate any requirement for animal ethics approval (in most cases), standardises tests for marine and freshwater discharges, and provides more defined information on the form of toxicity;
- DTAs should be conducted on samples that are *representative of the discharge*,
- The frequency of licensed DTAs should initially be on at least an annual basis and in cases where there is seasonal variability in the quality of the effluent, on the effluent that represents the worst-case. Case-specific factors, such as the frequency and volume of the discharge, changing influent or effluent quality characteristics, and the Environmental Values (EVs) of the receiving environment should be taken into consideration when determining the frequency of the licensed DTA requirements for the discharge;
- The test organisms to be used for DTAs are to be chosen in accordance with Section 8.3.6.8 of the ANZECC Water Quality Guidelines, taking into consideration locally occurring species, the location of the discharge and nature of the receiving environment;

[17] There are very few validated cellular based/methods currently available. Consequently the great majority of DTA-related bioassays will be Whole of Organisms tests.

- The toxicity tests chosen for the DTA should demonstrate that the effluent is neither acutely toxic within the initial mixing zone, nor exhibit observable chronic (or alternatively sub-lethal) toxicity in the test specimens outside of the mixing zone;
- The toxicity limits derived from the DTA should be reported to the EPA as No Observed Effect Level or No Observed Adverse Effect Concentration (for example NOAEC at 10% effluent concentration);

Applicable TIE procedures, as provided in the approved DTA program, must be undertaken if, following the QLD EPA review of the reported DTA results, the QLD EPA requests in writing that TIEs are required to be performed.

b. Spatial definition

The development application must specify the proposed mixing zone; including the location, boundary and area. In cases where the proposed residual waste water discharge is to a river, the percentage of the width occluded or blocked by the mixing zone must also be specified.

The mixing zone boundary may be determined by indicator concentrations in the residual waste water. Where indicator concentrations are predicted to be statistically indistinguishable from the receiving water concentrations, complete mixing has occurred and the mixing zone is presumed to have ended. Only one mixing zone, minimised to the greatest practicable extent may be included in the development application.

Where the assessed environmental risk is low, spreadsheet calculations may be used to establish plume geometry and the dilution of contaminants. This circumstance may include, for example, a proposed discharge involving a small volume of residual waste water containing one or two well-studied contaminants at concentrations only several times greater than the receiving waters.

Commensurate with increased scale and risk, the use of predictive numerical modelling may be required to evaluate mixing processes and impacts in the near-field. Model outputs would include the prediction of the size and behavior of the effluent plume and mixing zone impacts, in both the water column and sediments, over a range of input conditions. The development application must include both the results of numerical modelling and any experimental work for the assessment of impacts.

Predictive numerical modelling may incorporate relevant functional relationships between the contaminant discharge and environmental quality indicators likely to be affected. Where functional relationships are unknown, consistent with assessed environmental risk, additional laboratory or field experiments may be required to understand the likely effects of a discharge (for example to understand the impact of effluent contaminants on benthic communities in marine sediments).

General information on predictive numerical modelling is at Appendix 6.3.

c. Assessment of no or negligible change to HEV receiving waters

The development application must address both baseline monitoring of relevant indicators in the near-field, beyond the mixing zone boundary, and predictive impact modelling of the effects of the proposed waste water discharge to demonstrate no or negligible change to the physico-chemical, biological, habitat and flow attributes, above natural variation, in the near-field beyond the mixing zone boundaries. These matters and post operational water quality monitoring requirements are addressed below.

1. Establishment of baseline condition

The development application must establish the baseline water quality against which the no or negligible change requirement may be assessed for the natural range of values of physico-chemical, biological, habitat and flow indicators relevant to the proposed ERA.

To characterise the natural condition the baseline water quality monitoring program design should be consistent with the requirements of the *Before* component of a *Multiple Before-After Control-Impact* (MBACI) water quality assessment program (or equivalent assessment program). Refer Appendix 6.4 for MBACI water monitoring experimental design.

The adoption of MBACI water monitoring experimental design would allow the baseline data to be used in the predictive impact modelling of the effects of the proposed discharge to demonstrate no or negligible change in the near-field, beyond the mixing zone boundaries. The data may also be used for post operational compliance monitoring of impacts.

The baseline monitoring design must include at least two near-field monitoring sites adjacent to the proposed boundary of the mixing zone at the impact site. These near-field sites may comprise monitoring sites for the *Impact* location of the MBACI water quality monitoring design. A comparable number of indicators must be monitored at two control sites. Refer Appendix 6.4 for MBACI water monitoring experimental design.

The *Queensland Water Quality Guidelines 2006* recommend collection of a minimum of 24 samples over two years. However, this requirement may need to be adjusted for some biological and habitat indicators (for example indicators that represent an environmental response integrated over a longer timeframe). The two year time period is recommended to allow some measure of inter-annual variation. While two years will not capture the entire range of such variation it must provide some indication of its likely magnitude.

Notwithstanding, the aim is to properly characterise the whole natural range of the selected indicators and maximize the chance of detecting changes in environmental indicators beyond the effect sizes stipulated in the *Queensland Water Quality Guidelines 2006*.

2. Prediction of impacts of the proposed ERA—demonstration of no or negligible change

Having established the natural baseline, the development application must determine the effects of the proposed residual waste water discharge within the initial mixing zone and the near-field immediately beyond the mixing zone boundaries. The no or negligible change test would be satisfied if no significant difference was predicted between the impact site and the two control sites. Operational risks must be addressed.

For technical detail refer to Sections 8.4.2, 8.4.3 and 8.4.4 of the *Queensland Water Quality Guidelines 2006* and Section 3.2.2.1 of the *Australian Guidelines for Water Quality Monitoring and Reporting (2000)*.

Peer review assessment must be submitted with the development application.

3. Post operational monitoring

Development conditions must include the requirement for the applicant to initiate the *After* component of the *Multiple Before-After Control-Impact (MBACI)* monitoring program (or equivalent monitoring program) when the operation is at design capacity, or within 12 months of commissioning, to demonstrate actual compliance with the no or negligible change requirements.

As a guide, 24 sample sets over a 12-month period would be required.

Post operational non-compliance would require the implementation of expedited compliance actions under a *transitional environmental program* or other instruments under the EP Act.

After compliance is demonstrated, on-going water quality monitoring would be required. For some waters and contaminants there is the possibility of achieving this requirement through a contribution to a joint agency/stakeholder ecological health monitoring program.

In the context of continuous improvement the development conditions may also require the preparation and implementation of a *transitional environmental program* to reduce the size of the mixing zone, over time.

Appendix 6.3: Numerical modelling of environmental impacts and mitigation actions

Choice of model

The models used should be “fit for purpose” and any work based upon sound science and the best available information. The size and potential risk of the proposed activity will determine the scope and extent of the modelling required.

Predictive tools such as mathematical models are often required when assessing the benefits of various management options (or scenarios). Different types of computer models exist, including hydrodynamic (mixing and flow), water quality (biogeochemical), catchment (export) and groundwater models. The type of model used will depend on the application but generally a combination hydrodynamic and water quality models would be required to simulate receiving waters for decisions involving continuous point source discharges. Catchment models may be used to provide inputs into receiving water models. Hydrodynamic and water quality models are discussed further below.

The choice of hydrodynamic models needs to account for the properties of the discharge, bathymetry, as well as the local mixing conditions in the receiving waters. Some discharges such as brine concentrates from reverse osmosis plants have elevated salt concentrations or mineral processing effluents may have elevated temperatures. Receiving waters may also not be well mixed in all dimensions. For example some estuaries periodically stratify due to salt wedge formation. The model needs to be able to simulate the appropriate density effects or thermodynamic processes for the specific application.

Mixing models used to assess mixing zones are generally hydrodynamic models that simulate the initial dilution of the discharge with the receiving environment. To obtain concentration predictions in the mixing zone, background levels need to be added to the dilution predictions. These may be sourced from far-field models or estimates from monitoring.

Water quality models simulate the water quality processes occurring within waterways. The model of choice needs to include the relevant biogeochemical processes relevant to the contaminants in the discharge and the characteristics of the receiving environment. For example, for carbonaceous matter, the model will need to simulate the heterogenic bacterial activity that breaks down the carbonaceous matter. This process also consumes oxygen and therefore the models need to simulate surface re-aeration and solubility etc. For nutrients, the model will usually need to simulate the growth of algae and primary production.

A technical description of the model should be provided to the EPA covering the history of the model, development history, published articles and details of the conversion of the model into a software package. Details of the experience and training of the model users should be provided. Other requirements include a statement of objective to explain clearly the situation being modelled and the objectives of the modelling study and outputs required from the model. The choice of model should be justified to demonstrate that the model used is suitable for this study including examples of previous applications in similar situations and a conceptual diagram of how the model represents environmental processes.

Data inputs to the model

The quality of inputs to the model will greatly affect the predicted outcomes. All modelling assumptions should be stated. Initial assessment should include a review of the flows and contaminant concentrations for the proposed activity and other activities to be modelled. These usually form the basis of the scenarios used for the model runs. How well do they represent the likely release in terms of quantity and variability? For constant concentrations and flows, do they represent average or worst-case condition? For what period of time do the worst-case conditions exist, and how frequently? Further data inputs will include initial conditions (particularly for water quality variables) and boundary conditions (tidal flow and elevations at the seaward or upper catchment boundary of the model) of the model and these should be checked. The choice of environmental data such as rainfall will often be determined by the choice of baseline conditions. It is generally recommended that a statistical dry year is used to assess point source scenarios.

Data used for the modelling study and its source should be clearly defined, including the source, quality assurance and expected errors. Any data manipulation and related assumptions should be detailed. Raw data in electronic form should be made available to the EPA, on request.

Uncertainty of predictions (calibration)

The ability of the model to make reliable predictions will strongly depend on the above issues and should ideally be tested through both calibration (adjustment of model parameters to reproduce measured data) and validation (a comparison of predicted values against measured data). Validation is used to demonstrate the model accuracy. Without calibration or validation, model prediction should only be used for qualitative comparisons, rather than quantitative comparisons against water quality objectives. Sensitivity analysis can be used to demonstrate the effect of varying input data or parameters on key output variables. The uncertainty of model predictions should be stated and incorporated into any conclusions made by the applicant.

Appendix 6.4: Application of Multiple Before-After Control-Impact design to HEV water assessment

Introduction

The purpose of Multiple Before-After Control-Impact (MBACI) sampling designs is to allow a logically and statistically valid assessment of impact in the context of overall environmental variability. A discussion of these designs is available in Underwood (1992). Its application to HEV areas is aimed at determining whether or not the no change criterion has been met following commencement of an activity.

As its name implies, MBACI designs involve collecting samples before and after (BA) an impact may potentially occur to determine the significance of any change. It also involves collecting before and after samples at both control and impact (CI) sites. Inclusion of control sites makes it possible to infer whether changes detected at an impact site are due to the activity under investigation or are simply the result of broader scale natural variations that exist in the environment and are unrelated to the activity. The use of Multiple (M) control sites is to protect against the possibility of drawing erroneous conclusions from results at a single site, where an observed change may also be due the natural cycles occurring at different times in different places.

In scientific methodology, an experimental treatment is applied to some instances (for example fertiliser applied to a field or a new drug given to patients) and the results in these instances compared to those from testing instances where the treatment is absent (for example no fertiliser or a placebo given). An MBACI sampling program is essentially just a scientific experiment in which the experimental treatment is commencement of the subject activity, this being introduced at the project site and but not control sites.

The use of MBACI to assess change within HEV areas is essentially no different to its application elsewhere. It involves identification of adequate control and impact sites and collection of sufficient samples to allow a reasonable chance of detecting a predefined quantum of change. More detailed guidance on these issues with respect to HEV areas is provided below.

Indicators

The selection of indicators will of course be related and sensitive to the type of activity proposed. As a general guide, indicators must include:

- Indicators that reflect the potential direct physico-chemical impact of the activity in the water column;
- Where applicable, indicators that measure the potential impact on sediments; and
- Indicators that measure the biological response to the activity.

Control sites

Under the MBACI design, the smallest number of control sites is two. Additional sites will increase the strength of any inferences drawn from the program. The control sites must have similar hydrological, environmental and biological characteristics to the impact sites (in the before period). This may need to be verified through a pilot survey or existing information. In streams, control sites can be sited upstream of impact sites and/or in nearby similar (un-impacted) waterways. In embayments and estuaries, control sites must be located in physically and biologically similar locations but far enough away from the impact area to be unaffected once the activity commences. For small estuaries, use of similar nearby estuaries is preferable if this is practicable. Control sites must not be in a location in which material human activities take place (for example another waste water discharge or channel dredging).

Impact sites

It is undesirable to replicate the potential impact and thus there will typically be only one impact site. This will be located adjacent to the proposed mixing zone (if any) for the discharge or activity. For water quality assessment, at least two water quality monitoring sites must be located in the near-field adjacent to the mixing zone at the impact site. In smaller streams, the mixing zone must not be more than one third of the stream width. The near-field may be in the mid point of the stream adjacent and downstream of the mixing zone. In large estuaries or embayments, the near-field zone may be an area within 50m of the boundary of the mixing zone.

Number of samples

Where pre-existing data is unavailable or only available for some indicators, the data from the before phase of the MBACI program will be used establish both the environmental goals for environmental impact assessment and collect the before condition data for the requisite environmental monitoring program. The number of samples required is predicated on the need to achieve a relatively precise definition of existing condition (for the selected indicators) and also to have a reasonable chance of detecting an environmental change occurring at the requisite environmental effect size.

For HEV waters, the management aim is to have no change, but this is not logically or statistically testable. Instead, testing is carried out on the hypothesis that implementing the activity will significantly change monitored environmental variables. If the data do not support this, the null hypothesis that no significant change occurs is accepted.

As the testing is to determine if a change occurs, some minimum detectable environmental change needs to be defined. For physico-chemical water quality indicators, this issue is prescribed through a default method of assessing no change. This method is detailed in the Queensland Water Quality Guidelines in Section 8.4.2.1.1. In brief, during the before period, a minimum of 24 samples must be collected over a period of two years. The two-year time period is recommended to allow some measure of inter-annual variation. While two years will not capture the entire range of such variation it must provide some indication of its likely magnitude. These samples are taken as reasonably practicable at the same time for impact and control sites.

In the after period, an initial collection of 24 samples at each site is required. For continuous discharges or activities, this may need to be undertaken in a period of not less than 12 months. However, for intermittent discharges, the collection of samples must be tailored to the periods of discharge and potential impact.

For biological indicators the default approach described above may not be appropriate. Due to the wide range of possible biological indicators and differing time frames over which biological variables integrate impacts, it is not practicable to provide a prescriptive approach. However, the overriding aim remains the same i.e. to establish the natural range and to be able to detect any change to the natural range of values. The following general guidance is provided.

The before distribution of population values needs to be established with reasonable precision. This means that sufficient numbers of samples must be collected such that reasonably tight confidence intervals[18] (CI) around the estimated population 20/50/80 percentiles are established (CI ranges for the three percentiles must be clearly separated). What constitutes a sufficient number will vary depending on the indicator. The number of samples taken will depend upon natural variability of the chosen indicator(s). The number of samples is a compromise between degree of information gain with increasing replication and time, cost and practicality of increasing sampling effort. However, if the selected indicator is so variable that impractically high numbers of samples are required to achieve the desired outcome, then an alternative indicator must be considered.

The overall objective is to obtain a reasonable estimate of the sample population. A useful technique is to determine the coefficient of variation for increasing degrees of sample replication and sampling effort (for example plot size to estimate which techniques will give a reasonable estimate of variability).

[18] *In the default method for physico-chemical indicators, use of the 75th rather than 95th percentile CIs is recommended. This is similarly recommended for biological indicators. While this leads to an increase in the chance of making Type 1 errors, it considerably tightens up the CI ranges and decreases chance of Type II errors. This is considered a reasonable trade off for these HEV waters*

Sampling in the post-activity period must similarly aim to collect sufficient samples to be able to develop tight confidence intervals around the estimated population 20/50/80 percentiles. The before and after percentiles (with their associated confidence intervals) can then be compared for evidence of change. These percentiles are used so that monitoring may detect changes, which result in shifts in median levels as well as changes in variability.

Use of existing data

Where there is sufficient existing data from relevant sites for a particular indicator, the proponents may make use of this. The existing data could be used to characterise the environment and establish environmental goals for that indicator(s). If an environmental monitoring program is currently being conducted in relevant places, this data may be used for *before conditions* at control sites and/or the impact site as required.

Where long term data sets are available, information gained from assessment of spatial and temporal variation of an indicator could potentially be used to modify the program. For example, if spatial variation in an embayment was found to be very small for a particular indicator, this might justify a reduction in the number of control sites required to the minimum level.

In numerous waterways in Queensland, stakeholders jointly contribute to and carry out monitoring programs, a practice EPA encourages. A proponent proposing to use such data may need to contact stakeholders to discuss mutually acceptable arrangements for use of data and participation in the program.

An important caveat on the use of existing data is that it must be of proven high quality (i.e. it must have documented Quality Assurance information).

Reference

Underwood, A.J. (1992) Beyond BACI: the detection of environmental impacts on populations in the real, but variable world. *Journal of Experimental Marine Biology and Ecology.* 161: 145-178.

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Procedural Guide
Environmental Operations

Procedural information for the Operational Policy *Waste water discharge to Queensland waters*

This procedural guide informs the EPA Operational Policy Waste water discharge to Queensland water. It provides specific technical information that may assist EPA officers undertaking water quality assessment for strategic planning purposes or when considering development applications or environmental authority applications under the Environmental Protection Act 1994, Environmental Protection (Water) Policy 1997, Integrated Planning Act 1997 and State Development and Public Works Organisation Act 1971.

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Note this is a draft document for internal EPA purposes only.
It is not Government policy.

For further information please contact the EPA Strategy and Policy Division on:

Ph. 1800 177 291

Interested parties are invited to provide email comments by 28 March 2008 to:

Email EPA.EV@epa.qld.gov.au

Disclaimer

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Preamble

The purpose of the *Environmental Protection (Water) Policy 1997* (the EPP Water) is to achieve the protection of Queensland's water environment (surface tidal and non-tidal waters, groundwaters, lakes and wetlands) whilst allowing for development that is ecologically sustainable. The purpose is achieved by:

a) identifying environmental values (EVs) for Queensland waters;

b) deciding and stating water quality guidelines and objectives to enhance or protect the EVs – (ensuring healthy aquatic ecosystems and their ability to support human uses);

c) making consistent and equitable decisions about Queensland waters that promote efficient use of resources and best practice environmental management; and

d) involving the community through consultation and education, and promoting community responsibility.

The EVs for a water are protected if the measures for all indicators do not exceed the water quality objectives for the indicators.

1. Initial assessment of proposed activity

This Section informs Sections 2.1 and 2.4 of the Operational Policy

The initial assessment of the proposed activity should consider the industry type, materials used in processing, content and fate of waste streams and disposal options, reuse, recycling and re-treatment proposals, mass balance and water budget information, likely contaminants discharged in waste water to land or waters (including contaminated stormwater) and likely receiving water ecological and human health indicators potentially impacted by the waste water discharge. The waste management hierarchy for prioritising waste management practices under the EPP Water is at the Attachment to Section 1. Information that characterises the proposed waste water release should be included in applications seeking to discharge waste water to waters or land. Summary information is also at the Attachment to Section 1.

Particular industries and Environmentally Relevant Activities (ERAs) are associated with classes of aquatic ecosystem contaminants, e.g. waste water treatment plants and nutrients. The National Pollutant Inventory emission estimation technique manuals list 90 priority substances on the basis of health and environmental risk, by industry sector, and the USA EPA Toxic Release Inventory lists 313 priority substances. These inventories may assist in determining the likely waste water contaminants that may be associated with specific industry sectors or ERAs, and any potential issues with release to the environment (land or water).

The Modelling and Monitoring Assessment Decision Support System, refer Section 4.1, may also assist in identifying potential contaminants resulting from point or diffuse source emissions from specific industry sectors. The decision support tool includes relevant indicators and stressors and can be requested from water.tools@epa.qld.gov. Further information is at http://www.coastal.crc.org.au/3m/.

The e-Guides, refer Section 4.1, search facility includes links to all ANZECC Guidelines and may also assist in characterizing waste water toxicants that may be associated with specific industry sectors or ERAs. E-Guides are also available on request through **water.tools@epa.qld.gov**.

Attachment to Section 1

A. Waste management evaluation procedure

Figure 1 depicts the decision preference hierarchy in order to maximise the resource usage and minimise the impact on the EVs of the receiving waters under the EPP Water waste management evaluation procedure,

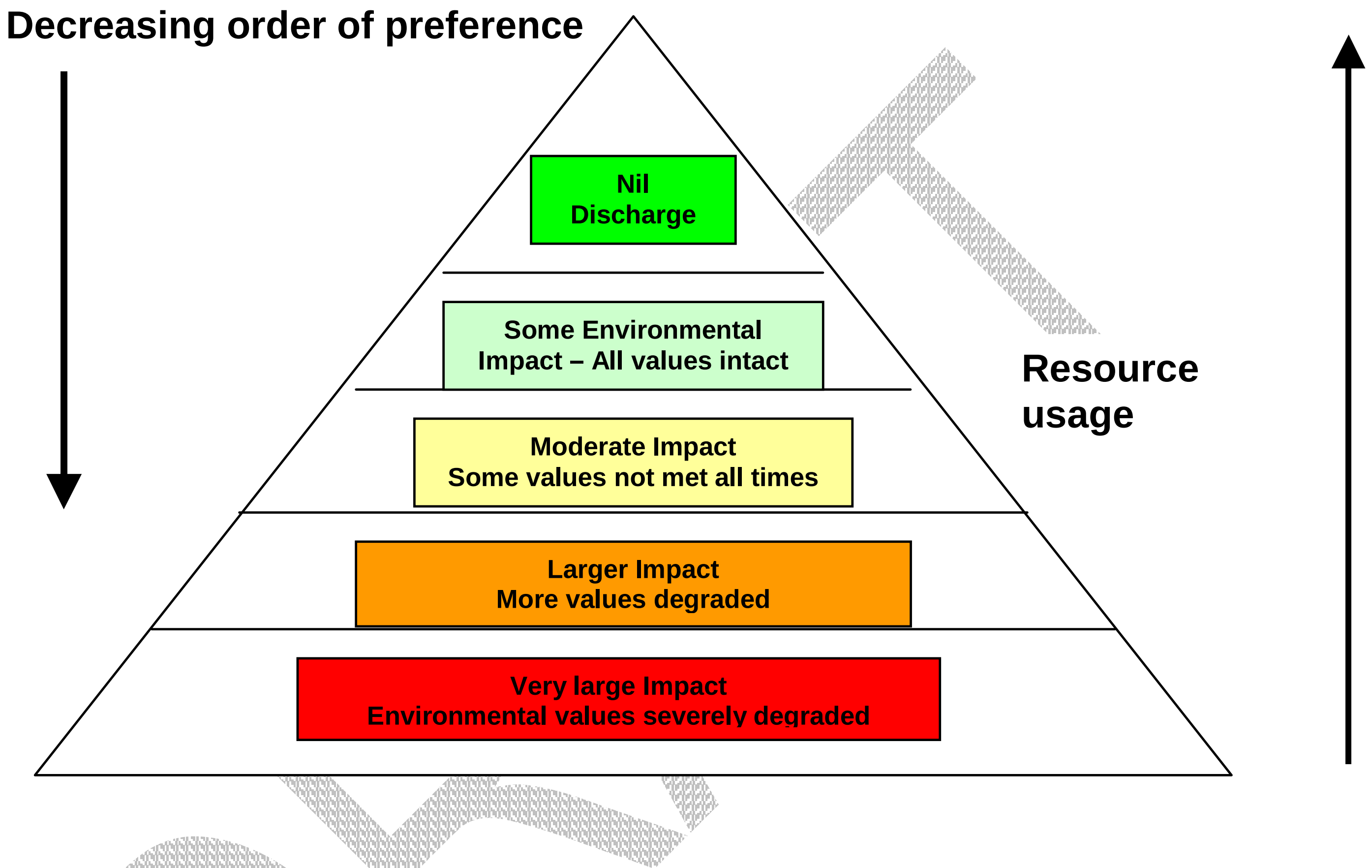

Figure 1. Decision preference hierarchy

Steps under the waste management evaluation procedure include:

Waste avoidance - Preventing the generation of waste water or reducing the amount of waste water generated.

Examples of practices for achieving avoidance include:

- input substitution;
- increased efficiency in the use of raw materials, energy, water or land;
- process redesign;
- product redesign;
- improved maintenance and operation of equipment; and
- closed-loop recycling.

Waste water re-use

Examples include:

- applying waste water to land in a way that gives agricultural and ecological benefits; and
- substituting waste water for potable water as input to a production process.

Waste recycling - Treating waste water that is no longer useable in its present form and using it to produce new products.

Energy recovery from waste - Recovering and using energy generated from waste.

Waste disposal - Disposing of waste water, or treating and disposing of waste water in a way that causes the least harm to the environment.

Examples of treatment before disposal include:

- employing a bio-treatment;
- employing a physico-chemical treatment (e.g., evaporation, drying, calcination, catalytic processing, neutralisation or precipitation); and
- blending or mixing waste to obtain a compound or mixture;

Examples of disposal include:

- disposal to storage dams.

B. Waste water assessment - contaminants, re-use, recycling, treatment and release, monitoring information

The following information should be included in applications involving waste water release to waters or land:

- source(s) of waste water;
- the key waste water contaminants released under steady state conditions, by concentration and load for key indicators. Identification of any toxicity concerns from the initial assessment and the inclusion of any screening results from direct toxicity assessment;
- the waste water avoidance measures incorporated in the process design and the waste water re-use, recycling and treatment proposals. The waste water disposal options considered prior to the final design should be included -- please attach diagram(s) of the treatment plant or process;
- quantitative comparisons of the above waste management measures with best practice environmental management for the activity;
- the proposed average, maximum and minimum daily and weekly volumes to be discharged, and maximum hourly discharge rate;
- the proposed times of discharge (and whether continuous or intermittent), wet weather and dry weather flow variation;
- the proposed diffuser details and the stated tidal or flow conditions of the waste water release;
- the facilities for measuring the volume or rate of discharge and for waste water discharge monitoring. List the proposed monitoring frequency and the indicators to be monitored;
- the name of the waters proposed to receive the waste water discharge and a plan or map showing the spatial location and latitude and longitude of the discharge outfall;
- the proposed impact monitoring program on the effect on the receiving environment (water or land) of the waste water release, specifying the proposed location of monitoring points (relative to the coordinates of the discharge outfall), the frequency of monitoring and the indicators to be monitored;
- the results of any investigations into the effects of waste waters discharged to land or receiving waters (please attach reports); and
- investigations assessing pre-development groundwater contamination should be in accordance with http://www.ephc.gov.au/pdf/cs/cs_01_inv_levels.pdf and

  http://www.ephc.gov.au/pdf/cs/cs_06_groundwater.pdf.

2. Receiving waters assessment – character, resilience and values of the receiving environment

This Section informs Sections 2.2, 2.3 and Section 3 of the Operational Policy

2.1 What EVs and WQOs and levels of aquatic ecosystems protection apply?

Environmental values (EVs) for waters

The EVs of waters to be enhanced or protected are listed in the documents in Schedule 1 of the EPP Water. For waters not listed in Schedule 1, the EVs are in the *Queensland Water Quality Guidelines 2006* (the QWQGs).

Water quality objectives (WQOs) - to protect or enhance the EVs for waters

The WQOs for a water are contained in the documents listed in Schedule 1. For waters not listed in Schedule 1, the WQOs are the set of water quality guidelines from the QWQGs and the Australian *Water Quality Guidelines for Fresh and Marine Waters 2001* for all indicators that will protect all EVs for the water.

Where do I find the information?

- For waters that are listed in Schedule 1 of the EPP Water the EVs and WQOs are available from the EPA website**.** The Schedule 1 documents for the water include the EVs and WQOs for different water types (upland and lowland freshwaters, upper, mid and lower estuarine waters, enclosed and open coastal waters, wetlands, lakes and reservoirs), the levels of aquatic ecosystems protection (HEV, SMD or HD) and river basin/sub-basin plans in jpeg format. Alternatively CD copies are available on request by emailing EPA.EV@epa.qld.gov.au, calling the free-call 1800 177 291 or contacting the local EPA office.
- For waters **that are not listed** in Schedule 1 of the EPP Water the Queensland Water Quality Guidelines provide EVs and WQOs for all other water types (see above) for Queensland regions/sub-regions. The default level of aquatic ecosystems protection is slightly to moderately disturbed. Both CD and printed copies are available on request as advised above. Note that the ANZECC Water quality guidelines for fresh and marine water quality provide concentration levels for indicators not included in the Queensland Water Quality Guidelines (for example, toxicants.). Other guidelines may also be relevant (for example food standards and recreation), see below and Section4.1.
- **Water quality guidelines are also available on-line through e-Guides,** refer Section 4.1. The current version contains:
  - ANZECC 2000 Water Quality Guidelines;
  - ANZECC 2000 Monitoring & Reporting Guidelines;
  - NHMRC 2005 Recreational Guidelines;
  - Queensland Water Quality Guidelines; and
  - Coastal CRC Users' Guide to Indicators for Monitoring.

Users can select the document that they would like to manually browse, or select the 'search' tab to search all the guides for key words. The searched items can be viewed, copied to another document or printed out for later reference. E-Guides are available on request from water.tools@epa.qld.gov.au.

Spatial datasets and metadata are available for:

- EPA staff through *Ecomaps* - Environment and Conservation category. Schedule 1 documents are available through the EPA Intranet system ROBIN (Fast find/EVs) or the QWQGs (link above);
- EPA GIS staff through Enterprise GIS ('O' drive). Schedule 1 documents as above;
- Other State Government Departments and Local Governments may access spatial data through the Queensland Government *Infolink*, accessible through the *GovNet* homepage at http://wwwhost.env.qld.gov.au/HomePage/GovNet.htm. Schedule 1 documents for the specific waters are available through the EPA website or the QWQGs (link above); and
- Consultants, stakeholders and members of the public, CD copies containing the spatial datasets, metadata and the EPP Water Schedule 1 documents are available on request through the EPA Environmental Information Systems Unit, by email from data.coordinator@epa.qld.gov.au or by telephone (07) 3227 6447.

Notes

1. The EPA has developed Queensland water quality guidelines (QWQGs) based on the ANZECC scientific principles and management protocols. The QWQGs are:

- based on data collected from un-impacted Queensland reference sites, that are listed in Appendix F (by region, site name and location (latitude and longitude.) The QWQGs are derived from the 20th and 80th percentiles of the reference sites' data--the 80th percentiles are used where high values of an indicator cause problems (e.g. nutrients or chlorophyll-a), the 20th percentiles where low values cause problems (Secchi depth) and both the 20th and 80th percentiles where high or low values could cause problems (pH and DO);
- given for different water types, to the limit of Queensland waters (three nautical miles). Water types include open and enclosed coastal waters, lower, mid and upper estuarine waters, lowland and upland fresh or riverine waters, freshwater lakes and reservoirs, wetlands and groundwaters; and
- based on geographic regions and subregions (river basins, sub-basins and localised guidelines) for southern, central and northern Queensland watersheds east of the Great Dividing Range.

2. The level of protection (for aquatic ecosystems) means the level of aquatic ecosystem condition that the water quality objectives for that water are intended to achieve. The stated levels of aquatic ecosystem protection are:

- Level 1 - High ecological value (HEV)— effectively unmodified or highly valued aquatic ecosystems;
- Level 2 - Slightly to moderately disturbed (SMD) — aquatic ecosystems in which biological diversity has been adversely affected by human activity to a relatively small but measurable degree; and
- Level 3 - Highly disturbed (HD) — measurably degraded aquatic ecosystems of lower ecological value.

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2.2 Receiving water quality information sources

Water quality information:

- informs strategic planning and development assessment - assessing current condition and trends in water quality;
- provides raw data to a range of client groups and the general public;
- informs the spatial and temporal variability that provides a basis for assessing compliance with the EPP Water and the Queensland Water Quality Guidelines*;*
- informs the development of reference values for Queensland waters; and
- informs regional environmental monitoring programs e.g. the SEQ Ecological Health Monitoring Program, and State of Environment reporting.

Water quality information sources include:

The Queensland waterways database contains current and historic water quality information from the EPA water quality monitoring program. The database includes monthly monitoring from more than 500 (mostly estuarine) sites across Queensland. View a map of the sites monitored in Queensland and click on the area or catchment of interest.

What indicators of water quality are monitored?

Brief indicator descriptions, sampling and determination methods can be viewed here. The range of water quality indicators include:

- physico-chemical indicators (temperature, pH, conductivity, dissolved oxygen, turbidity);
- chlorophyll-a , suspended solids, nutrient concentrations; and
- sediment metal concentrations, plankton samples and faecal coliform (bacteriological) counts.

How do I access water quality monitoring data and published information?

Download published water quality reports and brochures from the website publications page.

For access to the water quality monitoring data please contact the EPA Environmental Sciences Division, Freshwater and Marine Sciences, by emailing water.data@epa.qld.gov.au or telephone 3896 9250. Further information can be obtained at
http://www.epa.qld.gov.au/environmental_management/water/water_quality_monitoring

Other sources of water quality information include State and Commonwealth agencies, Local Governments, Queensland Port Authorities, Regional NRM Bodies and industry. Additionally Universities (particularly the University of Queensland, Griffith University, Central Queensland University and James Cook University of North Queensland), the Australian Institute of Marine Science, the CSIRO Division of Land and Water and the SEQ Healthywaterways Partnership conduct research projects that may inform water quality assessment.

Specific information sources include:

- Department of Natural Resources and Water (NRW) which collects, manages and delivers data on the quantity and quality of fresh water in the State's rivers and aquifers. NRW operates and maintains networks across the State to monitor:
    - quantity and quality of surface water;

   - groundwater quantity and groundwater quality; and
   - sediment transport and aquatic ecology.

  Data access is via NRW website the Stream Gauging Stations Index using stream name, or gauging station number. The water monitoring program operates under a certified quality management system at Water monitoring data collection standards. The validated field data is entered into easy access databases using formats specified in the Water monitoring data reporting standards.

- NRW State of Rivers projects provide 'snapshots' of the ecological and physical condition of Queensland riverine systems. Survey information for specific rivers is at *State of the Rivers* report. Condition ratings include riparian vegetation condition, aquatic vegetation and habitat condition, recreational and conservation value.
- Local Governments throughout Queensland which conduct water quality monitoring programs, including recreational (biological) monitoring.
- Great Barrier Reef Marine Park Authority which conducts lower estuarine and coastal water quality monitoring.
- Regional Environment Monitoring Programs (REMPs) that are supported collaboratively by State and local government and industry in parts of the State, including Trinity Inlet, SEQ/Moreton Bay, Cleveland Bay, the Great Barrier Reef and Port Curtis. In some cases development conditions related to receiving waters monitoring may be addressed by applicants by contributing to such REMPs.
- OzCoast website which includes an estuary database and information on coastal indicators that can be accessed at http://www.ozcoasts.org.au/.
- Water Quality Online website which includes products developed as part of the *National Action Plan for Salinity and Water Quality*. It includes water quality assessment tools that can be accessed at http://www.wqonline.info.
- Ports Corporation Queensland undertakes water quality monitoring at each of its ports to assess trends in water quality parameters over time. The current program of water quality monitoring commenced in mid-2004 and the links below provide a summary of the results obtained to date. Each file contains a map of the sampling area and locations, as well as the sampling results from; Abbot Point/Bowen. Lucinda. Mourilyan. Thursday Island. Weipa.
- Other information sources include the Department of Primary Industries and Fisheries (declared fish habitat areas under the *Fisheries Act 1994,* mangroves and seagrass mapping), Sunwater, SEQ Water and other water authorities throughout the State.

For further information please search the respective websites or contact the organisations.

2.3 Assessing water quality – for DA and strategic planning

Comparison of ambient or receiving water quality data from site monitoring programs or test data should be made with the WQOs for the waters under the EPP Water, either listed under Schedule 1 or from the QWQGs/ANZECC.

Compliance with the WQOs for all indicators from the Schedule 1 documents for the specific waters (and water types) is assessed by comparing the annual median value for each indicator and site with the WQOs for the water - at the stated level of aquatic ecosystems protection.

In the second case compliance is assessed by comparison with the water quality objectives from the QWQGs/ANZECC for relevant regions/subregions/catchment level information. Compliance is assessed for all indicators by comparing the annual median value for each indicator, by site and water type against the QWQGs/ANZECC guideline values.

In both assessment cases the level of level of aquatic ecosystem condition that the water quality objectives for that water are intended to achieve should be determined from either the Schedule 1 document for the waters, or from the QWQGs in conjunction with planning designations for impacted or downstream waters (e.g. marine park/national park, fish habitat areas, significant wetlands (Ramsar/Directory of Important Wetlands etc.))

Assessment of sample or test data against the WQOs for the waters

Median, 20th and 80th percentile values for each indicator at each sample site, or test data from model predictions, are compared with the WQOs as follows:

- If the median value of the sample or test data falls within the water quality objectives (less than the WQOs for nutrients, suspended solids, turbidity or chlorophyll-a; greater than the WQO for Secchi depth; less than the maximum and greater than the minimum for pH and dissolved oxygen), the water quality objectives are met and the waters are ecologically healthy; or
- If the median value of the sample or test data is not within the water quality objectives, but the 20th or 80th percentile is within the water quality objectives (20th percentile less than the WQO for nutrients, suspended solids, turbidity or chlorophyll-a; 80th percentile greater than the guideline for Secchi depth; 20th percentile less than the maximum guideline or 80th percentile greater than the minimum guideline for pH and dissolved oxygen), the waters are slightly/moderately impacted (SMD waters) with some signs of poor ecological health; or
- If both the median value of the sample or test data *and* 20th or 80th percentile values fall outside the water quality objectives (20th percentile greater than the WQO for nutrients, suspended solids, turbidity or chlorophyll-a; 80th percentile less than the guideline for Secchi depth; 20th percentile greater than maximum or 80th percentile less than minimum for pH/dissolved oxygen), the water quality objectives are not met and the waters are moderately/heavily impacted (HD waters).

Compliance can be assessed by producing box plots of the sample or test data (using the median values, the 20th and 80th percentiles and the highest and lowest values (not outliers) for comparison with the WQOs for the waters. Refer to Figure 2 below.

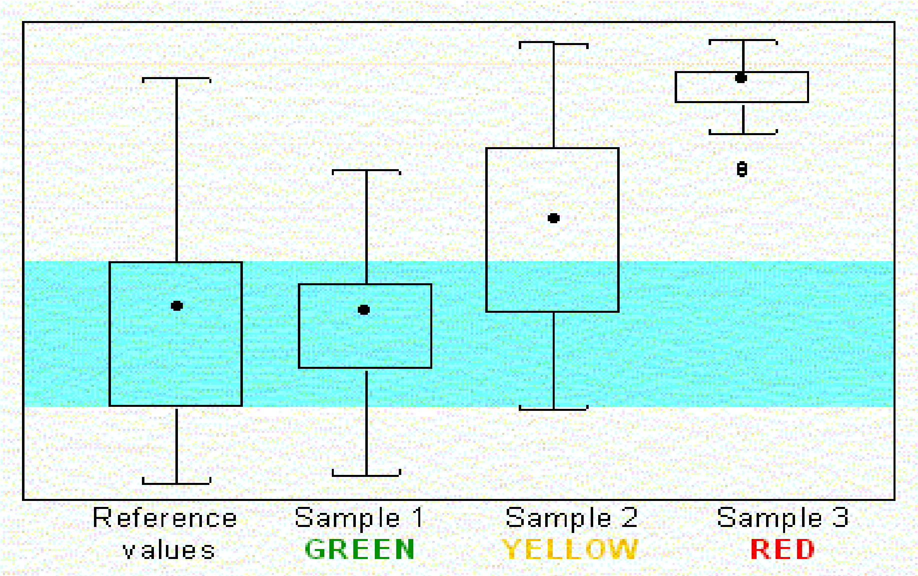


Figure 2. Box plot presentation of sample or test data against WQOs

Green: WQOs are met. Median value of sample or test data is within WQOs –.sample/test site is ecologically healthy/slightly impacted.

Yellow: Median exceeds WQOs, but 20th or 80th percentile is within the WQOs – sample/test site is sightly/moderately impacted with some signs of poor ecological health.

Red: WQOs not met. Median and 20th or 80th percentile exceeds WQOs – sample /test site is moderately/heavily impacted.

Integrated assessments of sample or test sites against the WQOs for the waters

Integrated assessment combines the results from the individual indicator/site assessments as follows:

Criteria			Result
	All sample or test sites green?	Yes	Green
			Yellow
	More sample/test sites yellow than green?	Yes	Yellow
	Any sample/test sites red?	Yes	Red
			Red

Notes

1. The S-PLUS statistical software package, or equivalent, to produce box plots for water quality assessment is the preferred method for sample/test data presentation and comparison with WQOs. S-PLUS software is available for EPA staff - contact the EPA Water Policy and Partnerships Unit by email at EPA.EV@epa.qld.gov.au, or telephone 1800 177 291.

2. The above assessment, based on annual medians, is not relevant for assessing the likely impact of toxicants, short term releases or pulse events on aquatic ecosystem values - refer to the ANZECC guidelines (via e-Guides) for approaches to these issues.

2.4 Assessing the contribution of multiple discharges to receiving waters

In assessing receiving water quality, the current condition reflects discharges from the whole catchment - including point source emissions, urban diffuse source emissions and rural diffuse source emissions. The relative contributions from the various emission sources should be understood in the assessment of applications for further waste water discharge or in strategic planning; particularly for slightly to moderately disturbed (SMD) waters without assimilative capacity or highly disturbed (HD) waters (that have no assimilative capacity.)

Possible information sources on existing waste water discharges to waters within a given catchment include:

- the EPA point source database and licensing database that provide information on existing point source discharges (quality/quantity/location);
- the results of compliance inspections conducted in specific areas of the State that may provide additional information on point source emissions and particular waterways/catchment issues;
- Local Government may have catchment level information on urban diffuse emissions;
- Healthy waterways strategies (including water quality improvement plans) and Regional NRM Plans may provide whole of catchment information, including rural and urban diffuse emissions; and
- EPA internal reports (via ROBIN) and external research publications via the Internet; also refer to Section 2.2.

2.5 Waste water discharge to ephemeral streams – ecological and hydrological impacts

Discharge of waste water to temporary streams requires special consideration due to their unique hydrological and ecological characteristics. The importance of maintaining water quality in the small number of permanent pools in ephemeral streams during naturally dry stages includes the protection of these habitats as refugia for aquatic species during the dry season. Waste water emissions during naturally dry stages are likely to disrupt the natural ecology and impact the aquatic ecosystem, and continuous or semi-continuous discharges of waste water should be avoided. Wet weather discharges of waste water should occur when receiving water flows are sufficient, from a risk based assessment, to maintain the water quality objectives of the receiving waters. (Data from any adjacent upstream gauging station may assist in determining the release period.) Feasible disposal alternatives should be investigated; including minimising the production of waste water, reuse opportunities and retention for discharge during wet conditions. Specific mine water disposal issues of a 'one-off' nature would be considered on a case-by-case basis with the administering authority.

Receiving water quality objectives should be based on the most appropriate local reference data collected from same stream above the discharge, or in an adjacent stream not affected by waste water discharges. Monitoring data should ideally cover the wetting stage as well as recessional or pool stages. In the absence of suitable reference data, default values from the Queensland and ANZECC Water Quality Guidelines should be adopted.

Information on methods to assess ephemeral stream water quality is available from http://www.acmer.uq.edu.au/research/attachments/FinalReport TempWatersSep20042.pdf

The discharge of waste water may also have adverse impacts on the hydrology of temporary and permanent surface receiving waters. The impacts relate to the volume and velocity of discharge relative to natural flows and may include bed and bank erosion and changes to the particle size distribution of sediments. Other effects may occur on biota where there is insufficient time to complete life cycles due to changed flow regimes. As a guide, modelling of flow characteristics should be considered where the waste water flow exceeds 10% of the natural flow of the waterway.

2.6 EPA guidelines - sampling / experimental design / sample analysis / data analysis and pre-development water quality monitoring

The EPA Water Quality Sampling Manual, at http://www.epa.qld.gov.au/environmental_management/water/water_quality_monitoring/publications/, is to be used by relevant parties in deciding sampling, sample analysis and statistical analysis requirements under the EPP Water, including when:

- taking samples, or making tests and measurements; or
- preserving and storing samples, or performing analyses on samples; or
- performing statistical analyses on the results of sample analyses.

Manual methods or the S-PLUS statistical software package, or equivalent, should be used to produce box plots for water quality assessment of sample or test data against water quality objectives.

Where pre-development water quality monitoring is required:

- the QWQGs recommend the taking 18 samples to provide estimates of median, 20th and 80th percentiles at a reference site, refer to section 3.4.3.1 and Figure 3.4.1. As a minimum samples should be collected over a period of at least 12 months and cover seasonal variations, on the understanding that further samples would be collected to meet the recommended number of 18. Note the ANZECC Water Quality Guidelines recommend the taking of 24 samples to estimate the above percentiles at a reference site; and
- The Australian Guidelines for water quality monitoring and reporting 2000 informs baseline studies that measure change, including the *Multiple Before After Control Impact* (MBACI) experimental design. MBACI examples detecting environmental impacts of marine aquaculture are at http://www.bio.usyd.edu.au/SOBS/TEACHING/ecol_04/marine/CAS%202004%20marine%20ecology%20lecture%2011.pdf.

The above protocols also inform the baseline studies required under the EPA Operational Policy *Waste water discharge to Queensland waters* in demonstrating '*an equivalent outcome of no, or negligible, change to the physico-chemical, biological, habitat and flow attributes beyond natural variation of HEV waters, excepting, in limited circumstances, within a defined initial mixing zone measured near the waste water release outfall location. The intent is that beyond the mixing zone boundaries, current environmental quality is maintained and the aquatic ecosystem is conservatively protected over time, taking into account the precautionary principle."* Appendix 6.4 of the Operational Policy, Application of MBACI design for HEV water assessment, provides further information.

Note

The method of assessing 'no change' to the physico-chemical, biological, habitat and flow ecosystem attributes of high ecological waters is given in the Queensland Water Quality Guidelines 2006 (Appendix D Compliance assessment protocols.)

2.7 Predicting the impacts of the proposed waste water discharge on the receiving waters

<u>This Section informs Section 2.3 and Section 3 of the Operational Policy</u>

When is predictive water quality modelling required to ascertain the impact from the proposed waste water discharge?

All development applications or environmental authority applications proposing waste water discharge to waters must quantitatively assess the impacts on the receiving waters.

- Where the assessed environmental risk of the proposed discharge is low (on the basis of toxicity assessment and contaminant load), the scale is small and spreadsheet calculations or simple box modelling indicates the increase in contaminant concentration does not exceed of the WQOs for the receiving waters, then more detailed predictive water quality modelling is not likely to be required. This circumstance may include a proposed discharge involving a small volume of waste water containing one or two well-studied contaminants at concentrations only several times greater than the well mixed mid/lower estuarine receiving waters. Refer to Attachment 2 to Section 2. Assimilative capacity must exist for the contaminant (that is the WQOs are not exceeded.)
- Commensurate with increased scale and risk, and including where the receiving waters are of high ecological value, the use of more complex predictive water quality modelling will be required to evaluate receiving waters impacts**.** Predictive modelling outputs would include the assessments over a range of input conditions or scenarios. Test data output should be analysed and compared with the existing receiving water quality and the WQOs of the receiving waters using box plots, refer Section 2.3.

What models / techniques should be used?

- **Mixing zone models** are used to assess water quality impacts from point source discharges**.** The most commonly used mixing zone model is Cormix available through the USEPA website is a water quality modeling and decision support system designed for environmental impact assessment of mixing zones resulting from waste water discharge from point sources. Although US focused, the compilation of mixing zone documents provides good background information.

  Mixing zone guidance includes:

  - to protect EVs, outfall diffusers would normally be required to ensure a minimum initial dilution level under the stated tidal or flow conditions (i.e. release during stated parts of the tide or above stated freshwater flows);
  - the maximum lateral dimension of the mixing zone should be the lesser of 50m diameter or 30 percent of the waterway width for riverine and estuarine waters; and a radius not exceeding 100m from the diffuser port for coastal waters;
  - boundaries of adjacent mixing zones be at least 200m apart, cumulative impacts should be assessed;
  - compliance with receiving water quality objectives should be met within 3 stream widths or 300m from the diffuser port, whichever is the smaller; and
  - application is primarily to toxicants. Nutrients should be assessed in terms of equilibrium concentrations at a certain distance (for example 300m) from the discharge port.

- **Catchment models** typically simulate the flows and loads of suspended sediment, total phosphorus and total nitrogen from freshwater catchments with consideration of land use, rainfall, soil characteristics, vegetation cover etc. Flows and loads are routed through stream networks, typically to the tidal limits of estuaries. Catchment models are available from a number of sources including CSIRO Land and Water, eWATER CRC and Regional NRM Groups.
- **Receiving water quality models** for estuaries and embayments are specific and complex models that simulate the hydrodynamic and water quality variations in the water body subject to external inputs. Receiving water quality models enable scenario modelling of water quality to be undertaken to predict the likely impacts of contaminants. Receiving water quality models are available through major consultant organisations for specific parts of the State, and are required to be used for significant projects.
- **Box models for estuarine water quality modelling** provide a simple computational framework that may be used to determine contaminant load estimates (e.g. N and P). Box models are relatively straightforward, available through most consultant organisations or may be developed for the estuarine waters of interest. A simple box model of steady state increase of contaminant concentration is at Attachment 1 to Section 2.

2.8 Considering the results of water quality assessments in accordance with the Operational Policy

Development applications and environmental authority applications proposing to discharge waste water to receiving waters should provide information to characterise the receiving environment and predicted impacts of the proposed discharge of waster water; in accordance with sections 2.1 to 2.7 above, and in summary as follows.

- Environmental values, water quality objectives, water types and levels of aquatic ecosystem protection for the receiving waters should be provided, preferably with spatial datasets including application details and relevant overlays (e.g. protected estate and constraints mapping).
- Waste water contaminant assessment, discharge and monitoring information – refer Attachment to Section 1.
- Existing receiving water quality and ecological health information should be sourced and collated to include riverine, estuarine and coastal waters and the broadest range of indicators and indicator values.
- Future planning intent for the catchment and associated waters should be determined.
- Conduct baseline water quality monitoring for HEV waters, and as required for SMD/HD waters. Use agreed experimental design to establish pre-development water quality at control sites and proposed impact sites:
  - The QWQGs provide guidance on the number of site samples and time period to establish baseline development water quality, refer also to Section 2.6; and
  - The EPA Sampling Manual informs sampling techniques and sample analysis requirements. Sample data statistical analysis should include the calculation of median values, 20th and 80th percentiles and data outliers, by indicators, by sample sites for a given water type. Box plot presentation is preferred.

- All applications must quantitatively assess the impact of the proposed waste water discharge on receiving water quality. Information on the proposed waste water discharge contaminants (indicators concentrations and loads) should be provided. Depending on the degree of risk, scale and initial estimates of contaminant concentration increases above background, predictive modelling may be required.
- Collate test data or site sample data on existing water quality. Use S-PLUS statistical analysis software or equivalent, comparing site sample data or site test data with the WQOs for the water type for key indicators.
- Use box plots to present data and develop integrated water quality assessments (GREEN, YELLOW and RED ZONES) to provide an evidence base that informs the subsequent analysis in accordance with the EPP Water:
  - **Green:** Median of site sample data and test data is within WQOs – sample or test sites are ecologically healthy/slightly impacted, WQOs are met prior to, and post the proposed discharge of the waste water;
  - **Yellow:** Median values of site sample data or test data exceeds WQOs, but 20th or 80th percentile is within the WQOs – sample /test site is sightly/moderately impacted site; and
  - **Red:** Median of site sample data or test data and 20th or 80th percentile exceeds WQOs – sample or test site is moderately/heavily impacted. WQOs are not met by the existing water quality. Further decline in water quality would be expected with additional discharge.

Assessment and decision making guidance

In assessing and deciding applications for development approval and environmental authority, the administering authority must comply with any relevant EPP requirement; consider the standard criteria and other prescribed matters. **That is, the assessment and decision making processes are determined by consideration of multiple criteria** – **not single criterion.** Refer to Endnotes 1, 2 and 3 for further detail.

The current EPP Water includes statements of policy about assessment and decision making that resulted from consultation on the Regulatory Impact Statement for the *Environmental Protection (Water) Amendment Policy No 1 2006* (the EPP (Water) AP). These are described in the corresponding Explanatory notes and summarized in the EPA Operational Policy.

- For proposed waste water discharge to HEV waters there should be no impact beyond the mixing zone (minimized to the greatest extent) and where practicable environmental offsets used to provide a net environmental gain to the receiving waters (refer Section 3 Environmental Offsets). Some assimilative capacity is preserved for future ESD.

  Note that mixing zone considerations apply to all environmental management decisions involving waste water discharge to surface water in accordance with s18 of the EPP Water; considerations include the use of diffusers, limiting the size of the mixing zone and releasing waste water under stated tidal or flow conditions.
- For GREEN ZONE assessment - proposed discharge of waste water to SMD waters with assimilative capacity (WQOs met prior to and post the discharge):

- seek to maintain current water quality, through innovative and proactive discussions working in close partnership with the applicant to investigate on feasible alternatives to waste water discharge - refer to the waste management hierarchy for guidance at the Attachment to Section 1);
- retain some assimilative capacity for future ESD; and
- limit non-compliance to the mixing zone, minimised to the greatest extent.

- For RED ZONE assessment - proposed discharge of waste water to SMD and HD waters that do not meet the WQOs (prior to or post the waste water discharge – i.e. the waters have no assimilative capacity for the discharge):
  - in constructive partnership with the applicant, seek innovative and proactive alternatives to waste water discharge (refer to the waste management hierarchy); and
  - consider the use of environmental offsets if there are no feasible alternatives to discharge.
  - Analyse key contributors discharging to catchment waters to understand the existing major emission sources. (Unrelated to the application being assessed, discussion with the Regional Manager may consider initiating a *strategic compliance management plan* involving area and industry sector inspection programs towards longer term improvements in receiving water quality).
- For YELLOW ZONE assessment - Median values of site sample data or test data exceeds WQOs, but 20th or 80th percentile is within the WQOs.
  - **Assess as above -** recognising there is no assimilative capacity in respect of the non-compliant water quality indicators and considering the use of environmental offsets where there is no feasible alternative to discharge. If the discharge will not affect a non-compliant indicator e.g. discharge of sediment where water clarity and any relevant biological indicators are met, assess as per green zone.

Endnotes

1. The *Environmental Protection Act 1994* (EP Act) s73A, AA, B and C informs the assessment of development applications for chapter 4 activities (other than for mining or petroleum activities), wherein the administering authority must comply with any relevant Environmental Protection Policy requirement and must consider the standard criteria of schedule 3 of the EP Act and additional information given in relation to the application. (This section does not limit the Integrated Planning Act (IPA), section 3.3.15 or chapter 3, part 5 (Decision stage) or division 2 (Assessment process) of that Act.)

Section 73B of the EP Act specifies the conditions of any development approval that may and must be imposed; including s73B (1) subject to the Integrated Planning Act s3.5.30 (conditions must be relevant or reasonable), the administering authority may impose the conditions on the development approval it considers are necessary or desirable and (2) the conditions must include any condition the authority is required to impose under an EPP requirement.

2. In assessing and deciding applications for environmental authority (mining activity) for level 1 mining projects, under s 193 the administering authority may in granting the application impose the conditions on the draft environmental authority it considers necessary or desirable.

In deciding whether to grant or refuse the application or to impose a condition the authority must:

(a) comply with any relevant Environmental Protection Policy requirement; and

(b) subject to paragraph (a), consider the application documents for the application, the standard criteria, the wild river declaration for the area—to the extent the application relates to mining activities in a wild river area, any suitability report obtained for the application and the status of any application under the Mineral Resources Act for each relevant mining tenement.

3. The standard criteria under Schedule 3 Environmental Protection Act 1994 means:

(a) the principles of ecologically sustainable development as set out in the 'National Strategy for Ecologically Sustainable Development'; and

(b) any applicable environmental protection policy; and

(c) any applicable Commonwealth, State or local government plans, standards, agreements or requirements; and

(d) any applicable environmental impact study, assessment or report; and

(e) the character, resilience and values of the receiving environment; and

(f) all submissions made by the applicant and submitters; and

(g) the best practice environmental management for activities under any relevant instrument, or proposed instrument, as follows—

(i) an environmental authority;

(ii) an environmental management program;

(iii) an environmental protection order;

(iv) a disposal permit;

(v) a development approval; and

(h) the financial implications of the requirements under an instrument, or proposed instrument, mentioned in paragraph (g) as they would relate to the type of activity or industry carried out, or proposed to be carried out, under the instrument; and

(i) the public interest; and

(j) any applicable site management plan; and

(k) any relevant integrated environmental management system or proposed integrated environmental management system; and

(l) any other matter prescribed under a regulation.

Attachment 1 to Section 2

Box Model estimation of steady state increase in total nitrogen concentration

Question – What is the steady state increase in total nitrogen concentration in a "box" of water given a constant daily load and a first order decay due to denitrification?

Conservative assumptions include:

- No advection
- No dispersion
- Tidal prism based on neap tidal range

Other assumptions include

- Losses due to denitrification – first order decay with a rate constant K_T of 0.05 day^{-1} (derived by John Bennett from modelling work on Southeast Queensland estuaries.)

The basic relationship is

$$\frac{d\ \text{Total N}}{dt} = \text{Load TN} - K_T\ \text{Total N}$$

i.e. the change in total nitrogen (TN) (kg) wrt. time is the load of TN (kg/day) minus losses of TN due to denitrification

<u>Calculating tidal prism in ML</u>
Determine areal extent (m^2) of waters upstream from discharge point.

Obtain data from site inspection/map/field visit. Distance upstream is limit of tidal influence for small streams. For large streams, use mean tidal velocity for an average tide (m/s) multiplied by time of tidal cycle e.g. 6hrs X 60min X 60secs for 2 tides/day

Calculate the tidal range under neap tides (m) from local tide data.

Tidal prism ML = areal extent (m^2) X depth (m) /1000

In this case, 40m wide X 3000 m long X 1.0m mean neap tide difference/1000

➔ **Tidal prism = 120 ML**

<u>Calculating aquaculture daily load of total nitrogen (TN)</u>

Daily Discharge in m^3 = 5% of growout pond volume
= 0.05 X 6 X 5000m^2 X 1m
= 1500 m^3

Daily Discharge in ML = discharge in m^3 /1000
= 1.5 ML

Max Daily Load TN (kg/day) = daily discharge (ML/day) x concentration TN (mg/L)
= 1.5 X 0.6
= 0.9 kg/day (Scenario 1)

<u>Calculating the change in total N (ΔTN)</u>

The Basic Relationship again is

$$\frac{d\ \text{Total N}}{dt} = \text{Load} - K_T\ \text{Total N}$$

Under steady state, change in Total N wrt. time is zero, therefore:

$$\frac{d\ \text{Total N}}{dt} = \text{Load} - K_T\ \text{Total N} = 0$$

transforming the equation gives:

Total N (kg) $= \dfrac{\text{Load (kg day}^{-1})}{K_T\ (\text{day}^{-1})}$ (Note from above, K_T (day^{-1}) value is a given factor)

= 0.9/0.05
= 18 kg

This is the steady state <u>additional</u> mass of TN in the tidal prism (i.e. the box) caused by the discharge

<u>Calculating the change in total N concentration (∆TN)</u>

∆TN mg/l = mass TN (kg) /volume (ML) of the tidal prism
= 18/120
= 0.15 mg/L

<u>Assessing Impact</u>

Add predicted increase in TN mg/L (i.e. 0.15mg/L) to ambient median TN

Scenario A: ambient median TN = 0.36mg/L
Scenario B: ambient median TN = 0.205 mg/L

Compare result to water quality objective for TN: 0.300mg/L

Alternate Scenario

Let's say that the discharge is instead to larger estuary with the following characteristics.

- Average width: 70 m for at least 12 km upstream
- Neap tidal range: same, 1.2 m
- Distance to extremity of tidal influence upstream from farm 20 km
- Average tidal current velocity during neap tides 0.5 metres per second.
- 2 tidal cycles per day i.e. approx. a 6 hour tidal cycle

To recalculate tidal prism:

1. Distance of tidal flow upstream = 0.5 m/sec X 6 hours
= 0.5 m/sec X 60 X 60 X 6 sec
= 10800 metres

2. Tidal prism

Tidal prism ML = areal extent (m^2) X depth (m) /1000

In this case, 70m wide X 10800 m long X 1.2 mean neap tide difference/1000
= 907.2 ML

Calculating the change in total N concentration (ΔTN)

ΔTN mg/l = mass TN (kg) /volume (ML) of the tidal prism
= 18/907.2
= 0.02 mg/L

Assessing Impact

Add predicted increase in TN mg/L (i.e. 0.03mg/L) to ambient median TN

Scenario A: ambient median TN = 0.36mg/L
Scenario B: ambient median TN = 0.205mg/L

Compare result to water quality objective for TN: 0.300mg/L

Attachment 2 to Section 2

Steady state calculations – estimation of activity impact

A. Dilution Ratio in Creek Method
Assumptions:

- Constant flow in creek
- Constant flow of discharge
- Calculates ratio of flow in creek to flow in discharge
- Gives a guide to potential dilution available.

[Note: This does not take account of mixing zone impacts]

<u>Assumed flows</u>

- Turtle Creek North – 12.77 cumecs = 12.77 cubic metres per second
- Turtle Creek South – 25.3 cumecs = 25.3 cubic metres per second

<u>Maximum waste water discharge</u>
= 5 ML/day
= 5000 cubic metres per day
= 0.058 cubic metres per sec

<u>Dilution Ratios</u>

Turtle Creek North – 12.77/0.058 = 220:1

Turtle Creek South – 25.30.058 = 436:1

B. Estimated concentration in creek method

To calculate the resultant water concentration the following formula can be used:

$$Cres \quad = \quad \frac{(Qcreek * Ccreek) + (Qdis * Cdis)}{(Qcreek + Qdis)}$$

With:
Cres = *Resultant concentration in the creek in µg/L*
Q creek = *Flow in the creek in (m^3/s) upstream of discharge*
Ccreek = *Concentration in Creek upstream of discharge (µg/L)*
Q dis = *Discharge volume of activity (m^3/s)*
Cdis - = *Concentration in discharge (µg/L)*

Assumptions:

- Constant flow in creek in one direction
- Constant flow of discharge into the creek
- Assumes all mix together
- Note this ignores a mixing zone effect and hence any mixing zone impacts.

<u>Example</u>

Data

Q creek - 12.77 cumecs =12.77 cubic meters per second
Ccreek from data = 0.4 µg/L maximum dissolved copper
Q dis = 0.058 m^3/s
Cdis = 30 µg/L maximum (assume all dissolved copper)

$$Cresulting \quad = \quad \frac{(12.77 * 0.4) + (0.058 * 30)}{(12.77 + 0.058)} = 0.5\ \mu g/L$$

C. Estimated minimum dilution in creek method

Question: What if we want to know what minimum dilution is necessary to meet ANZECC trigger values?

Data

Cresulting = 1.4 (ANZECC criteria for copper)
Q creek - x cumecs = x cubic meters per second
Ccreek from data = 0.4 µg/L maximum dissolved copper
Q dis = 0.058 m^3/s
Cdis = 30 µg/L maximum (assume all dissolved copper)

Substituting from equation above gives:

$$Cresulting \quad = \quad \frac{(x * Ccreek) + (Qdis * Cdis)}{(x + Qdis)}$$

$$\rightarrow \quad 1.4 \quad = \quad \frac{(x * 0.4) + (0.058 * 30)}{(x + 0.058)}$$

→ Qcreek = 1.6588

Flow in the creek (Q creek) must equal at least 1.6588 cumecs i.e. 1.6588 cubic meters per second if the resultant concentration is not to exceed 1.4 micrograms Cu per litre.

Minimum dilution ratio therefore is:

<u>1.6588 cubic meters per second flow in creek to achieve criteria</u>
Maximum daily discharge = 0.058 cubic meters per second

= 28.6 (rounded off say 29-30 times)

3. Environmental offsets

This Section informs Section 2.4 of the Operational Policy

3.1 What is an environmental offset in the context of waste water discharge?

Environmental offsets (offsets**)** means the measures taken to counterbalance the negative environmental impacts resulting from a residual waste water discharge that must first be avoided, then minimised before considering the use of offsets for any residual impacts. An offset is to be of a like-kind (i.e. the same contaminant and chemical form) and seeking to deliver a net environmental gain to the receiving waters. Offsets may be located within or outside a development site and should be legally secured.

Offsets will not replace or diminish existing environmental standards or regulatory requirements that must still be met; e.g. a discharge of poorly treated waste water or an activity that failed to incorporate best practice measures could not implement an offset to avoid adopting best practice environmental management. Offsets will not be used to allow development in areas where they could not otherwise occur or be used for purposes not otherwise allowed. They are simply intended be provide another tool that can be used during project design, environmental assessment and implementation to achieve the principles of ecologically sustainable development—the object of the EP Act.

Offsets counterbalance those impacts that still exist despite reduction through best practice waste avoidance, recycling and re-treatment, and adoption of environmentally sound discharge location and release circumstances in accordance with the EPP Water. Offsets should be distinguished from 'abatement measures' which refer to the range of actions that can be undertaken to reduce the level of impacts of a discharge (typically undertaken on-site and by adopting discharge strategies sensitive to environmental conditions).

3.2 When may an environmental offset be required?

The administering authority may require an offset or may approve an offset incorporated in a development proposal in making a decision about an application under the EP Act for a development approval for an environmentally relevant activity or environmental authority for a level 1 mining or petroleum activity. Refer to section 2.0 and 2.1 of the EPA Operational Policy. The policy intent is that for:

- HEV waters, where practicable the application includes a like kind environmental offset proposal - counterbalancing the discharge of residual waste water (the discharge) from the proposed ERA; and
- SMD and HD waters with no assimilative capacity, environmental offsets (offsets) may be considered by the administering authority where there are no feasible alternatives to residual waste water discharge.

For the purposes of the EPA Operational Policy, environmental offsets will not apply to SMD waters where assimilative capacity exists. Refer to the Operational Policy Section 2.3.4 Assimilative capacity and sustainable load. By definition HD waters have no assimilative capacity.

In all cases an environmental offset condition must only be imposed where it is considered to be either necessary or desirable in the context of the activity (see EP Act s 73B, 114 and 210). This means there must be a nexus between the offset and environmental protection of the subject waters, and the offset is either a necessary or desirable additional measure that assists in achieving the object of the EP Act.

Note
The Australian Government Department of Environment and Water Resources is addressing the use of environmental offsets in approval conditions under the EPBC Act, when a proposed development impacts on a matter of national environmental significance that is protected by that Act. When finalised, EPBC Act requirements should be considered in conjunction with this Operational Policy.

3.3 Queensland Government Environmental Offsets Discussion Paper

The consideration of environmental offsets is in accordance with the principles in the discussion paper on a proposed Queensland Government Environmental Offsets Policy, that are listed below.

- *Environmental impacts must first be avoided, then minimised before considering the use of offsets for any residual impacts*.
- *Offsets will not be used to allow development in areas where they could not otherwise occur, or for purposes not otherwise allowed*.
- *Offsets must achieve an equivalent or better environmental outcome.*
- *Offsets must provide environmental values as similar as possible to those being lost.*
- *Offsets must be provided with a minimal time-lag between the impact and delivery of the offset.*
- *Offsets must provide additional protection to values at risk or additional management actions to improve environmental values.*

3.4 Information on the development of an acceptable offsets proposal

In developing an offsets proposal under the EPA Operational Policy, offsets must be:

Enduring—they must offset the impact of the development for the period that the impact occurs. Where there is an approved increase in residual waste water discharge over time, a commensurate increase in offset quantity is required. Where the onset time is delayed, the offset will need to generate a larger amount of contaminant reduction in later years to balance any shortfall in the early establishment period. Development conditions or environmental authority conditions will specify the maintenance and monitoring requirements for the offset to ensure the achievement of the net environmental gain to the receiving waters over the life of the project.

Quantifiable and Monitored—the proposed environmentally relevant activity (ERA) discharge load increase and the counterbalancing offset load reduction must both be able to be measured or estimated with a reasonable level of confidence. Where the offset involves land-use change impacting on diffuse source contaminants, it is likely to be difficult to determine precisely the actual amount of pollution abated. In this case, measurement using a protocol agreed beforehand with the administering authority would be required. Measurement of baseline loads before implementation of the offset in accordance with the protocol would typically be included. Sound estimation tools should be based on the best available science and an acceptable level of understanding of how the offset measures work.

To measure the success of environmental offsets in delivering the desired environmental outcome, it is necessary that offset performance is monitored and audited, and the results included in reporting to the administering authority.

Targeted and located appropriately—they must offset the impacts on a ‘like-for-like’ basis (like kind offsets) of the same chemical type and form and be located appropriately. Offsets must impact on the same (receiving) waters and use offset ratios to achieve environmental equivalence between the proposed ERA discharge and offset sources. The administering authority will advise priority catchment locations for rural diffuse offsets.

Potential offset sources should discharge the same type and chemical form of contaminant and to the same waters as the proposed ERA discharge. In some cases a contaminant will be present in more than one form. For example, phosphorus is comprised of both soluble and non-soluble forms and most sources discharge a combination of these forms. As offset opportunities are considered, the form of the contaminant being discharged should be identified to ensure that offsets represent an equivalent impact on water quality.

The fate of a contaminant is also an important consideration in evaluating impacts. For example although an activity may discharge non-soluble phosphorus, if the environmental conditions result in indirect impacts these must also be considered (e.g. discharge to stratified receiving waters that solubilise phosphorus.) The applicant should establish:

- the type and form of the major contaminant proposed in the residual waste water discharge;
- catchment offset sources that discharge the same type and form of the contaminant;
- the impacts of concern for the contaminant and any variation based on different chemical forms; and
- the potential for differential impacts from the various forms of the contaminant.

Suitable—discharge contaminants that may be suitable for management by offsets include nutrients (nitrogen and phosphorus), sediment (TSS and TDS), organic carbon or other contaminants where the scientific basis can be demonstrated and the contaminants do not have human health impacts, irreversible environmental impacts or unacceptable biota impacts.

Criteria to determine if a particular contaminant is suitable for management by offsets include:

- the contaminant contributes to a chronic, cumulative environmental impact (load effect), not an acute, localized impact (concentration effect)—toxicants are not appropriate;
- practical off-site pollution abatement measures are available to remove the contaminant elsewhere in the catchment; and
- practical tools are available to measure or estimate diffuse and point source loads of the offset contaminant, including existing baseline loads before ERA discharge and the offset measures commence.

Contaminants such as pathogens, most heavy metals and other contaminants that are toxic, at very low levels, to humans and the environment cannot be addressed using offsets.

The Attachment to Section 3 informs phosphorus, nitrogen and sediment suitability for management by offsets.

Enforceable—the applicant is responsible for ensuring that the offset is implemented diligently and maintained in a proper and effective manner. The applicant must identify how offsite elements will be implemented. Where the applicant is not the owner of the land subject to the offset, evidence of owner consent should be included in the application and ongoing use of the land for offset activities. The location of the offset (lot and plan numbers) must be included in the Offset Agreement.

Supplementary—offsets must have been specifically proposed for the offset purpose and be beyond current regulatory requirements.

The offsets proposal must also consider financial assurance—the administering authority has discretion under Chapter 7 Part 6 of the EP Act, and applicants should discuss the possible requirement during pre-design conferencing with the administering authority. It is reasonable that any financial assurance be drawn down as offsets are progressively implemented.

3.5 Determining environmental equivalence of offsets at different discharge points - offset ratios

The application of an equivalence (or offset) ratio seeks to account for contaminant reductions (offsets) made at different points within a catchment and to ensure that the impact of the offsets from designated locations or areas are equivalent to the proposed ERA residual waste water discharge.

Offset ratios must be greater than 1:1

An offset ratio determines the quantity of contaminant that a proposed offset must reduce for each kilogram of contaminant emitted in the residual waste water discharge. The offset ratio 3:1 means that 3 kilograms of contaminant are offset for every 1 kilogram of contaminant discharged. Offset ratios account for:

- the policy intent for the management of HEV, SMD and HD waters (refer section 2.0 of the EPA Operational Policy);
- the scientific uncertainty in estimating the loads of contaminant emitted by the ERA proposal (the load being offset) and the load reduced by the offset actions; and
- the spatial, temporal, chemical and bioavailability differences between the contaminants released and offset.

Table 1 provides default offset ratios that may be used to provide a reasonable level of confidence that the contaminant discharge is offset. The default ratios are consistent with offset / trading ratios used nationally and internationally for a range of contaminants, refer http://www.environment.nsw.gov.au/resources/framework05260.pdf and http://www.epa.gov/owow/watershed/trading/traenvrn.pdf. Different default ratios may be needed to address the project contaminants and locality issues, and should be discussed at pre-design conferencing.

Table 1: Default offset ratios

Emission source of ERA contaminant	**Emission source of offset contaminant**	**Ratio (offset : impact)**	**Basis of ratio** (Offsets are in the same waters or different water types *upstream* of the ERA contaminant discharge.)
Point	Point	1.5:1	A 1:1 ratio is the minimum needed to achieve a nil net discharge. The ratio also reflects the risk and uncertainties of achieving the offset measure and to achieve a net environmental gain to HEV waters or SMD/HD waters not meeting WQOs.
Point	Diffuse (rural)	3:1	As above. In addition, the ratio has been increased to account for the greater uncertainty in achieving and quantifying rural diffuse offsets, in-stream processing effects and spatial, time and bioavailablity differences.
Point	Diffuse (urban)	3:1	As above.

Notes to Table 1

1. Table 1 provides **minimum default offset ratios** that may be used for point and diffuse offsets to waters in the same catchment. The ratios assume knowledge of the proposed ERA residual waste water discharge, over time, and the conduct of monitoring programs to inform offset compliance.

2. Applicants may choose to develop project specific offset ratios, based on catchment and offset modelling, for consideration by the administering authority. Where offsets are proposed to be implemented in waters of **adjacent catchments with common receiving waters**, this must be agreed with the administering authority at pre-design conferencing and the offset ratios determined from catchment and offset modelling.

3. Proposals to include **rural diffuse offsets** assumes the restoration or re-establishment of degraded riparian or wetland habitats, or other land management actions, according to priorities advised by the administering authority at pre-design conferencing.

4. Proposals to include **urban diffuse offsets** from either new or existing urban development should also be according to the priorities advised by the administering authority. (The use of modelling techniques to demonstrate treatment train effectiveness in reducing contaminant emissions from both existing and new urban development will be required by the administering authority. Note that with respect to new urban development, offset proposals would be required to address contaminants remaining after the application of best practice environmental management for urban stormwater.)

5. **Downstream offsets**. SMD and HD waters that have no assimilative capacity for the proposed ERA residual waste water discharge contaminants will show further deterioration in current condition and for HEV waters the natural values of HEV waters will not be maintained. Localized contaminant impacts post the ERA discharge may be exacerbated in riverine waters with low flows and/or a high capacity for contaminant retentiveness or in extended estuaries with limited tidal flushing. The adoption of downstream offsets in different water types (i.e. the offset is located in a different water type that is downstream of the proposed ERA discharge) has limited ability to address the policy intent of preventing further degradation and reversing the declining trend in water quality or maintaining natural values. Accordingly, the adoption of downstream offsets in different water types does not contribute to achieving the policy intent and is not considered suitable.

Offsets for proposed ERA residual discharge in riverine waters should be in the same water type, using the minimum default offset ratios as in Table 1.

3.6 Determining riparian and wetland buffer widths

The Department of Natural Resources and Water's *Regional Vegetation Management Codes* under the *Vegetation Management Act 1999* for the relevant Queensland bioregions (available through the website at www.nrm.qld.gov.au) should be used as **default buffer widths** to **re-establish degraded watercourse riparian or wetland function** — providing the offsetting contaminant load reduction to receiving waters by preventing bank erosion and filtering sediments, nutrients and other contaminants from stormwater run-off.

In the context of this Operational Policy the codes are used to provide default buffer widths — equivalent to the buffer widths under the codes to be retained in the clearing of vegetation to prevent loss of riparian function. Extracts in Table 2 below are for information only and reference must be made to the appropriate Queensland bioregion code for case-by-case assessment. Examples of degraded and functioning riparian buffers are at Figure 3.

Table 2 Default riparian and wetland buffer widths

Performance requirement To re-establish degraded watercourse riparian or wetland function.	**Buffer width** Guideline buffer widths to re-establish degraded watercourse riparian and wetlands function — shown below as ***bold/italics/underlined text***.
Watercourses To regulate the clearing of vegetation in a way that prevents the loss of biodiversity and maintains ecological processes — remnant vegetation associated with any **watercourse** is protected to maintain — a) **bank stability by protecting against bank erosion**; b) **water quality by filtering sediments, nutrients and other pollutants**; c) **aquatic habitat; and** d) **wildlife habitat.**	***Buffer width*** Clearing does not occur — a) in any watercourse; b) within ***200 metres from each high bank of each watercourse with a stream order 5 or greater***; c) within ***100 metres from each high bank of each watercourse with a stream order 3 or 4***; and d) within ***50 metres from each high bank of each watercourse with a stream order 1 or 2***.
Wetlands To regulate the clearing of vegetation in a way that prevents the loss of biodiversity and maintains ecological processes — remnant vegetation associated with any **significant wetland** and/or **wetland** is protected to maintain — a) **water quality by filtering sediments, nutrients and other pollutants**; b) **aquatic habitat; and** c) **wildlife habitat.**	***Buffer Width*** Clearing does not occur — a) in any wetland; b) in any significant wetland; c) within ***100 metres from any wetland***; and d) within ***200 metres from any significant wetland***.

Alternatively, applicants may conduct site based modelling studies acceptable to the administering authority to determine **riparian and wetland buffer widths** for Queensland bio-regions; e.g. the CSIRO Land and Water at http://www.clw.csiro.au/publications/technical99/tr32-99.pdf. In either case (i.e. default or site specific study) the riparian vegetation structure design must restore full ecological function; e.g. according to CSIRO Land and Water management objectives at http://downloads.lwa2.com/downloads/publications_pdf/PN061234_34-36.pdf.

Best practice environmental management includes fencing to exclude stock at least 5m upslope from the top of the bank, ensuring the bank is fully vegetated, incorporating a grass strip filter of the design width (but at least 15m) between the stream and the land use, adding an additional width equal to the height of the bank where this is greater than 15m, and including 30m or three widths of native trees/scrubs along the top of the bank.

Note that determining the **buffer length** to satisfy offset load requirements will require case by case land use and locality assessment, as prioritised by the administering authority. Site based modelling will be required.

Figure 3 Examples of degraded and effectively managed riparian zones © Photographs CSIRO Land and Water

Attachment to Section 3

A. Offset suitability for phosphorus

Sources of phosphorus include point sources such as waste water sewage treatment plants and diffuse sources such as agricultural activities. Phosphorus discharges and in-stream concentrations can be readily measured and the contaminant is relatively stable as it travels through waterways. As a result, water quality equivalence can be established between offset load reductions and ERA load increases.

Contaminant forms. Phosphorus forms include:

- Soluble phosphorus, as dissolved ortho-phosphates, that is more bioavailable than nonsoluble forms.
- Non-soluble sediment-bound or particulate-bound phosphorus, that is not as likely to promote rapid algal growth but has the potential to become biologically available over time.

The concentration of total phosphorus is based on the sum of the soluble and non-soluble phosphorus. Due to phosphorus cycling in a waterbody (conversion between forms), offsets should consider total phosphorus expressed in terms of annual loads as a common metric with ERA discharge loads.

Actual forms of phosphorus being discharged should be identified to establish an equivalent impact on water quality. E.g., if offset reductions have substantially divergent chemical form to ERA discharges (e.g., one primarily discharges soluble phosphorus while another primarily discharges non-soluble phosphorus) then the two may not be environmentally equivalent. Most diffuse phosphorus from grazing/rural lands is sediment-bound, non-soluble phosphorus and from irrigation/horticulture in soluble form.

Impact. Excessive phosphorus concentrations have both direct and indirect effects on water quality. Direct effects include nuisance algae growth. Indirect effects include low dissolved oxygen, elevated pH, cyanotoxins from blue-green algae production and trihalomethane in drinking water systems.

Phosphorus **fate and transport** in waterways are well understood. The phosphorus “retentiveness” of a waterway describes the rates that nutrients are used relative to their rate of downstream transport. Areas of high retentiveness are usually associated with low flows, impoundments, dense aquatic plant beds and heavy sedimentation. Offsets that involve phosphorus discharges through these areas will likely require higher offsets to achieve water quality equivalence. In areas with swift flowing water and low biological activity, phosphorus is transported downstream faster than it is used by the biota, resulting in low levels of retentiveness and minimal aquatic growth. In reaches where phosphorus is transported rapidly through the system, lower offsets may be required.

Timing. The key consideration for phosphorus offsets is the seasonal load variability amongst emission sources. Agricultural diffuse source loadings will vary seasonally, with greater loadings likely during the growing season and during storm events associated with soil runoff. Point sources generally discharge continuously.

Refer *Water Quality Trading Assessment Handbook, US EPA, November 2004* available at http://www.epa.gov/owow/watershed/trading/handbook/docs/NationalWQTHandbook_FINAL.pdf.

B. Offset suitability for nitrogen

Anthropogenic sources of nitrogen discharging to receiving waters include point sources, such as waste water treatment plants and industrial discharge, and diffuse sources from agricultural activities and rural lands. Human activity has had an important influence on nitrogen cycles causing an increase of mobilized nitrogen. In particular nitrogenous fertilizer use has increased nitrogen input to receiving waters since widespread use began in the 1950's. In addition, both natural and human disturbances of natural ecosystems (e.g., forest fires, forest clearing) can contribute significant quantities of biologically available nitrogen to receiving waters.

Nitrogen discharges can be measured or calculated and tracked along a waterway.

Contaminant forms. Nitrogen forms include:

- Organic nitrogen that refers to nitrogen contained in organic matter and organic compounds, and may include both dissolved and particulate forms. Sources of organic nitrogen include decomposition of biological material, animal manure, soil erosion, waste water treatment plants and some industries. Organic nitrogen is not available for aquatic plant uptake, but over time organic forms may convert to inorganic, bioavailable forms.
- Inorganic nitrogen that includes nitrate ($NO3^-$), nitrite ($NO2^-$), ammonia (NH3) and ammonium ($NH4^+$). The primary sources of inorganic nitrogen are mineralized organic matter, nitrogenous fertilizers, point source discharges and atmospheric deposition. Inorganic nitrogen is bioavailable.

Total nitrogen is typically calculated based on the total load - it is assumed that all of the organic nitrogen will become bioavailable within a relevant time period. Offsets are based on total nitrogen load.

Impact. The effects of excessive nitrogen include those related to eutrophication—such as habitat degradation, algal blooms, hypoxia, anoxia and direct toxicity effects. While nutrient and eutrophication impacts associated with excess phosphorus may be more commonly of concern in freshwater systems, nitrogen is generally the limiting nutrient in marine environments and thus has a greater impact in estuarine systems. Some forms of nitrogen may pose particular problems; including ammonia that can cause localized toxicity problems and high concentrations of nitrate in drinking water may raise human health concerns.

A key consideration in determining offset requirements is to understand the nitrogen loss from the waterway. In addition to nitrogen exiting the waterway via irrigation diversions is nitrogen attenuation in the waterway, e.g. vegetation can draw dissolved inorganic nitrogen (NO3 and $NH4^+$) from the system. Another form of attenuation involves the process of "denitrification" whereby nitrate is reduced to gaseous nitrogen mainly by microbiological activity. Waterway reaches associated with high denitrification are usually associated with low, shallow flows. If offset nitrogen is mainly in the form of nitrate a (potentially large) portion of nitrogen may not reach the receiving waters and hence higher offset requirements. Conversely, nitrogen loads discharged to swiftly flowing, deep waters will have less opportunity for denitrification and have lower offset requirements.

Another factor important to water quality impacts in estuarine environments is the degree of flushing activity, particularly from tides. For example some estuarine waters may have a low level of tidal activity, mixing, and flushing. It is likely that these zones will retain the nitrogen for long periods of time and may have significant water quality concerns from discharge to such waters.

Timing. Nitrogen offsets are expressed in terms of annual loads as a common metric to ERA discharge loads. While point sources such as WWTPs are likely to have relatively consistent discharge timing, rural diffuse sources will have variable loadings that change seasonally based on land management activities and increased nitrogen levels during periods of high rainfall.

C. Offset Suitability for sediments

Sediment from erosion or unconsolidated deposits is transported by, suspended in, or deposited by water. The erosion, transport and deposition of sediment become a problem when increases in sediment supply exceed the water body assimilation capacity. Sediment problems involve the presence of excess fine sediment such as silt and clay particles that increase turbidity when suspended, and form muddy bottom deposits when they settle. Excessive fine suspended and bedload sediments cause aquatic ecosystem impairments.

Sources. Major sources include soil erosion carried by surface runoff and within-channel erosion of banks and bedload sediments.

In catchments where human activity has markedly increased overland flow and run-off, and in-channel erosion and sediment load, excess sediment may be a common event with resulting impairment. Diffuse sediment sources include streambank destabilization due to riparian vegetation removal, agricultural activities without adequate buffer zones, urban sources during stormwater runoff from construction and permanent land development activities, sand and gravel extraction and road construction and maintenance.

Impacts. Excessive amounts of sediment can directly impact aquatic life and fisheries. Deposition can choke spawning gravels, impair fish food sources and reduce habitat complexity in stream channels. Stream scour can lead to destruction of habitat structure. Sediments can cause taste and odour problems for drinking water, block water supply intakes, foul treatment systems, and fill reservoirs. High levels of sediment can impair swimming and boating by altering channel form, creating hazards due to reduced water clarity, and adversely affecting aesthetics.

Indirect effects include low dissolved oxygen levels due to the decomposition of organic sediment materials and water column enrichment of attached nutrients loads. Elevated stream bank erosion rates also lead to wider channels that can contribute to increased water temperatures.

Contaminant forms. Sediment sources discharge a range of particle sizes and loads based on:

- Suspended or “water column” sediments are particles that are small and light enough to remain suspended in the water column, generally less than 1 mm. Sources discharge two types of these suspended sediments: geological particles, which are derived from rock and soil, and biological particles such as planktons and other microscopic organisms.
- Bedload sediments are generally larger particles that are too heavy to be suspended in the water column. They are discharged by diffuse sources and are transported along the bed of the stream and range in size from fine clay particles to coarse material.

Timing. Sediment delivery to streams from diffuse sources is episodic and rainfall related. Metrics for sediment offsets are expressed as average load per year.

4. Science & Capacity Building

4.1 Decision Support Software

eGuides
eGuide is an electronic document which consists of a number of commonly referred to water quality guideline documents. The current version of eGuides contains the following documents.

- ANZECC/ARMCANZ 2000 Monitoring & Reporting Guidelines
- ANZECC/ARMCANZ 2000 Water Quality Guidelines
- NHMRC 2005 Recreational Guidelines
- Queensland Water Quality Guidelines
- Coastal CRC Users' Guide to Indicators for Monitoring

These documents have been compiled into a standard "HTML" version of Windows help systems (shown below) and can be installed in any personal computer for easy and quick access to information. Users can select the document that they would like to manually browse, or select the 'search' tab to search all the guides for some key words. The searched items can be viewed, copied to another document or printed out for later references. The beta version of this tool has been released and available on request from water.tools@epa.qld.gov.au.

Modelling and Monitoring Assessment Decision Support System (MAMA DSS)
The Modelling and Monitoring Assessment Decision Support System (MAMA DSS) is a decision support tool to help choose and review modelling and monitoring undertaken as part of Environmental Impact Assessments (EIAs). Decision-making about activities in the coastal zone is generally underpinned by information from monitoring and modelling. The DSS is designed to provide a process for choosing and reviewing assessment techniques considering the management objective, the potential pollutants from point or diffuse sources, the features of the environment and the relevant indicators, stressors, and processes.

The DSS is supported by a help system containing information about water quality modelling approaches such as: biogeochemical modelling (also called process modelling), statistical modelling (also called non-process modelling), and monitoring and experimentation methods such as in-field monitoring, autosampling, remote sensing, and experimentation.

The MAMA DSS can be requested from water.tools@epa.qld.gov. Further information on the tool can be obtained from http://www.coastal.crc.org.au/3m/.

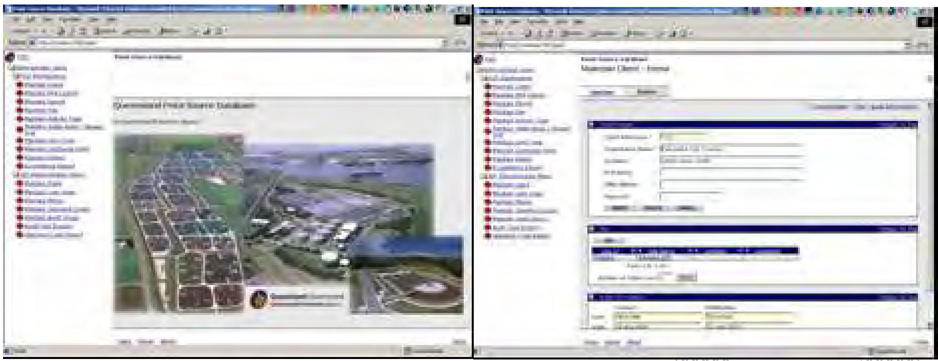
Queensland Waterways Database

The Queensland Waterways Database is a repository for all current and historical water quality monitoring data for Queensland waterways collected by the EPA. Approximately 350 sites across Queensland are monitored every month for a range of water quality indicators. Government agencies, research organisations and community groups use this information to assess the health of Queensland's waterways. Within the agency, water quality data is used in the production of reports, maps and models and to assist in compliance investigations, decision-making and planning.

Further information can be obtained by emailing water.data@epa.qld.gov.au or from http://www.epa.qld.gov.au/environmental_management/water/water_quality_monitoring

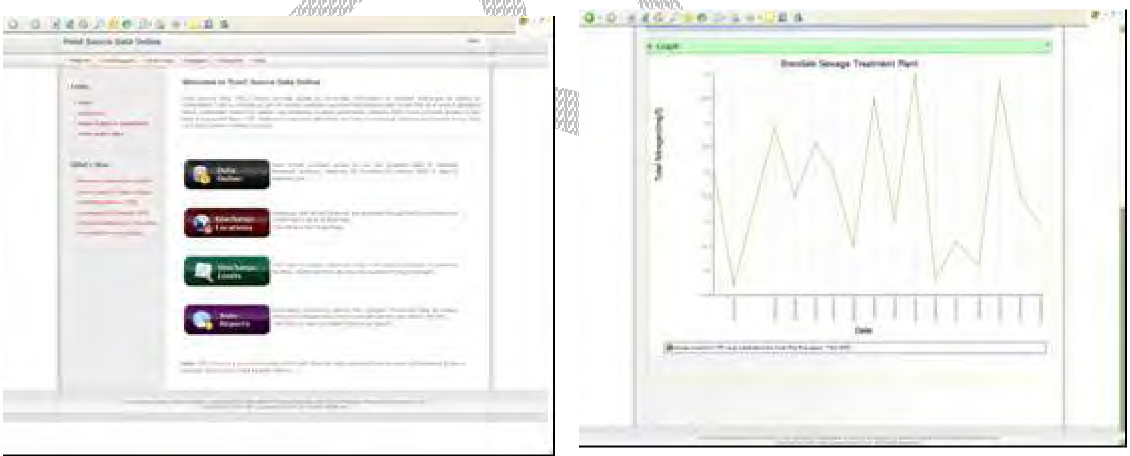
Point Source Database

Information on licensed discharges to water is monitored as part of licensees' permits issues by the EPA. The EPA's Point Source Database has been developed since 2003 and allows electronic submission, automated checking and storage of data. It is aimed to assist compliance and allow improved access to discharge information for a range of other uses. The database currently contains information on major sewage treatment plants in Queensland but will be extended in the future to all industries with licensed discharges. Further information on the database is provided in Appendix 1.



In addition to monitoring data, licence limits and discharge locations have been collated and are available to EPA staff via Ecomaps (http://mudlark.env.qld.gov.au/website/index.htm). Further information on how to access this layer of Ecomaps is provided in Attachment 2.

A further initiative is Point Source Data (PSD) Online which will provides access to up-to-date information on licensed discharges to waters in Queensland. The current application is a prototype and a beta version should be available EPA in mid 2008. PSD Online will provides access to raw data and graphed data contained in the EPA database. Other features include load estimation and links to discharge locations and licence limits in Ecomap. Instructions on how to use PSD Online will be provided.



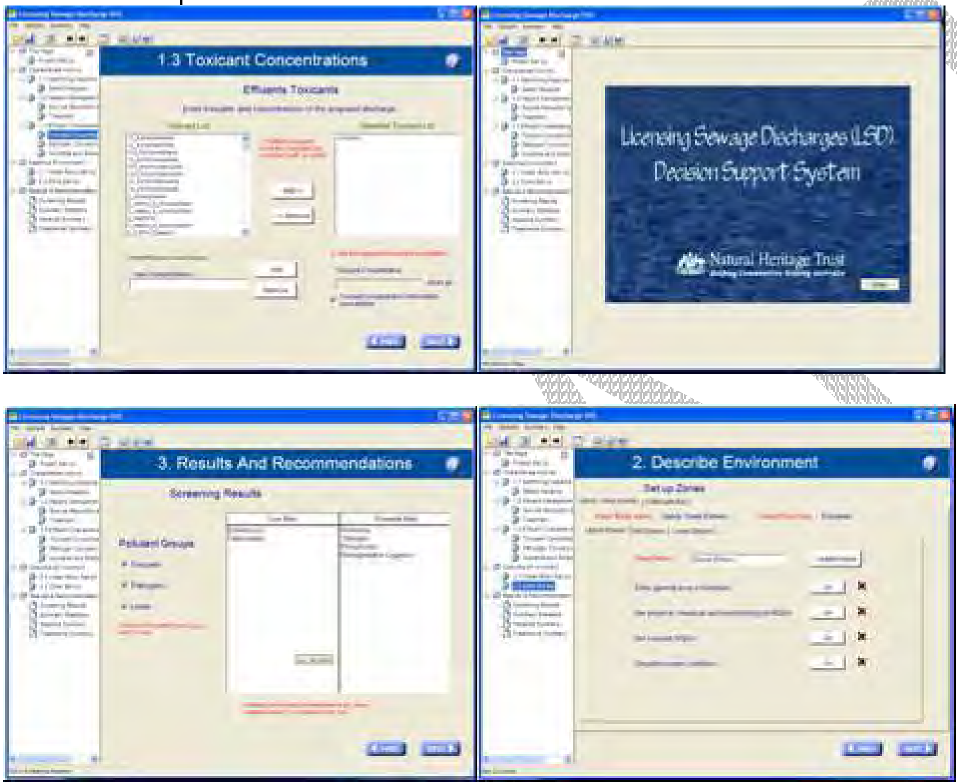
Point source data is available to EPA staff, other organisations and the community on request from water.data@epa.qld.gov.au. Information on the database is available to the public from http://www.epa.qld.gov.au/environmental_management/water/water_quality_monitoring/reporting_of_licensed_discharges_to_waterways/.
For further information, email psd.help@epa.qld.gov.au or contact the Freshwater & Marine Sciences Group of the EPA.

Licensing Sewage Discharges Decision Support System (LSD DSS)

The Licensing Sewage Discharges Decision Support System (LSD DSS) is a support tool for the assessment of the aquatic aspects of proposed discharges from sewage treatment plants. It has been designed to be used by licensing officers in the early stages of screening a licensed application. There is an associated help system that is fully searchable. It includes screen explanations and the knowledge bases on typical sewer pollutants, waste water treatment, risk assessment protocols and relevant water quality guidelines.

The DSS was originally developed by the Queensland Environmental Protection Agency in collaboration with the Environment Protection Authority Victoria and the NSW Department of Environment and Conservation. The latest beta version was produced in collaboration with the e-Water Cooperative Research Centre.

For further information about the DSS please contact water.tools@epa.qld.gov.au or the Freshwater & Marine Sciences Group of the EPA.



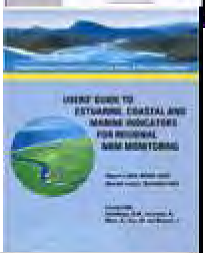
Water Quality Online Website
Water Quality Online is a website that contains information on water quality information and products developed as part of the National Action Plan for Salinity and Water Quality for regional managers in Queensland. It includes some of the tools discussed above in addition to a range of other tools that could assist water quality assessment. Water quality online is located at http://www.wqonline.info

OzCoasts/OzEstuaries Website
The OzCoast and OzEstuaries provides comprehensive information about Australia's coast, including its estuaries and coastal waterways. This information helps to generate a better understanding of coastal environments, the complex processes that occur in them, the potential environmental health issues and how to recognise and deal with these issues. It includes a database on estuaries, information on coastal indicators, geomorphology and geology, conceptual models, the simple estuary response model (SERM) plus more. It can be accessed at http://www.ozcoasts.org.au/.

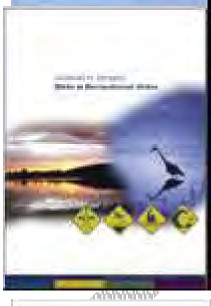
4.2 Relevant Water Quality Guidelines

ANZECC & ARMCANZ - Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2000. These guidelines provide substantial information on the nationally agreed approaches and trigger values for the protection of fresh and marine water. The guidelines are available with eGuides described above or can be downloaded from http://www.environment.gov.au/water/publications/quality/ index.html#nwqmsguidelines

ANZECC & ARMCANZ - Australian Guidelines for Water Quality Monitoring and Reporting 2000. These national guidelines present useful information on water quality monitoring covering planning, designing, fieldsampling, laboratory analysis and reporting. The guidelines are available with eGuides described above or can be downloaded from http://www.environment.gov.au/water/publications/ quality/index.html#nwqmsguidelines

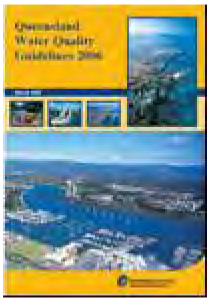


The Coastal CRC's User's Guide to Estuarine, Coastal and Marine Indicators for Regional NRM Monitoring, Coastal Zone CRC. These guidelines were designed to assist regional natural resource managers choose indicators when dealing with estuarine and marine environment. It provides substantial information on the stressors and indicators that could be applicable to these environments. The guidelines are available with eGuides described above or can be downloaded from http://www.coastal.crc.org.au/Publications/indicators.html



NHMRC Guidelines for Managing Risks in Recreational Waters, endorsed June 2005. These guidelines are the most recently published in Australia for the management of recreational waters. It covers of range of hazards including microbial contamination. It includes a new risk assessment approach including sanatory surveys and new indicators/classifications to assess risks from pathogens. The guidelines are available with eGuides described above or can be downloaded from http://www.nhmrc.gov.au/publications/synopses/eh38.htm.

NHMRC Australian Drinking Water Guidelines 2006. The Australian Drinking Water Guidelines (the ADWG) are intended to provide a framework for good management of drinking water supplies. They are concerned with safety from a health point of view and with aesthetic quality. The guidelines are available from http://www.nhmrc.gov.au/publications/ synopses/eh19syn.htm.



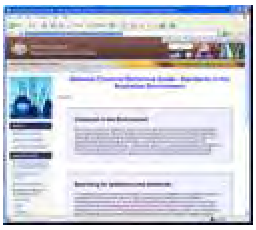
Queensland Water Quality Guidelines, Queensland EPA, March 2006. These guidelines were developed to complement the ANZECC/ARMCANZ Freshwater and Marine Guidelines. It includes site specific trigger values for regions of Queensland based on monitoring data from relevant reference sites. The guidelines are available with eGuides described above or can be downloaded from http://www.epa.qld.gov.au/environmental_management/water/queensland_water_quality_guidelines/#gen0

A guide to the application of the ANZECC/ARMCANZ Guidelines in the minerals industry, Australian Centre for Environmental Research (ACMER), September 2003. These guidelines provide advice on the application of the national guidelines to mining industry and includes relevant case studies. More information on obtaining this document is available at http://www.acmer.uq.edu.au/ publications/handbooks.html

Review of Methods for Water Quality Assessment for Temporary Stream and Lakes Systems, Australian Centre for Environmental Research (ACMER), September 2004. This document provides information on methods used to assess ephemeral streams. The document is available from http://www.acmer.uq.edu.au/research/attachments/FinalReportTempWatersSep20042.pdf

Licensing Discharges from Sewage Treatment Plants, Case Study No.2, EPA. This document provides an example of how EPA licensing officers may apply the agency's Procedural Guide for Licensing Discharges to Aquatic Environments. It involves a large sewage treatment plant which discharges to an estuary. It is available from the EPA's Ecostep system.

Water Quality Sampling Manual, EPA, 1999. This document is the third edition of the Queensland EPA's Water Quality Sampling Manual. It is for used in deciding 'protocols' under section 10 of the Queensland Environmental Protection (Water) Policy 1997 (subordinate legislation 1997 No. 136). It can be obtained from http://www.epa.qld.gov.au/environmental_management/water/water_quality_monitoring/publications/



National Chemical Reference Guide - Standards in the Australian Environment. This is an Australian Government website that provides you with standards for chemicals such as in foods. It is found at http:// hermes.erin.gov.au/pls/crg_public/!CRG_OWNER.CRGPPUBLIC.pStart

4.3 Water Quality Advice & Technical Services

The Freshwater & Marine Sciences Group of the EPA provides services to internal EPA clients on request (see electronic form on requesting services). These services include general advice, review of documents, modelling, field investigations and monitoring services and will typically cover only water quality aspects of a project. In requesting services, you need to clearly state the objective of the project or the problem to be solved staff. Additional documents should be sent via email or post.

The general turn-around time for reviews of EIS/IAS or similar major documents is 10 working days. However, the time required to complete any particular project will depend on the scope of the work and the available staff resources within the group at the time of the request. In general, the Freshwater & Marine Sciences Group will provide staff time on an in-kind basis, subject to director's approval. The requestor should cover any additional project costs, such as analysis costs and airfares.

Contacts for the Freshwater & Marine Sciences Group
Email: water.workrequests@epa.qld.gov.au
Phone: [redacted]
Postal: Indooroopilly Sciences Centre
EPA (Botany Building)
80 Meiers Road, Indooroopilly
Brisbane, QLD, 4068

Attachment1 to Section 4

The Point Source Database Information Guide for EPA Staff
October 2007
Version 3.0

Overview

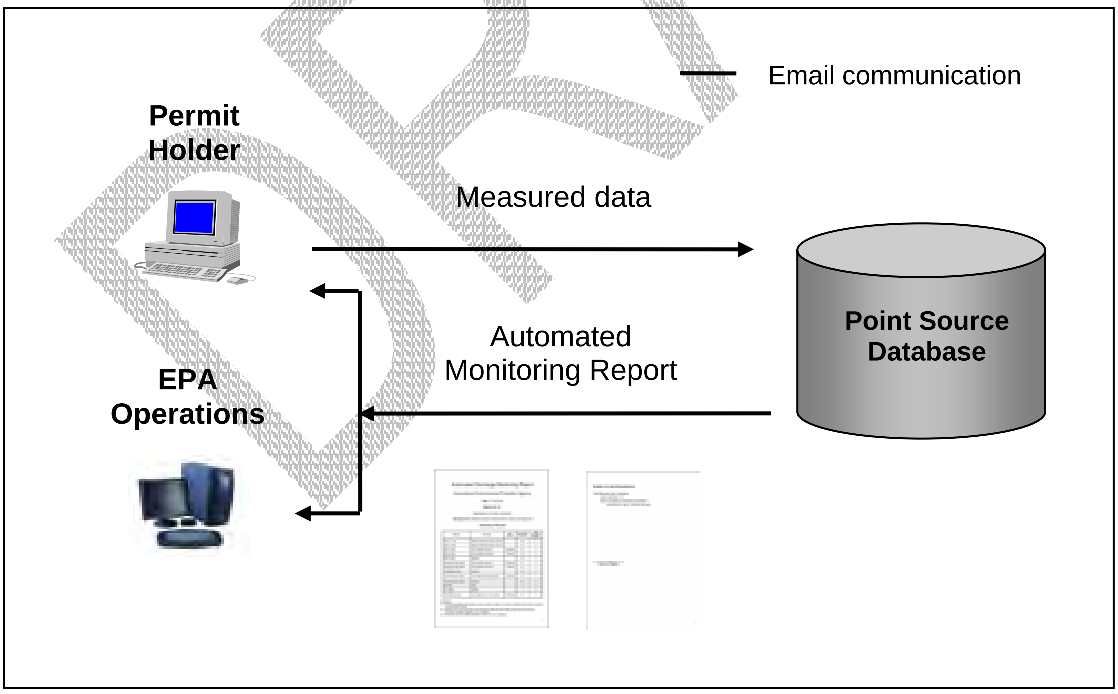
The Point Source Database (PSD) was designed and developed by the EPA to hold monitoring data for discharges to water required under EPA development permits for environmentally relevant activities (ERA's). It allows electronic submission of data and undertakes automated checks of the data against compliance limits. The submitted data can be viewed graphically by EPA staff while discharge locations and limits can be viewed using Ecomaps.

Benefits

The purpose of the PSD is to support compliance although it is not designed to replace notification requirements for non-compliance and incidents as prescribed in development permits. The database will also reduce the time taken by both EPA staff and registered operators in dealing with data requests and improve EPA decisions and projects through providing more complete and up-to-date information. Reporting of point source releases through mechanisms such as State of Environment Reporting, National Pollution Inventory and the Southeast Queensland's Ecosystem Health Report Card will be improved.

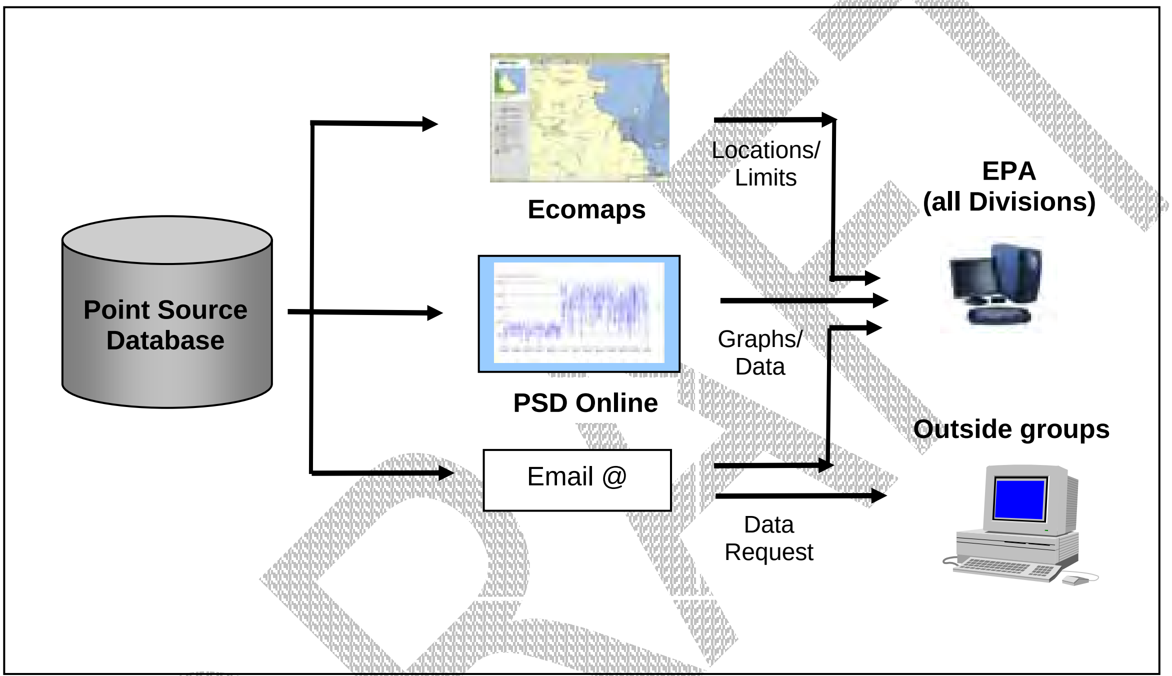
For registered operators submitting electronic data to the EPA, the requirement for this data and the related analysis to be submitted with the permit holder's annual return will be waived.

Electronic Submission and Reporting



The PSD requires registered operators to prepare a text file of measured data using a specific Excel template and attached this file to an email which is sent to the database. For registered operators of sewage treatment plants, this is currently at least every three months. The email is then received by the database and the file is firstly checked, and if in a correct format, imported into the database. The database then compares the submitted measured data to permits limits that are stored in the database and an automated monitoring report is produced. This provides a summary of results for each permit limit of the release as well as more detailed information on any exceedences – see Automated Monitoring Report for more information. The automated monitoring report is then sent, along with a copy of the submitted data, via email to the specified permit holder's email address and the relevant EPA district office email address.

Getting Point Source Data and Information



Information will be available to EPA staff via Ecomaps, an internal website called Point Source Data Online or on request. The Ecomaps layers contain information on each the facilities, discharge locations and discharge limits. Point Source Data Online will provide direct access to most recent and historical data received by the database either as raw data or through viewing measured data via graphs. The data can be compared directly to permit limits and saved as an Excel file. Point Source Data Online also provides a facility to estimate pollutant loads for each facility based on submitted data. Guidance on accessing the ecomaps layer is provided in Appendix 2 (coming soon for Point Source Data Online). Requests for data or limits/locations can also be made to the Environmental Sciences Division – see contact details below.

External organisations do not have direct access to measured data, graphs, permit limits or discharge locations. However, the Environmental Sciences Division will respond to all reasonable data requests received in writing by an organisation or individual from government, universities, private industry or the general public. Data will generally be provided to partner organisations (those contributing to EPA monitoring programs) free of charge. The EPA will reserve the right to charge a nominal fee for services for any other data request.

Requests for data can also be made from Freshwater & Marine Sciences Group via email (water.data@epa.qld.gov.au). The GIS layer of locations and limits can be requested from the Environmental information Systems Unit via email (data.coordinator@epa.qld.gov.au).

Implementation Overview

The PSD has currently been implemented for all sewage treatment plants greater than 10,000 equivalent persons (ERA 15 (e), (f) and (g) under Schedule 1 of the *Environmental Protection Regulation 1998*) that involve a direct discharge to waters. Historical data for these discharges has been collected, in most cases back to the year 2000. Electronic submission of quarterly data commenced for these discharges in 2007.

The PSD has been initially set up to collect information on direct releases to water. However, flow measurements of "recycled water" leaving the registered operators premises are also being collected for sewage treatment plants. At this stage, flows or quality of waters release to land covered under the permits are not collected or checked against permit limits, although this may be implemented in the future.

The next phase of the implementation will target major industry and the remaining sewage treatment plants, firstly in South East Queensland (SEQ) and then the remainder of Queensland. Some historical data for major industry in SEQ has already been collected.

Guidance to Registered operators

Registered operators participating in electronic submission of data will generally have received a Point Source Database Implementation Manual and attended an information session run by the EPA. The following information is generally provided to the registered operator prior to submission.

The EPA will request participation from a registered operator in writing to submit their data electronically. The registered operator should notify the EPA in writing if they wish to participate. The EPA should also be notified in writing if the registered operator no longer wishes to submit electronic data to the EPA. In this case, reporting and data analysis is required as part of the licensees' annual return and data will need to be provided to the EPA on request. All correspondence with registered operators should be available on the relevant EPA files.

In preparing for electronic submission, the EPA will request the permit holder to provide historical data (preferably back to the year 2000) in an electronic format to the EPA. The data does not need to be in any specific format and existing Excel spreadsheets will suffice as long as they can be easily interpreted. The EPA will then import this data manually into the database. Automated checking of this data against permit limits is not usually undertaken. The data can then be used for data requests and to provide a previous history for assessment of long term limits that are usually up to 12 months when the first automatic submission is received.

Submission of electronic data to the EPA should be done using the templates provided by the EPA for the permit holder's specific plant or based on the EPA's electronic submission guide (available from psd.help@epa.qld.gov.au). The completed templates should be attached to an email as a .CSV file (comma delimited text file) and sent to psd.data@epa.qld.gov.au. For large point source emitters, data should be submitted to the EPA on no less than a quarterly basis and coincide with the end of the financial and calendar years. Data should be submitted for whole calendar months. Data submission will become due one calendar month after the end of the yearly quarter. The EPA will provide an email reminder to each licensee at this time. Data is to be submitted within thirty days of becoming due.

The provision of correct and accurate data is the sole responsibility of the permit holder and should be undertaken as set out in the development permit/s. The EPA will not be held responsible for submission of incorrect data. If incorrect data has been submitted, please contact the database manager on psd.help@epa.qld.gov.au.

The licensee should provide the EPA with a single generic email address so that all electronic correspondence in relation to the Point Source Database can be emailed to this address. It is the responsibility of the licensee to manage this email address and notify the EPA of any changes.

Registered operators who submit monitoring data required under their development permit/s for the release to water are not required to submit this data or any related analysis with their annual return. However, submission of data to the Point Source Database does not remove an organization's obligation to report non-compliances and incidents as prescribed by their development permit/s.

New Permits or Change to Permit Limits

The PSD contains permit limits for every licensed discharge to water contained in the database. It is essential that these permits limits are kept up-to-date as they are used for automated checking against submitted data. The permit limits are also displayed in Ecomaps, which is currently updated periodically.

Project Managers in the Environmental Operations Division are responsible for notifying the PSD administrators of any new development permits involving a discharge to waters and of any amendments to existing discharge quality limits on a development permit. This is required to be completed prior to submission to the Delegate and the process is included in the standard template "Assessment Report – Environmentally Relevant Activities". If a new permit involving a discharge to waters has been approved and is not currently in the PSD, please contact the Freshwater & Marine Science (email psd.help@epa.qld.gov.au). If you become aware that the permit limits in the database, either from automated monitoring reports or from the layer in Ecomaps, also please contact Freshwater & Marine Sciences.

The PSD current holds information for all permits or amended permits but does not include details of Environmental Management Programs (EMPs). Please notify Freshwater & Marine Sciences if an EMP exists for a permit involved in electronic submission.

Automated Monitoring Report

The EPA will produce an automated monitoring report (see attached sample) when new monitoring data is received from registered operators. A copy of the automated monitoring report and the data submitted will be sent to the relevant EPA Environmental Operations office and to the registered operator. Limit exceeded events are highlighted in the report and correspond to when the monitoring data provided exceeds permit limits. These are provided as a guide but should not be used as the primary basis for non-compliance.

The automated monitoring report is produced for each discharge plant/monitoring point. The report shows the date of submission, a unique return ID allocated by the database, the date period for which the new data have been submitted and the plant/discharge point name. A summary of results is provided in a tabular form with each line corresponding to a different indicator and limit type set out in the relevant permit. The indicators column shows the indicator name and units. The limit type column shows a range of limit types including maximum, range (maximum and minimum), loads, medians and a combination of short-term and long-term percentiles. For medians and percentiles, the limit period over which the limit is applied is shown in the next column and can include numbers of days, weeks or months. The frequency of sampling is not specifically tested by the database. However, the number of data points submitted to the database are counted and presented in the summary report. This allows the reader to scan the column and for those indicators taken at the sample frequency, the number of data points should be the same. Note there are typically more flow data points (typically measured daily) than water quality concentrations.

More detailed information on limit exceedences is provided in the automated monitoring report after the summary table. For each indicator/limit type combination, information is presented on the limit values and the date and values of any exceedences. The time period and samples required for the limit are also shown for medians and percentile limit types.

If the automated monitoring report contains exceedences, it is important to note that this may not be because of non-compliance. The limits in the monitoring report should be checked against current known limits. The limits may not be up-to-date or there may be an Environmental Management Program (EMP) in place allowing higher discharge levels. The data should also be checked. The raw data is provided with the automated monitoring report. Alternatively, data can be obtained or visualised using Point Source Data Online which allows direct comparison against limits. It should be noted incorrect data can be submitted to the database and that the database and online tool may not correctly represent the limit calculations as set out in development permits. Therefore, even if the limits and exceedence appear correct, it is strongly recommended that the registered operator are contacted and provided an opportunity to confirm that the data and the limit exceeded events are correct. The limit exceeded events can also be checked against the non-compliances already notified to the EPA. If the limit exceeded events have not been reported, the registered operators should again be contacted. Based on the response from the registered operators, further actions may be required by the EPA.

Further Information

The Point Source Database is a joint initiative Environmental Sciences and Environmental Operations Divisions. For further information, please contact Freshwater & Marine Sciences on (07) 3896 9250 or psd.help@epa.qld.gov.au.

Sample Automated Monitoring Report

Automated Discharge Monitoring Report

Queensland Environmental Protection Agency

Date: 06/08/2007

Return Id: 845

Data Period: 01/04/2007 - 29/06/2007

Discharge Point: *Coombabah / GCCCRP2*

Summary Results

Indicator	Limit Type	Limit Period	Data Points in Period	Limit Exceeded Events
BOD 5 (mg/l)	80th percentile (short-term)	5 Weeks	13	0
BOD 5 (mg/l)	90th percentile (long-term)	12 Months	13	0
BOD 5 (mg/l)	maximum		13	0
D.O. (mg/l)	minimum		13	0
Suspended Solids (mg/l)	maximum		13	0
Suspended Solids (mg/l)	80th percentile (short-term)	5 Weeks	13	0
Suspended Solids (mg/l)	90th percentile (long-term)	12 Months	13	0
Faecal Coliforms (CFU/100ml)	80th percentile (1 day)	1 Days	13	0
Faecal Coliforms (CFU/100ml)	median (1 day)	1 Days	13	0
Free Residual Chlorine (mg/L)	maximum		13	0
pH (Unit)	range		13	0
Total Phosphorus (mg/l)	maximum		13	2
Total Nitrogen (mg/l)	maximum		13	0
Total Nitrogen (mg/l)	50th percentile (long-term)	12 Months	13	0
N-NH3 (mg/l)	no limit		N/A	N/A
Total Nitrogen (mg/l)	Annual Load		13	0

Disclaimer

- It is the responsibility of the licensee to ensure samples are taken in accordance with their permit. Refer to permit for more information on limits.
- Although all care has been taken in the development of this report, the results may be incorrect and do not necessarily constitute compliance or non-compliance.
- This report does not constitute notification to EPA of any non-compliance.

1

Indicator	Limit Type	Limit Period	Data Points in Period	Limit Exceeded Events
Total Phosphorus (mg/l)	Annual Load		13	0
Flow (L)	maximum (dry day)		51	0
Flow (L)	maximum (wet day)		39	0

Details of Limit Exceedence

BOD 5 (mg/l), 80th percentile (short-term)
Lower/upper limit: < 15
Time period for limit application: 5 Weeks
Samples required in time period: 5
Date of exceedence (result):
Nil.

BOD 5 (mg/l), 90th percentile (long-term)
Lower/upper limit: < 10
Time period for limit application: 12 Months
Samples required in time period: 52
Date of exceedence (result):
Nil.

BOD 5 (mg/l), maximum
Lower/upper limit: < 30
Date of exceedence (result):
Nil.

D.O. (mg/l), minimum
Lower/upper limit: > 4
Date of exceedence (result):
Nil.

Suspended Solids (mg/l), maximum
Lower/upper limit: < 45
Date of exceedence (result):
Nil.

Attachment 2 to Section 4

Point Source Database – New Ecomaps Layers
Version 1.0

Introduction

Two new layers relating to point source discharges have been added to Ecomaps. The two layers are (i) Point source discharge plants and (ii) Point source discharges. They currently contain similar metadata information but have been included as the locations of the plants and the discharges are usually different. The layers shows the location of point source discharges/plants and a description of each including the plant name, ecotrack number, permit reference, Environmentally Relevant Activity (ERA) type, licensee, location details. There is also a link to permit limit details that are the indicators and numerical limits placed on each of those limits in the relevant permit.

This document provides instruction on how to access these layers on Ecomaps that is located at: http://mudlark.env.qld.gov.au/website/index.htm

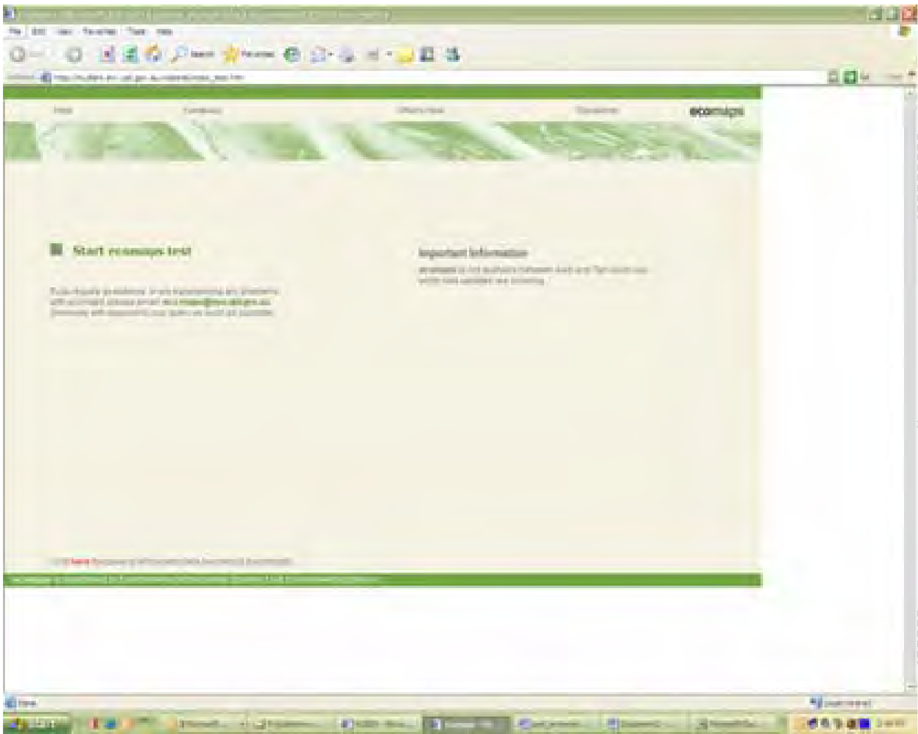
Although all care has been taken with the compilation of the data, please note that the information presented in this layer may contain errors or not be up-to-date. In terms of permit limits, Environmental Management Plans or other statutory mechanisms may be in place that are not recorded on these layers. Please contact the relevant Environmental Operations Office for the most recent information.

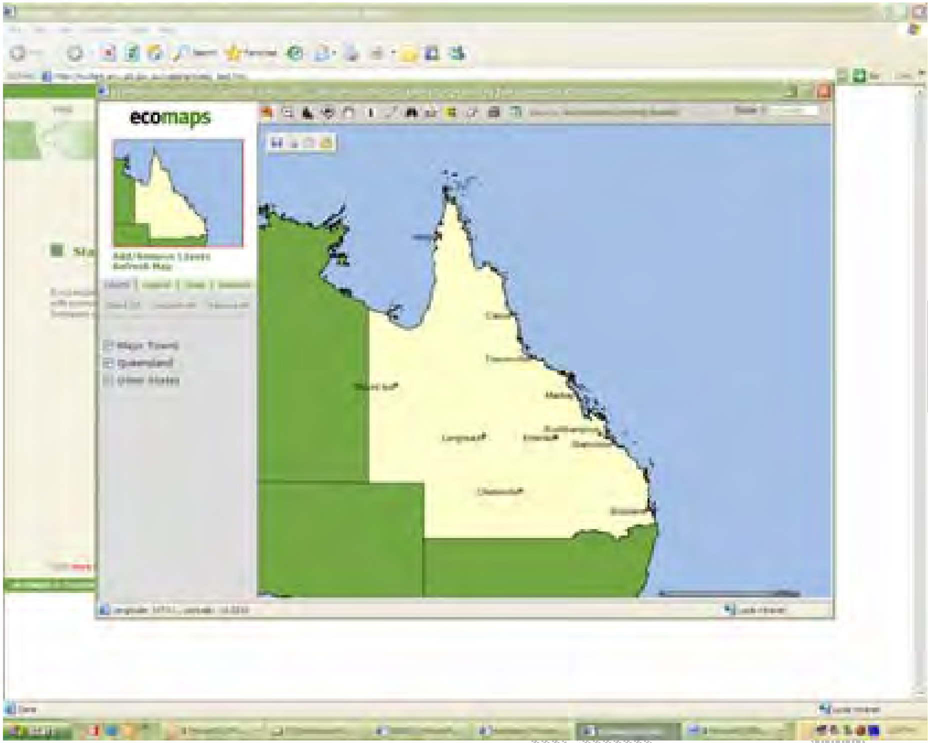
The Point Source Database is a joint initiative Environmental Sciences and Environmental Operations Divisions. For further information or feedback, please contact Freshwater & Marine Sciences on (07) 3896 9250 or psd.help@epa.qld.gov.au.

Instructions

Step 1 – Start Ecomaps using the link and click on Start "ecomaps test"

http://mudlark.env.qld.gov.au/website/index.htm





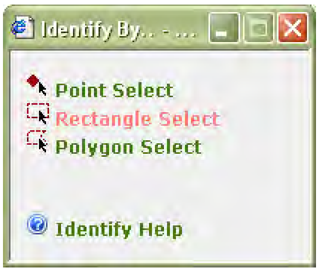
Step 2 – Click on Add/Remove Layers and choose Environment and Conservation. You can click the two boxes related to Point Sources and then Close

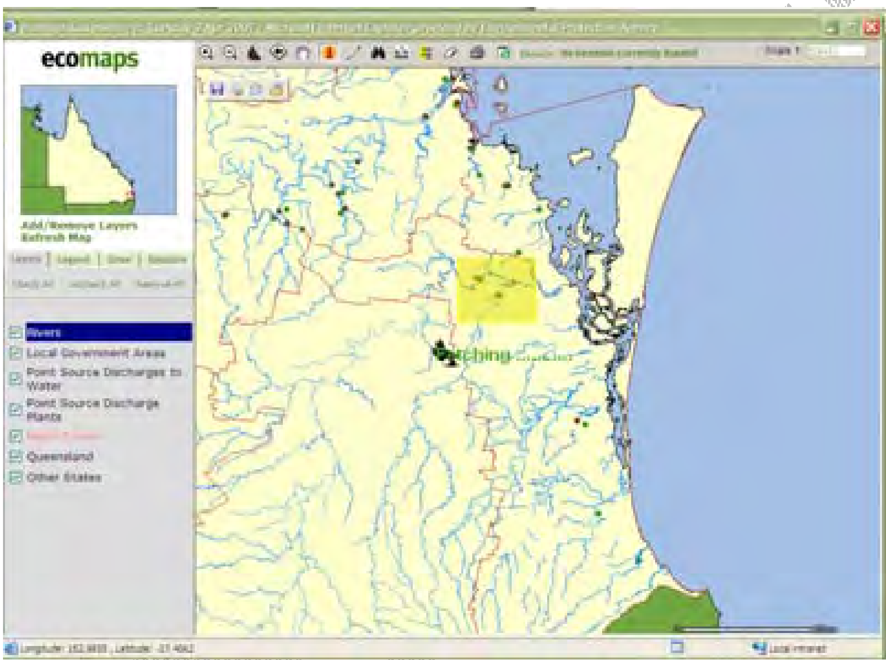
Step 3 – Check both boxes on the main screen and then Refresh Map

Step 4 – Add any other layers you want such as local government boundaries, rivers etc. and then Refresh Map

Step 5 – Zoom into some area of choice using the magnifying glass symbol

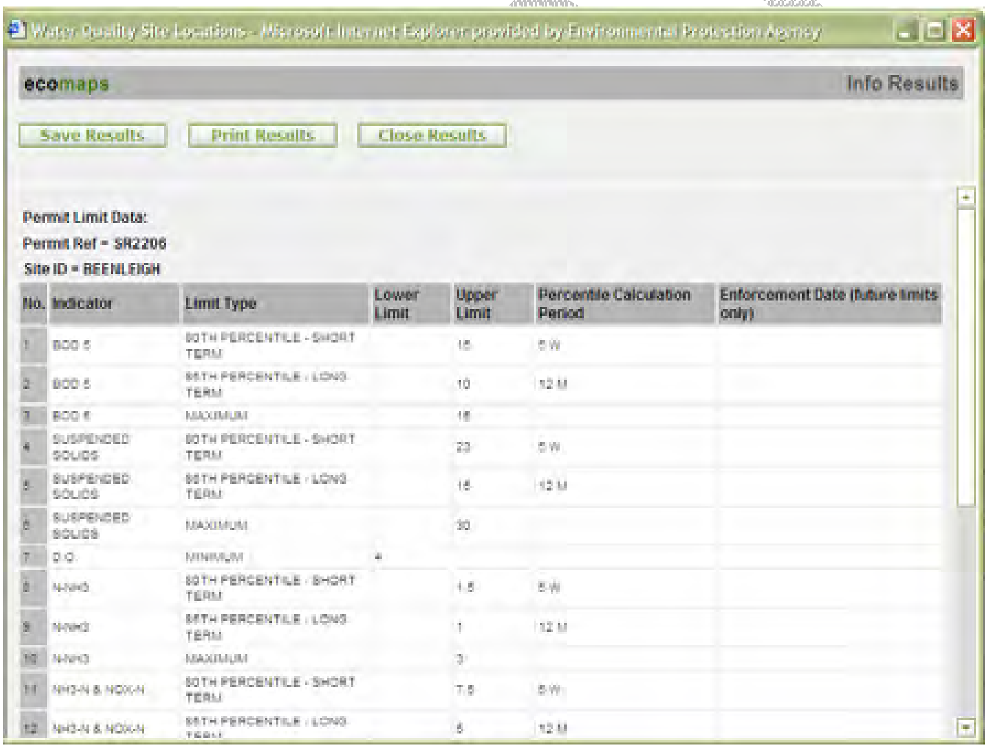
Step 6 – Click on i symbol and then choose Rectangle Select and select an area





Scroll down till you see the point source information:

Step 7 – Click on View Permit Limit Data for your Plant/Discharge of choice:



Permit Limit Data:
Permit Ref = SR2206
Site ID = BEENLEIGH

No.	Indicator	Limit Type	Lower Limit	Upper Limit	Percentile Calculation Period	Enforcement Date (future limits only)
1	BOD 5	80TH PERCENTILE - SHORT TERM		15	5 W	
2	BOD 5	85TH PERCENTILE - LONG TERM		10	12 M	
3	BOD 5	MAXIMUM		15		
4	SUSPENDED SOLIDS	80TH PERCENTILE - SHORT TERM		23	5 W	
5	SUSPENDED SOLIDS	85TH PERCENTILE - LONG TERM		15	12 M	
6	SUSPENDED SOLIDS	MAXIMUM		30		
7	D.O	MINIMUM	4			
8	N-NH3	80TH PERCENTILE - SHORT TERM		1.5	5 W	
9	N-NH3	85TH PERCENTILE - LONG TERM		1	12 M	
10	N-NH3	MAXIMUM		3		
11	NH3-N & NOX-N	80TH PERCENTILE - SHORT TERM		7.5	5 W	
12	NH3-N & NOX-N	85TH PERCENTILE - LONG TERM		5	12 M	

5. Direct Toxicity Assessment

This Section provides 'stand alone' information in considering a requirement for direct toxicity assessment. It also informs Section 2.3 of the Operational Policy.

5.1 Introduction

This section of the *Procedural Guide* has been prepared by the Freshwater & Marine Sciences Unit (Environmental Sciences Division) for staff of the Environmental Protection Agency involved with regulating wastewater discharges to aquatic receiving environments.

The following subsections outline what assistance this document can provide for EPA staff contemplating the need to request or impose Direct Toxicity Assessment of an existing or proposed effluent discharge and what information would be required to make an informed decision. The following sections in the *Procedural Guide* will detail the specific effluent quality data required to determine whether or not there is a significant risk of toxic effects and therefore whether one-off, event-based or routine assessment for the toxic potential of the effluent is required. This assessment is referred to as a Direct Toxicity Assessment.

It should be noted that a Direct Toxicity Assessment (DTA) is also widely known as Whole Effluent Toxicity (WET) tests and both refer to an experimental procedure aimed at quantifying the potential toxicity of a sample of effluent through exposing a range of test specimens to that effluent. To remain consistent with the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC & ARMCANZ 2000), only the term DTA will be used hereafter.

This Document (the Procedural Guide/Policy)

This *Procedural Guide* will assist EPA officers who have reason to believe (or suspect) that:

- an effluent may have the potential of exhibiting toxic effects in aquatic biota, and consequently
- need to decide whether or not a DTA of the effluent is warranted.

A new Development Application (DA) or Amendment to an existing DA should contain detailed information that characterises the effluent and the receiving aquatic environment.

Information Submitted by the Proponent

The information provided in an Environmental Impact Assessment (EIA), Environmental Impact Statement (EIS), or other equivalent document, will form the basis of the assessment to determine whether or not there is a significant risk of toxic effects being caused by the effluent. If the required effluent quality data has not been presented in EIA/EIS then the priority would be to obtain it via a Request for Further Information (RFI).

In most cases however, the EIA/EIS should already contain detailed information that:

- identifies and quantifies the actual (or expected) effluent water quality characteristics;
- discusses whether or not the contaminants in the effluent comply with local Water Quality Objectives (WQOs) and preserve the Environmental Values (EVs) attributed to the specific receiving waters, and
- describes the effluent quality criteria in comparison to *Toxicity Trigger Values* (TTVs) presented in (ANZECC & ARMCANZ 2000) or alternate equivalent guideline.

5.2 Warranting Direct Toxicity Assessment

Performing a DTA usually involves initiating a series of laboratory-based toxicological bioassays that are designed to determine whether or not the effluent is toxic to any of a range of aquatic biota. The DTA of an effluent is both a time-consuming undertaking (at least several weeks) and expensive; hence for a DTA to be warranted there needs to be one or more issues of concern regarding some aspect of the:

- toxicant concentrations;
- discharge characteristics, and

- aquatic receiving environment.

Each of these aspects of an effluent is addressed below individually, however it must be pointed out that these are by no means separate issues; they are interrelated. An obvious example would be that a salinity concentration of 20 parts per thousand (ppt) would not be considered a toxicant in an estuarine or marine environment, but would be in a freshwater environment.

Toxicant Concentrations

The primary reason for warranting a DTA of an effluent relates directly to the expected or observed concentrations of potential toxicants. There is a need for a DTA of the effluent to be performed when:

- one or more toxicant concentrations in the effluent are shown to exceed the TTVs at the appropriate *Percentage Level of Species Protection* (refer to Section 3.4).

Additionally, a requirement to have a DTA conducted should also be considered when there is a notable lack of measured effluent quality data, such as when the effluent quality data are:

- incomplete;
- based only on:
    - medians, means or 50th percentiles;
    - non-validated modelling outputs, or
    - best available estimations;
- relevant only for a short monitoring period and the quality of the effluent is:
    - likely to experience significant process-based fluctuations, or is
    - seasonally variable and the toxicant data is not representative of seasonality.

Characterising the effluent

In order to determine whether the effluent poses a significant toxicological risk in the receiving environment, the first step is to review the quality characteristics of the effluent. Toxicity or environmental harm could be caused by one or more of the following characteristics:

- physicochemical variables;
- known toxicants, and
- unknown toxicants.

Each of these aspects of an effluent is addressed individually below.

Physicochemical Variables

Although physicochemical variables are not toxicants per se, they may still cause harm to aquatic biota when they occur outside of a certain range or beyond certain limits. The main physicochemical variables that need to be considered when determining if a DTA is warranted are:

- pH (note that ammonia toxicity varies with pH; refer to ANZECC & ARMCANZ 2000);
- temperature;
- dissolved oxygen (DO) concentration/saturation, and
- conductivity/salinity/total dissolved salts
- hardness/total dissolved solids (TDS).

The acceptable ranges or limits for these water quality characteristics can be available for specific water bodies, climatic regions, aquatic environment types, or catchments, and can be available in either State or National publications, or by the private sector (i.e. generated by environmental consultants). Physicochemical variables are generally part of the WQOs and for Queensland, those can be found in the *Queensland Water Quality Guidelines* (QLD EPA 2006).

Known Toxicants

Known toxicants are toxicants that are known to be have the potential to harm the health of aquatic receiving environments and are therefore frequently analyses via chemical analysis. The following categories contain the names of known toxicants that should be considered when characterising an effluent and where appropriate, example ANZECC & ARMCANZ (2000) TTVs are presented.

Metals & Metalloids

A more complete list of metals and metalloids with the potential to cause toxic effects in aquatic biota is presented in Table 3.4.1 of the ANZECC & ARMCANZ (2000). The most commonly encountered metals and metalloids of concern have been reproduced below (Table 1) for the reader's convenience.

Table 1. Excerpt from Table 3.4.1 in ANZECC 2000 – Toxicity Trigger Values for most Metals & Metalloids at alternative levels of protection.

Values in grey shading are the trigger values applying to typical *slightly-to-moderately* disturbed systems.

Chemical		Toxicity Trigger Values for Freshwater (µg/L)				Toxicity Trigger Values for Marine Water (µg/L)			
		Level of Protection (% species)				Level of Protection (% species)			
		99%	95%	90%	80%	99%	95%	90%	80%
Metals & Metalloids									
Aluminium	pH >6.5	27	55	80	150	ID	ID	ID	ID
Aluminium	pH <6.5	ID	ID	ID	ID	ID	ID	ID	ID
Arsenic (As III)		1	24	94[C]	360[C]	ID	ID	ID	ID
Arsenic (As V)		0.8	13	42	140[C]	ID	ID	ID	ID
Boron		90	370[C]	680[C]	1300[C]	ID	ID	ID	ID
Cadmium		0.06	0.2	0.4	0.8[C]	0.7[B]	5.5[B,C]	14[B,C]	36[B,A]
Chromium (Cr III)		ID	ID	ID	ID	8*	27*	50*	90*
Chromium (Cr VI)		0.01	1.0[C]	6[A]	40[A]	0.14	4.4	20[C]	85[C]
Cobalt		ID	ID	ID	ID	0.005	1	14	150[C]
Copper		1.0	1.4	1.8[C]	2.5[C]	0.3	1.3	3[C]	8[A]
Lead		1.0	3.4	5.6	9.4[C]	2.2	4.4	6.6[C]	12[C]
Mercury (inorganic)		0.06	0.6	1.9[C]	5.4[A]	0.1	0.4[C]	0.7[C]	1.4[C]
Mercury (methyl)		ID	ID	ID	ID	ID	ID	ID	ID
Nickel		8	11	13	17[C]	7	70[C]	200[A]	560[A]
Selenium (Total)		5	11	18	34	ID	ID	ID	ID
Silver		0.02	0.05	0.1	0.2[C]	0.8	1.4	1.8	2.6[C]
Zinc		2.4	8.0[C]	15[C]	31[C]	7	15[C]	23[C]	43[C]

* These figures are provided in the errata for the ANZECC & ARMCANZ (2000) Guidelines (http://www.mincos.gov.au/pdf/anz_water_quality/gfmwq-guidelines-vol1-errata.pdf)

A Figure may not protect key test species from acute (and chronic) toxicity – see Table 3.4.1 in ANZECC & ARMCANZ (2000) for more information.

B Chemicals for which possible bioaccumulation and secondary poisoning effects should be considered – see Table 3.4.1 in ANZECC & ARMCANZ (2000) for more information.

C Figure may not protect key test species from chronic toxicity – see Table 3.4.1 in ANZECC & ARMCANZ (2000) for more information.

H The figure has been calculated for a Hardness of 30 mg/L $CaCO_3$ and should be adjusted for site specific hardness – see Table 3.4.1 in ANZECC & ARMCANZ (2000) for more information.

ID Insufficient data to derive a trigger value – see Table 3.4.1 in ANZECC & ARMCANZ (2000) for more information.

Non-metallic Inorganics

Table 2 is a complete listing of non-metallic inorganic toxicants as per Table 3.4.1 of the ANZECC & ARMCANZ (2000).

Table 2. Excerpt from Table 3.4.1 in ANZECC 2000 – Toxicity Trigger Values for Non-metallic Inorganics at alternative levels of protection.

Values in grey shading are the trigger values applying to typical *slightly-to-moderately* disturbed systems.

Chemical	Toxicity Trigger Values for Freshwater (µg/L)				Toxicity Trigger Values for Marine Water (µg/L)			
	Level of Protection (% species)				Level of Protection (% species)			
	99%	95%	90%	80%	99%	95%	90%	80%
Non-metallic Inorganics								
Ammonia	320	900C	1430C	2300A	500	910	1200	1700
Chlorine	0.4	3	6A	13A	ID	ID	ID	ID
Cyanide	4	7	11	18	2	4	7	14
Nitrate*	4900	7200	8700C	12000A	ID	ID	ID	ID
Hydrogen Sulfide	0.5	1.0	1.5	2.6	ID	ID	ID	ID

* The TTVs for nitrate are officially under review (refer to ANZECC & ARMCANZ (2000) errata), however the values provided here have been recalculated by prominent Australian toxicologists involved in the writing of the Guideline and are therefore likely to be adopted.
A, B, C, H, ID – Refer to the footnotes to Table 1.
D Ammonia as total ammonia [NH_3-H] at pH 8 – see Table 3.4.1 in ANZECC & ARMCANZ (2000) for more information.
E Chlorine as total chlorine, as [Cl] – see Table 3.4.1 in ANZECC & ARMCANZ (2000) for more information.
F Cyanide as un-ionised HCN, measured as [CN] – see Table 3.4.1 in ANZECC & ARMCANZ (2000) for more information.
G Sulfide as un-ionised H_2S, measured as [S] – see Table 3.4.1 in ANZECC & ARMCANZ (2000) for more information.
J Figures protect against toxicity and do not relate to eutrophication issues – see Table 3.4.1 in ANZECC & ARMCANZ (2000) for more information.
* Note that these figures differ from those in ANZECC & ARMCANZ (2000) due to a subsequent review of the values {{XXXXXXXXX}}

Aromatic Hydrocarbons, Phenols & Xylenols, Organic Sulfur Compounds

If an effluent is shown to contain significant concentrations (i.e. as low as 1-10 µg/L or greater) of aromatic hydrocarbons, phenols, xylenols, organic sulphurous compounds or phthalates, then it may cause harm to an aquatic receiving environment. Table 3 provides some examples.

Table 3. Excerpt from Table 3.4.1 in ANZECC 2000 – Toxicity Trigger Values for some Aromatic Hydrocarbons, Phenols & Xylenols, Organic Sulfurous Compounds and Phthalates.

Values in grey shading are the trigger values applying to typical *slightly-to-moderately* disturbed systems.

Chemical		Toxicity Trigger Values for Freshwater (µg/L)				Toxicity Trigger Values for Marine Water (µg/L)			
		Level of Protection (% species)				Level of Protection (% species)			
		99%	95%	90%	80%	99%	95%	90%	80%
AROMATIC HYDROCARBONS									
Benzene		600	950	1300	2000	500	700	900	1300
o-xylene		200	350	470	640	ID	ID	ID	ID
p-xylene		140	200	250	340	ID	ID	ID	ID
Naphthalene		2.5	16	37	85	50C	70C	90C	120C
Nitrobenzene		230	550	820	1300	ID	ID	ID	ID
Polychlorinated Biphenyls (PCBs) & Dioxins									
Aroclor 1242	B	0.3	0.6	1.0	1.7	ID	ID	ID	ID
Aroclor 1254	B	0.01	0.03	0.07	0.2	ID	ID	ID	ID
PHENOLS & XYLENOLS									
Phenol		85	320	600	1200C	270	400	520	720
2,4,6-tetrachlorophenol	T,B	3	20	40	95	ID	ID	ID	ID
2,3,4,6-tetrachlorophenol	T,B	10	20	25	30	ID	ID	ID	ID
Pentachlorophenol	T,B	3.6	10	17	27A	11	22	33	55A
ORGANIC SULFUROUS COMPOUNDS									
Carbon Disulfide		ID	ID	ID	ID	ID	ID	ID	ID

PHTHALATES									
Dimethylphthalate		3000	3700	4300	5100	ID	ID	ID	ID
Dibutylphthalate	B	9.9	26	40.2	64.6	ID	ID	ID	ID

A,B,C,ID – Refer to the footnotes to Table 1.
T Tainting or flavour impairment of fish flesh may occur at lower concentrations – see Table 3.4.1 in (ANZECC & ARMCANZ 2000) for more information.

Pesticides (Insecticides, herbicides, fungicides) and other synthetic organic compounds

If an effluent is shown to contain significant concentrations (i.e. as low as 1-10 µg/L or greater) of aromatic hydrocarbons, phenols, xylenols or sulphurous compounds, then it may cause harm to an aquatic receiving environment. Table 4 provides some examples.

Table 4. Excerpt from Table 3.4.1 in ANZECC 2000 – Toxicity Trigger Values for some Pesticides, Herbicides and Fungicides.

Values in grey shading are the trigger values applying to typical *slightly-to-moderately* disturbed systems.

Chemical	Toxicity Trigger Values for Freshwater (µg/L)				Toxicity Trigger Values for Marine Water (µg/L)			
	Level of Protection (% species)				Level of Protection (% species)			
	99%	95%	90%	80%	99%	95%	90%	80%
ORGANOCHLORINE PESTICIDES								
Chlordane	0.03	0.08	0.14	0.27C	ID	ID	ID	ID
Heptachlor	0.01	0.09	0.25	0.7A	ID	ID	ID	ID
Lindane	0.07	0.2	0.4	1.0A	ID	ID	ID	ID
ORGANOPHOSPHATE PESTICIDES								
Chlorpyrifos B	0.00004	0.01	0.11A	1.2A	0.0005	0.009	0.04A	0.3A
Diazinon	0.00003	0.01	0.2A	2A	ID	ID	ID	ID
Dimethoate	0.1	0.15	0.2	0.3	ID	ID	ID	ID
Parathion	0.0007	0.004C	0.01C	0.04A	ID	ID	ID	ID
HERBICIDES & FUNGICIDES								
Atrazine	0.7	13	45C	150C	ID	ID	ID	ID
Diquat	0.01	1.4	10	80A	ID	ID	ID	ID
2,4-D	140	280	450	830	ID	ID	ID	ID
2,4,5-T	3	36	100	290	ID	ID	ID	ID
Glyphosate	370	1200	2000	3600A	ID	ID	ID	ID
Simazine	0.2	3.2	11	35	ID	ID	ID	ID

A,B,C,ID – Refer to the footnotes to Table 1.

Endocrine Disrupting Chemicals

Endocrine Disrupting Chemicals (EDCs) are comprised of many elements and different groups of compounds from a variety of sources, including industrial reagents, and domestic, health and personal care products. Although many are also be toxicants capable of causing lethal effects when they occur at sufficient concentration, at much lower concentrations they are referred to as *micropollutants*. EDCs are believed to cause detrimental effects in biota through disrupting the proper function of glands of the endocrine system. The glands and the hormones they release influence almost every cell, organ, and function in an organism. The endocrine system is instrumental in regulating mood (in humans), growth and development, tissue function, and metabolism, as well as sexual function and reproductive processes. For more information refer to CRC-WQT (2007).

A list of common known EDCs is provided in 0

Pharmaceuticals

Pharmaceuticals, including veterinary chemicals should be screened for in effluents derived from wastes where hospitals and large-scale livestock operations occur. Some of these compounds have been shown to pass through secondary treatment trains more readily than others. Some of these substances act as EDCs. Please refer to CRC-WQT (2007).

A list of common known pharmaceutical EDCs is provided in 0.

Unknown Toxicants

Unknown toxicants can be of two types; *Known-Unknowns* and *Unknown-Unknowns*. These are explained below.

Known-Unknown Toxicants

Known-Unknown Toxicants are chemicals that are known to be in use and form a component of the effluent, but are unstable and degrade quickly to levels outside the detection capabilities of today's instruments, or there are no chemical analysis procedures or instruments capable of reliably detecting or quantifying them to-date.

Examples of Known-Unknown Toxicants would include undescribed disinfection by-products (making them undetectable in chemical analyses aimed at detecting specific compounds) and anti-scaling agents. Anti-scaling agents (such as orthanophosphates) are routinely used in Reverse Osmosis (RO) treatment of treated sewage effluent and sea water. At the present time there is no reliable method of detecting this group of compounds and their potential for toxicological effect have not yet been fully described; therefore, they are a potential Known-Unknown toxicant.

When Known-Unknown Toxicants are used in treatment processes and suspected to persist at significant concentrations in an effluent, and no readily available scientific literature exists that could be used to estimate the potential risk they pose to the aquatic receiving environment in question, then a DTA would be warranted.

Unknown-Unknown Toxicants

Unknown-Unknown Toxicants are chemicals suspected of being present in some effluent streams but cannot be quantified or detected. Unknown-Unknown Toxicants could be present due to:

- illegal or undeclared substances that either directly or indirectly enter the effluent stream;
- complex mixtures of organic compounds reacting with strong oxidising agents (e.g. chlorine) forming undescribed toxicants, and
- undescribed degradation products of pesticides and other complex substances.

When the effluent is likely to incorporate industrial and/or trade wastes that include chemicals of concern, and when the characteristics of the discharge are likely to match the scenarios presented under Section 0, it may be prudent to recommend that a DTA be performed.

Discharge Characteristics

There may be good reason to order that a DTA of the effluent be performed whenever the proposed effluent is:

- being discharged to an aquatic environment attributed with High Ecological Value (HEV);
- voluminous, and being discharged into a relatively small receiving environment; or
- being discharged without a diffuser into:
  - a moderately to poorly-mixed (medium to low kinetic energy) environment, or
  - a receiving environment with a significantly different density.

Some general information on mixing zones is presented below that will be helpful in determining whether or not adequate mixing is taking place to manage acutely toxic concentrations of contaminants.

Mixing Zone characteristics

The mixing zone of an effluent discharge is typically defined as the area or zone at which the concentrations of contaminants may be above water quality objectives. This means that the mixing zone could be a different size for different contaminants, depending on the:

- Concentration of the contaminant in the effluent;
- Ambient or baseline concentration of the contaminant; and the
- Water quality objectives for the contaminant.

For instance, if Contaminant A

- is typically present in the effluent at 10 mg/L and
- the water quality objective for that contaminant is 1 mg/L, and background concentrations will be very low, then;
- 10 times dilution would be required for Contaminant A to meet water quality objectives, and that level of dilution would be achieved within;
- Distance X of the discharge point, based on dilution modelling.

For Contaminant B, it:

- is typically present in the effluent at 30 mg/L and;
- the water quality objective for that contaminant is 1 mg/L, and background concentrations will be very low, then;
- 60 times dilution would be required for Contaminant B to meet water quality objectives, and that level of dilution would be achieved within;
- Distance Y of the discharge point, based on dilution modelling.

Note that Distances X and Y should typically be determined using the average dilution scenario (e.g. mean current velocity and tide). A worst-case dilution scenario with low velocity (e.g. 0.05m/s) at low tide should also be determined to check no overlap with other mixing zones or contact with the shore line.

Therefore, Contaminant A and B will mostly likely possess mixing zones of differing dimension. This applies to all contaminants. There are a multitude of factors that will influence the size and extent of a mixing zone and the dilution rate of an effluent, and these should be presented as the input variables and assumptions used in the modelling for the discharge. The validity and applicability of those input variables should be assessed.

(i) *Near-field Mixing Zone and Far-field Diffusion*

Near-field Mixing Zone occurs in the area within the mixing zone where the most rapid dilution takes place. This area is situated from the point of discharge to a certain distance away from that point, and the mixing is generally driven by the exit velocity of the effluent. Thereafter, where the effluent has lost its exit inertia and has become assimilated with the hydrodynamics of the aquatic receiving environment, a slower dilution-rate (a diffusion-based dilution rate) presides. The **Far-field Diffusion Zone** occurs from the extent of the near-field mixing to a distance where an elevation in the concentration of *any* contaminant from the effluent is no longer detectable from that in the ambient environment.

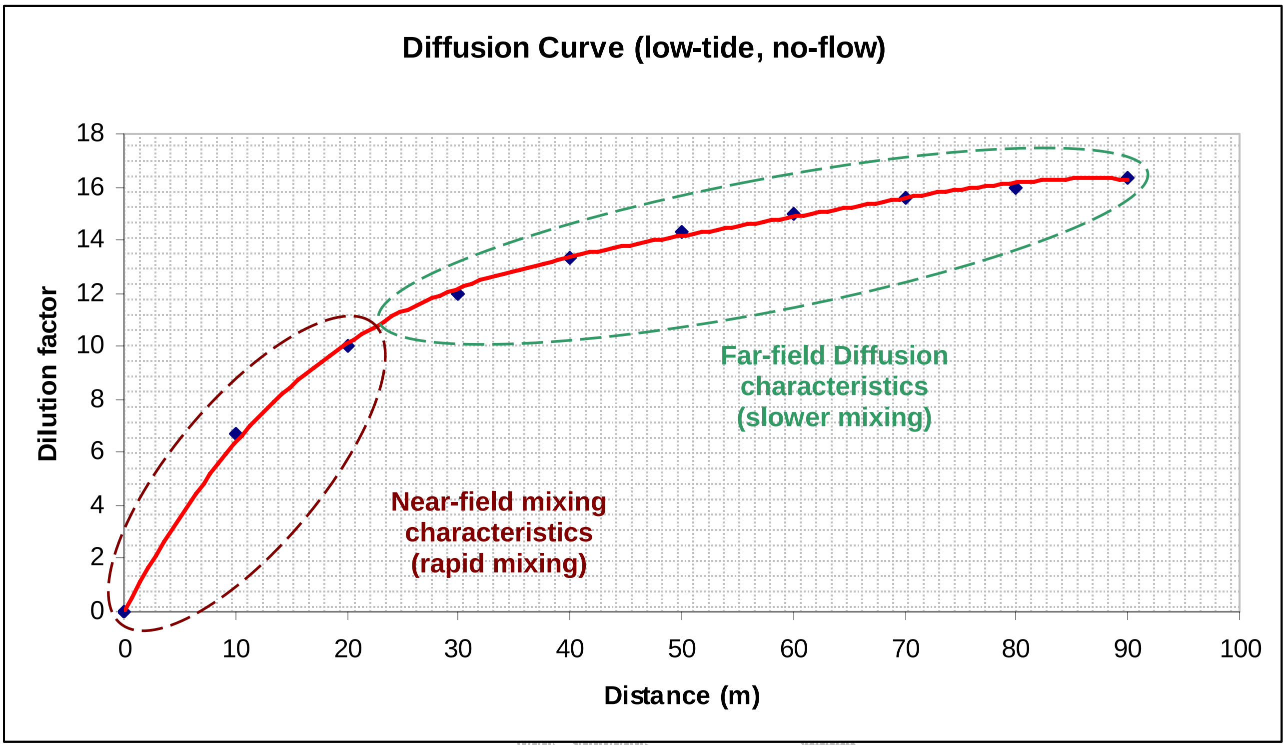


Figure 1. Example Diffusion Curve and related mixing characteristics

Hydrodynamic mixing models can provide estimates of the extent of these areas under differing conditions in the receiving environment, such as no-flow (worst-case), low-flow, and high-flow (best-case) conditions, and dilution curves (see Figure 1) can be produced for each scenario.

The dilution curves coupled with computer modelling of lateral diffusion dynamics are capable of producing a visual representation of the area likely to be affected by the discharge. This area is often described as the *plume* (see Figure 2). Both the near-field mixing zone and far-field diffusion occur within the boundary of the plume.

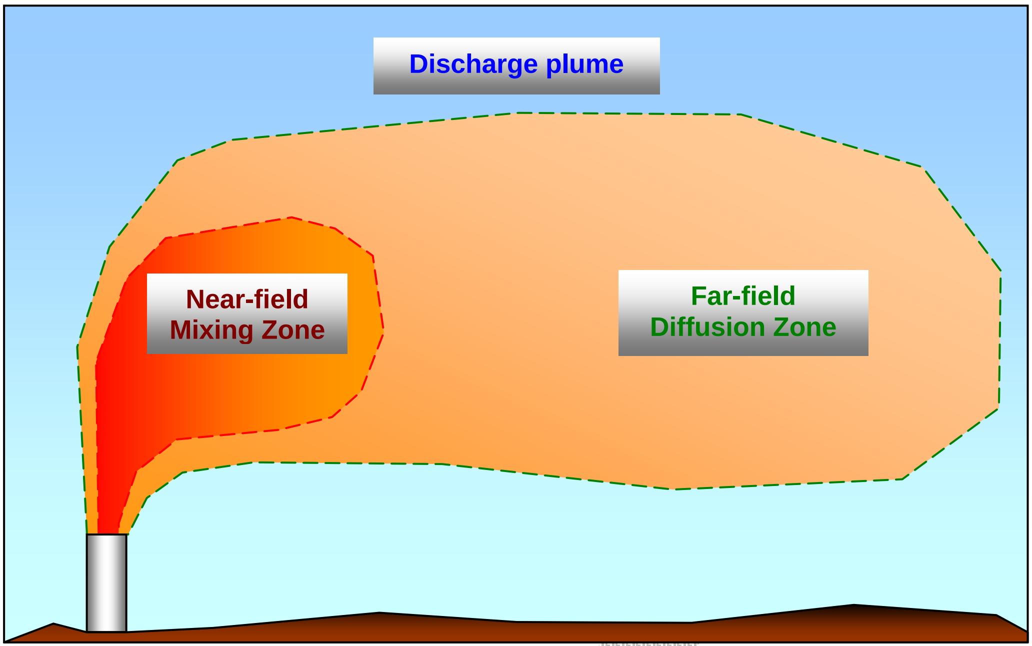


Figure 2. Representative diagram of a Near-field Mixing Zone and Far-field Diffusion.

Toxicity zone mapping can be performed by correlating the diffusion curve with the measured or estimated toxicant concentrations in the discharged effluent, or alternatively, DTA results. This approach can be taken in regards to identifying acute and chronic toxicity zones within the plume; see below (Section 00).

Acute Toxicity and Chronic Toxicity Mixing Zone

In regards to toxicity assessment, the typical mixing zone of an effluent discharge may posses up to two distinct areas relating to toxicity; the:

- acute toxicity zone, and
- chronic toxicity zone.

The ideal situation is where there is neither an acute nor a chronic toxicity zone however this is rarely the case. More typically, there will either be Chronic Toxicity Zone within the plume (Figure 3 A), or both an Acute and a Chronic Toxicity Zone within the plume (Figure 3 B).

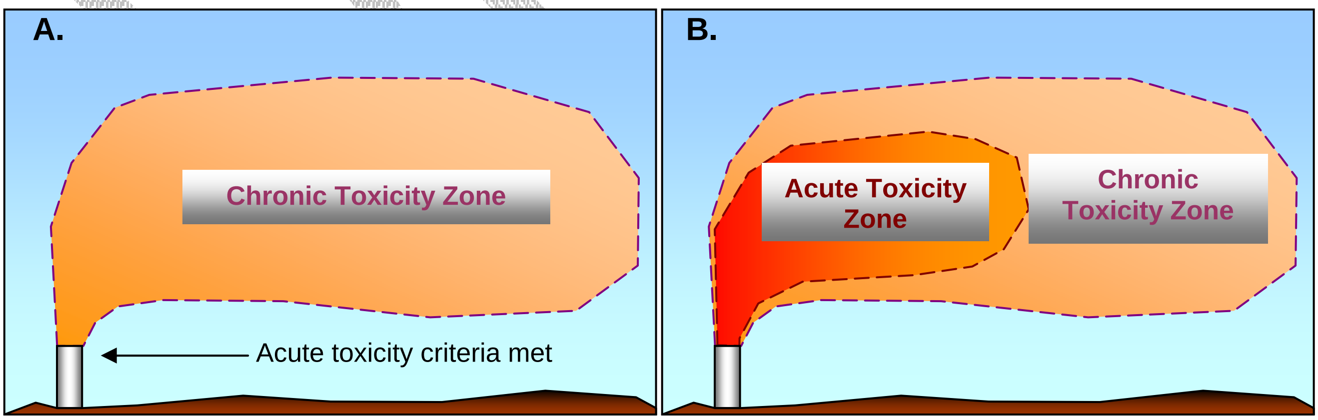


Figure 3. Acute and Chronic Toxicity Zones in a Mixing Zone

The EPA should always ensure, or negotiate toward, a no Acute Toxicity Zone scenario (see Figure 3 A.). It can be assumed that an acute toxicity zone is absent when all toxicant concentrations are below the acute toxicity criteria (i.e. ANZECC & ARMCANZ (2000) TTVs) at the end-of-pipe. In such a case, only a chronic toxicity zone may be present, and only long-term continuous exposure to these levels of toxicants would be likely to result in any observable adverse effects to the exposed biota.

Unfortunately however, having the effluent meet the (ANZECC & ARMCANZ 2000) TTVs at the end-of-pipe is not always achievable by the proponent. In such cases, the EPA needs to assess the risk posed to the receiving environment by the toxicants in the effluent.

Aquatic Receiving Environment

Effluents are generally discharged to surface waters that can be classified into four categories:

- Freshwaters;
- Brackish waters;
- Estuarine waters, and
- Marine waters.

Considerations that relate to a discharge to each of these environments are discussed below.

Discharges to Freshwaters

Freshwaters are by definition very soft (i.e. water hardness is very low; salinity 0.05-1.0 ppt (ANZECC & ARMCANZ 2000)) and this condition promotes the solubility and consequently the bioavailability of toxicants, especially heavy metals and metalloids. Therefore the same 'total' metal concentrations in freshwater will tend toward being more toxic in freshwater than the same concentration in marine waters (refer to Table 1).

Discharges to Brackish or Estuarine waters

Brackish waters are slightly-to-moderately saline waters (salinity between 0.5 and 30 ppt (ANZECC & ARMCANZ 2000)), often resulting from saline ocean waters mixing with, and being diluted by, freshwater sources, as in estuaries. This variability in salinity normally excludes freshwater species being used as the test specimens in toxicity bioassays, although some freshwater biota can tolerate a certain degree of brackishness.

It is common however that marine species are selected for assessing effluent being discharged into brackish or estuarine waters. This is possible by simply elevating the effluents' salinity to a concentration preferred by the test specimen through the addition of pure salt. Naturally, this approach is not appropriate if it is the toxicity of the salinity itself what is being assessed.

Discharges to Marine waters

Marine waters are saline waters (salinity between 30-40 ppt ANZECC & ARMCANZ (2000)) and the presence of salt generally suppresses the bioavailability of metal and metalloid toxicants. This does not always translate to less toxic effects being observed in marine environments because some marine species can be more susceptible to toxic reactions to specific toxicants than freshwater species (e.g. copper; refer to Table 1).

Only marine species should be selected for DTA of discharges to marine environments.

5.3 Essential Components of the DTA Design

Test-effluent Management

As mentioned in Section 0, the effluent needs to be characterised so that an appropriate DTA can be designed with applicable test specimens that can be used to determine the existence and magnitude of toxicological effects. Other important considerations that may affect the results of a DTA, such as the way the effluent is collected, stored and transported as well as the natural water used for dilutions are discussed in the following subsections.

Effluent Dilution Series

In order to determine the level of dilution required for an effluent to no longer exhibit observable toxic effect in the test biota, the DTA incorporates a dilution series into the design. The dilution series typically takes the form of serial 1:1 dilutions that result in the following concentrations of effluent:

Table 5. Effluent dilution series

Dilution ratio (parts effluent: parts dilution water)	**Resultant Percentage of the original effluent concentration**
(undiluted)	100%
1:1	50%
1:3	25%
1:7	12.5%
1:15	6.25%
1:31	3.125%

The most appropriate water that can be utilised for the dilutions would be collected from the actual receiving environment for the proposed discharge (refer to Section 0), otherwise tap water, deionised or demineralised water, artificially manufactured sea water, or some other uncontaminated dilution water would be required.

Normalising for Salinity

When the salinity of the effluent varies significant from the salinity of the receiving waters then there is the potential for an adverse impact on the environment to occur. This can be true for effluents more saline and for effluents less saline than receiving waters; however, the former is by far the more common case and of greater concern due to the potential of the denser brine solution sinking to engulf benthic biota.

In cases such as this, marine or estuarine test specimens should be selected (even for effluents proposed for a freshwater discharge) and the salinity of the effluent artificially increased to match that preferred by the test specimen (refer to {{58 Krassoi, R. 1995}}). In this way, any observable effects due to salinity are negated and the only effects from toxicants remain observable. Even though the test specimen is not representative of the receiving environment, the effects of elevated salinity are taken out of the toxicity equation.

Collection and Use of Effluent and Bulk Natural Water

Certain complications can arise with the bulk collection of natural water for purpose of diluting effluent for DTA. These complications arise due to fluctuations in water quality variables that may occur between the times of collection to the commencement of the bioassays. Critical water quality parameters should be measured in the field (at the time of collection) wherever possible using portable probes and spectrometers; then again prior to the commencement of the bioassay so that any deviation from the field values is documented:

- pH
- Temperature
- Dissolved Oxygen (DO) concentration
- Conductivity (Salinity)
- Ammonia
- Suspended Solids

Where suspended solids (SS) are in high concentration in the receiving environment, it can interfere with observing the test specimens and can be a cause for toxic effects in some test specimens and therefore the bulk water should be allowed to settle or should be filtered. Bulk natural water should also be refrigerated to slow the activity of microbes consuming carbonaceous compounds and dissolved oxygen, and transport times should be kept to a minimum (i.e. use of local laboratories are preferable to interstate arrangements). In all other aspects, bulk natural water should be collected as per the *Water Quality Sampling Manual* (QLD EPA 2008) or the latest issue.

Appropriate End Points

Ideally, a well designed DTA program that is in accordance with the guidelines stipulated in ANZECC & ARMCANZ (2000) must firstly incorporate five test specimens selected from four major taxonomical groups, but should also aim to examine multiple toxicological end point types (i.e. acute, sub-lethal and chronic effects) over the varying selected periods of exposure. These concepts are discussed in more detail below.

Acute Effects

Acute effects are observed when the substance(s) being tested causes death or severely incapacitates the organisms to the point where they are unable to maintain normal functions that will lead to certain death in the very near future (e.g. organisms become moribund through their inability to feed themselves, their nervous system has been irreparably damaged, etc.).

These are the most unlikely effects observable in the receiving environment, predominantly because the EPA will regulate the toxicant concentration levels in the discharge as to avoid acute toxicological effects from occurring, but also because biota are unlikely to remain in an unhospitable environment long enough for acute effect to manifest. On the contrary however, some biota are incapable of avoiding or vacating such inhospitable environments before permanent and lethal damage has occurred (e.g. slow-moving or sessile organisms).

Sub-lethal Effects

Sub-lethal effects are observed when a substance being tested causes detrimental effects that will certainly compromise the individual organisms' ability to survive (e.g. through retarding growth and/or development) or the species' ability to persist (i.e. affecting fecundity, gestation or other reproductive success rates).

These effects can be exhibited in an organism later on in life after a larval or early development life stage was exposed to a short-term or pulse exposure to a toxicant, or can be the effect of long-term chronic exposure. This type of effect is more likely to occur in the receiving environment than are acute effects however they are rarely observed due to lack of in-depth monitoring.

Chronic Effects

Chronic effects are observed when the substance causes the organism to be unable to maintain normal biological functions that will lead to certain death in the long-term (e.g. it compromises the organisms' ability to resist disease, causes biochemical changes that affect absorption rate of nutrient through the gut wall, etc.).

These effects are most likely to occur in the receiving environment but due to the lack of routine monitoring associated with effluent discharges, they are rarely observed. Even when the effects of chronic toxicity are observed, it is difficult to identify the specific effluent(s) or source(s) responsible for the observed effect because long-term chronic exposures are difficult to link back to specific point-source discharge(s).

Exposure Times

Toxicological effects are dependant on the concentration of the toxicant versus the time of exposure. To examine the potential short-term and long-term effects that a substance may exhibit on test specimens, short-term exposures (1 hour) and medium-term exposures (96 hours) should be incorporated into the DTA design. Although longer-term exposures (e.g. weeks, months or even years) may exhibit adverse effects on biota in the receiving environment, it is unfeasible to explore these effects within the scope of most DTAs. It may be necessary that a long-term monitoring program be implemented if the circumstances of the discharge warrant continued vigilance (refer to Section 0).

Appropriate Test Specimens

The best DTAs utilise test specimens that are directly relevant to the receiving environment for the discharge, however this may not always be possible for several reasons, including:

- Unavailability of the organism in sufficient numbers to perform the bioassays
- Inability to maintain the organism in the laboratory in a healthy state
- The organisms' relative sensitivity to a toxicant is unknown making its selection dubious
- State laws prohibited its use upon grounds of animal ethics (e.g. vertebrates)

In all other cases the best compromise should be sought. The most important considerations are:

- the test specimens should:
    - be sensitive to the main toxicant(s) of concern; this may be the case according to:
        - taxa versus toxicant type (e.g. use insect or crustacean macroinvertebrates for organophosphate pesticides),
        - life stage of the test organism (e.g. juveniles may be more sensitive than adults);
    - reasonably or closely relevant to the receiving environment, or
    - a standard test organism (see Section 0)

Acclimatised Species

It may be appropriate to capture and rear local specimens that have acclimatised to local background toxicant concentrations. This may be particularly applicable where background toxicants exceed the ANZECC 2000 TTVs but locally captured organisms don't seem adversely affected.

This approach is more in the realms of scientific research and therefore normally out of the scope of a general DA however if the proponent is willing to wait for the research to be performed and invest the money required then this should be considered by EPA officers.

Some Standard Test Specimens used in Australia

Table 6. Some generic Direct Toxicity Assessment toxicity bioassays

Organism	Test Type	Test Duration & Effect	Test Endpoint	Substance Tested	Receiving Environment	Sources
Plant						
Selanastrum capricornutum Freshwater micro alga	Laboratory	96 hours chronic	Growth inhibition	WE, chemicals, sediment, leachates, groundwater	Freshwater	USEPA Method 1003.0 OECD Method 201 Stauber 1994b Bailey et al 2000
Lemna gibba *Lemna minor* Duckweed	Laboratory	4-7 days chronic	Plant growth	WE, chemicals, sediment, leachates, groundwater	Freshwater (incl. turbid waters)	USEPA OPPTS 850.4300 ASTM (1998) OECD Guideline 221
Iscochrysis aff. galbana Marine microalga	Laboratory	72-96 hours chronic	Growth inhibition	WE, chemicals, sediment, leachates, groundwater	Marine	USEPA Method 1003.0 APHA Method 8111 Stauber et al. (1996)
Chlorella protothecoides	Laboratory	72 hours chronic	Cell division rate			
Fish (vertebrate)						
Insect (invertebrate)						
Mollusc (invertebrate)						
Saccostrea commercialis Rock oyster *Mimachlamys asperrima* Doughboy scallop	Laboratory	48 hours chronic	Larval abnormality	WE	Estuarine, marine	Krassoi et al. (1996)
Crustacean (invertebrate)						
Ceriodaphnia dubia *Ceriodaphnia cf. dubia* *Daphnia carinata* Freshwater water fleas	Laboratory	24-96 hours acute ~7 days chronic	Juvenile survival 3rd brood of neonates	WE, chemicals, sediment, leachates, groundwater	Freshwater	USEPA Method 1003.0 Stauber et al. (1996)

Daphnia magna Freshwater water flea	Laboratory				Freshwater	
Amphipod (invertebrate)						
Corophium cf. volutator Aquatic amphipod	Laboratory	10 days acute	Juvenile survival, emergence and reburial	Sediment	Freshwater, estuarine, marine	USEPA OPPTS 850.1020
Echinoderm (invertebrate)						
Heliocidaris tuberculata Sea urchin	Laboratory	1 hour acute	Fertilisation success	WE, chemicals, sediment, leachates, groundwater	Estuarine, marine	APHA Method 8810C Simon and Laginestra (1997)
		72 hours chronic	Larval development			APHA Method 8810D Simon and Laginestra (1997)

Region- and Habitat-specific Test Specimens

(ii) ***Queensland Freshwaters***

Table 7. Some Direct Toxicity Assessment toxicity bioassays appropriate for Queensland Freshwaters

Organism	Test Type	Test Duration & Effect	Test Endpoint	Substance Tested	Receiving Environment	Sources
Plant						
Chlorella sp. Green alga	Laboratory	72 hours chronic	Population growth	Cu, herbicides, WE	Lowland streams, floodplains	{{56 Riethmuller, N. 2003;}}
Chlorella sp. (2 tropical species)	Laboratory	48 or 72 hrs chronic	Cell division rate	WE		Franklin et al 1998 Franklin et al (in press)
Ceratophyllum dermersum Hornwort	Laboratory	96 hours chronic	Growth inhibition	Cu, herbicides, WE	Lowland streams, floodplains	{{56 Riethmuller, N. 2003;}}
Lemna aequinoctialis sp. Duckweed	Laboratory	4-7 days chronic	Plant growth	Cu, herbicides	Lowland streams, floodplains	{{56 Riethmuller, N. 2003;}}
Monoraphidium arcuatum Tropical green alga	Laboratory	72 hours chronic	Cell division rate	Cu		{{69 Levy, J.L. 2007;}}
Fish (vertebrate)						
Melanotaenia nigrans Black-banded rainbowfish	*In-situ/* Laboratory	96 hours acute	Larval survival	U, Cu, WE	Escarpment streams, floodplains	eriss notes
Magurnda magurnda Purple-spotted gudgeon	Laboratory	96 hours acute	Larval survival	U, Cu, WE	Upland streams, floodplains	{{56 Riethmuller, N. 2003;}}
Insect (invertebrate)						

Chironomus crassiforceps Chironomid	Laboratory	5 days chronic	Larval growth	U, Cu	Permanent billabongs, floodplains	eriss notes
Mollusc (invertebrate)						
Amerianna cumingii Freshwater gastropod	*In-situ*	96 hours chronic	Reproduction, juvenile survival	U, Cu, WE	Permanent billabongs, floodplains	eriss notes
Crustacean (invertebrate)						
Moinodaphnia macleayi Freshwater cladoceran	Laboratory	6 day sub-lethal	Reproduction (3 brood)	U, Cu, HCN, Mn, NO_3, Cd, WE	Permanent billabongs	{{56 Riethmuller, N. 2003;}}
		24 hours chronic	Feeding inhibition			
		6 day acute	Survival			
Cnidarian (invertebrate)						
Hydra viridissima Green hydra	Laboratory	96 hours chronic	Population growth	U, Cu, Mg, Na, WE	Permanent billabongs, floodplains	{{56 Riethmuller, N. 2003;}}

Cd – Cadmium
Cu – Copper
HCN – Cyanide
Mg – Magnesium
Mn – Manganese
Na – Sodium
NO_3 – Nitrite
U – Uranium
WE – whole-effluent
WS – whole-sediment

Queensland Brackish Waters

Queensland Marine Waters

Table 8. Some Direct Toxicity Assessment toxicity bioassays appropriate for Queensland Marine Waters

Organism	Test Type	Test Duration & Effect	Test Endpoint	Substance Tested	Receiving Environment	Sources
Plant						
Nitzschia closterium Marine microalga (diatom)	Laboratory	72-96 hours chronic	Growth inhibition	WE, chemicals, sediment, leachates, groundwater	Marine	USEPA Method 1003.0, APHA Method 8111, Stauber et al. (1996)
Nitzschia closterium (tropical) Marine microalga (diatom)	Laboratory	72 hours chronic	Cell division rate	WE	Marine	{{62 Johnson, H.L. 2007;}}
Phaeodactylum tricornutum Marine microalga (diatom)	Laboratory	72 hours chronic	Cell division rate	WE	Marine	{{63 Franklin, N.M. 2001;}}
Entomoneis cf *punctulata* microalga (diatom)	Laboratory	72 hours chronic	Cell division rate	WS	Marine	{{64 Adams, M.S. 2004;}}
		24 hour acute	Esterase inhibition			
Dunaliella tertiolecta Green alga	Laboratory	1 hour acute	Enzyme inhibition	WE	Marine	Peterson & Stauber
		72 hour chronic	Cell division rate			{{59 Stauber, J.L. 1994;}}
Fish (vertebrate)						
Insect (invertebrate)						
Mollusc (invertebrate)						
Tellina deltoidalis bivalve	Laboratory	10 days acute	Survival	WS	Estuarine, marine	{{68 Simpson, S.L. 2005;}}
	Laboratory	4 week chronic	Growth			Strom/simpson
Spiculla trigonella Bivalve	Laboratory	10 days acute	Survival	WS	Estuarine, marine	Strom spadaro simpson
Crustacean (invertebrate)						

Penaeus monodon Tiger prawn	Laboratory	96 hours acute	Juvenile survival	WE	Estuarine, marine	USEPA OPPTS 850.1045
Amphipod (invertebrate)						
Allorchestes compressa Marine amphipod *Hyale crassicornis* *Melita spp.*	Laboratory	96 hours acute	Juvenile survival	WE, chemicals, sediment, leachates, groundwater*	Marine	USEPA OPPTS 850.1020
Melita plumulosa Epibenthic deposit feeder	Laboratory	10 days acute	Survival, growth	WS	Estuarine, marine	{{66 King, C.K. 2006;}}
		6 week chronic	Reproduction			{{67 Gale, S.A. 2006;}}
		13 day chronic	Reproductive index			Hyne et al
Copepod (invertebrate)						
Acartia sinijiensis (tropical) Copepod	Laboratory	48 hours acute	Immobilisation	WE	Marine	{{65 Rose, A. 2006;}}
Nitocra ap. Copepod	Laboratory	7 day chronic	Life cycle (split) 7 day reproduction 7 day development	WE	Marine	?
Cnidarian (invertebrate)						

Toxicity Identification Evaluation

Once the toxicological bioassays of a DTA are complete and toxic effects have been observed, there may be a need to determine which constituents in the effluent were responsible for those observed effects. The process for this determination is described by a series of procedures published by the USEPA but basically takes the following approach; the following Phase I TIE manipulations of the effluent are performed and then a repeat of the initial DTA is initiated, with subsequent Phase II and Phase III manipulations if required:

- Phase I TIE manipulations:
    - EDTA chelation – removes divalent metal ions (e.g. Cu, Zn, Ag, Hg) to reduce toxicity of the effluent;
    - pH adjustment – ammonia and aluminium toxicity can be reduced significantly by adjusting the effluent of pH;
    - Aeration – oxidisable or volatile toxicants are stripped or converted in the effluent to reduce overall effluent toxicity
    - Sodium thiosulphate – binds oxidative chemicals (such as Cl and Br) and some metals (e.g. Cu) making them unavailable as toxicants;
    - Solid Phase Extraction (SPE) – columns with C18 or C8 resin absorb non- or moderately polar organic chemicals from the effluent;
    - Filtration and centrifugation – removes particulate-bound toxicants;
    - Sublimation and Foam fractionation – removes sublimatable compounds such as surfactants;
    - Piperonyl Butoxide (PBO) addition – affects the action of some metabolically activated pesticides for that their toxicity is reduced or eliminated but may enhance the toxicity of pyrethroids.
- Phase II TIE manipulations:
    - SPE elution pattern – an enhanced version of Phase I SPE extraction;
    - HPLC elution pattern – similar to SPE elution pattern but with higher resolution;
- Phase III TIE manipulations:
    - Confirmation (spiking) study – suspect toxicants are spiked into the sample at double the concentration they exist at in the sample to observe enhanced toxic effect.

Identification of the compound(s) responsible for the observed toxicological effects on DTA test specimens may assist in developing strategies to reduce or remove the toxicants in question from the effluent (through the addition or modification of a treatment step), or be used to support or negate other management options.

5.4 Related Matters

This section deals with when, why and how DTAs should be conditioned into Discharge Licenses and what needs to be considered in Receiving Environment Monitoring Programs (REMPs) so that the repercussions of the observations made in DTAs are adequately covered in the monitoring.

Routine DTAs

Where it is considered that there is continuing potential risk for an effluent to cause environmental harm then routine DTAs of the effluent may be required. Routine DTAs can be required:

- On an annual or bi-annual basis, or required at some other regular interval;
- whenever a treatment process change is implemented that is likely to significantly alter the effluent quality;
- whenever the influent quality into a sewage Treatment Plant (STP) for example, or Advanced Water Treatment Plant (AWTP), changes significantly, or
- when new information becomes available that puts into doubt the quality of the effluent so that the EPA can no longer confidently consider the effluent as being non-acutely toxic at the point of release.

An example of such a situation is where a ROC from a STP effluent that is being collected from a sewer catchment with a significant proportion of industrial effluents contributing to the bulk influent. Because of the many parties involved with contributing to the STP influent and the high potential for unreported process changes and/or reagent changes to occur, it would be appropriate that there be a requirement that DTA be conducted on the effluent on a regular (routine) basis.

Requirement for Regular DTA

NEGATIONS REGARDING THIS ISSUE ARE IN PROGRESS

Requirement for Irregular or Event-based DTA

NEGATIONS REGARDING THIS ISSUE ARE IN PROGRESS

No Requirement for DTA

NEGATIONS REGARDING THIS ISSUE ARE IN PROGRESS

Receiving Environment Monitoring Programs

Where an existing or proposed discharge is considered to present unknown risk of acute, sub-lethal or chronic toxicological effects for reasons beyond the results of the DTA, then it may be appropriate to condition a biota monitoring component into a Receiving Environment Monitoring Program (REMP). Such reasons would include:

- Effluent diffusion is poor (poor mixing) during certain tidal or other variables (see Section 0);
- Receiving environment is of special significance (e.g. Ramsar wetlands, Wetlands of State Significance, HEV areas, etc.; see Section 0);
- The DTA test specimens:
  - were not directly relevant to the receiving environment (see Section 0), or
  - did not include the taxa that are most sensitive to the toxicant(s) in the effluent, or
- The effluent tested was not truly representative of the long-term discharge.

Biota monitoring can be for an interim period, or indefinite. Generally, an interim period would be a minimum of 2-3 years in duration so that seasonal changes and patterns of subsequent years can be analysed.

5.5 References

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QLD EPA (1999). Water Quality Sampling Manual. 3rd Edition.

5.6 Acronyms and Abbreviations

ANZECC	Australian and New Zealand Environment and Conservation Council
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
AWTP	Advanced Water Treatment Plant
CRC-WQT	Co-operative Research Centre for Water Quality and Treatment
DA	Development Application
DO	Dissolved Oxygen
DTA	Direct Toxicity Assessment
EC_{50}	median Effective Concentration for 50% of exposed specimens
EDC	Endocrine Disrupting Chemical
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
eriss	Environmental Research Institute of the Supervising Scientist
EV	Environmental Value
HEV	High Ecological Value
LC_{50}	median Lethal Concentration for 50% of exposed specimens
mg/L	milligrams per litre
NATA	National Association of Testing Authorities of Australia
OPPTS	Office of Prevention, Pesticides and Toxic Substances
PCB	Poly-Chlorinated Biphenyl
pH	potential (of) Hydrogen
ppt	parts per thousand
QLD EPA	Queensland Environmental Protection Agency
RFI	Request for Further Information
RO	reverse osmosis
ROC	reverse osmosis concentrate
SPE	Solid-phase extraction
SS	Suspended Solids
STP	Sewage Treatment Plant
TDS	Total Dissolved Salts or Total Dissolved Solids
TIE	Toxicity Identification and Evaluation
TTV	Toxicity Trigger Value
µg/L	micrograms per litre
USEPA	United States Environment Protection Agency
WE	Whole effluent
WET(T)	Whole Effluent Toxicity (Testing)
WEMW	Whole effluent mine wastewater
WQO	Water Quality Objective

5.7 Glossary

Acute Toxicity Acute toxicity is the ability of a substance or mixture of substances to cause lethal effects over a relatively short period of time, usually upon single or pulse exposures.

Aquatic Ecosystem Any watery environment from small to large, from pond to ocean, in which plants and animals interact with the chemical and physical features of the environment.

Biota The sum total of the living organisms in any designated area.

Chronic Lingering or continuing for a long time; often for periods from several weeks to years. Can be used to define either the exposure of an aquatic species or its response to an exposure (effect). Chronic exposure typically includes a biological response of relatively slow progress and long continuance, often affecting a life stage.

Chronic Toxicity Chronic toxicity is the ability of a substance or mixture of substances to cause harmful effects over an extended period, usually upon repeated or continuous exposure sometimes lasting for a significant proportion of the life of the exposed organism.

Cladoceran Water flea; zooplankton belonging to the fourth Order of the Branchiopoda, the Cladocera.

Contaminant Biological (e.g. bacterial and viral pathogens) and chemical (see **Toxicants**) introductions capable of producing and adverse response (effect) in a biological system, seriously injuring structure or function or producing death.

Direct Toxicity Assessment The use of toxicity tests to determine the acute and/or chronic toxicity of waste water discharges or total pollutant loads in receiving waters. (Assesses the toxicity of mixtures of chemicals rather than individual chemicals).

EC_{50} The concentration of material in water that is estimated to be effective in producing some response in 50% of the test organisms. The EC_{50} is usually expressed as a time dependant value (e.g. 24 hour or 96 hour EC_{50}).

Near-field mixing zone The Near-field Mixing Zone (or the **Initial Mixing Zone**) is the area within the mixing zone where the most rapid dilution takes place. This area is situated from the point of discharge to a certain distance away from that point, and the mixing is generally driven by the exit velocity of the effluent.

Far-field Mixing Zone The Far-field Mixing Zone (or the **Absolute Mixing Zone**) extends from the end of the **Near-field mixing zone** to a distance where an elevation in the concentration of *any* contaminant from the effluent is no longer detectable from that in the ambient environment. It may also be described as where the effluent has lost its exit inertia and has become assimilated with the hydrodynamics of the aquatic receiving environment; therefore a slower dilution-rate (i.e. a diffusion-based dilution rate) presides.

LC_{50} The concentration of material in water that is estimated to be effective in producing some lethal response in 50% of the test organisms. The LC_{50} is usually expressed as a time dependant value (e.g. 24 hour or 96 hour LC_{50}).

TIE Toxicity characterisation procedures involving use of selective chemical manipulations or separations and analyses coupled with toxicity testing to identify specific classes of chemicals and ultimately individual chemicals that are responsible for the toxicity observed in a particular sample.

Total Dissolved Salts A measure of the inorganic salts dissolved in water. The organic component of the water has been removed via some laboratory technique.

Total Dissolved Solids A measure of the inorganic salts (and organic compounds) dissolved in water.

Total Metal The concentration of a metal in an unfiltered sample that is digested in strong nitric acid.

Toxicant A chemical capable of producing an adverse response (effect) in a biological system at concentrations that might be encountered in the environment, seriously injuring structure and function or producing death. Examples include pesticides, heavy metals and biotoxins (i.e. domoic acid, ciguatoxin and saxitoxins).

Toxicity The inherent potential or capacity of a material to cause adverse effects in a living organism.

Trigger Values These are the concentrations (or loads) of the key performance indicators measured for the ecosystem, below which there exists a low risk that adverse biological 9ecological) effects will occur. They indicate the risk of impact if exceeded and should 'trigger' some action, either further ecosystem specific investigations or implementation of management/remedial actions.

Water Quality Criteria Scientific data evaluated to derive the recommended quality of water for various uses.

Whole Effluent Toxicity Testing The use of toxicity tests to determine the acute and/or chronic toxicity of effluents.

Source: ANZECC & ARMCANZ (2000)

5.8 Appendices

Endocrine Disrupting Chemicals (Pesticides)

Table 9 lists some commonly used pesticides and industrial chemicals that are known or believed to possess endocrine disrupting qualities. Use this list as a guide to help ascertain which compounds should be included in chemical analyses of wastewater effluents from systems with these activities taking place within the sewage catchment.

Table 9. Examples of known and suspected Agricultural and Industrial Endocrine Disrupting Chemicals

Chemical	Common Uses
Amitrol	Defoliant, a herbicide, photography, plant growth regulation, non-selective weed control
Atrazine	herbicide for weed control in agriculture
Arsenite	Sodium arsenite: Dyes, soap, treating scale diseases; insecticide (termites); antiseptic, topical acaricide, hide preservative, herbicide. Copper Acetoarsenite: Insecticide, wood preservative, larvicide, pigment (particularly for ships and submarines), fungicide, bactericide and molluscicide.
Benzophenone	Fixative for heavy perfumes, manufacture of antihistamines, hypnotics; insecticides.
Benzo(a)pyrene	Petrochemicals combustion by-product.
Bisphenol A	Basic building block of polycarbonate plastic, an intermediate in the manufacture of polymers, epoxy resins, , fungicides, antioxidants, dyes, phenoxy, polysulfone and certain polyester resins, flame retardants and rubber chemicals.
Butylated hydroxyanisole (BHA)	Preservative and antioxidant in fat-containing foods, in edible fats and oils; and in cosmetic formulations.
Cadmium	Heavy metal with widespread use: electroplating, photoelectric cells, soft solder and solder for aluminium; deoxidizer in Ni plating, Ni-Cd storage batteries; process engraving, electrodes for cadmium vapour lamps, photometry of ultraviolet sun-rays. The powder is also used as an amalgam (1 Cd: 4 Hg) in dentistry. Cadmium chloride: photography, paints, pigments, glass, glazes, electronic components, nemoticide, pesticide and a fungicide, dyeing and calico printing, in the manufacture of cadmium yellow, galvanoplasty, manufacture of special mirrors, ice-nucleating agent, lubricant, in analysis of sulfides to absorb hydrogen sulfide, polymerization catalyst. Cadmium oxide: electroplating, storage battery electrodes, catalyst, semi-conductors, silver alloys, ceramic glazes, nematocide, anthelminic, phosphors, glass, cadmium electroplating, and an aracaricide in pigs.
Dithiocarbamate	Sodium Diethyldithiocarbamate: pesticide, fungicide, chelating agent. It is used in the evaluation of T-cell deficient diseases, in the inhibition of superoxide dismutase in mice and of cisplatin nephrotoxicity in rats, in AIDS-related complex, in immunopharmacology and in cancer immunotherapy. It has clinical use in acute nickel carbonyl, cadmium and thallium poisoning. It is used in colorimetric determination of small quantities of copper and for its separation from other metals. It is also used as a latex accelerator in rubber processing and as a chemical intermediate in the production of other diethyldithiocarbamate metal salts, such as zinc selenium and tellurium salts. Sodium Dimethyldothiocarbamate: fungicide; corrosion inhibitor; rubber accelerator; intermediate; polymerization shortstop; nematocide and herbicide with a fumigant action. Lead Dimethyldothiocarbamate: vulcanization accelerator.

DDT	One of the 12 POPS listed by the Stockholm Convention on Persistent Organic Pollutants, DDT's allowed use is now restricted to disease vector control, specifically to kill mosquitoes spreading malaria in the developing world.
p, p'-DDE	One of the principal metabolites (breakdown products) of DDT
Dieldrin	Usage banned by the Stockholm Convention on Persistent Organic Pollutants. A non-systemic, persistent organic insecticide with contact and stomach action.
Endosulfan	Insecticide; pesticide. Very widespread modern use.
Ethylene thiourea	Polymer vulcanizing and curing agent, accelerator in curing polychloroprene (neoprene) and other elastomers. It is also used in electroplating baths, as an intermediate for anti-oxidants, in insecticides, dyes, pharmaceuticals and synthetic resins.
Furans	Usage banned by the Stockholm Convention on Persistent Organic Pollutants. Combustion by-products of combustion of organochlorine chemicals, furans have also been used as intermediates in the preparation of pharmaceuticals, insecticides, resins and in the formation of lacquers.
Heptachlor	Usage banned by the Stockholm Convention on Persistent Organic Pollutants. Heptachlor was used for control of the cotton boll weevil, termites, ants, grasshoppers, cutworms, maggots, thrips, wireworms, flies, mosquitoes, soil insects, household insects and field insects. It has some fumigant action, and was applied as a soil treatment, a seed treatment or directly to foliage.
Kepone	Used as an insecticide, fungicide, pesticide for control of the banana root borer and tobacco wireworm and bait for control of ants and cockroaches.
Lindane	Banned in many (but not all) countries; a pesticide to control lice and other ectoparasites, a foliar spray and soil application for insecticidal control of a broad spectrum of phytophagous and soil dwelling insects, animal ectoparasites and public health pests. It is used on ornamentals, fruit trees, nut trees, vegetables, tobacco and timber. This chemical is found in baits and seed treatments for rodent control. In pet shampoo it kill ticks, lice and sarcoptic mange mites.
Malathion	Insecticide on fruits, vegetables, ornamentals, household and livestock use, an acaracide, control of flies and other insect pests in animal and poultry houses, adult mosquitoes in public health programs, human body and head lice and in flea and tick dips. It is used in veterinary medicine as an ectoparasiticide.
Methoxychlor	Insecticide for a wide range of insect pests (particularly chewing insects) in field crops, forage crops, fruit, vines, flowers, vegetables, and in forestry, in animal houses and dairies, in household and industrial premises and in veterinary medicine as an ectoparasiticide.
Mirex	Usage banned by the Stockholm Convention on Persistent Organic Pollutants. Insecticide, pesticide, flame retardant for plastics, rubber, paint, paper and electrical goods; in antifouling paints, rodenticides and additives for antioxidant and flame retardant mixtures for stabilized polymer compositions, ablative compositions, anthelmintic compositions and lubricant compositions. Applied in paper, paint, rubber, electrical, adhesive and textile applications; also used in thermoplastic, thermosetting and elastomeric resin systems.
Nitrofen	Herbicide used on many vegetables, broad-leafed and grass weeds, cereals, rice, sugar beet, some ornamentals, broccoli, cauliflower, cabbage, brussel sprouts, onions, garlic, celery, roses and chrysanthemums.
Pentachlorophenol	Insecticide for termite control, pre-harvest defoliant, general herbicide, wood preservative, synthesis of pentachlorophenyl esters, molluscide, fungicide, bactericide, anti-mildew agent, slimicide and algaecide. The technical material finds extensive use in cooling towers of electric plants, as additives to adhesives based on starch and vegetable and animal protein, in shingles, roof tiles, brick walls, concrete blocks, insulation, pipe sealant compounds, photographic solutions, and textiles and in drilling mud in the petroleum industry.
Pentachloronitrobenzene	Fungicide for seed and soil treatment, herbicide, in slime prevention in industrial waters and to control damping off and other fungal infections.
Phenol, 4-tert-Butyl	Intermediate in the manufacture of varnish and lacquer resins, soap antioxidant;

	ingredient in de-emulsifiers for oil field use and motor oil.
Phthalates	Butyl benzyl phthalate (BBP) resins: solvent and a fixative in perfume. Di-n-butyl phthalate (DBP): plasticisers, cosmetics, safety glass, insecticides, printing inks, paper coatings, adhesives, elastomers and explosives; as a solvent in polysulfide dental impression materials, solvent for perfume oils, perfume fixative, textile lubricating agent and solid rocket propellant. Di-ethylhexylphthalate (DEHP): vacuum pumps; as a plasticizer for polyvinyl chloride (PVC) for medical devices, resins and elastomers. Solvent in erasable ink and dielectric fluid. Acaricide in orchards, an inert ingredient in pesticides, a detector for leaks in respirators, testing of air filtration systems and component in cosmetic products. Di-n-pentyl phthalate (DPP): plasticizer for nitrocellulose and resin lacquers; anti-foaming agent in the manufacture of glue; in rubber cements.
Thiram	Fungicide, bacteriostat, pesticide, rubber vulcanization accelerator, scarabicide, seed disinfectant, animal repellent, insecticide, lube oil additive, and wood preservative. Anti-septic sprays, lubricant oils. It is used against Botrytis, rusts and downy mildews and as a seed dressing against "damping off" and verticillium wilt. It is also used as an ethanol antagonist and deterrent in mixtures of the methyl, ethyl, propyl and butyl derivatives. Antioxidant in polyolefin plastics and a peptizing agent in polysulphide elastomers. Soaps and rodent repellents and as a nut, fruit and mushroom disinfectant.
Toxaphene	Usage banned by the Stockholm Convention on Persistent Organic Pollutants. Insecticide and pesticide. It was used on cotton crops, cattle, swine, soybeans, corn, wheat, peanuts, lettuce, tomatoes, grains, vegetables, fruit and other food crops; for control of animal ectoparasites, grasshoppers, army-worms, cutworms and all major cotton pests. It controls livestock pests such as flies, lice, ticks, scab mites and mange. It also controls mosquito larvae, leaf miners, bagworms, church bugs, yellow jackets and caterpillars.
Trifluralin	Pre-emergence herbicide, especially for cotton plants.
Zineb	Agricultural fungicide; insecticide.
Ziram	Fungicide and repellent to birds and rodents. Rubber vulcanization accelerator. Adhesives including those used in food packaging, paper coats for non-food contact, industrial cooling water, latex-coated articles, neoprene, paper and paperboard, plastics (polyethylene and polystyrene) and textiles.

Source: http://www.ourstolenfuture.org/Basics/chemuses.htm

Endocrine Disrupting Chemicals (Pharmaceuticals)

Table 10. Example known and suspected Pharmaceutical Endocrine Disrupting Chemicals

Aspirin	Analgesic
Bacitracin	Antibiotic
Carbamazepine	Antiepileptic
Chlorampenicol	Antibiotic
Ciprofloxacin[1]	Antibiotic
Clofibrate	Lipid regulator
Clofibric Acid	Lipid regulator
Enroflaxin[2]	Antibiotic
Eryrthromycin	Antibiotic
Fluvoxetine HCl	Antidepressant
Fluvoxamine	Antidepressant
Ibuprofen	Analgesic/Anti-inflammatory
Lincomycin[1,2]	Antibiotic
Naladixic acid[2]	Antibiotic
Naproxen sodium	Analgesic/Anti-inflammatory
Norfloxacin[2]	Antibiotic
Oleandomycin[2]	Antibiotic
Oxytetracycline	Antibiotic
Paracetamol	Analgesic
Paroxetine HCl	Antidepressant
Roxithromycin[2]	Antibiotic
Salicyclic Acid	Topical keratolytic
Sulfamethoxazole[1]	Antibiotic
Sulfamethazine	Antibiotic
Tetracycline	Antibiotic
Triclosan	Antibacterial
Trimethoprim[1,2]	Antibiotic
Tylosin[2]	Antibiotic

Source: CRC-WQT (2007)

1 Detected in STP and AWTP effluent {{57 Watkinson, A.J. 2007;}}

2 Detected in AWTP product water {{57 Watkinson, A.J. 2007;}}

329 Failure to make decision on environmental report taken to be refusal

If the administering authority fails to decide whether or not to accept an environmental report within the time it is required to make a decision on the report, the failure is taken to be a decision by the authority to refuse to accept the report at the end of the time.

Part 3 Transitional environmental programs

Division 1 Preliminary

330 What is a transitional environmental program

A ***transitional environmental program*** is a specific program that, when complied with, achieves compliance with this Act for the activity to which it relates by doing 1 or more of the following—

(a) reducing environmental harm caused by the activity;

(b) detailing the transition of the activity to an environmental standard;

(c) detailing the transition of the activity to comply with—

(i) a condition, including a standard environmental condition, of an environmental authority or code of environmental compliance; or

(ii) a development condition.

331 Content of program

A transitional environmental program must, for the activity to which it relates—

(a) state the objectives to be achieved and maintained under the program for the activity; and

(b) state the particular actions required to achieve the objectives, and the day by which each action must be carried out, taking into account—

  (i) the best practice environmental management for the activity; and

  (ii) the risks of environmental harm being caused by the activity; and

(c) state how any environmental harm that may be caused by the activity will be prevented or minimised, including any interim measures that are to be implemented; and

(d) if the activity is to transition to an environmental standard, state—

  (i) details of the standard; and

  (ii) how the activity is to transition to the standard before the program ends; and

(e) if the activity is to transition to comply with a condition of an environmental authority or code of environmental compliance, or a development condition, state—

  (i) details of the condition and how the activity does not comply with it; and

  (ii) how compliance with the condition will be achieved before the program ends; and

(f) state the period over which the program is to be carried out; and

(g) state appropriate performance indicators at intervals of not more than 6 months; and

(h) provide for monitoring and reporting on compliance with the program.

Division 2 Submission and approval of transitional environmental programs

332 Administering authority may require draft program

(1) The administering authority may require a person or public authority to prepare and submit to it for approval a draft trausitional environmental program—

(a) as a condition of an environmental authority; or

(b) as a development condition of a development approval.

(2) The administering authority may also require a person or public authority to prepare and submit to it for approval a draft transitional environmental program if it is satisfied—

(a) an activity carried out, or proposed to be carried out, by the person or authority is causing, or may cause, unlawful environmental harm; or

(b) it is not practicable for the person or public authority to comply with an environmental protection policy or regulation on its commencement; or

(c) that a condition of an environmental authority held by the person or public authority is, or has been, contravened; or

(ca) that a standard environmental condition of a code of environmental compliance for a chapter 4 activity is, or has been, contravened by the person or public authority; or

(d) a development condition of a development approval is, or has been, contravened and the person or public authority is—

(i) an owner of the land for which the approval is granted; or

(ii) another person in whom the benefit of the approval vests.

(3) A requirement under subsection (1) or (2) must be made by written notice given to the person or public authority.

(4) The notice must state—

(a) the grounds on which the requirement is made; and

(b) the matters to be addressed by the program; and

(c) the period over which the program is to be carried out; and

(d) the day (at least a reasonable period after the notice is given) by which the program must be prepared and submitted to the administering authority; and

(e) the review or appeal details.

(5) A person of whom a requirement under subsection (1) or (2) has been made must comply with the requirement unless the person has a reasonable excuse.

Maximum penalty for subsection (5)—100 penalty units.

333 Voluntary submission of draft program

(1) A person or public authority may, at any time, submit for approval a draft transitional environmental program to the administering authority for an activity the person or public authority is carrying out or proposes to carry out.

(2) A person or public authority may submit a document under subsection (1) if it contains or provides for the matters mentioned in section 331, even though the document was not originally prepared for this Act.

(3) The document is taken to be a draft transitional environmental program.

334 Fee for consideration of draft program

A person or public authority that submits a draft transitional environmental program to an administering authority for approval must pay the authority the fee prescribed by regulation.

335 Public notice of submission for approval of certain draft programs

(1) This section applies if a person or public authority submits for approval a draft transitional environmental program that states a period longer than 3 years over which the program is to be carried out.

(2) Within 2 business days after the application date, the person or public authority must give public notice of the submission by—

(a) advertisement published in a newspaper circulating generally in the area in which the activity to which the draft program relates is, or is proposed to be, carried out; and

(b) if the program relates to premises—

(i) placing a notice on the premises; and

(ii) serving a notice on the occupiers of all premises adjoining the premises.

(3) The notice must—

(a) be in the approved form; and

(b) invite submissions on the draft program from government departments, public authorities, local governments, land-holders, industry, interested groups and persons and members of the public; and

(c) state the day (at least 10 business days after compliance with subsection (2)) nominated by the administering authority as the day by which submissions may be made to the authority.

336 Authority may call conference

(1) The administering authority may invite the person or public authority that has submitted a draft transitional environmental program and another person who has made a submission under section 335 about the program, to a conference to help it in deciding whether or not to approve the program.

(2) The administering authority must give written notice to all persons invited to attend the conference of when and where the conference is to be held.

(3) However, if the administering authority considers it is impracticable to give notice to all persons invited to attend the conference, the authority may give notice of the conference by publishing a notice in the newspapers the authority decides.

(4) The administering authority must endeavour to appoint an independent person to mediate the conference.

337 Administering authority to consider draft programs

(1) The administering authority must decide whether to approve a draft transitional environmental program submitted to it within 20 business days after—

   (a) if public notice is required under section 335—the day stated in the notice as the day by which submissions may be made to the administering authority; or

   (b) otherwise—the application date.

(2) If public notice is required to be given of the submission of the draft program, the administering authority must be satisfied public notice has been properly given before making a decision.

338 Criteria for deciding draft program

(1) In deciding whether to approve or refuse to approve the draft program or the conditions (if any) of the approval, the administering authority—

(a) must comply with any relevant regulatory requirement; and

(b) subject to paragraph (a), must also consider the following—

(i) the standard criteria;

(ii) additional information given in relation to the draft program;

(iii) the views expressed at a conference held in relation to the draft program.

(2) If the draft program is prepared because of a requirement of a development condition of a development approval, the authority may approve the draft program only if it is not inconsistent with other conditions of the approval.

339 Decision about draft program

(1) The administering authority may—

(a) approve a draft transitional environmental program—

(i) as submitted; or

(ii) as amended at the request, or with the agreement, of the administering authority; or

(b) refuse to approve a draft transitional environmental program.

(2) The administering authority may impose on an approval of a draft transitional environmental program—

(a) any conditions the authority must impose under a regulatory requirement; and

(b) any other conditions the administering authority considers appropriate.

(3) If the draft transitional environmental program is approved, the approval remains in force for the period stated in the notice of the approval given under section 340.

340 Notice of decision

(1) The administering authority must, within 8 business days after making a decision under section 339, give the person or public authority that submitted the program a written notice about the decision.

(2) If the administering authority approves the program, the notice must—

(a) identify the documents forming the approved transitional program, including any amendments under section 339(1)(a)(ii); and

(b) state any conditions imposed on the approval by the administering authority; and

(c) state the day the approval ends.

(3) If the administering authority refuses to approve the program or approves the program with conditions, the notice must be an information notice.

341 Content of approved program

An approved transitional environmental program consists of the following—

(a) the draft of the program submitted under section 332 or 333, as amended at the request, or with the agreement, of the administering authority;

(b) any conditions imposed on the program by the administering authority.

342 Substantial compliance with Act may be accepted as compliance

(1) This section applies if, under this Act, a person or public authority is required to give public notice of the submission of a transitional environmental program and the administering authority is not satisfied public notice has been properly given.

(2) The administering authority may consider and decide whether to approve the draft program if it is satisfied there has been substantial compliance with this Act.

343 Failure to approve draft program taken to be refusal

If the administering authority fails to decide whether to approve or refuse a transitional environmental program within the time it is required to make a decision on the program, the failure is taken to be a decision by the authority to refuse to approve the program at the end of the time.

Division 3 Amendment of approval for transitional environmental programs

344 Application

(1) Division 2 (other than section 335(1)) applies, with all necessary changes, to a submission by the holder of an approval for a transitional environmental program for an environmentally relevant activity to amend the approval.

(2) Without limiting subsection (1), if the holder submits for approval an amendment of the approval that extends the period over which the program is to be carried out to longer than 5 years, section 335(2) and (3) applies to the submission as if the submission were for the approval of a draft transitional environmental program.

(3) Also, the administering authority may approve the amendment only if it is reasonably satisfied it will not result in increased environmental harm being caused by the carrying out of the activity under the amended approval than the environmental harm that would be caused by carrying out the activity if the approval were not granted.

(4) Without limiting the matters to be considered in deciding the application, the administering authority must have regard to—

(a) the period under the original approval; and

(b) the period that remains under the original approval; and

(c) any change to the period under the original approval; and

(d) the nature of the risk of environmental harm being caused by the activity.

Division 4 Miscellaneous

345 Annual return

The holder of an approval of a transitional environmental program must, within 22 business days after each anniversary of the day of approval of the program, give to the administering authority an annual return in the approved form.

Maximum penalty—100 penalty units.

346 Effect of compliance with program

(1) This section applies if an approved transitional environmental program authorises the holder to do, or not to do, something under the program.

(2) The holder, or a person acting under the approval may do, or not do, the thing under the program despite anything in—

(a) a regulation; or

(b) an environmental protection policy; or

(c) an environmental authority held by the holder; or

(d) a development condition of a development approval; or

(e) a standard environmental condition of a code of environmental compliance for a chapter 4 activity; or

(f) an accredited ERMP.

(3) Without limiting subsection (2), the doing, or not doing, of the thing under the program is not a contravention of—

(a) a regulation; or

(b) an environmental protection policy; or

(c) a condition of an environmental authority held by the holder; or

(d) a development condition of a development approval; or

(e) a standard environmental condition of a code of environmental compliance for a chapter 4 activity; or

(f) an accredited ERMP.

347 Notice of disposal by holder of program approval

(1) This section applies if the holder of an approval of a transitional environmental program proposes to dispose of the place or business to which the program relates to someone else (the ***buyer***).

(2) Before agreeing to dispose of the place or business, the holder must give written notice to the buyer of the existence of the program.

Maximum penalty—50 penalty units.

(3) If the holder does not comply with subsection (2), the buyer may rescind the agreement by written notice given to the holder before the completion of the agreement or possession under the agreement, whichever is the earlier.

(4) On rescission of the agreement under subsection (3)—

(a) a person who was paid amounts by the buyer under the agreement must refund the amounts to the buyer; and

(b) the buyer must return to the holder any documents about the disposal (other than the buyer's copy of the agreement).

(5) Subsections (3) and (4) have effect despite any other Act or anything to the contrary in the agreement.

(6) Within 10 business days after agreeing to dispose of the place or business, the holder must give written notice of the disposal to the administering authority.

Maximum penalty for subsection (6)—50 penalty units.

348 Notice of ceasing activity by holder of program approval

Within 10 business days after ceasing to carry out the activity to which a transitional environmental program relates, the holder of the approval for the program must give written notice of the ceasing the activity to the administering authority.

Maximum penalty—50 penalty units.

349 Compliance with Act at completion of program

The holder of an approval for a transitional environmental program must achieve full compliance with this Act for the matters dealt with by the program at the end of the period over which the program is carried out.

338 Criteria for deciding draft program

(1) In deciding whether to approve or refuse to approve the draft program or the conditions (if any) of the approval, the administering authority—

(a) must comply with any relevant regulatory requirement; and

(b) subject to paragraph (a), must also consider the following—

(i) the standard criteria;

(ii) additional information given in relation to the draft program;

(iii) the views expressed at a conference held in relation to the draft program.

(2) If the draft program is prepared because of a requirement of a development condition of a development approval, the authority may approve the draft program only if it is not inconsistent with other conditions of the approval.

Procedural guide

Environmental Protection Act 1994
Transitional environmental program (TEP)

Part 1 – Notice requiring a draft TEP

This document is designed to assist Environmental Services officers to issue a notice requiring a draft TEP under the provisions of Chapter 7, Part 3 of the Environmental Protection Act 1994.

What is a TEP?

Section 330 of the *Environmental Protection Act 1994* (the Act) provides that a transitional environmental program (TEP) is a specific program which, when complied with, facilitates compliance with the Act for the activity to which the TEP relates by doing one or more of the following—

- reducing environmental harm caused by the activity
- detailing the transition of the activity to an environmental standard
- detailing the transition of the activity to comply with:
    - a condition (including a standard environmental condition) of an environmental authority or code of environmental compliance or
    - a development condition.

The legislative provisions in respect to TEPs can be found in Chapter 7, Parts 3 and 4 (ss330-357) of the Act.

Who can enter into a TEP?

A person or public authority may enter into a TEP voluntarily or may be required to submit a draft TEP by the Department.

When can a TEP be used?

TEPs are intended to be used where a significant change or changes are needed to be made by a person to achieve compliance. One of the reasons for this is that a person has some protection from prosecution for actions conducted under the TEP for the duration of the TEP.

(a) Requirement to submit a draft TEP

There are certain circumstances when the Department may require a person or public authority to prepare and submit for approval a draft TEP. These circumstances are set out in Section 332 of the Act.

(b) Voluntary TEP

Section 333 of the Act provides that a person or public authority may also, at any time, submit a draft TEP to the Department for an activity the person or public authority is carrying out or proposes to carry out.

(c) Program notices

A person intending to prepare and submit a voluntary TEP may give the Department a program notice under s350 of the Act. For further information in regard to program notices, see: Procedural Guide - Program notices TEP

(d) Fee for consideration of draft TEP

A person or public authority that submits a draft TEP to the Department for consideration and approval must pay the Department the fee prescribed by regulation. See: Operational policy - Transitional Environmental Program (TEP) fees

An invoice for the fees incurred should be issued to the person or public authority that has submitted the draft TEP for approval at the time when the notice stating the Department's decision is issued.

How do I successfully issue a notice requiring a draft TEP?

Officers must complete an assessment report to document the decision to issue a notice requiring a draft TEP, as well as completing the notice.

Step 1 - Complete the Assessment Report

Before completing the notice requiring a draft TEP, officers must complete an assessment report. The assessment report sets out the facts and circumstances relating to the matter and documents the decision-making process of the Department in determining whether or not to issue the notice.

The following sections of the procedural guide are a guide to completing the assessment report. The numbering and headings of the sections in the procedural guide correlate with those in the assessment report for ease of reference.

The assessment report is not intended to replicate the Departmental file. Rather it should capture all critical aspects considered by the Department in making a decision. Accordingly, officers should include relevant points only. A template assessment report may be found on the Compliance Support Materials page on the Departmental intranet.

1. Brief history of the matter

Briefly outline any historical information relevant to the decision. This information should be presented in succinct chronological dot points and include how the Department became aware of the issues that led the Department to consider issuing a notice requiring a draft TEP.

For example:

- *Previous compliance inspections have identified risks with stormwater controls and management on the site (CA123 – Ecotrack – May 2008) (CA456 – Ecotrack – May 2009).*
- *The operator made significant investments in stormwater management infrastructure in 2002, however the business has grown substantially since this period with no changes to stormwater management.*
- *Discussions with the operator during a compliance inspection on 10 May 2010 indicated an acceptance of the need to investigate and pursue further stormwater management improvements and included a discussion of the potential submission of a draft TEP.*

- *The Department wrote to the operator on 1 June 2010 to advise of the outcomes of the May compliance inspection.*
- *The Department received an Annual Return Form from the operator attaching stormwater release monitoring results demonstrating non-compliance with development approval conditions C11 and C12.*
- *The Department issued a notice requiring a draft TEP to another timber preservation/treatment operator in the region for non-compliance with development approval conditions associated with stormwater management issues.*

2. Grounds for issuing a notice requiring a draft TEP

The legislation provides in Section 332 that the Department may require the submission of a draft TEP—

- as a condition of an environmental authority or
- as a development condition of a development approval.

The Department may also require the preparation and submission of a draft TEP if satisfied that—

- an activity carried out, or proposed to be carried out by the person or authority is causing, or may cause unlawful environmental harm or
- it is not practicable for the person or public authority to comply with an environmental protection policy or regulation on its commencement or
- a condition of an environmental authority held by the person or public authority is, or has been, contravened or
- a standard environmental condition of a code of environmental compliance for a chapter 4 activity is, or has been, contravened by the person or public authority or
- a development condition of a development approval is, or has been, contravened and the person or public authority is:
    - an owner of the land for which the approval is granted or
    - another person in whom the benefit of the approval vests.

In this section, an officer must identify the relevant grounds upon which the decision to issue the notice requiring a draft TEP is based. For example:

A timber preservation/treatment operator is required under development approval conditions to ensure that stormwater released from the site meets specific limits. A compliance inspection was undertaken on the site that identified some issues with stormwater controls and management. Following the inspection, a letter was sent by the Department to the operator advising of the outcomes of the inspection and reminding the operator of its responsibilities. The operator submitted monitoring results indicating that on occasion, stormwater was released from the site in breach of the release limits.

A notice requiring a draft TEP was issued to the operator based on the following grounds:

1. *that an activity carried out, or proposed to be carried out, by the person is causing, or may cause, environmental harm and/or*
2. *that a development condition of a development approval is, or has been, contravened and the person is an owner of the land for which the approval is granted.*

3. Expand upon the grounds

The purpose of this section is to clearly identify the elements, or what the Department must 'prove' before deciding to use a notice requiring a draft TEP, and should be used to expand upon the grounds which have previously been identified. This can include identifying the specific offence or breach under investigation or any statutory requirements listed in the legislation which must be met by the Department prior to issuing the notice.

In instances where one action has resulted in multiple breaches, each breach should be listed independently. For example, a site inspection could potentially detect a number of breached conditions associated with a single development approval. In this situation each breach would need to be proven on its own merits and should be listed separately.

Each ground (including breaches or requirements) should be allocated a separate number.

4. Detail the matters considered

The purpose of the table in the assessment report is to link the elements of the breach to the evidence gathered and the conclusions formed. This is achieved by identifying:

- the elements of any specific breach or allegation
- the evidence which has been considered for each element and
- the conclusion that has been reached by the officer after considering the information sourced.

When documenting the evidence, officers should limit the information to relevant points only. This can include (but is not limited to):

- notes recorded in an officer's official notebook
- samples collected for analysis and any subsequent lab reports
- photographs and copies of documents and
- any observed actions and direct testimony received from individuals.

The last column in the table requires officers to detail the relevant facts and circumstances. Officers are encouraged to consider the accuracy and relevance of available evidence, historical details, professional expertise and the weight attributed to any direct testimony provided.

After considering the details, evidence, facts and circumstances, officers are required to set out how the TEP would deal with the issues.

5. Provide for Natural Justice

Prior to the Department making a decision which may adversely impact on an individual or group it must:

- **Notify** - Notify the individual that the Department is considering issuing a notice requiring a draft TEP
- **Respond** - Provide the individual with an opportunity to respond to the allegation and
- **Consider** - Consider any representations made by the affected person before finalising the decision.

The seriousness of the matter will dictate the process by which natural justice is provided and is likely to vary from case to case. Accordingly, officers should use their discretion in determining how to best ensure natural justice is afforded and the amount of time provided to the affected person to respond. In some circumstances it may be appropriate for an officer to discuss the above information with the affected person during a site inspection or a telephone interview and to take contemporaneous notes. In more serious circumstances a written notification which includes a specific closing date for submissions should be used.

Regardless of the manner in which natural justice is afforded, any information provided by the affected person is to be documented. The summary of information should include how natural justice was provided as well as any responses given by the affected person. For example:

Following each of the compliance inspections, the Department wrote to the site operator advising of the outcomes of the inspections and the risks identified with stormwater management on the site:

- *CA123 – May 2008*
- *CA456 – May 2009*
- *CA780 – May 2010*

On-site discussions with the operator during the May 2010 compliance inspection indicated an acceptance of the need to investigate and pursue further stormwater management improvements and included commitments to consider drafting a voluntary TEP.

Since the May 2010 compliance inspection the Department has had further discussions with the operator, raising the implications of the exceedances of the release limits observed in the stormwater quality monitoring results for the last 12 months. The operator was also informed that the Department's intention was to issue a notice requiring a draft TEP and given a period of five business days to submit any further information for consideration by the Department. The operator did not submit any formal submissions to the Department but has advised by telephone of an intention to engage a suitably qualified consultant to assist with drafting a plan of action for site upgrades.

6. Proposed requirements of the TEP

Officers are required to include the following things (amongst other things as set out in s332(4)) in the notice requiring a draft TEP—

- the matters to be addressed by the program and
- the period over which the program is to be carried out and
- the day (at least a reasonable period after the notice is given) by which the program must be prepared and submitted to the Department.

In instances where it is recommended that requirements are imposed upon the affected person, officers are required to develop proposed requirements for consideration by the delegate. As affected persons are able to seek a review of the Department's decision to impose one or more conditions/requirements, it is necessary for officers to provide justification for their inclusion.

Requirements must be specific, measureable, achievable, relevant to the activity and time-specific. For further information, refer to the Procedural Guide - Writing effective and enforceable conditions. For example:

Proposed requirement	**Justification**
The draft TEP must include a stormwater management plan in order to cease all unlawful releases of stormwater from the site on or before 30 November 2011 and be submitted to DERM by 1 July 2011.	*The development of a stormwater management plan is considered to be best practice and is a requirement which is currently being met at other ABC Pty Ltd development sites in Queensland.* *Compliance inspections conducted in May 2008, 2009*

The stormwater management plan must include the following— *1. An assessment of the existing site infrastructure, including but not limited to:* *(a) a determination of the effectiveness of existing stormwater infrastructure in controlling stormwater runoff and capturing contaminants to prevent or minimise the release of contaminants to waters and* *(b) a determination of the effectiveness of existing containment facilities associated with the storage, transport and production of materials in minimising the release of contaminants to the stormwater system and* *(c) a determination of the effectiveness of current management practices and procedures regarding the minimisation of stormwater contamination.* *2. An identification of measures to improve stormwater management on site, which must:* *(a) assess the adequacy of existing pollution control measures and* *(b) identify opportunities to reduce areas of surface contamination and minimise contact of stormwater with contaminants and* *(c) identify opportunities to separate the clean and contaminated stormwater catchments and* *(d) identify opportunities for harvesting clean stormwater for beneficial reuse and* *(e) identify the infrastructure (including its appropriate structural design) required to effectively manage stormwater in each of the stormwater catchments.* *3. A program of activities to construct measures to improve stormwater management on the site, including but not limited to:* *(a) a program of activities informed by 1 and 2 above and* *(b) stormwater quality monitoring to inform the effectiveness of (a) above.* *4. The operator is required to propose a reasonable timetable for consideration of approval by the*	*and 2010 have identified a number of exceedances of release limits of stormwater, with an increase in the last 12 months.* *The Department has consulted with the operator on a number of occasions and discussed the implications of the exceedances. However, such consultation has not resulted in any action by the operator in relation to reducing unlawful stormwater releases.* *The Department estimates that it will take at least 12 months for the operator to upgrade the site to a standard that results in compliance with stormwater release limits.* *After considering all of the issues and the estimated time-frame for the operator to achieve compliance, the Department considers that requiring the operator to provide a draft TEP is the most appropriate and effective course of action.* *As ABC Pty Ltd is currently operating in a regional area, the Department has allowed ABC Pty Ltd 9 weeks (5 weeks more than for an urban area) to develop the plan.*

administering authority for the above actions to be completed.	

7. Recommendation

The responsible officer is required to make a recommendation in relation to the alleged breach. For example:

It is the opinion of the Department that ABC Pty Ltd failed to comply with development conditions D11 and D12 of development approval IPDE123456 by allowing stormwater to leave 24 Jones Road and enter Murphy Creek. After considering all factors the Department has determined that requiring a draft TEP would be the most effective way of achieving the operator's compliance with the development conditions. It is recommended that a notice requiring a draft TEP be issued.

Administrative decisions are made based upon the balance of probabilities. This means that the decision-maker must be able to determine whether, based upon the information available, it was more likely than not that the event occurred.

Officers are encouraged to consider alternative actions/tools, the Department's enforcement guidelines, details of any consultations including site visit details and discussions with the ERA contact officer (if applicable) prior to making a recommendation. The reasonableness of proposed timeframes for the completion and submission of the draft TEP for consideration and approval, and the period over which the TEP is to be carried out, should be taken into account. For example, if the location is geographically isolated, or there is an impending wet season, the Department may consider allowing additional time for the recipient of the notice to prepare the draft TEP.

6. Approval

The assessment report is to be approved by an appropriately delegated officer. The Department's list of delegations can be found at: http://insite2.dnr.qld.gov.au/derm/delegations/

Step 2 - Complete the notice requiring a TEP

The notice requiring a draft TEP must meet a number of legislative requirements in order to be legally binding. A requirement to prepare and submit a draft TEP must be made by written notice which must state—

- the grounds on which the requirement is made and
- the matters to be addressed by the TEP and
- the period over which the TEP is to be carried out and
- the day (at least a reasonable period after the notice is given) by which the TEP must be prepared and submitted to the Department and
- the review or appeal details.

A template notice requiring a draft TEP is included in the TEP material.

The notice and the assessment report must be signed by the decision-maker.

Service of a notice requiring a draft TEP

Service means delivery to the party who will be responsible for actioning the notice. Officers are encouraged to use their discretion as to the most appropriate form of service, having regard to the recipient in question. Methods of service are provided for in ss39 and 39A of the *Acts Interpretation Act 1954* (AI Act).

A notice requiring a draft TEP may be served:

- on a person:
  - by delivering it to the person personally or
  - by leaving at, or by sending it by post, facsimile or similar facility (e.g. email) to the person's last known place of residence or business or
- on a body corporate - by leaving it at, or sending it by post, facsimile or similar facility (e.g. email) to the head office, a registered office or a principal office of the body corporate.

The date, time and method of service should be documented by contemporaneous notes, a file note, any receipts arising from the postage or any facsimile confirmations and email 'read' receipts.

What follow-up is required?

It is important that the matter is appropriately followed up to make sure that the person to whom the notice requiring a draft TEP is issued complies within the required time-frame. Follow-up is to be scheduled by the relevant officer and confirmed with the business area manager. The business area manager is responsible for ensuring follow-up is undertaken within the agreed time frame.

Once a notice has been issued, dates for the submission of the draft TEP and the review and appeal periods should be diarised and monitored. If the draft TEP is not submitted by the due date, follow-up should be carried out by way of a site visit or telephone call. The recipient should be reminded that the time-frame has expired and that non-compliance with the notice could lead to prosecution.

The recipient of the notice requiring a draft TEP may contact the Department during the period of the notice and establish legitimate reasons for non-compliance with the relevant time frame. In this instance the Department may consider granting an extension of time. However, it must be remembered that the affected person should communicate any issues with time-frames prior to their expiration. For further information regarding amendments to an issued notice requiring a draft TEP, please see the paragraph below headed 'Amendments to an issued notice requiring a draft TEP'.

What are my record-keeping responsibilities?

Officers are required to record all allegations of non-compliance in the EcoTrack system. This includes creating a complaint report, uploading copies of any relevant documents, updating the description field with commentary on actions and recording any decisions made on the enforcement measures screen (this includes a decision to take no further action). Hard copies of any relevant documents should be placed on the paper file. The Department is required to make and record an informed decision about all allegations of non-compliance.

Amendments to an issued notice requiring a draft TEP

If minor changes to the notice requiring a draft TEP or an extension of time to respond are required, the recipient of the notice should be notified in writing.

If significant changes are required, officers should, in order to avoid confusion, repeal (revoke) the original notice, and issue a fresh one on the same grounds with the necessary changes.

The repeal and issue of a fresh notice requiring a draft TEP should be carried out in the same way, and subject to the same conditions as the issuing of the original notice. Accordingly, a new assessment report should be completed and endorsed by the appropriate delegate.

It is preferable if the decision to issue a fresh notice is made by the original decision-maker. If this is not possible the decision should be made by a person with the appropriate delegation who holds a position equal to or higher than that of the original decision-maker.

Officers should also update and record the changes or the decision to repeal and re-issue the notice in EcoTrack or CIRaM and place hard copies of any documents on the paper file.

Review of decisions and appeals

The provisions regarding review of decisions and appeals may be found in Chapter 11, Part 3 of the Act.

The Act specifies that a person who is dissatisfied by a decision made by the Department in respect to a notice requiring a draft TEP may apply for a review of an original decision by submitting an application on the approved form to the Department—

- within 10 business days after the day on which the person received notice of the original decision or the Department is taken to have made the decision, or
- if there are special circumstances, whatever longer period the Department allows.

An approved form for the review of an original decision may be found at Application form - Review of Original Decision

A person who has made an application for review of an original decision may immediately apply to the Planning and Environment Court for a stay of the decision.

If the person is dissatisfied with the review decision, the person may appeal against that decision to the Planning and Environment Court by filing written notice of appeal with the registrar of the Court within 22 business days after the day the person receives notice of the decision or the decision is taken to have been made, unless the Court extends the period for filing the notice of appeal.

The court may grant a stay of a decision appealed against until such time the appeal is decided. An appeal against a decision does not affect the operation or the carrying out of a decision unless the decision is stayed.

Further information about review of decisions and appeals may be found in the Information sheet - Internal review (DERM) and appeal to the Planning and Environment Court

Non-Compliance with a notice requiring a draft TEP

Officers must respond and may take further action in relation to non-compliance with a notice requiring a draft TEP. The following issues should be considered—

- **Providing extra time** – If extra time to comply has been granted, officers should document the details of the extra time allowed and the reasons for giving the extension of time. Confirmation of these details should be provided in writing to the recipient of the notice.
- **Other tools** – It may be that using another compliance tool would be more likely to achieve compliance. For example, issuing an Environmental Protection Order (EPO) in relation to the non-compliance may be a more appropriate way to achieve compliance due to the far higher penalty for breaching the EPO.
- **Prosecution** – If no other action is likely to be effective, officers should consider prosecuting a non-compliant recipient of a notice requiring a TEP for both failure to comply with the notice as well as for the environmental harm being caused.

What penalties exist for non-compliance with a notice requiring a draft TEP?

A person must comply with a notice requiring a draft TEP, unless the person has a reasonable excuse (s332(5)).

Maximum penalty for non-compliance with a notice requiring a TEP—

For an individual – 100 penalty units or $10,000.00.

For a corporation – 500 penalty units or $50,000.00.

Procedural guide

Environmental Protection Act 1994
Transitional environmental program (TEP)

Part 2 - Considering and making a decision about a draft TEP

This document is designed to assist users to critically evaluate the content of a draft TEP and assess whether or not the proposed objectives and actions meet the legislative requirements.

Consideration of a draft TEP submitted by a person or public authority

If a person submits a draft TEP to the Department of Environment and Resource Management (the Department), the Department is required to consider the draft TEP and make a decision whether to approve or refuse the draft TEP, or to approve it with conditions.

Section 337 of the *Environmental Protection Act 1994* (the Act) provides that the Department must make its decision within 20 business days after—

- if a public notice is required under s335—the day stated in the notice as the day by which public submissions may be made to the Department or
- otherwise—the application date.

The terms *application date* and *person* are defined below.

Application date (s552)

The *application date* is important because many actions in relation to a draft TEP must be made within a certain number of days from the application date. Subsection 552(2) of the Act states that the application date relating to a draft TEP is 10 business days after the day it has been submitted to the Department.

However, if the Department requires additional information about the draft TEP within 8 business days after the day it has been submitted, the application date is the day the Department states in a written notice to the applicant as being the application date (s552(3)). This day must not be earlier than two business days after the person has received the written notice (s552(6)).

If, within 8 business days after a person submits a draft TEP, the Department advises the person who made the submission that the TEP (or proposed amended TEP) does not contain or provide for a matter mentioned in s331 (content of a program), and the person is required by the Department to amend the submission so that the TEP (or proposed amended TEP) is compliant with s331 and to resubmit the submission to the Department, the application date is the day that is 10 business days after the day the amended TEP is submitted to the Department.

Or, if the Department requires additional information about the amended TEP within 8 business days after the day the amended TEP is submitted to the Department, the application date is the day the Department states in a written notice to the applicant as being the application date (s552(5)). This day must not be earlier than 2 business days after the person has received the written notice (s552(6)).

Person

The term *person* includes an individual, public authority or corporation.

Fee for consideration of a draft TEP (s334)

A person that submits a draft TEP to the Department for consideration and approval must pay to the Department the fee prescribed by regulation. See: Operational policy - Transitional Environmental Program (TEP) fees

An invoice for the fees incurred should be issued to the person that has submitted the draft TEP for approval at the time when the notice stating the Department's decision is issued.

What must be included in the content of a draft TEP? (s331)

Section 331 of the Act requires that a draft TEP must, for the activity to which it relates—

(a) state the objectives to be achieved and maintained under the TEP for the activity and

(b) state the particular actions required to achieve the objectives, and the day by which each action must be carried out, taking into account:

- (i) the best practice environmental management for the activity and
- (ii) the risks of environmental harm being caused by the activity and

(c) state how any environmental harm that may be caused by the activity will be prevented or minimised, including any interim measures that are to be implemented and

(d) if the activity is to transition to an environmental standard, state:

- (i) details of the standard and
- (ii) how the activity is to transition to the standard before the TEP ends and

(e) if the activity is to transition to comply with a condition of an environmental authority or code of environmental compliance, or a development condition, state:

- (i) details of the condition and how the activity does not comply with it and
- (ii) how compliance with the condition will be achieved before the TEP ends and

(f) state the period over which the TEP is to be carried out and

(g) state appropriate performance indicators at intervals of not more than six months and

(h) provide for monitoring and reporting on compliance with the program.

Is public notice required? (s335)

Public notice is required where the person submits a draft TEP for approval that states the TEP is to be carried out over a period of longer than three years. Within 2 business days after the application date, the person must give public notice of the submission by:

- an advertisement published in a newspaper circulating generally in the area in which the activity to which the draft program relates is, or is proposed to be, carried out and
- if the program relates to premises, a notice must also be placed on the premises and served on the occupiers of all adjoining premises

- invite submissions on the draft TEP (s335(3)(b)) and state the day (at least 10 business days after the advertisement and service of notice) nominated by the Department as the day by which submissions may be made to the Department.

The notice must meet the requirements of the Act,

In what circumstances may the Department call a Conference? (s336)

The Department may invite the person that has submitted a draft TEP, and another person that has made a submission under section 335 about the TEP, to a conference to help it decide whether or not to approve the draft TEP. See section 336 of the Act for details of notice and other requirements regarding conferences.

Other consultation and considerations

Depending on the content of the draft TEP, officers may need to consult with other business units or Departments in order to ensure that the risks from, and effects of, the draft TEP have been fully understood. For example, if the draft TEP involves releases of water, Queensland Health and/or the Office of the Water Supply Regulator should be consulted. Releases to air may also require consultation with Queensland Health.

Officers should consider whether a formal risk assessment should be undertaken to ensure that any risks from approving the draft TEP are identified and adequately managed.

Consideration of draft TEPs (s337)

The Department must decide whether to approve a draft TEP submitted to it within 20 business days after the application date. Or, if a public notice is required under s335, the Department must make a decision 20 business days after the day stated in the notice as the day by which submissions may be made to the Department. If public notice of the submission of the draft TEP is required to be given, the Department must be satisfied that public notice has been properly given before making a decision (s337(2)).

If the Department fails to decide whether to approve or refuse a TEP within the time it is required to make a decision, the failure is taken to be a decision by the Department to refuse to approve the program at the end of the time (s343).

What must be taken into consideration? (s338)

When deciding whether or not to approve the draft TEP or the conditions (if any) of the approval, the Department—

- must comply with any relevant regulatory requirement and
- subject to the above, must also consider the following:
  - the standard criteria
  - additional information given in relation to the draft TEP and
  - the views expressed at a conference held in relation to the draft TEP.

If the draft TEP is prepared because of a requirement of a development condition of a development approval, the Department may approve the draft TEP only if it is not inconsistent with other conditions of the approval.

Decision about draft TEP (s339)

Section 339 of the Act provides that the Department may—

- approve a draft TEP as submitted or
- approve a draft TEP as amended at the request, or with the agreement, of the Department or
- refuse to approve a draft TEP.

If the Department approves the draft TEP it may impose—

- any conditions the Department must impose under a regulatory requirement and
- any other conditions considered appropriate by the Department.

If the draft TEP is approved, the approval remains in force for the period stated in the notice of the approval given pursuant to s340 of the Act.

How does an officer successfully consider and make a decision about a draft TEP?

Officers must complete an assessment report to document the decision whether to accept the draft TEP (with or without conditions), to require amendments to the draft TEP or to reject the draft TEP. If the draft TEP is accepted (with or without conditions) or rejected, a notice of decision must be issued under s340 of the Act.

Step 1 - Complete the assessment report

Before issuing a notice of decision under s340 of the Act, officers are required to complete an assessment report which sets out the facts and circumstances relating to the matter and documents the decision-making process used in determining whether to approve or refuse the draft TEP (with or without conditions).

The assessment report lists all the matters that must be considered by officers during the decision-making process. This includes the criteria by which the TEP must be assessed, the matters that must be addressed by the draft TEP and the matters that officers must consider when making a decision about the draft TEP. Each matter has checkboxes beside it, as well as text fields for officers to provide further information if necessary. The text fields contain explanatory notes indicating the types of information that is to be provided. Officers should check the relevant checkboxes to indicate that the particular matter has either been adequately addressed or is not applicable to that particular draft TEP. If a matter is applicable, but has not been adequately addressed, the checkbox should not be checked, and details as to how the particular matter has not been adequately addressed should be inserted in the text field provided.

The following sections of the procedural guide are a guide to completing the assessment report. The numbering and headings of the sections in the procedural guide correlate with those in the assessment report for ease of reference. Officers should refer to the procedural guide for information while completing the assessment report.

The assessment report is not intended to replicate the Departmental file. Rather, it is designed to capture all critical aspects that have let to the Department's decision. Accordingly, officers should limit the information included to relevant points only.

A template assessment report may be accessed at the Compliance Support Materials site on the DERM intranet.

1. Brief history of the matter

Briefly outline any historical information relevant to this decision. This information should be presented in succinct, chronological dot points and should include the reasons why a draft TEP is now being considered, for example, as a result of a program notice, voluntary submission or in response to a notice requesting the submission of a TEP.

2. Matters that must be considered when making a decision about the draft TEP (s338)

A significant amount of care should go into checking and considering the potential effects of the draft TEP, because by approving the draft TEP, the officer is authorising everything it permits.

Accordingly, the assessment criteria are an instrumental part of the decision-making process. Firstly, they establish the critical objectives that the draft TEP must achieve and how the content of the draft TEP will deliver on these objectives. Secondly, from the view of compliance and enforceability, and to establish that the draft TEP passes the *SMART* test, the requirements must be specific, measureable, achievable, relevant and time-specific. These are vital considerations given that in future, the Department may have to establish beyond a reasonable doubt that the TEP has not been complied with in order to take action against the person for failure to comply with the TEP. For this reason, the contents of the draft TEP must be clearly drafted, unambiguous and easily auditable.

More information about drafting SMART requirements and conditions may be found in the Procedural guide - Writing effective and enforceable conditions

Achieving compliance with the Act (s330)

A TEP should, for the activity to which it is concerned, achieve compliance with the Act by doing one or more of the following things—

- reducing environmental harm caused by the activity
- detailing the transition of the activity to an environmental standard
- detailing the transition of the activity to comply with:
    - a condition, including a standard environmental condition, of an environmental authority or code of environmental compliance or
    - a development condition.

The term *environmental standard* is defined as being:

- an environmental standard (however called) set out, or otherwise provided for, in a regulation under the Act or
- an outcome or objective that is directed at protecting or enhancing environmental values set out in an environmental protection policy.

A *standard environmental condition* for an environmental authority or code of environmental compliance means a standard environmental condition approved by the Minister pursuant to s549 of the Act.

A *development condition* of a development approval means a condition of the approval imposed by, or because of a requirement of, the Department if it is the assessment manager or concurrence agency for the application for the approval.

The draft TEP must set out how the activity is currently in non-compliance with the Act and how the person proposes to make the activity compliant. If it is not clear from the information provided in the draft TEP that by doing one or more of these things compliance with the Act will be achieved by the end of the operative period of the TEP, the draft TEP must not be approved.

Content of the TEP (s331)

A TEP, for the activity to which it relates, must include the following—

(a) Objectives to be achieved and maintained under the TEP

A draft TEP must clearly set out what it is trying to achieve. For example:

EXAMPLE 1

To bring the operator into compliance with conditions G12 and H5 of development approval 123456

EXAMPLE 2

To prevent or minimise environmental harm caused by the migration of landfill gas.

The objectives should be as specific and clear as possible so that, if the draft TEP is approved, the Department can assess whether the objectives have been met.

(b) State the particular actions

The draft TEP must set out the actions that the person will carry out in order to achieve the objectives. It is important that the actions are as definite, specific and as clear as possible. If they are vague or uncertain, it will be difficult for the Department to assess whether the person is doing what they have said they will do, which may prevent the Department from taking enforcement action in future. Each action must have a due date by which it will be completed, and must comply with the SMART principles.

Progress reporting dates and final reporting dates should be included in the actions.

In stating the particular actions required to achieve the objectives, the draft TEP must take into account best practice environmental management. Officers should refer to s21 of the Act for a definition of *best practice environmental management*.

(c) Prevention and minimisation of environmental harm

The risks of environmental harm being caused by the activity should also be taken into account. The draft TEP must state how any environmental harm that may be caused by the activity will be prevented or minimised, including any interim measures that are to be implemented.

(d) Transition to an environmental standard

If the objective of the draft TEP is to transition to meet an environmental standard, the draft TEP must provide details of the standard and set out how the activity is to transition to the standard before the operative period of the TEP comes to an end. Please see ‘Achieving compliance with the Act’ above for a definition of *environmental standard*.

(e) Transition to comply with a condition of an environmental authority or code of environmental compliance, or a development condition

If the objective of the draft TEP is for an activity to transition to comply with a condition of an environmental authority or code of environmental compliance, or a development condition, the draft TEP must set out each condition and detail how the activity does not comply with the condition. The draft TEP must also state how compliance with the condition will be achieved before the end of the operative period of the TEP.

(f) Period over which the TEP is to be carried out

To be approved, the draft TEP must state the period over which the TEP is to be carried out. If the person has submitted for approval a draft TEP that states it will be carried out over a period longer than three years, the person must give public notice of the submission within 2 business days after the application date in accordance with s335 of the Act.

(g) Performance indicators

The draft TEP must state appropriate performance indicators at intervals of not more than 6 months. The performance indicators must show how the applicant is progressing in achieving the objectives of the TEP. The indicators must also be capable of being measured and be specific enough to enable the Department to assess with certainty whether or not they have been met. The date on which each performance indicator will be met must be set out in the TEP.

(h) Monitoring and reporting

The draft TEP must provide for sufficient monitoring and reporting on compliance with the program. It should provide for the person to monitor and report on—

- the carrying out of the actions
- whether or not the objectives are being achieved
- whether or not the required time-frames are being met and
- any environmental and scientific testing.

The draft TEP should also allow for the person to provide—

- reports on progress with the TEP, including any failure to carry out prescribed actions by the stipulated dates
- reports on any environmental monitoring requirements (including interpretation) and
- a final report to the Department demonstrating that compliance with the Act has been achieved.

Regulatory requirements (s338(1)(a))

Sections 46-64 of the *Environmental Protection Regulation 2008* specify the matters that must be considered when the Department is making environmental management decisions. An *environmental management decision* is a decision under the Act for which the Department is required to comply with regulatory requirements. All matters relevant to the draft TEP must be considered when making a decision about it, for example, if there are certain matters specified where release of water to land is contemplated.

Standard criteria (s338(1)(b)(i))

As stated above, the Department **must** consider the standard criteria, set out below, before deciding whether or not to approve the draft TEP—

- **The principles of ecologically sustainable development as set out in the 'National Strategy for Ecologically Sustainable Development (ESD)'**

  Consider the following guiding principles:

  - Has the decision effectively integrated long- and short-term economic, environmental, social, and equity considerations?

- Has due regard been given to the precautionary principle? In other words, where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.
- Does the decision have due regard to the global dimensions of environmental impacts and policies?
- Does the decision assist in the development of a strong, growing and diversified economy, which can enhance the capacity for environmental protection?
- Has the need to maintain and enhance international competitiveness in an environmentally sound manner been considered when making the decision?
- Have cost effectiveness and flexible policy instruments (for example, improved valuation, pricing and incentive mechanisms) been adopted?
- Does the decision/action allow for broad community involvement on issues that affect them?

- **Any applicable Environmental Protection Policies (EPPs)**
  - Is the draft TEP consistent with the EPPs on water, air, noise and waste (where relevant)?
- **Any applicable Commonwealth, State or local government plans, standards, agreements or requirements**
  - Consider guidelines such as the State and Regional Coastal Plan, National Health and Medical Research Council (NHMRC) and the Australian and New Zealand Environment and Conservation Council (ANZECC) Guidelines.
- **Any applicable environmental impact study, assessment or report**
  - Consider any findings or recommendations that are relevant to the draft TEP.
- **The character, resilience and values of the receiving environment**
  - Does the draft TEP have regard to the environmental values of the receiving environment?
  - What is the impact on the values of the actions contained in the draft TEP?
- **All submissions made by the applicant and submitters**
  - Consider any submissions made by the applicant and anyone who properly makes a submission about the draft TEP.
- **Best practice environmental management for the activity to which the draft TEP relates**
  - Analyse how approving the draft TEP with or without conditions will ensure that best practice environmental management is achieved.
- **The financial implications of the requirements**
  - Explore the financial implications for the client in complying with conditions of the TEP. Are they reasonable in the particular circumstances?
- **The public interest**
  - Is it in the interest of the community that the draft TEP be approved?
- **Any applicable site management plan**
  - If there is a site management plan for contaminated land (approved under Chapter 7, Part 8 of the Act), and is the draft TEP consistent with the site management plan? If not, is the inconsistency necessary for addressing the matters in the draft TEP? How will any inconsistency be reconciled?

Consult with the Contaminated Land Unit as early as possible when there are any contaminated land issues.

- **Any relevant integrated environmental management system or proposed integrated environmental management system (IEMS)**
  - Is the draft TEP consistent with the IEMS? If not, is the inconsistency necessary for addressing the matters in the draft TEP? How will any inconsistency be reconciled?
- **Any other matter prescribed by a regulation**
  - See 'regulatory requirements' above.

Additional information (s338(1)(b)(ii))

The Department must consider any additional information given in relation to the draft TEP. Has all supporting information provided by the applicant been considered? Having considered the draft TEP and any supporting information, is it clear that the draft TEP achieves compliance with the Act?

Views expressed at a conference (s338(1)(b)(iii))

If a conference has been held as part of a public notice process, the views expressed at that conference in relation to the draft TEP must be considered and the reasons for having regard to, or not having regard to, those views must be recorded.

Consistency with development conditions of a development approval (s338(2))

If the draft TEP is prepared because of a development condition of a development approval, the Department must not approve the draft TEP unless it is consistent with other conditions of the development approval.

Public notice of submission of draft TEP (s337(2)) and substantial compliance with the Act (s342)

If public notice is required, before approving the draft TEP, ensure that the person or public authority submitting the draft TEP has properly given public notice and complied with the requirements of s335 of the Act.

The Department must be satisfied that the public notice has been properly given before making a decision (s337 of the Act). If the Department is not satisfied that public notice has been properly given, it may consider and decide whether to approve the draft program if it is satisfied there has been substantial compliance with the public notice requirements of the Act (s342).

See 'Is public notice required?' above for further information regarding public notice.

Satisfaction that the draft TEP meets the requirements of the Act

Having considered all of the above matters, officers completing the assessment report must decide whether they are satisfied the draft TEP adequately addresses all of the relevant matters. If any of the issues in the assessment report were answered 'no', officers should proceed to section 4. Otherwise, proceed to section 3.

3. Request for further information and/or amendments to the draft TEP

In some cases the draft TEP may substantially address the required matters, but cannot be approved because some matters have not been adequately addressed. In this situation, the Department may request that further information be provided or that particular amendments be made to the draft TEP. It is important to recognise that if there are major problems with the draft TEP, or a large number of matters that have not been addressed by the draft TEP, officers should recommend to the Delegate that it not be approved and a notice of decision should be sent to the person or public authority that submitted the draft TEP advising of this decision.

However, if it is likely that the draft TEP would be approved if further information is provided or some changes are made, it is preferable for the Department to write to the person submitting the draft TEP and request the further information and/or amendments, rather than approve the TEP subject to conditions, owing to the fact that conditions may be difficult to enforce. See 'Key considerations regarding conditions' below for further information.

Officers should consult with their supervisor when considering whether to request further information or amendments to the draft TEP, and in formulating the amendments required to be made (if any). A request for amendments to a draft TEP should be made in writing. If, after the draft TEP is amended, it is approved, the amended TEP will form part of the approved TEP.

It is highly recommended that a request for amendments be made within 8 business days after the draft TEP is submitted to the Department, as this means that the application date will then be 10 business days after the date that the amended TEP is submitted to the Department. Consequently, the Department will have additional time to consider the amended TEP and make a decision whether or not to approve it.

Time-frames

For information regarding a change in time-frames if further information is sought or the Department requests amendments to the draft TEP, see the section 'Application date' above.

Minor amendments and/or further information

If only very minor amendments are necessary, officers should consider suspending the decision-making process, so as to provide the opportunity to the person submitting the draft TEP to make the requested amendments. If the requested amendments are made, the assessment report can then be completed to reflect the amendments. Then, if all relevant matters have been adequately addressed, officers may recommend that the Delegate approve the draft TEP.

More significant amendments

If the amendments required are more significant or complicated, officers should list the requested amendments in the assessment report and recommend that the Delegate approve a request for the required amendments. Then, if the amendments are provided by the person submitting the draft TEP, officers must complete a fresh assessment report and provide a new recommendation to the Delegate.

4. Approval of the draft TEP

The assessment report lists all the matters that must be considered by officers during the decision-making process, with checkboxes beside each matter. At least one checkbox must be checked beside each matter before a decision can be made to approve the draft TEP.

Key considerations regarding conditions

The Act does make provision for an approval of a draft TEP to be subject to conditions the Department considers appropriate. However, the enforceability of conditions placed on a TEP is unclear. Accordingly, conditions should not be imposed except for minor matters. Conditions must not be used to alter the terms of the TEP itself. If the TEP is not satisfactory, it must be refused or amendments sought from the applicant. Conditions in the notice of decision should not be used as a quasi-development approval, or to alter or amend the TEP to meed the requirements of the Act.

Financial assurance conditions (ss364-367)

Under s364 of the Act, the Department may, by condition of an approval of a TEP, require the holder of the approval to give the Department financial assurance as security for—

- compliance with any conditions of the TEP and
- costs or expenses, or likely costs or expenses, that the Department incurs, or might reasonably incur, in taking action to:
  - prevent or minimise environmental harm or rehabilitate or restore the environment, in relation to the carrying out of an activity under a TEP approval or
  - secure compliance with the TEP, or any conditions of the TEP, for which financial assurance has been given.

However, under s364(2) the Department may impose a condition requiring a financial assurance to be given only if it is satisfied that the condition is justified, having regard to—

- the degree of risk of environmental harm being caused, or that might reasonably be expected to be caused, by the activity carried out, or to be carried out, under the program and
- the likelihood of action being required to rehabilitate or restore and protect the environment because of environmental harm being caused by the activity and
- the environmental record of the holder.

Section 365 of the Act provides that before approving a draft TEP subject to the condition that financial assurance be given, the Department must give the person who submitted the draft TEP a written notice that must –

- state the grounds for the condition and
- state the form and extent of the financial assurance and
- invite the person to make representations to the Department to show why the approval of the draft TEP should not be subject to the condition and
- state the period (at least 22 business days after the notice is given to the person) within which the representations may be made and
- the representations must be made in writing (s365(3)).

Within 20 business days after the end of the period stated in the notice (s365(4)), the Department must—

- consider the representations properly made by the person and
- if the Department gives the approval subject to the condition that the holder of the approval give financial assurance—the Department must give written notice to the person giving reasons for imposing the condition.

5. Refusal to approve a draft TEP

The draft TEP cannot be approved unless a checkbox has been checked next to each matter listed on the assessment report, either to confirm the matter has been adequately addressed, or to indicate that the matter is not applicable to the draft TEP. If a checkbox has not been checked next to a matter, officers are to provide details in the text field provided.

If any of the required matters are not addressed in the draft TEP, officers should either recommend a refusal of the draft TEP, or seek further information or amendments to the draft TEP from the person that submitted it. (See 'Request for further information and/or amendments to the draft TEP' above). If the deficiencies in the draft TEP are too serious to be addressed by further information and amendments, the Department should refuse to approve the draft TEP.

6. Provide for natural justice

The Department must ensure that decisions are made in a fair and consistent manner. This includes ensuring that the affected individual is provided with 'natural justice' (that they are given an opportunity to make their case for why the decision should go in their favour) and that people involved in making the decision are free from bias or the perception of bias.

Any submissions made by the applicant that have not already been considered earlier in the assessment report process must be documented in section 5 of the assessment report.

7. Recommendation

Officers are required to make a recommendation as to whether or not the draft TEP should be approved (with or without conditions) or refused.

8. Approval

An officer with the appropriate delegation must consider the contents of the assessment report and the recommendation and make a decision about whether to approve (with or without conditions) or refuse the draft TEP. The Department's list of delegations can be found on the Department's intranet at http://insite2.dnr.qld.gov.au/derm/delegations/.

Step 2 – Complete the notice of decision

Section 240 of the Act provides that within 8 business days of making a decision under s339, the Department must give the person or public authority that submitted the draft TEP a written notice of the decision (the notice of decision).

If the delegate approves the draft TEP, the notice of decision must—

- identify the documents forming the approved TEP, including any amendments under s339(1)(a)(ii) and
- state any conditions imposed on the approval by the Department and
- state the day the approval ends.

If the draft TEP is approved, the approval remains in force for the period stated in the notice of decision (s339(3)).

Content of approved program (s341)

An approved TEP consists of the following—

- the draft program submitted under section 332 or 333, as amended at the request, or with the agreement of the Department

- any conditions imposed on the program by the Department.

Information notice

If the Department refuses to approve the draft TEP, or approves it with conditions, the notice of decision given to the person or public authority that submitted the program must be an information notice (s340(3)).

An *information notice* means a written notice stating—

- the decision and
- the reasons for the decision and
- the review and appeal details.

Officers must issue an invoice for the fees for consideration of the draft TEP to the person or public authority that has submitted the draft TEP for approval at the time when the notice stating the Department's decision is issued. See: Operational policy - Transitional Environmental Program (TEP) fees

What is the effect of compliance with the approved TEP? (s346)

An approved TEP protects the holder, or a person acting under the approval, from enforcement action for non-compliance with the relevant—

- regulation or
- environment protection policy (EPP) or
- environmental authority (EA) held by the holder or
- development condition of a development approval (DA) or
- standard environmental condition of a code of environmental compliance for a chapter 4 activity or
- accredited environmental risk management plan (ERMP) under the Great Barrier Reef protection measures.

What follow-up is required?

It is an offence for the holder of an approved TEP to contravene the program. Officers should diarise all performance indicator requirements listed in the program or conditions and ensure they are monitored for compliance.

Officers are encouraged to use tools such as reminders in Microsoft outlook to ensure the matter is followed up in a timely manner.

Review of decisions and appeals

The provisions regarding review of decisions and appeals may be found in Chapter 11, Part 3 of the Act.

The Act specifies that a person who is dissatisfied by a decision made by the Department about a draft TEP, may apply for a review of an original decision by submitting an application on the approved form to the Department—

- within 10 business days after the day on which the person received notice of the original decision or the Department is taken to have made the decision, or

- if there are special circumstances, whatever longer period the Department allows.

An approved form for the review of an original decision may be found at Application form - Review of Original Decision

A person who has made an application for review of an original decision may immediately apply to the Planning and Environment Court for a stay of the decision.

If the person is dissatisfied with the review decision, the person may appeal against that decision to the Planning and Environment Court by filing written notice of appeal with the registrar of the Court within 22 business days after the day the person receives notice of the decision or the decision is taken to have been made, unless the Court extends the period for filing the notice of appeal.

The court may grant a stay of a decision appealed against until such time the appeal is decided. An appeal against a decision does not affect the operation or the carrying-out of a decision unless the decision is stayed.

Further information about review of decisions and appeals may be found in the Information sheet - Internal review (DERM) and appeal to the Planning and Environment Court

What penalties exist for a contravention of a requirement of a TEP (s432)?

The holder of an approval of a TEP, or a person acting under a TEP, must not wilfully contravene a requirement of the program.

Maximum penalty—1665 penalty units ($166,500.00) or 2 years imprisonment.

The holder of an approval of a TEP, or a person acting under a TEP, must not contravene the program.

Maximum penalty—835 penalty units ($83,500.00).

The maximum penalty for a corporation is five times the penalty for an individual.

What penalties exist for contravention of a condition of approval (s432A)?

A person must not, without reasonable excuse, contravene a condition of an approval of a transitional environmental program.

Maximum penalty—835 penalty units ($83,500.00)

The maximum penalty for a corporation is five times the penalty for an individual.

Assessment report

Environmental Protection Act 1994
Transitional Environmental Program (TEP)

Part 1 – Notice requiring a draft TEP

This document is intended for internal use to assist Environmental Services officers to record the information considered by the Department when deciding to issue a notice requiring a draft TEP.

Identifying Details	
Compliance activity number	Number
EcoTrack number	Number
Permit number:	Permit number (if applicable)
File number:	File Number
Applicant number:	Number
Trading as:	Trading as details (if applicable)
Registered business address:	Registered business address

Note:

1. Assessment reports recommending a decision be made are to be structured in the format shown below.
2. Explanatory notes for completing the report are given under each heading.
3. The report is to be endorsed by the responsible officer, supervisor and the delegated decision-maker.

1. Brief history of the matter

Briefly outline any historical information relevant to this decision in chronological order.

Briefly outline the historical information in chronological order.

2. Grounds for issuing a notice requiring a draft TEP

Section 332 of the *Environmental Protection Act 1994* provides that the Department may require the submission of a draft Transitional Environmental Program (TEP) in certain circumstances. Identify on which of the following grounds the decision to issue a notice requiring a draft TEP is based.

The Department may require a person or public authority to prepare and submit to it for approval a draft TEP:

☐ As a condition of an environmental authority (EA).

OR

Department of Environment and Resource Management
www.derm.qld.gov.au ABN 46 640 294 485
Queensland Government

☐ As a development condition of a development approval (DA).

The Department may also require a person or public authority to prepare and submit to it for approval a draft Transitional Environmental Program if it is satisfied:

☐ An activity carried out, or proposed to be carried out, by the person or authority is causing, or may cause, unlawful environmental harm.

OR

☐ It is not practicable for the person or public authority to comply with an environmental protection policy or regulation on its commencement.

OR

☐ That a condition of an environmental authority held by the person or public authority is, or has been, contravened.

OR

☐ That a standard environmental condition of a code of environmental compliance for a Chapter 4 activity is, or has been, contravened by the person or public authority.

OR

☐ A development condition of a development approval is, or has been, contravened and the person or public authority is:

- ☐ an owner of the land for which the approval is granted or
- ☐ another person in whom the benefit of the approval vests.

3. Expand Upon the Grounds

Expand upon the grounds identified for issuing the notice requiring a draft TEP. This can include identifying an alleged offence or any statutory requirement which must be met prior to the Department issuing the notice.

Each ground should be listed independently and allocated a separate number.

Number	Specific Ground
1	Example: ABC Pty Ltd is a timber preservation/treatment operator. While conducting timber preservation/treatment activities, ABC Pty Ltd has released stormwater from its operating site that does not comply with release limits, thereby causing unlawful environmental harm. If ABC Pty Ltd does not upgrade its site and improve its stormwater management system, it is likely that non-compliant releases of stormwater from the site will continue, thereby causing further environmental harm.
2	
3	
4	

4. Detail the Matters Considered

The purpose of the following table is to ensure that there is evidence to support the use of the statutory tool. This is achieved by linking the elements of the breach to the evidence gathered and the conclusions formed (I.e. the facts and circumstances).

When analysing evidence or developing the facts and circumstances, officers are encouraged to consider the accuracy and relevance of the information available, historical details, professional expertise and the weight attributed to any direct testimony provided.

Elements of the offence or legislative requirement *List the elements of any grounds for issuing the notice requiring a TEP*	**Evidence** *Identify the evidence considered which is relevant to the elements or requirement (i.e. statements, photographs, and recordings)*	**Facts and Circumstances** *Detail the facts and circumstance that support the Department's findings.*
Number 1 (Number taken from Section 2)		
An activity carried out, or proposed to be carried out by the person.........	Compliance Inspection CA123: Notes from officer's official notebook taken during site inspection on 20 May 2008.	ABC Pty Ltd carries out timber preservation and treatment activities at its site at 123 Creek Road, Murphyville. The inspection has shown that whilst the operators have some stormwater controls in place, it is apparent that the current system would not be able to effectively manage an increase in production and/or increased rain levels.
	Photographs (x20) of the ABC Pty Ltd site taken during the site inspection on 20 May 2008.	Photographs taken of the existing stormwater management infrastructure, including the stormwater catchments show that the catchments are 80% full. An increase in production or heavy rain is likely to fill the catchments to overflowing.
Is causing, or may cause, unlawful environmental harm.....	Compliance inspection CA456: Notes from officer's official notebook taken during compliance inspection on 3 May 2009.	A visual inspection of the stormwater catchments show that they are 90% full.
	Copy of letter to ABC Pty Ltd from the Department dated 12 May 2010.	Letter to ABC Pty Ltd outlining the Department's concerns in relation to stormwater controls and management on the site and reminding the site operator of its responsibilities.

	Copy of the company's stormwater quality monitoring results for the past 12 months.	The stormwater quality monitoring results indicate that ABC Pty Ltd has exceeded its release limits on 2 occasions in the past 12 months.
	Compliance inspection CA780: Copy of the site operator's stormwater quality monitoring results for the previous 12 months collected from the operator during compliance inspection on 15 May 2010.	The stormwater quality monitoring results indicate that the operator has exceeded stormwater release limits on 6 occasions in the past 12 months.
	Compliance inspection CA780: Notes from officer's official notebook taken during compliance inspection on 15 May 2010.	During the site inspection, Departmental officer Mary Green had further discussions with the site operator regarding the implications of the repeated exceedances of the stormwater release limits. The site operator says that ABC Pty Ltd has made significant investment in stormwater management infrustructure in 2005. However, the business has grown substantially since this time. During the discussions the site operator indicated an acceptance of the need to investigate and pursue further stormwater management improvements and included a commitment to consider drafting a voluntary TEP.
	File note written by environmental officer Mary Green on 23 June 2010.	ABC Pty Ltd is carrying out timber preservation/treatment activities at a site at 123 Creek Road, Murphyville. Visual inspections of the site in 2008, 2009 and 2010 have indicated that the business has grown substantially and the stormwater managment system and infrastructure are no longer coping and require improvements. Annual stormwater release quality monitoring records for 2009 and 2010 indicate that ABC Pty Ltd has exceeded its stormwater relase limits on a number

		of occasions. The repeated exceedences of the stormwater release limits by ABC Pty Ltd are causing unlawful environmental harm and may cause further unlawful environmental harm. The operator indicated that it would voluntarily submit a draft TEP. However, a voluntary draft TEP has not been submitted. In the circumstances, the Deparment considers that a notice requiring a draft TEP should be issued to ABC Pty Ltd.
Number 2		
Number 3		

5. Natural Justice

The investigating officer is required to notify the affected person that the Department is considering issuing a notice requiring a TEP and that the individual may make representations to the Department as to why this action should not be taken. Any information provided by the affected person is to be documented and considered.

☐ The person has been provided with the opportunity to put their side of the story forward.

Describe how this was achieved.

☐ All information and/or defences provided were considered.

Describe any information or defences provided.

☐ The Department has considered the information or defences provided.

Describe the consideration given and the conclusions formed by the Department based on the information provided.

☐ The decision-maker and the environmental officer are free from bias or the perception of bias.

6. Recommended Conditions (if appropriate)

If appropriate, please list any proposed conditions below. In order to ensure conditions are enforceable, they should be SMART - Specific, Measureable, Achievable, Relevant and Time-specific. Refer to the Procedural Guide - Writing effective and enforceable conditions

To ensure the conditions are reasonable, officers are required to provide justification for the inclusion of the condition.

Proposed Requirement	**Justification**
Proposed requirement	Justification
Proposed requirement	Justification
Proposed requirement	Justification
Proposed requirement	Justification
Proposed requirement	Justification
Proposed requirement	Justification
Proposed requirement	Justification
Proposed requirement	Justification
Proposed requirement	Justification
Proposed requirement	Justification
Proposed requirement	Justification
Proposed requirement	Justification
Proposed requirement	Justification

7. Recommendation

The responsible officer is required to make a recommendation in relation to the allegation.

Recommendation:

8. Approval

Environmental Officer	Supervisor
Print Name:	**Print Name:**
Position:	**Position:**
Date:	**Date:**

Delegate Decision-Maker	Approve / Reject Recommendation (Circle One)

Reasons for Decision *For example:* *I approve this recommendation based upon the information set out above.* *Or, I approve this decision for the reasons set out above and I note Mr Rodgers has previously received a warning letter in relation to this matter.* *Or, I reject the above recommendation as I consider it more appropriate for the Department to take an educational approach to this breach.*
Print Name:
Position:
Date:

Department of Environment and Resource Management

Assessment Report

Environmental Protection Act 1994
Transitional environmental program (TEP)

Part 2 - Considering and making a decision about a draft TEP

This document is for internal use to assist users in critically evaluating the content of a draft TEP and making a decision to either approve (with or without conditions) or refuse a draft TEP.

Identifying details	
Compliance activity number	Compliance activity number
Ecotrack number	Ecotrack number
Permit number	Permit number
File number	File number
Applicant name	Applicant name
Registered office or place of business	Registered office or place of business
Date draft TEP received.	Date *Note: The department has 20 business days after the application date in which to make a decision in relation to the draft TEP.*

Note:

1. Assessment reports recommending a decision be made are to be structured in the format shown below.
2. Explanatory notes for completing the report are given under each heading.
3. The report is to be signed by the investigating officer, supervisor and the delegated decision-maker.

Considering and making a decision about a draft TEP

The legislative provisions in regard to transitional environmental programs (TEPs) are found in Chapter 7, Part 3 of the *Environmental Protection Act 1994* (the Act).

A person or public authority may submit a draft TEP to the Department for consideration, either voluntarily under s333 of the Act or pursuant to a notice requiring a draft TEP issued by the Department under s332 of the Act. Once a draft TEP is received, the Department must consider it and decide whether or not to approve it within 20 business days after the application date or, if public notice is required under s335, within 20 business days of the day stated in the notice as the day by which submissions must be made to the Department. Detailed below are the matters that the Department must consider when making a decision about a draft TEP.

1. Brief history of the matter

Briefly outline any historical information relevant to this decision.

Provide historical information relating to the matter in succinct, dot point form.

2. Matters that must be considered when making a decision about the draft TEP

Achieving compliance with the Act (s330)

Identify how, if approved, the draft TEP will achieve compliance with the *Environmental Protection Act 1994* (the Act) by doing one or more of the following things—

☐ reducing environmental harm caused by the activity

☐ detailing the transition of the activity to an environmental standard

☐ detailing the transition of the activity to comply with:

- ☐ a condition, including a standard environmental condition, or an environmental authority or code of environmental compliance or
- ☐ a development condition.

Content of the TEP (s331)

To be approved, the draft TEP, for the activity to which it relates, must accomplish the following—

(a) Objectives to be achieved and maintained under the TEP

☐ The draft TEP clearly sets out the objectives to be achieved and maintained under the TEP (i.e. what the draft TEP is trying to achieve).

Provide a brief summary of the objectives to be achieved and maintained under the TEP.

(b) State the particular actions

☐ The draft TEP states the particular actions required to achieve the objectives, and the date by which each action must be completed.

Briefly state the actions required to achieve the objectives and the dates by which each action must be completed.

☐ When stating the required actions, the draft TEP takes into account—

- ☐ the best practice environmental management for the activity and

  Provide brief notes about how, when stating the required actions, the draft TEP takes into account the best practice environmental management for the activity.

- ☐ the risks of environmental harm being caused by the activity.

  Provide brief notes about how, when stating the required actions, the draft TEP takes into account the risks of environmental harm being caused by the activity.

(c) Prevention and minimisation of environmental harm

☐ The draft TEP states how any environmental harm that may be caused by the activity will be prevented or minimised, including any interim measures that are to be implemented.

Briefly describe how any environmental harm that may be caused by the activity will be prevented or minimised, including any interim measures that are to be implemented.

(d) Transition to an environmental standard

☐ If an objective of the draft TEP is for the activity to transition to an environmental standard, the draft TEP states—

- ☐ details of the standard and
- ☐ how the activity is to transition to the standard before the TEP ends.

Provide details of the standard and briefly describe how the activity is to transition to the standard before the TEP ends.

OR

☐ It is not an objective of the draft TEP for the activity to transition to an environmental standard.

(e) Transition to comply with a condition of an environmental authority or code of environmental compliance, or a development condition

☐ If an objective of the draft TEP is for an activity to transition to comply with a condition of an environmental authority or code of environmental compliance, or a development condition, the draft TEP states—

- ☐ details of the condition and how the activity does not comply with it and
- ☐ how compliance will be achieved before the end of the TEP.

Provide details of the relevant condition and how the activity does not comply with it, and describe briefly how compliance will be achieved before the end of the TEP.

OR

☐ It is not an objective of the draft TEP for the activity to transition to compliance with an environmental authority, or code of environmental compliance or a development condition.

(f) Period over which TEP is to be carried out

☐ The draft TEP states the period over which the TEP is to be carried out.

State the period over which the TEP is to be carried out.

(g) Performance indicators

☐ The draft TEP states appropriate performance indicators at intervals of not more than 6 months.

Provide brief details of the performance indicators.

(h) Monitoring and reporting

☐ The draft TEP adequately provides for monitoring and reporting on compliance with the program.

Briefly describe how the draft TEP provides for monitoring and reporting on compliance with the program.

If the Department has issued a notice under s332 requiring a person to prepare and submit a draft TEP to it for approval

☐ If the draft TEP was submitted in response to a written notice issued by the Department under s322 of the Act, the draft TEP has addressed all of the requirements stated in the notice.

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If the draft TEP was submitted in response to a written notice under s322, and it does not address all of the matters required to be addressed, provide details of the matters that the draft TEP does not adequately address.

OR

☐ The draft TEP was not submitted in response to a written notice issued under s322 of the Act.

Regulatory requirements (s338(1)(a))

Chapter 4, Part 1 (ss46-64) of the *Environmental Protection Regulation 2008* (the Regulation), sets out the regulatory requirements that the Department is required to comply with when making a decision whether to accept (with or without conditions) or reject a draft TEP.

☐ When deciding whether accept (with or without conditions) or reject the draft TEP, the Department has complied with all relevant regulatory requirements stipulated in ss46-64 of the Regulation.

Briefly describe the relevant sections of the Regulation that were considered and how they relate to the draft TEP.

Note that regulatory requirements may also be contained in environmental protection policies.

☐ All relevant regulatory requirements contained in environmental protection policies have been considered by the Department.

If applicable, briefly describe any regulatory requirements contained in environmental protection policies and how they relate to the draft TEP.

OR

☐ There are no applicable regulatory requirements contained in environmental protection policies.

Standard criteria (s338(1)(b)(i))

☐ The Department has considered all relevant matters in the standard criteria.

Provide brief details in the table below of each relevant standard criterion and how it relates to the Department's consideration of the draft TEP. If a particular criterion is not applicable, write 'N/A'.

Standard criterion	Details
Ecologically sustainable development	
Environmental protection policies (EPPs)	
Plans, standards or agreements	
Environmental impact study, assessment or report	
Receiving environment	
Submissions made by the applicant and submitters	
Best practice environmental management	

.

Financial implications	
Public interest	
Site management plan	
Environmental management systems (IEMS)	

Additional information (s338(1)(b)(ii))

☐ The Department has considered additional information (if any) given in relation to the draft TEP.

If applicable, briefly describe the additional information provided.

OR

☐ No additional information has been provided.

Views expressed at a conference (s338(1)(b)(iii))

☐ If a conference has been held in relation to the draft TEP, the Department has considered the views expressed at the conference.

If applicable, provide brief notes of the views expressed at the conference and the consideration given to those views.

OR

☐ No conference has been held.

Consistency with development conditions of a development approval (s338(2))

☐ If the draft TEP has been prepared because of a development condition of a development approval, the draft TEP is consistent with other conditions of the development approval.

If applicable, describe how the draft TEP is not consistent with the other conditions of the development approval.

OR

☐ The draft TEP has not been prepared because of a development condition of a development approval.

Public notice of submission of draft TEP (s337(2)) and substantial compliance with the Act (s342)

☐ If public notice is required to be given at the submission of the draft TEP, the Department is satisfied that the public notice has been properly given.

OR

☐ The Department is not satisfied that the required public notice has been properly given, but is satisfied that there has been substantial compliance with the Act and will accept this as compliance.

Provide brief details of how the public notice has not been properly given and why the Department is satisfied that there has been substantial compliance with the Act which it will accept as compliance.

OR

☐ Public notice is not required.

Is the Department satisfied with the draft TEP?

For the draft TEP to be approved, at least one box should be checked next to each of the above matters for consideration. If any of the matters remain unchecked, then the draft TEP can not be approved.

☐ If a box has been checked next to each requirement - Proceed to section 3.

☐ If a box has not been checked next to each requirement - Proceed to section 4.

3. Request for further information and/or amendments to a draft TEP

If the draft TEP substantially addresses all of the relevant matters listed in s331 of the Act, but cannot be approved unless further information is provided or some amendments are made, the Department may request that the person or public authority provide further information or an amended TEP. Note that if there are significant problems with the draft TEP and it will require major changes or re-writing before it can be approved, the Department should refuse to approve it.

If it is appropriate that further information or a request for amendments be made, officers should consider the following alternatives—

☐ Further information is required.

Officers are to list the further information required about the draft TEP and suspend the assessment report process while waiting for the further information to provided.

☐ Minor amendments are required.

Officers are to list the minor amendments required and suspend the assessment report process while waiting for the person to provide the amended TEP.

☐ More substantial amendments are required.

Officers are to list the more substantial amendments required and present them to the Delegate for approval.

4. Approval of the draft TEP

Prior to making a recommendation to issue a notice of decision approving the draft TEP (with or without conditions), it is important to take into account that the Act stipulates that a TEP is a program that achieves compliance with the Act for the activity to which it relates.

If the draft TEP does **not** meet the requirements of the Act it must be refused. Whilst the Act does make provision for the approval to be subject to conditions, the conditions should address relatively minor issues only. Conditions stated in a notice of decision must not be used to rectify significant issues with a draft TEP.

A notice of decision must be issued within 8 business days of making the decision to approve the TEP. If the approval is subject to conditions, the notice of decision must be an information notice.

☐ The notice of decision identifies the documents forming the approved TEP, including any amendments under section 339(1)(a)(ii).

☐ The notice of decision sets out any conditions imposed on the approval by the Department.

☐ The notice of decision states the day the approval ends.

- [ ] If conditions have been imposed on the approval, the notice of decision is in the form of an information notice.

If the notice is in the form of an information notice, it must include:

- [ ] the decision and
- [ ] the reasons for the decision and
- [ ] any available rights of internal and external review.

5. Refusal to approve a draft TEP

The draft TEP cannot be approved unless at least one checkbox has been checked beside each of the matters required to be addressed by the draft TEP. If the draft TEP does not meet all of the requirements, and any deficiencies will not be addressed by a request for further information and/or amendments to the draft TEP, then the Department should refuse to approve the draft TEP.

If the Department refuses to approve the TEP, the notice of decision must be an information notice. Consequently, the notice of decision must include:

- [ ] the decision and
- [ ] the reasons for the decision and
- [ ] any available rights of internal and external review.

6. Provide for natural justice

In order to provide natural justice, the Department must advise the person that submitted the draft TEP if it intends to do one of the following things—

- request further information about the draft TEP and/or
- request amendments to the draft TEP or
- refuse to approve the draft TEP.

The Department must also provide the person with the opportunity to make submissions in response to the Department's intentions.

- [ ] The person has been provided with the opportunity to put their side of the story forward.

  Describe how this was achieved.

- [ ] All information provided has been considered.

  Describe any information or submissions provided.

- [ ] The Department has considered the information.

  What consideration was provided and what conclusions have the Department formed?

- [ ] The decision-maker and environmental officer are free from bias or the perception of bias.

6. Recommendation

The environmental officer is required to make a recommendation in relation to the draft TEP.

Recommendation:

For example, "I recommend that the draft TEP be approved OR I recommend that the draft TEP be approved with the amendments agreed in the letter to the company dated XXX OR I recommend that the draft TEP be refused.

7. Approval

Environmental officer	Supervisor
Print name:	**Print name:**
Date:	**Date:**

Delegated decision-maker	Approve / Reject recommendation (circle one)
Reasons for decision.	
Print name:	
Date:	

Administrative Practice Note x/10

Environmental Protection Act 1994

Assessing draft Transitional Environmental Programs

The following administrative practice is to be followed when assessing draft Transitional Environmental Programs under the Environmental Protection Act 1994*. In the Report of November 2008 by Professor Barry Hart to the Queensland Premier a recommendation was made that the procedures used to develop TEPs be reviewed. This administrative practice note is the outcome of that review.*

Background

A Transitional Environmental Program (TEP) is an environmental compliance program, drafted by the holder of a development approval or an environmental authority for an environmentally relevant activity or an environmental authority, for which approval is applied for to the administering authority.

Section 330 of the Environmental Protection Act 1994 provides the definition for a TEP:

A transitional environmental program is a specific program that, when approved, achieves compliance with this Act for the matters dealt with by the program by:

(a) reducing environmental harm; or

(b) detailing the transition to an environmental standard.

There are three ways in which a client may develop a TEP:

1. the administering authority may require a client to develop a TEP to address a specific issue (a compliance tool), by issuing a 'Notice to Prepare' under section 332 of the *Environmental Protection Act 1994*;
2. the client may voluntarily develop and submit a TEP under section 333 of the *Environmental Protection Act 1994*; or
3. a client may lodge a Program Notice to the administering authority under section 350 of the *Environmental Protection Act 1994* and be required to develop and lodge a TEP.

In circumstances where a person has given the administering authority a Program Notice about an act or omission that has caused or threatened environmental harm in the carrying out of an activity by the person and the activity is lawful apart from the provisions of the *Environmental Protection Act 1994*, the administering authority is required to give the person a notice nominating a day by which a draft TEP must be submitted.

The information given in a Program Notice is privileged and can not be used in evidence by the administering authority.

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Deleted: <#>The administering authority may require the preparation of a TEP or a person or public authority may voluntarily submit a TEP.¶

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Assessing draft Transitional Environmental Programs

A TEP is similar to a contract, in which the contents of the program are legally binding on its approval.
A person will make an application for approval of a TEP for some or all of the following reasons:

- An approved TEP can result in a person being provided immunity from charges specifically related to an incident which is the subject of a Program Notice;
- An approved TEP can result in a person being given a period of time in which to carry out certain specified activities that will enable them to comply with the conditions of an environmental authority or achieve an environmental standard. The person can not be prosecuted for non-compliance while the matters are being addressed in accordance with the requirements of the TEP.

A TEP especially when combined with a Program Notice is an extremely powerful tool so its approval should always be approached with care and due diligence as to the consequences of the shield that it may provide with respect to activities that may cause or potentially cause environmental harm.

Duties of the administering authority

Requiring a draft TEP to be prepared

The administering authority can require a TEP be drafted by a person if it is satisfied that the following events have occurred:

- The activity currently being carried out, or proposed to be carried out, is or may cause unlawful environmental harm;
- It is impractical for a person to comply with any policy or regulation on its commencement;
- That a condition of an environmental authority is or has been contravened;
- That a standard environmental condition of a Code of Environmental Compliance for a Chapter 4 activity is or has been contravened; or
- A development condition of a development approval is or has been contravened.

The administering authority may make this requirement as a condition of an environmental authority or development approval or by issuing a statutory notice.

Where a statutory notice is issued it must state:

- The grounds on which the requirement to prepare a draft TEP is made;
- The matters that are to be addressed by the TEP. These must be stated with sufficient particularity for the person to whom the notice is issued to understand and supply a draft document that meets these requirements;
- The period over which the TEP is to be carried out;
- The day by which the draft TEP must be prepared and submitted; and

- The review and appeal details that apply to the decision to require the submission of a draft TEP.

If the statutory notice clearly sets out the matters to be addressed (particularly in terms of setting up what will ultimately be the objectives or outcomes to be achieved through the TEP), then the negotiation of an approved TEP is more likely to result in the objectives or outcomes sought.

In drafting the statutory notice the administering authority should have regard to the matters that it is required to give consideration to in deciding to approve or refuse a draft TEP. These matters are set out in the *Environmental Protection Act 1994*, and the *Environmental Protection Regulation 2008*. Inclusion of details about relevant information that should be submitted as part of the draft TEP in the statutory notice will assist in the assessment of a draft TEP and avoid requests for additional information.

Assessing a draft TEP

General

A draft TEP must meet the content requirements of section 331 of the *Environmental Protection Act 1994*, while also meeting the purpose of a TEP. The legislation states that a TEP must:

- state the objectives to be achieved and maintained under the TEP,
- state how the objectives are to be achieved, taking into account:
  - the best practice environmental management for the activity, and
  - the risk of environmental harm being cause by the activity,
- state a timetable of the actions to be undertaken to achieve the objectives,
- state the performance indicators to be used to identify both the progress and completion of the objectives. The performance indicators are not to be spaced at intervals greater than six months, and
- make provisions for monitoring and reporting compliance with the TEP.

As an approved TEP can protect the holder from enforcement action for non-compliances with *the Act*, the commitments or terms of the TEP need to be clearly drafted, unambiguous and easily auditable.

Note: Failure to comply with the terms of a TEP is an offence so the terms outlined within the document act in a similar way to conditions contained within a Development Approval or Environmental Authority.

In deciding whether to approve or refuse a draft TEP, the criteria for making the decision outlined in section 338 of the *Environmental Protection Act 1994* must be considered. This section refers the assessor to:

- any relevant regulatory requirement, and
- the standard criteria.

The decision whether to approve or refuse a draft TEP is an "environmental management decision" as per the *Environmental Protection Regulation 2008*. In assessing a TEP the administering authority must comply with the regulatory requirements for making an environmental management decision, consider the standard criteria, any additional information that has been given in relation to the draft TEP, and the views that have been

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expressed at any conference called by the administering authority to help it decide whether to approve or refuse a draft TEP.

It is also important for the assessor to consider, if the TEP was lodged due to a 'notice to prepare', whether the TEP meets the requirements of the statutory notice. If the administering authority considers that the submitted draft TEP will not achieve the objectives or outcomes specified in the statutory notice then it is critically important that all changes required by the administering authority to ensure that the TEP achieves the required objectives or outcomes are incorporated into the TEP before it is approved.

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The assessment of a draft TEP must result in the preparation of an assessment report that is sufficiently detailed to demonstrate that all mandatory aspects have been considered. The assessment report must be provided to the delegate of the administering authority to assist with decision making and must be kept on the permanent file record to document the decision making process.

Where the assessment requires specific environmental and / or environmental knowledge or skills, and these are not available within the office with the responsibility for assessing the application, these shall be sought to assist with the assessment and the advice or information documented as part of the assessment report.

Risk Assessment

Undertaking a review of all the matters that must be statutorily considered will provide an informal risk assessment.

Notwithstanding the matters for consideration set out in the statute, should the nature of a proposed TEP be significantly complex and / or the nature of the receiving environment (including the potential impacts on people) be significantly sensitive, consideration must be given to undertaking a formal risk assessment in accordance with the Australian Standard AS/NZS ISO 31000:2009 Risk management –Principles and guidelines.

When deciding whether to undertake a formal risk assessment to assist with consideration of whether to approve or refuse a draft TEP the administering authority will consider the importance, including, but not limited to, aspects such as:

- The nature and quantity of any contaminants proposed to be released;
- The nature (e.g. pristine or otherwise) of the receiving environment;
- The number of people potentially affected by any release and the manner in which they may be affected.

Context of draft TEP

Assessing draft Transitional Environmental Programs

When assessing the draft TEP against the regulatory requirements set out in the *Environmental Protection Regulation 2008*, the requirements must be considered in the context of the proposal e.g. if the proposal is for a release to surface waters, assessment against subsections (1) (d) and (e) must be considered along with the additional requirements for the release of water, other than stormwater, to surface water, in the context of the nature of the waterway and the impact of the release on users of the waterway such as irrigators, local governments and others who draw water supplies from the waterway.

<u>Community Interest</u>

Where there is, or there is expected to be, significant public interest in the draft TEP and any decision to approve it, the administering authority will consider seeking comment from the public (or other interested parties) prior to making a decision. This will, if necessary, be done under the relevant provisions of the *Environmental Protection Act 1994*. Where this action is proposed by the administering authority, comments will be sought at least through a public notice in local newspapers.

Such information may also be sought by the administering authority directly contacting interested persons or organisations which may be able to contribute to the assessment process (e.g. local governments, other government departments).

Information obtained by such means must be considered by the administering authority when making a decision to approve or refuse a draft TEP.

Where there is likely to be ongoing community interest in the progress of the implementation of a TEP during its life, the administering authority will consider requiring the applicant to include community consultation as part of the TEP.

Assessing draft Transitional Environmental Programs

Approval of a TEP

A draft TEP may be approved, approved with conditions, or refused.

A draft TEP must only be approved if the administering authority is satisfied that it covers all of the matters and includes a program of specific actions that will allow it when complete to achieve the objectives or outcomes specified in the TEP.

A certificate of approval for a TEP may contain conditions, those conditions are not enforceable, therefore it is critically important that the draft TEP contains all of the matters that the administering authority considers are required to achieve the objective or outcomes of the TEP. The administering authority must negotiate variations to the draft TEP and not rely on the certificate of approval to vary or modify a draft TEP.

<u>Delegation for decision making</u>

The responsibility for decision making with respect to approving or refusing a draft TEP must be in accordance with the current Environmental Protection Delegation. Where it is appropriate, due to the technical complexity of the assessment and / or the potential impacts of the decision, the decision may be made by a delegate with greater seniority in the organisation.

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Refusal of a TEP

If the administering authority is not satisfied with a draft TEP, and is unable to negotiate a satisfactory TEP, it may refuse an application for approval.

If a decision on whether to approve or refuse a draft TEP is not given within the statutory time, the decision is deemed to have been a refusal.

If the administering authority refuses a draft TEP it must provide an information notice about the decision.

Fees for assessment of a TEP

The *Environmental Protection Act 1994* provides for the administering authority to charge a person or public authority, the fee prescribed by regulation, for submitting a draft TEP for approval. For further information on the charging of fees for the assessment of a TEP refer to Operational Policy titled, *Transitional Environmental Program (TEP) fees.*

Amending a TEP

The administrative authority must give the same consideration to an application to amend an approved TEP as it would an original application for approval of a draft TEP.

If the amendment of an approved TEP would extend the period in which the TEP is carried out to longer than 5 years then the applicant must give public notice of the application to amend the approved TEP. In assessing the amendment application, the administering authority will look for evidence that these requirements have been complied with.

The administering authority may only approve an amendment application if it is reasonably satisfied that it will not result in increased environmental harm being caused by the carrying out of the activity under the amended approval than the environmental harm that would be caused were the approval not granted.

Annual Return

The holder of an approved TEP must, within 22 days of the anniversary day of the approval of the TEP, give to the administering authority an annual return in the approved form.

The administering authority should discuss the requirements for the content of the annual return at the time that the TEP is applied for and include in the draft TEP the form and content of the information that is to be provided in the annual return.

Notice of disposal of the benefit of a TEP

If the holder of an approved TEP proposes to dispose of the place or business to which the TEP relates to another person they must give written notice to the buyer of the place or business of the existence of the TEP. The importance of any failure of the holder of a TEP to give such notice is that it is a statutory grounds for rescinding any agreement.

The holder of an approved TEP must give the administering authority written notice within 10 days of the disposal of a place or business that is subject to an approved TEP.

Enforcing a TEP

If the holder of an approved TEP does not comply with the requirements of the TEP, as distinct from the requirements of a certificate of approval, the administering authority may prosecute the holder for a breach of the TEP.

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Where the TEP contains defined milestones that are clear and quantifiable, the administering authority may also prosecute the holder of an approved TEP for breach of those milestones. Given the time and effort required to compile a brief of evidence, it is, in the face of an investigation and action for breach, possible for the holder of an approved TEP to bring themselves into compliance, and thereby frustrate or mitigate the action for breach of the TEP.

Where the holder of an approval is recalcitrant in performing the obligations imposed through the approved TEP, action for breach of milestones should be considered, especially where the approved TEP has a period of more than a year.

All non-compliances with an approved TEP must be responded to in a timely and appropriate manner keeping in mind that the approval of a TEP is already a mechanism for dealing with an inability for the holder to comply with environmental requirements.

Approved by:

X
X
Department of Environment and Resource Management

Date: xx/mm/2010

Enquiries:

Permit and Licence Management
Ph: **1300 368 326**
Fax: (07) 3115 9600
Email:
eco.access@derm.qld.gov.au

Request for Statutory Approval

Department of **Environment** and **Resource Management**

s337 of the *Environmental Protection Act 1994*

CONSIDERATION OF A TRANSITIONAL ENVIRONMENTAL PROGRAM (TEP)

CLIENT:	XXXX
REGISTERED OFFICE ADDRESS:	XXXX
	XXXX
	XXXX
	XXXX
	XXXX
TENEMENT:	XXXX
ENV AUTHORITY NO.:	XXXX
	XXXX
FILE NO.:	XXXX
PROGRAM NOTICE/REQUIRED:	XXXX
REASON FOR TEP:	XXXX
DATE SUBMITTED:	XXXX
DECISION DUE DATE:	XXXX
(if approval required)	
TIME SPENT:	XXXX

1.0 SUMMARY

XXXX

Has the TEP been entered in EcoTrack:	Yes/No
EcoTrack Compliance Reference (if applicable): -	XXXX
EcoTrack TEP Reference Number: -	XXXX

If Approving the TEP

Has a notice approving the TEP been completed:	Yes/No
Has a certificate of approval been developed:	Yes/No
Were additional conditions set on the certificate of approval:	Yes/No

2.0 STATUTORY REQUIREMENTS

330 What is a transitional environmental program
A transitional environmental program is a specific program that, when approved, achieves compliance with this Act for the matters dealt with by the program by—
(a) reducing environmental harm; or
(b) detailing the transition to an environmental standard.
XXXX

337 Administering authority to consider draft programs
(1) The administering authority must decide whether to approve a draft transitional environmental program submitted to it within 20 business days after the application date.

XXXX

(2) If public notice is required to be given of the submission of the draft program, the administering authority must be satisfied public notice has been properly given before making a decision.

XXXX
338 Criteria for deciding draft program
(1) In deciding whether to approve or refuse to approve the draft program or the conditions (if any) of the approval, the administering authority—
(a) must comply with any relevant regulatory requirement;
and

XXXX

Environmental Protection Regulation 2008
Chapter 4 Regulatory Requirements

Part 2 Regulatory Requirements for all environmental management decisions

s51 Matters to be considered for environmental management decisions
XXXX

s52 Conditions to be considered for environmental management decisions
XXXX

s53 Matters to be considered for decisions imposing monitoring conditions
XXXX

Part 3 Additional regulatory requirements for particular environmental management decisions

s55 Release of water or waste to land
XXXX

s56 Release of water, other than stormwater, to surface water
XXXX

s57 Release of stormwater
XXXX

s58 Release of water or waste to particular wetlands for treatment
XXXX

s59 Activity involving berthing, docking or mooring a boat
XXXX

s60 Activity involving storing or moving bulk material
XXXX

s61 Activity involving acid sulphate soil
XXXX

s62 Activity involving acid-producing rock
XXXX

s63 Activity involving direct release of waste to groundwater
XXXX

s64 Activity involving indirect release of contaminants to groundwater
XXXX

(b) subject to paragraph (a), must also consider the following—
(i) the standard criteria;

- *The principles of ecological sustainable development as set out in the 'National Strategy for Ecologically Sustainable Development'.*
  XXXX

- *Any applicable environmental protection policy.*
  XXXX

- *Any applicable Commonwealth, State or local government plans, standards, agreements or requirements.*
  XXXX

- *Any applicable environmental impact study, assessment or report.*
  XXXX

- *The character, resilience and values of the receiving environment.*
  XXXX

- *All submissions made by the applicant and submitters.*
  XXXX

- *The best practice environmental management for activities under any relevant instrument, or proposed instrument, as follows – a transitional environmental program.*
  XXXX

s21 of the *Environmental Protection Act 1994* - Best practice environmental management
*(1) The **best practice environmental management** of an activity is the management of the activity to achieve an ongoing minimisation of the activity's environmental harm through cost-effective measures assessed against the measures currently used nationally and internationally for the activity.*
*(2) In deciding the **best practice environmental management** of an activity, regard must be had to the following measures—*
(a) strategic planning by the person carrying out, or proposing to carry out, the activity;
(b) administrative systems put into effect by the person, including staff training and monitoring and review of the systems;
(c) public consultation carried out by the person;
(d) product and process design;
(e) waste prevention, treatment and disposal.
*(3) Subsection (2) does not limit the measures to which regard may be had in deciding the **best practice environmental management** of an activity.*

- *The financial implications of the requirements under an instrument, or proposed instrument, mentioned in paragraph (g) (above) as they would relate to the type of activity or industry carried out, or proposed to be carried out, under the instrument.*
  XXXX

- *The public interest.*
  XXXX

- *Any applicable site management plan.*
  XXXX

- *Any relevant integrated environmental management system or proposed integrated environmental management system.*
  XXXX

- *Any other matter prescribed under a regulation.*
  XXXX

  (ii) additional information given in relation to the draft program;
  Maps and background information was submitted and considered.

  (iii) the views expressed at a conference held in relation to the draft program.
  N/A.

(2) If the draft program is prepared because of a requirement of a development condition of a development approval, the authority may approve the draft program only if it is not inconsistent with other conditions of the approval.
XXXX

<u>331 Content of program</u>
A transitional environmental program must—
(a) state the objectives to be achieved and maintained under the program for an activity; and
XXXX

(b) state how the objectives are to be achieved, and a timetable to achieve the objectives, taking into account—
(i) the best practice environmental management for the activity; and
XXXX

(ii) the risks of environmental harm being caused by the activity; and
XXXX

(c) state appropriate performance indicators at intervals of not more than 6 months; and
XXXX

(d) make provision for monitoring and reporting compliance with the program.
XXXX

343 Failure to approve draft program taken to be refusal
XXXX

4.0 RECOMMENDATION
XXXX

XXXX
Senior Environmental Officer

Signed –

Date -

Reviewed & Endorsed By	
XXXX Senior Environmental Officer	**Delegate** Manager - Emerald

Signed – Date:	Signed – Date:

standard criteria means—

(a) the principles of ecologically sustainable development as set out in the 'National Strategy for Ecologically Sustainable Development'; and

(b) any applicable environmental protection policy; and

(c) any applicable Commonwealth, State or local government plans, standards, agreements or requirements; and

(d) any applicable environmental impact study, assessment or report; and

(e) the character, resilience and values of the receiving environment; and

(f) all submissions made by the applicant and submitters; and

(g) the best practice environmental management for activities under any relevant instrument, or proposed instrument, as follows—

  (i) an environmental authority;

  (ii) a transitional environmental program;

  (iii) an environmental protection order;

  (iv) a disposal permit;

  (v) a development approval; and

(h) the financial implications of the requirements under an instrument, or proposed instrument, mentioned in paragraph (g) as they would relate to the type of activity or industry carried out, or proposed to be carried out, under the instrument; and

(i) the public interest; and

(j) any applicable site management plan; and

(k) any relevant integrated environmental management system or proposed integrated environmental management system; and

(l) any other matter prescribed under a regulation.

standard environmental conditions, for an environmental authority or a chapter 4 activity, means the standard environmental conditions approved for the authority or activity under section 549.

Part 2 Regulatory requirements for all environmental management decisions

50 Application of pt 2

This part applies to the administering authority for making any environmental management decision.

51 Matters to be considered for environmental management decisions

(1) The administering authority must, for making an environmental management decision relating to an activity, consider the following matters—

(a) each of the following under any relevant environmental protection policies—

(i) the management hierarchy;

(ii) environmental values;

(iii) quality objectives;

(iv) the management intent;

(aa) environmental values declared under this regulation;

(b) the characteristics of the contaminants or materials released from carrying out the activity;

(c) the nature and management of, including the use and availability of technology relating to, the processes being, or to be, used in carrying out the activity;

(d) the impact of the release of contaminants or materials from carrying out the activity on the receiving environment, including the cumulative impact of the release with other known releases of contaminants, materials or wastes;

(e) the characteristics of the receiving environment and the potential impact on it from carrying out the activity;

(f) for each affected person for the activity—the order of occupancy or use between the person carrying out the activity and the affected person;

(g) the remaining capacity of the receiving environment to accept contaminants or wastes released from future activities while protecting environmental values;

(h) the quantity and type of greenhouse gases released, and the measures proposed to demonstrate the release is minimised using best practice methods that include strategies for continuous improvement.

(2) In this section—

affected person, for an activity, means a person affected, or who may be affected, by the release of a contaminant or waste from carrying out the activity.

52 Conditions to be considered for environmental management decisions

(1) The administering authority must, for making an environmental management decision relating to an activity, consider whether to impose conditions about the following matters—

(a) implementing a system for managing risks to the environment;

(b) implementing measures for avoiding or minimising the release of contaminants or waste;

(c) ensuring an adequate distance between any sensitive receptors and the relevant site for the activity to which the decision relates;

Examples of a condition for paragraph (c)—

a condition requiring riparian buffers, noise buffers or buffers for protecting endangered regional ecosystems

(d) limiting or reducing the size of the initial mixing zone or attenuation zone, if any, that may be affected by the release of contaminants;

(e) treating contaminants before they are released;

(f) restricting the type, quality, quantity, concentration or characteristics of contaminants that can be released;

(g) the way in which contaminants may be released;

Examples of a condition for paragraph (g)—

- a condition restricting the release of a contaminant at a particular temperature, velocity or rate or during particular meteorological conditions or water flows
- a condition restricting the release of a contaminant to a depth below the level of surface waters

(h) ensuring a minimum degree of dispersion happens when a contaminant is released;

Example of a condition for paragraph (h)—

a condition requiring the use of a diffuser for releasing a contaminant

(i) protecting environmental values, and meeting quality objectives, under relevant environmental protection policies;

(j) recycling, storing, transferring or disposing of waste in a particular way;

(k) rehabilitating land to achieve particular outcomes;

(l) measures for the ongoing protection of environmental values that are, or may be, adversely affected by the activity.

(2) In this section—

attenuation zone means the area around a release of contaminants to groundwater in which the concentration of the contaminants in the release is reduced to ambient levels through physico-chemical and microbiological processes.

sensitive receptor means a sensitive receptor under any relevant environmental protection policies.

53 Matters to be considered for decisions imposing monitoring conditions

(1) The administering authority must, for making an environmental management decision relating to an activity, consider whether to impose monitoring conditions about the release of contaminants from the activity on the receiving environment.

(2) For considering whether to impose a monitoring condition, the administering authority must consider the following matters—

(a) the potential impact on the receiving environment of—

(i) the activity to which the decision relates; and

(ii) the release of the contaminant;

(b) the characteristics of the contaminant;

(c) the potential for a control measure to fail and the effect of a failure of a control measure on the receiving environment;

(d) the protocols relevant to monitoring the release of the contaminant;

(e) whether the monitoring should be continuous or intermittent.

(3) In this section—

monitoring condition, about the release of contaminants from an activity on the receiving environment, means a condition about any of the following matters—

(a) monitoring the quantity, quality, characteristics, timing and variability of the release;

(b) monitoring indicators of the effective operation of control measures;

(c) monitoring the characteristics of the receiving environment;

(d) assessing the effectiveness of remedial or rehabilitation measures;

(e) monitoring the impact of the release on the values, objectives and biota in the receiving environment;

(f) analysing monitoring data against objectives and standards including, for example, by predictive modelling;

(g) reporting the results of monitoring in a stated form and timeframe;

(h) reporting on the time and way in which the release is made to the receiving environment.

Part 3 Additional regulatory requirements for particular environmental management decisions

54 Application of pt 3

If an environmental management decision relates to an activity mentioned in a provision in this part, the administering authority making the decision must comply with the provision in addition to part 2.

55 Release of water or waste to land

(1) This section applies to the administering authority for making an environmental management decision relating to an activity that involves, or may involve, the release of water or waste to land (the ***relevant land***).

(2) The administering authority must consider the following matters—

(a) the topography, including the flooding potential of the relevant land;

(b) the climatic conditions affecting the relevant land;

(c) the available land on which the water or waste can be released;

(d) the storage of the water or waste in wet weather;

Example—

storage of water or waste in ponds or tanks

(e) the way in which the water or waste will be released to the relevant land;

(f) the need to protect soil and plants on the relevant land from damage;

(g) the potential for infiltration of the water or waste to groundwater;

(h) the potential for generation of aerosols or odours from the water or waste;

(i) the impact of any transfer or run-off of contaminants from the relevant land to surface waters;

(j) the ongoing availability of the land for the release of the water or waste.

(3) The administering authority must also consider whether to impose conditions about each of the following matters—

(a) developing and implementing a land release management plan for the relevant area that protects the environmental values affected, or that may be affected, by the activity;

(b) the way in which, or rate at which, the water or waste may be released;

(c) releasing the water or waste in a way that minimises infiltration to groundwater;

(d) if the water or waste is to be transferred to another entity—the circumstances under which the transfer may occur;

(e) releasing the water to a bio-retention system, including, for example, a constructed wetland, for the removal of nutrients from the water.

(4) In this section—

land release management plan, for the relevant area, means a plan that achieves the following outcomes for the area—

(a) the efficient application of water or waste using best practice methods;

(b) control of sodicity in the soil;

(c) minimal degradation of soil structure;

(d) control of the build-up, from water, waste or other sources, of nutrients and contaminants in the soil and subsoil;

(e) prevention of subterranean flows of contaminants to waters;

(f) prevention of impact of infiltration on groundwater resources;

(g) prevention of run-off by controlling the rate of application of water or waste, and by using structures, including, for example, tailwater dams;

(h) prevention of surface ponding;

(i) prevention of spraydrift or overspray from the relevant area;

(j) prevention of damage to native vegetation;

(k) reporting the results of monitoring, and an assessment of the impact on the groundwater in the relevant area of the release of the water or waste.

56 Release of water, other than stormwater, to surface water

(1) This section applies to the administering authority for making an environmental management decision relating to an activity that involves, or may involve, the release of water, other than stormwater, to surface water.

(2) The administering authority must consider each of the following matters—

(a) any available toxicity data relevant to the release and the receiving environment;

(b) if there is an initial mixing zone—

(i) whether there is any practicable alternative that would reduce or eliminate the initial mixing zone; and

(ii) whether the size of the initial mixing zone is likely to adversely affect an environmental value or the ecological condition of the receiving environment, including, for example, a watercourse or wetland; and

(iii) whether concentrations of contaminants in the initial mixing zone are acutely toxic to the biota.

(3) The administering authority must also consider whether to impose conditions about the following matters—

(a) releasing the water to tidal waters only during particular tidal conditions, including, for example, phases of the tide;

(b) releasing the water to non-tidal waters only if the rate of flow of the surface water is greater than a particular level.

57 Release of stormwater

(1) This section applies to the administering authority for making an environmental management decision relating to an activity

that involves, or may involve, the release of stormwater to the receiving environment.

(2) The administering authority must consider the following matters—

(a) the topography of, and climatic conditions affecting, the receiving environment;

(b) if the activity involves exposing or disturbing soil—the soil type, its characteristics and the way it is managed;

(c) if the activity involves the storage of materials or wastes that are exposed to rainfall or stormwater run-off—the characteristics and containment of the material or waste;

(3) The administering authority must also consider whether to impose conditions about the following matters—

(a) diverting upstream stormwater run-off away from the area contaminated or disturbed by the activity (the ***affected area***);

(b) minimising the size of the affected area;

(c) covering, paving, roofing and cleaning the affected area;

(d) cleaning the affected area without using water;

(e) analysing and managing soil;

(f) installing and maintaining appropriate control measures;

Examples of control measures—

bio-retention system, buffers for improving waste water quality, first flush stormwater diversion systems, oil separators, rubbish traps, sediment fences, sediment traps

(g) treating the affected area.

Examples—

mulching, revegetating, using surface covers or soil agglomerants

58 Release of water or waste to particular wetlands for treatment

(1) This section applies to the administering authority for making an environmental management decision relating to an activity that involves, or may involve, the release of water or waste to a referable wetland or a significant coastal wetland for treatment.

(2) The administering authority must refuse to grant the application if the authority considers that, because of the activity—

(a) the wetland will be destroyed or reduced in size; or

(b) the biological integrity of the wetland may not be maintained.

(3) In this section—

referable wetland means an area shown as a wetland on a document called 'Map of referable wetlands' made available by the chief executive.

Editor's note—

On the day this regulation was notified in the gazette, the document was available on the department's website.

significant coastal wetland has the same meaning as in the State coastal management plan.

State coastal management plan means the State coastal management plan prepared under the *Coastal Protection and Management Act 1995*.

Editor's note—

On the day this regulation was notified, the State coastal management plan was published on the department's website.

59 Activity involving berthing, docking or mooring a boat

(1) This section applies to the administering authority for making an environmental management decision relating to an activity

that involves, or may involve, berthing, docking or mooring a boat.

(2) The administering authority must consider the following matters—

(a) the availability of facilities for collecting and disposing of wastes generated from the boat;

(b) whether to impose a condition to provide facilities for collecting and disposing of wastes generated from the boat.

Examples of waste generated from a boat—

bilge waste, garbage, sewage

60 Activity involving storing or moving bulk material

(1) This section applies to the administering authority for making an environmental management decision relating to an activity that involves, or may involve, storing or moving bulk material.

Examples of bulk material—

alumina, cement, coal, grain, metaliferous ores, quarried materials, woodchips

(2) The administering authority must consider each of the following matters—

(a) the chemical and physical characteristics of the material;

(b) the way in which the material is, or is to be, contained during each stage of the storage or movement of the material;

(c) the methods of cleaning up any spillage during movement of the material;

(d) if storage or movement of the material is likely to result in the release of part of the material into waters, the impact of the accumulation of the material on the bed of the waters.

(3) The administering authority must also consider whether to impose conditions about the following matters—

(a) installing and maintaining appropriate control measures;

Examples—

- installing devices for collecting dust at places where bulk material is being moved
- installing dust collectors at transfer points
- enclosing, roofing or screening equipment used for storing or moving bulk material

(b) managing stockpiles of the material in a particular way;

Example—

setting a maximum height for a stockpile

(c) collecting, removing or disposing of spillage released while moving the material;

(d) monitoring the impact of releases of contaminants or waste from storing or moving bulk materials on the receiving environment including, for example, the impact of environmental nuisance and impacts on the biota of adjacent waters.

61 Activity involving acid sulfate soil

(1) This section applies to the administering authority for making an environmental management decision relating to an activity that involves, or may involve, disturbance of acid sulfate soil.

(2) The administering authority must consider—

(a) 'State Planning Policy 2/02—Planning and Managing Development Involving Acid Sulfate Soils' (***SPP 2/02***); and

(b) the guideline for SPP 2/02 (the ***guideline***).

Note—

The guideline states that it may be used as a source of general advice on investigation and management of acid sulfate soils for situations outside the scope of SPP 2/02.

Editor's note—

On the day this regulation was notified, SPP 2/02 and the guideline were available on the website of the Department of Infrastructure and Planning at <www.dip.qld.gov.au>.

(3) The administering authority must also consider whether to impose conditions about the following matters—

(a) minimising the generation of contaminated water;

(b) treating acid sulfate soils;

(c) treating or disposing of leachate and run-off;

(d) managing the fluctuations in the watertable;

(e) maintaining minimum levels of cover over any buried acid sulfate soils.

(4) In this section—

acid sulfate soil means actual acid sulfate soil or potential acid sulfate soil.

actual acid sulfate soil means soil or sediment containing highly acidic soil horizons or layers affected by the oxidation of iron sulfides.

disturbance, of acid sulfate soil, means disturbance of the soil by—

(a) excavating or removing the soil; or

(b) exposing the soil to air; or

(c) changing the level of groundwater.

potential acid sulfate soil means soil or sediment containing iron sulfides or other sulfidic material that has not been exposed to air and oxidised.

62 Activity involving acid-producing rock

(1) This section applies to the administering authority for making an environmental management decision relating to an activity

that involves, or may involve, disturbance of acid-producing rock.

Example of an activity involving disturbance of acid-producing rock—

tailings from processing acid-producing rock in a mining operation

(2) The administering authority must consider the following matters—

(a) the physical and chemical characteristics of the rock;

(b) the potential of the rock to generate or neutralise acidity;

(c) the characteristics of the leachate leaching from, or potentially leaching from, the rock including, in particular, contaminants in the leachate that are likely to cause environmental harm if released to the environment.

(3) The administering authority must also consider whether to impose conditions about the following matters—

(a) the ways in which waste may be disposed of or stored, including for example, the location of areas for waste disposal or storage;

(b) minimising the ingress of oxygen or water to areas used, or to be used, for waste disposal or storage;

(c) inhibiting the generation of acidity from waste rock, including for example, through using particular treatments;

(d) processes for collecting, storing and treating any generated leachate;

(e) monitoring of the waste disposal and storage areas including, for example, the water balance and oxygen levels;

(f) monitoring the potential seepage zone for indications of the formation of acid rock drainage.

(4) In this section—

acid-producing rock means rock containing sulfidic minerals that have the potential to oxidise and generate acidity.

disturbance, of acid-generating rock, means disturbance of the rock by—

(a) excavating or removing the rock; or

(b) exposing the rock to air; or

(c) changing the level of groundwater.

63 Activity involving direct release of waste to groundwater

(1) This section applies to the administering authority for making an environmental management decision relating to an activity that involves, or may involve, the release of waste directly to groundwater (the ***receiving groundwater***).

Example of direct release of waste to groundwater—

an activity involving the release of contaminated water to groundwater through a well, deep-well injection or a bore

(2) The administering authority must refuse to grant the application if the authority considers—

(a) for an application other than an application relating to an environmental authority for a petroleum activity—the waste is not being, or may not be, released entirely within a confined aquifer; or

(b) the release of the waste is affecting adversely, or may affect adversely, a surface ecological system; or

(c) the waste is likely to result in a deterioration in the environmental values of the receiving groundwater.

(3) In this section—

confined aquifer means an aquifer that is contained entirely within impermeable strata.

64 Activity involving indirect release of contaminants to groundwater

(1) This section applies to the administering authority for making an environmental management decision relating to an activity that involves, or may involve, the release of contaminants indirectly to groundwater (the ***receiving groundwater***).

Example of indirect release of waste to groundwater—

storage of contaminated water in a pond allowing infiltration of contaminated water to groundwater

(2) The administering authority must consider the following matters—

(a) the geological stability of the relevant site for the activity;

(b) the location, quality and use, or potential use, of the receiving groundwater;

(c) the permeability of the earth under the place where the activity is carried out;

(d) the presence of containment devices at the relevant site for the activity and their effectiveness in preventing or minimising the release of the waste;

Example of a containment device—

a liner for a storage pond

(e) the distance separating the receiving groundwater from any containment device;

(f) the potential for fluctuations in the level of the receiving groundwater;

(g) the way in which materials, including contaminants, will be removed from the containment system;

(h) whether or not materials, including contaminants, will be removed from the containment devices and if so, the effectiveness of the methods that will be used for the removal.

(3) The administering authority must also consider whether to impose conditions about the following matters—

(a) the design, construction, function, protection and maintenance of containment devices;

(b) maintaining a particular distance between the receiving groundwater and the point of contact between each containment device and the underlying earth;

(c) removing materials from the containment devices.

Department of Environment and Resource Management

Public Register Copy

Environmental Protection Act 1994

Level 1 Environmental Authority (chapter 5A activities)

DERM Permit[1] Number: PEN100015907

Under section 312M of the *Environmental Protection Act 1994* this permit is issued to:

Principal Holder
CH4 Pty Ltd
AM-60
Level 19
42 Albert Street
BRISBANE QLD 4000

Joint Holders
AGL Energy Limited
Level 22
101 Miller Street
NORTH SYDNEY NSW 2060

Shell CSG (ATP364) Pty Ltd
Level 2 LS
8 Redfern Road
HAWTHORN EAST VIC 3123

in respect to carrying out a Level 1 chapter 5A activity(ies) as per Section 23 of the *Environmental Protection Regulation 2008* on the relevant resource authorities listed below:

Project Name	Resource Authority Type(s) and Number(s)
Moranbah Gas Project	**Petroleum Lease (PL) 191** **Petroleum Lease (PL) PL196** **Petroleum Pipeline Licence (PPL) 115** **Petroleum Pipeline Licence (PPL)116**

This environmental authority takes effect from 14 September 2010

The anniversary date of this environmental authority is 1 October.

This environmental authority is subject to the attached schedule of conditions.

[redacted]

14 September 2010
Date

[redacted]
Delegate of Administering Authority
Department of Environment and Resource Management

[1] Permit includes licences, approvals, permits, authorisations, certificates, sanctions or equivalent/similar as required by legislation administered by the Department of Environment and Resource Management.

Additional advice about the approval

1. This approval is for the carrying out the following level 1 chapter 5A activity(ies):

Level 1 chapter 5A activity(ies):
6. A petroleum activity carried out on a site containing a high hazard dam or a significant hazard dam
8. A petroleum activity, other than a petroleum activity mentioned in items 1 to 7, that includes 1 or more chapter 4 activities for which an aggregate environmental score is stated, namely: ERA 8 (3)(a) – Chemical storage ERA 9(c) – Hydrocarbon gas refining ERA 15 – Fuel burning (500kg/hr or more) ERA 60 (1)(d)– Waste disposal ERA 63 (2)(b) – Sewage treatment

2. This approval pursuant to the *Environmental Protection Act 1994* does not remove the need to obtain any additional approval for this activity which might be required by other State and/or Commonwealth legislation. Other legislation administered by DERM for which a permit may be required includes but is not limited to the:

   - *Aboriginal Cultural Heritage Act 2003*;
   - The contaminated land provisions of the *Environmental Protection Act 1994*;
   - *Nature Conservation Act 1992*; and
   - *Water Act 2000*;
   - *Forestry Act 1959*;
   - *Water Supply (Safety and Reliability) Act 2008*.

   Applicants are advised to check with all relevant statutory authorities and comply with all relevant legislation.

3. This approval for the carrying out of a level 1 petroleum activity is not an acceptance of impacts on water levels or pressure heads in groundwater aquifers in or surrounding coal seams. The holder of this environmental authority may have obligations to minimise or mitigate these impacts under other state legislation.

4. This environmental authority consists of the following Schedules

Schedule A	General Conditions	Schedule G	Waste
Schedule B	Water	Schedule H	Rehabilitation
Schedule C	Regulated Dams	Schedule I	Monitoring Programs
Schedule D	Land	Schedule J	Community Issues
Schedule E	Environmental Nuisance	Schedule K	Notification Procedures
Schedule F	Air	Schedule L	Definitions

SCHEDULE A – GENERAL CONDITIONS

Authorised Petroleum Activities

(A1) In the carrying out of the petroleum activity(ies), the holder of this environmental authority must not exceed the numbers and maximum size(s) for each of the specified petroleum activities listed in Schedule A - Table 1 for each petroleum tenure.

Schedule A, Table 1 – Authorised Petroleum Activities

Tenure No.	Petroleum Activity	Number	Maximum size (where applicable)
PL191	Seismic (kms)	N/A	N/A
	Core Well(s)	N/A	N/A
	Exploration Wells	N/A	N/A
	Production Well(s)	210	N/A
	Compressor Station(s)	25	N/A
	Evaporation Dam(s)	0	N/A
	Regulated Dam(s) >401 megalitres	0	N/A
	Regulated Dam(s) <400 megalitres	14	<400 megalitres
	Reverse Osmosis Plants	1	2ML/day
	Brine Encapsulation Facilities	0	N/A
	Sewage Treatment Plant(s)	1	56KL/day/plant
PL196	Seismic (kms)	N/A	N/A
	Core Well(s)	N/A	N/A
	Exploration Wells	N/A	N/A
	Production Well(s)	20	N/A
	Compressor Station(s)	0	N/A
	Evaporation Dam(s)	0	N/A
	Regulated Dam(s) >400 megalitres	0	N/A
	Regulated Dam(s) <400 megalitres	1	<400 megalitres
	Reverse Osmosis Plants	0	N/A
	Sewage Treatment Plant(s)	0	N/A

Prevent or Minimise Likelihood of Environmental Harm

(A2) This environmental authority does not authorise environmental harm unless a condition contained in this environmental authority explicitly authorises that harm. Where there is no condition, the lack of a condition shall not be construed as authorising harm.

Maintenance of Measures, Plant and Equipment

(A3) The holder of this environmental authority must:

(a) install all measures, plant and equipment necessary to ensure compliance with the conditions of this environmental authority;
(b) maintain such measures, plant and equipment in their proper and effective condition; and
(c) operate such measures, plant and equipment in a proper and effective manner.

(A4) No change, replacement or alteration of any plant or equipment is permitted if the change, replacement or alteration materially increases, or is likely to increase, the environmental harm caused by the petroleum activity.

Operational Plan

(A5) The holder of this environmental authority must develop an Operational Plan (the Plan) that provides detailed information about the activities to be carried out under this environmental authority.

(A6) The activities identified in the Plan must incorporate, but not be limited to, the petroleum activities set out in the approved Development Plan for the relevant petroleum authorities as required under the *Petroleum Act (1923)* or the *Petroleum and Gas (Production and Safety) Act 2004*.

(A7) The Plan must be consistent with the requirements of this environmental authority and include, but not be limited to:

- (a) a stated period, not exceeding three (3) years, to which the Plan applies;
- (b) a description of the existing infrastructure for conducting the petroleum activity(ies);
- (c) a description of proposed infrastructure that will be developed during the term of the Plan
- (d) a map or maps that:
  - i. record the location of the infrastructure in place for conducting the petroleum activity(ies) that exists at the commencement of the period of the Plan, including but not limited to:
    - regulated dams;
    - wells;
    - transmission flow lines;
    - gas processing facilities; and
    - water treatment facilities;
  - ii. record the location of approved additional infrastructure that will be developed for the conduct of the petroleum activities during the period of the Plan.
- (e) for proposed disturbance or vegetation clearing in an Environmentally Sensitive Area (ESA) provide details on the scale and extent of the disturbance or clearing and if required a commitment to provide an environmental offset
- (f) for each site to be disturbed, a description of the rehabilitation activities to be performed during the period of the Plan, including but not limited to:
  - i. location (e.g. tenure, coordinates) and disturbance type (e.g. well lease, flow line, access track);
  - ii. area to be rehabilitated;
  - iii. use of reference sites;
  - iv. species compositions; and
  - v. post-disturbance land use;
- (g) a description of progressive rehabilitation carried out including performance in relation to the requirements set out in the environmental authority and the proposed rehabilitation activities set out in the previous Plan; and
- (h) the calculation of the financial assurance for the proposed maximum disturbance expected during the period of the Plan.

(A8) The initial Plan must be submitted to the administering authority within three months after the granting of this environmental authority.

(A9) Revised Plans must be submitted to the administering authority not less than three months prior to the expiry of the current Plan.

Financial Assurance

(A10) The holder of this environmental authority must:

(a) provide to the administering authority financial assurance in the amount and form required from time to time by the administering authority for the authorised petroleum activity(ies); and
(b) review and maintain the amount of financial assurance based on the activities and rehabilitation to be undertaken during the period of the Plan.

(A11) The calculation of financial assurance must be in accordance with the most recent version of the Department of Environment and Resource Management's Guideline "Financial assurance for petroleum activities".

(A12) The financial assurance is to remain in force until the administering authority is satisfied that no claim is likely to be made on the assurance.

Third Party Audit

(A13) Compliance with the conditions of this environmental authority must be audited by an appropriately qualified third party auditor, nominated by the holder of this environmental authority and accepted by the administering authority, for each period of the Operational Plan required under Conditions A5 – A9.

(A14) Notwithstanding Condition A13, the holder of this environmental authority may, prior to undertaking the third party audit, negotiate with the administering authority the scope and content of the third party audit

(A15) The report of the third party auditor for the relevant prior period must be submitted to the administering authority by the holder of this environmental authority with each revised Operational Plan submitted in accordance with Condition A8 and Condition A9.

(A16) The third party auditor must certify (including a statutory declaration) the findings of the audit in the report.

(A17) The financial cost of the third party audit is to be borne by the holder of this environmental authority.

(A18) The holder of this environmental authority must immediately act upon any recommendations arising from the audit report by:

(a) investigating any non-compliance issues identified; and
(b) as soon as practicable, implementing measures or taking necessary action to ensure compliance with the requirements of this environmental authority.

(A19) Subject to Condition A18, and not more than three (3) months following the submission of the audit report, the holder of this environmental authority must provide a written report to the administering authority addressing the:

(a) actions taken by the holder of this environmental authority to ensure compliance with this environmental authority; and
(b) actions taken to prevent a recurrence of any non-compliance issues identified.

Cultural Heritage

(A20) In the carrying out of the petroleum activity(ies) the holder of this environmental authority must not adversely impact on the cultural heritage values of any place registered on the Queensland Heritage Register.

SCHEDULE B – WATER

Contaminant Release

(B1) Contaminants must not be directly or indirectly released to any waters except as permitted under this environmental authority.

Erosion and Sediment Control

(B2) Erosion protection measures and sediment control measures must be implemented and maintained to minimise erosion and the release of sediment and contaminated stormwater to waters.

(B3) An Erosion and Sediment Control Plan must be developed and implemented for all stages of the petroleum activity(ies) and which has been certified by a professional with appropriate experience and/or qualifications accepted by the administering authority and must include but not be limited to:

- (a) diverting uncontaminated stormwater run-off around areas disturbed by petroleum activity(ies) or where contaminants or wastes are stored or handled that may contribute to stormwater;
- (b) contaminated stormwater runoff and incident rainfall is collected; and treated, reused, or released in accordance with the conditions of this environmental authority;
- (c) roofing or minimising the size of areas where contaminants or wastes are stored or handled;
- (d) revegetating the disturbed area as soon as practicable after the completion of works;
- (e) using alternate materials and or processes (such as dry absorbents) to clean up spills that will minimise the generation of contaminated waters;
- (f) erosion and sediment control structures are placed to minimise erosion of disturbed areas and prevent the contamination of any waters;
- (g) an inspection and maintenance program for the erosion and sediment control features;
- (h) provision for adequate access to maintain all erosion and sediment control measures especially during the wet season months from December to March;
- (i) erosion and sediment control measures for construction of wells and pipelines on slopes >10%; and
- (j) identification of remedial actions that would be required to ensure compliance with the conditions of this environmental authority.

(B4) A copy of the Erosion and Sediment Control Plan must be submitted to the administering authority upon request.

Maintenance and Cleaning

(B5) The maintenance and cleaning of vehicles and any other equipment or plant must be carried out in areas from where the resultant contaminants cannot be released into any waters, roadside gutter or stormwater drainage system.

Watercourses, Wetlands and Springs

(B6) In the carrying out of the petroleum activity(ies) the holder of this environmental authority must not clear vegetation, excavate or place fill, except for the construction of roads and pipelines, in or within:

- (a) 200 metres from any natural significant wetland;
- (b) 100 metres from any natural wetland, lakes or springs; or
- (c) 100 metres of the high bank of any other watercourse.

(B7) The holder of this environmental authority must not excavate or place fill in a way that interferes with the flow of water in a watercourse, wetland, or spring, including works that divert the course of flow of the water or works that impound the water.

(B8) Despite Condition B7 pipeline and road construction works may be undertaken in watercourses, wetlands or springs where there is no practicable alternative such as the use of horizontal directional drilling methods, for a maximum period of ten (10) days, provided that the works are conducted in accordance with the following order of preference:

(a) conducting work in times of no flow; and
(b) using all reasonable and practical measures to reduce impacts in times of flow.

(B9) Activities or works resulting in significant disturbance to the bed or banks of a watercourse or wetland, or a spring must:

(a) only be undertaken where necessary for the construction and/or maintenance of roads, tracks and pipelines that are essential for carrying out the authorised petroleum activity(ies) and no reasonable alternative location is feasible;
(b) be no greater than the minimum area necessary for the purpose of the significant disturbance;
(c) be designed and undertaken by a suitably qualified and experienced person taking into account the matters listed in Section 5. Planning Activities and Section 6 Impact Management During Activities of DERM's "*Guideline – Activities in a watercourse, lake or spring associated with mining operations*" dated April 2008, or more recent editions as such become available; and
(d) upon cessation of the activities or works, commence rehabilitation immediately such that the final rehabilitation is to a condition that will ensure the ongoing physical integrity and the natural ecosystem values of the site.

(B10) Sediment control measures must be implemented to minimise any increase in water turbidity due to carrying out petroleum activity(ies) in the bed or banks of a watercourse or wetland, or a spring.

(B11) Routine, regular and frequent visual monitoring must be undertaken while carrying out construction work and/or any maintenance of completed works in a watercourse, wetland or spring. If, as a result of the petroleum activity(ies), water turbidity increases in the watercourse, wetland or spring outside contained areas, works must cease and the sediment control measures must be rectified to limit turbidity before activities recommence.

(B12) Petroleum activity(ies) must not be carried out in River Improvement Trust Asset Areas without the approval of the relevant River Improvement Trust.

Groundwater

(B13) The extraction of groundwater as part of the petroleum activity(ies) from underground aquifers must not directly or indirectly cause environmental harm to any spring, wetland or other surface waters.

Wild Rivers

(B14) In a declared Wild River Area, petroleum activity(ies) must be consistent with the conditions stated in the relevant Wild River declaration and in circumstances where there is any inconsistency or conflict the conditions of the Wild River declaration prevail.

Floodplains

(B15) The holder of this environmental authority must ensure that petroleum activity(ies), excluding limited petroleum activity(ies) do not significantly:
(a) concentrate flood flows;
(b) divert flood flows from natural drainage paths and alter flow distribution;
(c) increase the local duration of floods;
(d) increase the risk of detaining flood flows;
(e) increase the risk to the safety of persons from flooding; or
(f) increase the risk of damage to property from flooding.

Contaminant Release

(BA1) The release of contaminants to waters must only occur from the release points specified in Schedule BA, Table 1 – Contaminant Release Points, Sources and Receiving Waters and depicted in Figure 1 attached to this environmental authority.

Schedule BA, Table 1 - Contaminant Release Points, Sources and Receiving Waters

Release Point (RP)	Latitude or northing (GDA94)	Longitude or easting (GDA94)	Contaminant Source and Location	Monitoring Point	Receiving waters description
RP 1	-21° 57' 42"	148° 2' 35"	Treated CSG water from the reverse osmosis plant located on PL191 after 31 July 2011.	End of pipe for temperature and dissolved oxygen For all parameters in Schedule BA, Table 2, excluding temperature and dissolved oxygen; RO Facility Location -21° 58' 20" 148° 1' 0"	Isaac River – Dam 5 Discharge Point
RP2	-21° 57' 58"	148° 2' 45"			Isaac River (downstream) – Blair Athol Railway Bridge

(BA2) The release of contaminants to waters must not exceed the release limits stated in Schedule BA, Table 2 – Contaminant Release Limits for Release Point RP1 and RP2 when measured at the monitoring points specified in Schedule BA, Table 1 - Contaminant Release Points, Sources and Receiving Waters for each quality characteristic.

Schedule BA Table 2 – Contaminant Release Limits for Release Point RP1 and RP2

Physicochemical Parameters	Release Limits	Limit Type	Monitoring frequency
Electrical conductivity (µS/cm)	No limit	N/A	Daily during discharge events and for two days after cessation of discharge
pH (pH Unit)	6.5- 8.5	Range	
Dissolved oxygen (mg/L)	2	Minimum	
Turbidity (NTU)	25	Maximum	
Chloride (mg/L)	22 – 120	Range	
Sulphate (mg/L)	3 – 9	Range	
Calcium (mg/L)	>5	Minimum	
Magnesium (mg/L)	>1	Minimum	
Sodium (mg/L)	50	Maximum	
Chlorophyll-a (µg/L)	5	Maximum	

(BA3) The release of contaminants to waters from the release points must be monitored at the locations specified in Table 1 - Contaminant Release Points, Sources and Receiving Waters for

[redacted]

each quality characteristics and at the frequency specified in Table 2 – Contaminant Release Limits for Release Point RP1 and RP2.

Contaminant Release

(BA4) The holder must install, operate and maintain a stream flow gauging station(s) as specified in Schedule BA Table 3 – Contaminant Release during Flow Events to determine and record stream flows at the locations upstream of each Release Point(s) as shown in Schedule BA Table 1 - Contaminant Release Points, Sources and Receiving Waters, for any receiving water into which a release occurs.

(BA5) Notwithstanding any other condition of this environmental authority, the release of contaminants to waters must only take place during periods of natural flow events specified as minimum flow in Schedule BA Table 3 – Contaminant Release during Flow Events for the contaminant release point(s) specified in Schedule BA Table 1 - Contaminant Release Points, Sources and Receiving Waters.

Schedule BA, Table 3 – Contaminant Release during Flow Events

Receiving water description	Gauging station description	Latitude or northing (GDA94)	Longitude or easting (GDA94)	Minimum Flow in Receiving Water Required for a Release Event	Flow recording Frequency
Isaac River	Gauging station 1	-21° 57' 37"	148° 2' 17"	> or = 5 m^3/sec	Continuous (minimum daily)

(BA6) The total volume release through the release points must not exceed 0.023 m^3/s and 2 ML/day.

(BA7) The environmental authority holder must install and maintain a measuring device to measure/ meter the volume of treated CSG water released under this environmental authority.

(BA8) The measuring device/ meter must be installed prior to commencement of release of treated CSG water and its installation must comply with the most recent version of '*Draft standards and specifications for measuring /metering disposal of treated CSG water*'.

(BA9) Upon practical completion of the meter installation, the environmental authority holder must provide a completed 'Meter Installation Form" signed by the installer and the environmental authority holder confirming that the installation complies with the manufacturer's specifications and/or national standards and/or DERM's metering standards.

(BA10) The environmental authority holder must provide the administering authority with safe access to facilitate inspections, and comply with the manufacturer's instructions or best practice for the operation of the pump and meter installation.

(BA11) The releases to waters must be undertaken so as not to cause erosion of the bed and banks of the receiving waters, or cause a material build up of sediment in such waters.

Characterisation of Other Contaminants

(BA12) Prior to the release of water, the environmental authority holder must have prior written approval from the Office of the Water Supply Regulator (OWSR).

(BA13) If water has been released from authorised release points listed in Schedule BA, Table 1 – Contaminant Release Points, Sources and Receiving Waters authorised release points, the environmental authority holder must undertake an annual assessment of the contaminants of treated CSG water to determine the risk of environmental harm from release of treated CSG water to surface waters. This should consider the contaminants mentioned in the ANZECC & ARMCANZ 2000 guidelines. This [redacted]essment must be included in the Annual Return.

Notification of Release Event Exceedance

(BA14) If the release limits defined in Schedule BA, Table 2 – Contaminant Release Limits for Release Point RP1 and RP2 are exceeded, the holder of the environmental authority must notify the administering authority within twenty-four (24) hours of receiving the results.

(BA15) The environmental authority holder must, within twenty-eight (28) days of a release that exceeds the conditions of this environmental authority, provide a report to the administering authority detailing:

(a) the reason for the release;
(b) the location of the release;
(c) all water quality monitoring results;
(d) any general observations;
(e) all calculations;
(f) measures taken to prevent a repeat of the exceedance taking place; and
(g) any other matters pertinent to the water release event.

Event Based Surface Water Monitoring

(B16) Each monitoring and release point as specified in Schedule BA, Table 1 and Schedule BA, Table 3 must be marked and readily identifiable from the banks of the Isaac River.

(B17) The water quality of the Isaac River must be monitored for the physiochemical parameters and at the frequency specified in Schedule BA, Table 2 Contaminant Release Limits for Release Point RP1 and RP2 at a monitoring point 50 - 100 metres upstream; in addition to 200 metres and 1000 metres downstream of release point R2.

(B28) The holder of this environmental authority must keep written records of all discharge events to the Isaac River. The records must include, but not be limited to:

(a) The volume of water released through the release point(s);
(b) The release rate;
(c) date and time of discharge;
(d) flow rate at Gauging Station 1 during the discharge event;
(e) water quality characteristics monitoring results; and
(f) details of any observed impacts.

Water General

(BA19) The release of contaminants directly or indirectly to waters:
(a) must not produce any visible discolouration of receiving waters; nor
(b) must not produce any slick or other visible or odorous evidence of oil, grease or petrochemicals nor contain visible floating oil, grease, scum, litter or other objectionable matter.

Sewage Treatment Works

Release of Treated Sewage Effluent Contaminants to Land

(BC1) The peak design capacity of the sewage treatment plant must not exceed 216 equivalent persons based on a waste water generation rate of 250L/person/day.

(BC2) Sewage pump stations must be fitted with a stand-by pump and a visible or audible high level alarm.

(BC3) Treated effluent may only be released to land at the designated, fenced and delineated contaminant release area/s.

(BC4) Treated effluent must be not released to land within 100 metres of any residential area, watercourse, wetland, spring or protection area.

(BC5) The contaminant release area/s must be maintained in a proper and efficient condition so as to provide adequate assimilation, percolation, evaporation and transpiration of the released contaminants.

(BC6) Treated effluent must not be applied by spray irrigation and must be applied in a manner that does not cause damming or runoff of effluent beyond the contaminant release area/s.

(BC7) When weather conditions or soil conditions preclude the release of contaminants, for example, during and immediately after rainfall, the contaminants must be directed to on-site storage or lawfully disposed of off-site.

Quality of Contaminants Released from the Sewage Treatment Works

(BC8) Treated effluent must comply, at the sampling and in-situ measurement point(s), with each of the release limits specified in Schedule BC, Table 1 - Treated Sewage Effluent Standards for each quality characteristic.

(BC9) The release of contaminants to land must be monitored at the frequency and at the sampling and in-situ measurement point specified in Schedule BC, Table 1 - Treated Sewage Effluent Standards and records of the monitoring results kept for at least five years and made available to the administering authority on request.

Schedule BC, Table 1 - Treated Sewage Effluent Standards

Quality Characteristic	Sampling and in-situ measurement Point Location	Limit Type	Release Limit	Frequency
5-day Biochemical Oxygen Demand (inhibited)	Release pipe from sewage treatment plant after disinfection	maximum	20 mg/L	Monthly
Suspended Solids		maximum	30 mg/L	
pH		range	6.0 to 9.0	
E-Coli		80 percentile	1000 cfu per 100 mL	
		maximum	10000 cfu per 100 ml	

SCHEDULE C – REGULATED DAMS

(C1) The name of each regulated dam must be clearly signed at the dam location at all times.

(C2) Construction of any dam or modifications to an existing dam determined to be in the high hazard or significant hazard category in accordance with the most recent version of *"Manual for Assessing Hazard Categories and Hydraulic Performance of Dams"* is prohibited unless the required design plan details have been entered into the Regulated Dam Register and approved by the chief executive officer for the holder of the environmental authority, or their delegate, as being accurate and correct.

Regulated Dam Register

(C3) The holder of this environmental authority must maintain a Register of Regulated Dams that must include, as a minimum, the following information for each Regulated Dam:

(a) dam name, the coordinates for its location and date of entry in the register;
(b) dam purpose and its proposed/actual contents;
(c) hazard category assessed using the most recent version of *"Manual for Assessing Hazard Categories and Hydraulic Performance of Dams"*;
(d) details of the composition and construction of any liner;
(e) dimensions (metres) and surface area (hectares) measured at the footprint of the dam;
(f) maximum operational volume (megalitres);
(g) design storage allowance at 1 November each year (megalitres);
(h) mandatory reporting level (metres);
(i) date construction was certified as compliant with the design plan;
(j) name and qualifications of certifier;
(k) dates on which the dam was inspected for structural and operational adequacy;
(l) date on which the report of the annual structural and operational adequacy inspection was provided to the administering authority;
(m) dates on which the dam was inspected for the detection of leakage through any liner; and
(n) dates on which the dam was inspected for the purpose of annually ascertaining the available storage capacity on the 1 November each year.

(C4) The holder of this environmental authority must provisionally enter the required information in the Register of Regulated Dams when a design plan for a Regulated Dam is submitted to the administering authority.

(C5) The holder of this environmental authority must make a final entry of the required information in the Register of Regulated Dams once compliance with Condition C16 has been achieved.

(C6) The holder of this environmental authority must ensure that the information contained in the Register of Regulated Dams is complete and current on any given day.

(C7) The holder of this environmental authority must submit the Register of Regulated Dams or information contained in the Register available to the administering authority at each annual return and when requested to do so in the form requested by the administering authority.

Construction and Operational Requirements for New Dams

(C8) All aggregation dams must:

(a) be designed with a floor and sides of material that will contain the wetting front and any entrained contaminants within the bounds of the containment system during its operational life including any period of decommissioning and rehabilitation; and
(b) have a system that will detect any passage of the wetting front or entrained contaminants through the floor or sides of the dam and enable the repair of the containment system or its decommissioning and rehabilitation.

[redacted]

(C9) All new aggregation dams must be designed and operated so that during any period of thirty (30) days, following the first ninety (90) days of operation of the dam, the total volume of water leaving the dam other than by evaporation must not be less than 85% of the volume of water that has entered the dam.

(C10) By 1 October 2011, all brine dams must:

(a) be designed with a floor and sides of material that will contain the wetting front and any entrained contaminants within the bounds of the containment system during its operational life including any period of decommissioning and rehabilitation;
(b) have a system that will detect any passage of the wetting front or entrained contaminants through the floor or sides of the dam, enable the repair of the containment system or its decommissioning and rehabilitation; and
(c) the collection and proper disposal of any contaminants that move beyond the bounds of the containment system.

(C11) All Regulated Dams must be designed in accordance with the requirements of the most recent version of *"Manual for Assessing Hazard Categories and Hydraulic Performance of Dams"* by and constructed under the supervision of a suitably qualified and experienced person.

(C12) The hazard category of any dam must be determined by a suitably qualified and experienced person, prior to its design and construction, upon any change in its purpose or its stored contents, and at least once in each two (2) year period after its construction.

(C13) The construction and operation of all new Regulated Dams, is prohibited unless the holder of this environmental authority has submitted to the administering authority a copy of the design plan, together with the certification of a suitably qualified and experienced person that the regulated dam:

(a) will deliver the performance stated in the design plan;
(b) has had its hazard category assessed and been designed in accordance with the requirements of the most recent version of *"Manual for Assessing Hazard Categories and Hydraulic Performance of Dams"*; and
(c) when constructed and operated, will be compliant in all respects with the relevant conditions of this environmental authority subject to specific exemptions provided in C29.

(C14) The design plan must include, but not be limited to:

(a) a statement of the relevant legislation, regulatory documents and engineering practice relied upon in the design plan;
(b) a statement of the facts and data being used in the design plan and the limitations to the application and interpretation of that material;
(c) an assessment of the hazard category of the proposed dam based on the indentification of potential impacts on any sensitive receptors for any applicable dam failure scenarios, including the cumulative impact should all dams fail at once;
(d) detailed specifications for the design, operation, maintenance and decommissioning of the dam(s);
(e) an operational plan that includes contingency / emergency response procedures designed to avoid / minimise discharges resulting from any overtopping or loss of structural integrity of the dam;
(f) design, specification and operational rules for any related structures and systems used to prevent the overtopping of the proposed dam;
(g) a detailed plan for the decommissioning and rehabilitation of the dam at the end of its operational life;
(h) any other matter required by the certifying suitably qualified and experienced person; and
(i) evidence supporting the claims of the certifier that they are a suitably qualified and experienced person.

(C15) If, within the 20 business days following the lodgement of a certified design plan the administering authority notifies the holder of this environmental authority, in writing, that the design plan is not compliant wit[redacted]

(a) the conditions of this environmental authority; or
(b) the requirements set out in the most recent version of "*Manual for Assessing Hazard Categories and Hydraulic Performance of Dams*"

then the construction and operation of the Regulated Dam is prohibited until the administering authority provides written advice that its construction may proceed.

(C16) When construction of any Regulated Dam is complete, the holder of this environmental authority must submit to the administering authority one hard copy and one electronic copy of a set of 'as constructed' drawings, together with the certification of a suitably qualified and experienced person that the dam 'as constructed' will deliver the performance stated in the design plan and at the time of certification it is compliant in all respects with the conditions of this environmental authority.

(C17) Each Regulated Dam must be maintained and operated in a manner that is consistent with the design plan and the certified 'as constructed' drawings for the duration of its operational life and until decommissioned and rehabilitated.

Livestock and Wildlife

(C18) The holder of this environmental authority must ensure reasonable and practicable control measures are in place to ensure that harm is not caused to livestock or wildlife through the construction and operation of a Regulated Dam.

Mandatory Reporting Level

(C19) The Mandatory Reporting Level must be marked on each Regulated Dam in such a way that it is clearly observable during routine inspections of each dam.

(C20) The holder of this environmental authority must notify the administering authority immediately when the level of the contents of any Regulated Dam reaches the Mandatory Reporting Level, and immediately act to prevent or, if unable to prevent, to minimise any actual or potential environmental harm.

Annual Inspection and Report

(C21) Each Regulated Dam must be inspected annually by a suitably qualified and experienced person.

(C22) At each annual inspection, the condition and adequacy of each Regulated Dam must be assessed for dam safety and against the necessary structural, geotechnical and hydraulic performance criteria contained in the certified design plan.

(C23) An assessment of the adequacy of the available storage in each Regulated Dam is to be made, based on an actual dam level observed in the month of October in each year, and the resultant estimate of the level in that dam as at 1 November in each year must be equal or less than the design storage allowance for the dam.

(C24) Where the assessment of the adequacy of the available storage in any Regulated Dam indicates that the design storage allowance will be exceeded, or at any other time the holder of this environmental authority becomes aware that the design storage allowance has been or will be exceeded, the holder of this environmental authority must notify the administering authority within 24 hours, and immediately act to prevent or, if unable to prevent, to minimise any actual or potential environmental harm.

(C25) For each annual inspection, a copy of a report on the condition and adequacy of each Regulated Dam, certified by the suitably qualified and experienced person and including any recommended

[redacted]

actions to be taken to ensure the integrity of each Regulated Dam, must be provided to the administering authority upon request.

(C26) The holder of this environmental authority must, upon receipt of the annual inspection report, consider the report and its recommendations, take action to ensure that each Regulated Dam will safely perform its intended function, and within one month of receiving the report, notify the administering authority in writing of the recommendations of the inspection report and the actions taken to ensure the integrity of each Regulated Dam.

Requirements for Existing Dams

(C27) By 1 October 2011, all existing aggregation dams must:

(a) Have a floor and sides constructed with material that will contain the wetting front and any entrained contaminants within the bounds of the containment system during its operational life including any period of decommissioning and rehabilitation; and
(b) have a system that will detect any passage of the wetting front or entrained contaminants through the floor or sides of the dam; and
(c) either be capable of repair to rectify any passage of the wetting front through the floor or sides of the dam or be decommissioned and rehabilitated.

(C28) By 1 October 2011, all existing CSG aggregation dams must be operated so that during any period of thirty (30) days, the total volume of water leaving the dam other than by evaporation must not be less than 85%of the volume of water that has entered the dam.

Specific authorisation for Dam 11

(C29) Despite Condition D8, Dam 11 may be constructed within Category B and C ESA buffer zones provided that the dam is located within the control points (CP) listed in Schedule C, Table 1.

Schedule C, Table 1 – Control Points for Dam 11

Control Point	Easting (MGA Zone 55)	Northing (MGA Zone 55)
1	603957	7572921
2	604344	7572921
3	604342	7572533
4	603957	7572534

SCHEDULE D — Land

General

(D1) Contaminants must not be directly or indirectly released to land except as permitted under this environmental authority.

Disturbance to Land – General

(D2) Prior to conducting petroleum activity(ies) that involve significant disturbance to land, an assessment must be undertaken of the condition, type and ecological value of any vegetation in such areas where the activity is proposed to take place.

(D3) The assessment required by Condition D2 must be undertaken by a suitably qualified person and include the carrying out of field validation surveys, observations and mapping of any category A, B or C Environmentally Sensitive Areas (ESA's) and the presence of species classed as endangered, vulnerable, rare or near threatened under the *Nature Conservation Act 1992.*

(D4) The holder of this environmental authority, when carrying out (a) petroleum activity(ies) must:

- (a) avoid, minimise or mitigate (in order of preference) any impacts on areas of vegetation or other areas of ecological value;
- (b) minimise the risk of injury, harm, or entrapment to wildlife and stock;
- (c) minimise disturbance to land that may otherwise result in land degradation;
- (d) ensure that for land that is to be significantly disturbed by (a) petroleum activity(ies):
  - i. the top layer of the soil profile is removed;
  - ii. stockpiled in a manner that will preserve its biological and chemical properties; and
  - iii. used for rehabilitation purposes (in accordance with Condition H6) and
- (e) prior to carrying out field based activities, make all relevant staff, contractors or agents carrying out those activities, aware of the location of any category A, B or C ESA's and the requirements of this environmental authority.

(D5) In accordance with Condition (D4) above, if significant disturbance to land is unavoidable, the holder of this environmental authority must not clear vegetation, excavate or place fill:

- (a) in a way which significantly isolates, fragments or dissects tracts of vegetation resulting in a reduction in the current level of ecosystem functioning, ecological connectivity (i.e. stepping stone or contiguous bioregional/local corridor networks) and/or results in an increase in threatening processes (e.g. potential impacts associated with edge effects or introduced species);
- (b) on slopes greater than 10% for activities other than pipelines and wells; or
- (c) in discharge areas.

(D6) Clearing of remnant vegetation shall not exceed ten (10) metres in width for the purpose of establishing tracks and 20 metres in width for dual carriageway roads unless otherwise approved by the administering authority in writing.

(D7) Cleared vegetation must be stockpiled in a manner that facilitates respreading or salvaging and does not impede vehicle, stock or wildlife movements.

Disturbance to Land – Environmentally Sensitive Areas

(D8) Notwithstanding Conditions D2 to D7 inclusive, the holder of this environmental authority must ensure that the petroleum activity(ies):

- (a) are not conducted in or within 200 metres of any listed category A, B or C ESA's; and
- (b) do not involve activities other than (a) limited petroleum activity(ies) within 1km of a listed category A ESA, or within [redacted]sted category B or C ESA.

(D9) (A) limited petroleum activity(ies) carried out in accordance with Condition D8(b) must be preferentially located in pre-existing areas of clearing or significant disturbance to the greatest practicable extent.

Disturbance to Land – Endangered and Of Concern Regional Ecosystems

(D10) Despite Condition D8, where it can be demonstrated that no reasonable or feasible alternative exists, (a) limited petroleum activity(ies) may be undertaken within an endangered/of concern regional ecosystem (RE) and its associated buffer zone, provided that the area is not part of another listed category A, B or C ESA (e.g. a National Park) or associated buffer zone, subject to the following:

(a) the limited petroleum activity(ies) is/are located and carried out in areas according to the following order of preference:
   i. pre-existing cleared areas or significantly disturbed areas less than 200m from an Endangered/Of Concern RE;
   ii. undisturbed areas less than 200m from an Endangered/Of Concern RE;
   iii. pre-existing areas of significant disturbance within an endangered/of concern regional ecosystem (e.g. areas where significant clearing or thinning has been undertaken within a regional ecosystem, and/or areas containing high densities of weed or pest species which has inhibited re-colonisation of native regrowth);
   iv. areas where clearing of an endangered or of concern regional ecosystem is unavoidable;

(b) any vegetation clearing in an Endangered/Of Concern RE or associated buffer zone must not exceed any of the following areas:
   i. 10% of the remnant unit of Endangered/Of Concern regional ecosystem as ground truthed and mapped before any activity commences as per condition D2 and D3 of this environmental authority for the life of the project; or
   ii. more than $30m^2$ for the construction of a sump; or
   iii. six (6) metres in width for tracks; or
   iv. twelve (12) metres in width for pipeline construction purposes; and

(c) all reasonable and practical measures are taken to minimise the area cleared and to avoid the clearing of mature trees, which must include but not be limited to, for each well site, a risk assessment to determine the minimum amount of disturbance possible.

(D11) Details of any significant disturbance to land in or within 200m of Endangered or Of Concern regional ecosystems, along with a record of the assessment required by Conditions D2 and D3 must be kept and submitted to the administering authority upon request.

(D12) If the assessment required by Conditions D2 and D3 indicates that an ecosystem mapped as Endangered or Of Concern regional ecosystem by the Queensland Herbarium should be in a lower conservation value classification and the holder of this environmental authority wishes to undertake activities as if the ecosystem is of the lower conservation value they must notify the administering authority in writing before any significant disturbance to land takes place.

(D13) If, within the 20 business days following the lodgement of the notification under Condition D12 the administering authority notifies the holder of this environmental authority, in writing, that the regional ecosystem mapping requires further validation, then significant disturbance to land in the mapped regional ecosystem is prohibited until the administering authority provides written advice that significant disturbance to land may proceed.

(D14) When requested by the administering authority, the holder of this environmental authority must enter into an agreement with the administering authority to provide an environmental offset to counterbalance the impacts of the activity on Endangered or Of Concern regional ecosystem.

(D15) The holder of this environmental authority must comply with any environmental offset agreement made in accordance with the conditions of this environmental authority.

[redacted]

Disturbance to Land – State Forests and Timber Reserves

(D16) Despite Condition D8, activities may be undertaken within State Forests or Timber Reserves provided the holder of the environmental authority has written approval from the authority responsible for the administration of the *Forestry Act 1959.*

(D17) Where activities are to be undertaken in a State Forest or Timber Reserve that are also Endangered or Of Concern Regional Ecosystems, such activities may be undertaken in accordance with Condition D10 of this environmental authority, provided the holder of this environmental authority has written approval from the authority responsible for the administration of the *Forestry Act 1959.*

Soil Management

(D18) The holder of this environmental authority must develop and implement soil management procedures for areas to be disturbed by (a) petroleum activity(ies) prior to commencement of (a) petroleum activity(ies) in these areas to prevent or minimise the impacts of soil disturbance. These procedures must include but not be limited to:

(a) establishment of baseline soil information for areas to be disturbed including soil depth, pH, electrical conductivity (EC), chloride, cations (calcium, magnesium and sodium), exchangeable sodium percentage (ESP), particle size and soil fertility (including nitrogen, phosphorous, potassium, sulphur and micronutrients);
(b) a soils monitoring program outlining parameters to be monitored, frequency of monitoring and maximum limits for each parameter;
(c) identification of soil units within areas to be disturbed by petroleum activities at a scale of 1:100000, in accordance with the *"Guidelines for Surveying Soil and Land Resources, 2nd Edition"* (McKenzie *et al.* 2008), *"Australian Soil and Land Survey Handbook, 3rd Edition"* (National Committee on Soil and Terrain 2009) and *"The Australian Soil Classification"* (Isbell 2002);
(d) development of soil descriptions that are relevant to assessment for agricultural suitability, topsoil assessment, erodibility and rehabilitation, for example:
  i. shallow cracking clay soils;
  ii. deep cracking clay soils;
  iii. deep saline and/or sodic cracking clay soils with melonholes;
  iv. thin surface, sodic duplex soils;
  v. medium to thick surface (say >15 cm), sodic duplex soils; and
  vi. non-sodic duplex soils;
(e) detailed mitigation measures and procedures to manage the risk of adverse soil disturbance in the carrying out of the petroleum activity; and
(f) for areas of good quality agricultural land, detailed methods to be undertaken to minimise potential impacts.

(D19) A copy of the soil management procedures must be made available to the administering authority upon request.

Acid Sulfate Soils

(D20) The holder of this environmental authority must, when clearing in areas with acid sulfate soils or potential acid sulphate soils, develop and implement an acid sulfate soil environmental management plan prepared in accordance with Appendix 4 of the "*State Planning Policy 2/02 Guideline Acid Sulfate Soils*" and the Department of Environment and Resource Management's *"Queensland Acid Sulphate Soil Technical Manual" (Version 2.2 September 2004)* or more recent editions or supplements to these documents as such become available.

Fauna Management

(D21) The holder of this environmental authority must develop and implement fauna management procedures for the carrying out of the petroleum activity(ies), in particular pipeline construction,

[redacted]

construction and use of dams, to prevent or minimise harm or the potential risk of causing harm to fauna.

(D22) The fauna management procedures must include training and awareness of staff and contractors and ensure that any planned fauna handling is undertaken by a suitably qualified person.

(D23) A copy of the fauna management procedures must be made available to the administering authority upon request.

Pest management

(D24) In carrying out the petroleum activity(ies) the holder of this environmental authority must develop and implement an effective pest management program that includes but is not limited to the following:

(a) identification of pest species and infestation areas;
(b) prevents and/or minimises the introduction and/or spread of pests; and
(c) control and management of pest outbreaks as a result of petroleum activities.

(D25) A copy of the pest management program must be made available to the administering authority upon request.

Chemical and Fuel Storage

(D26) All explosives, hazardous chemicals, corrosive substances, toxic substances, gases, dangerous goods, flammable and combustible liquids (including petroleum products and associated piping and infrastructure) must be stored and handled in accordance with the relevant Australian Standard where such is available.

(D27) Notwithstanding the requirements of any Australian Standard, any liquids stored on site that have the potential to cause environmental harm must be stored in or serviced by an effective containment system that is impervious to the materials stored and managed to prevent the release of liquids to waters or land. Where no relevant Australian Standard is available, the following must be applied:

(a) storage tanks must be bunded so that the capacity and construction of the bund is sufficient to contain at least 110% of a single storage tank or 100% of the largest storage tank plus 10% of the second largest storage tank in multiple storage areas; and
(b) drum storages must be bunded so that the capacity and construction of the bund is sufficient to contain at least 25% of the maximum design storage volume within the bund.

(D28) All containment systems must be designed to minimise rainfall collection within the system.

Well Drilling, Completion and Stimulation

(D29) Hydraulic fracturing fluids must not contain benzene, ethylbenzene, toluene, xylene, naphthalene, phenanthrene or diesel.

(D30) A hydraulic fracturing chemical risk assessment is required to be carried out and submitted to the administering authority prior to hydraulic fracturing on PL191 and PL196.

(D31) The hydraulic fracturing chemical risk assessment required by Condition D30 must be reviewed:

a) when new or additional toxicological information becomes available for the chemicals used; and

b) when new chemicals, chemical concentrations or mixtures are used in hydraulic fracturing fluids.

(D32) The updated risk assessment required by Condition D31(a) must be submitted to the administering authority upon request .

(D33) The updated risk assessment required by Condition D31(b) must be submitted to the administering authority prior to the use of the new chemicals, chemical concentrations or mixtures for hydraulic fracturing on PL191 and PL196.

(D34) The holder of this environmental authority must monitor for the chemicals used in hydraulic fracturing fluids used on PL191 and PL196 and keep a record of the groundwater quality in any landholder's bore, subject to access being permitted by the landholder, that is located within a one (1) kilometre radius of a well subject to hydraulic fracturing.

(D35) The monitoring required under Condition D34 must be undertaken at least:

(a) within 2 months of hydraulic fracturing being undertaken;
(b) weekly for the first month subsequent to hydraulic fracturing being undertaken;
(c) monthly for the first six (6) months subsequent to hydraulic fracturing being undertaken; and
(d) annually for the first five (5) years subsequent to hydraulic fracturing.

(D36) The results of the monitoring required by Conditions D34 and D35 must be made available upon request to:
(a) the administering authority; and
(b) the landholder.

(D37) If the results of the monitoring required by Conditions D34 and D35 indicate that there has been a material impact caused by petroleum activities on groundwater quality, the holder of this environmental authority must notify:
(a) the administering authority within 24 hours; and
(b) any affected landholders within 24 hours or as per written agreement between the holder of this environmental authority and the landholder.

(D38) The holder of this environmental authority must ensure that the hydraulic fracturing process is carried out in such a manner that hydraulic fractures are only contained within the target coal seam.

SCHEDULE E – ENVIRONMENTAL NUISANCE

Odour, Dust and other Airborne Contaminants

(E1) The release of odour, dust or any other airborne contaminant(s), or light from the petroleum activity(ies) must not cause an environmental nuisance at any sensitive place or commercial place.

Noise

(E2) In the event of a complaint about noise from the carrying out of the petroleum activity(ies) being made to the administering authority and that the administering authority considers is not frivolous nor vexatious nor based on mistaken belief, then the emission of noise from the licensed place must not result in total noise levels at any sensitive or commercial place greater than those specified in Schedule E, Table 1 – Noise limits or Schedule E, Table 2 - Noise Limits for Main NQGP Compressor Station.

Schedule E, Table 1 – Noise limits

Time period	Noise level at a sensitive place measured as the Adjusted Maximum Sound Pressure Level $L_{A,max,adj,T}$
7am– 6 pm	Background noise level plus 5 dB(A)
6pm–10pm	Background noise level plus 5 dB(A)
10pm–7am	Background noise level plus 3 dB(A)
Time period	**Noise level at a commercial place measured as the Adjusted Maximum Sound Pressure Level $L_{A,max,adj,T}$**
7am –6 pm	Background noise level plus 10 dB(A)
6pm–10pm	Background noise level plus 10 dB(A)
10pm–7am	Background noise level plus 8 dB(A)

General note: In no case is the background noise level, $L_{A90,\,15\,mins}$ to be less than 25 dB(A). In the event that measured background noise level is less than 25 dB(A), then 25 dB(A) is to be used.

Schedule E, Table 2 - Noise Limits for Main NQGP Compressor Station

Noise level dB(A) measured as	Monday to Saturday			Sundays and Public Holidays		
	7am - 6pm	6pm - 10pm	10pm – 7am	9am - 6pm	6pm - 10pm	10pm - 9am
	Noise Measured at a 'Noise Sensitive Place' in Zones 1, 2, 4, 5, 9,12, 13*					
$L_{A10,\,adj,\,10\,mins}$	40	35	28	40	35	28
$L_{A1,\,adj,\,10\,mins}$	45	40	33	45	40	33
	Noise measured at a 'Commercial place' in Zones 1, 2, 4, 5, 9,12, 13*					
$L_{A10,\,adj,\,10\,mins}$	45	40	33	45	40	33
$L_{A1,\,adj,\,10\,mins}$	50	45	38	50	45	38
	Noise Measured at a 'Noise Sensitive Place' in Zones 3, 6, 7, 8, 10, 11, 14*					
$L_{A10,\,adj,\,10\,mins}$	45			45		

$L_{A1,\ adj,\ 10\ mins}$	50	50
$L_{Aeq,\ 10\ mins}$ in sleeping areas (interior)	35	

* Refers to the Planning Scheme of the Shire of Belyando (Moranbah and environs) approved 23 February 1995

General note: In no case is the background noise level, $L_{A90,\ 15\ mins}$ to be less than 25 dB(A). In the event that measured background noise level is less than 25 dB(A), then 25 dB(A) is to be used.

(E3) In the event of a complaint about noise from the carrying out of temporary petroleum activity(ies) being made to the administering authority and that the administering authority considers is not frivolous nor vexatious nor based on mistaken belief, then total noise emitted from the temporary petroleum activities must not exceed the noise acoustic quality objective of 55 dB(A)at any sensitive or commercial place between 7.00 am and 6.00 pm and background plus 3 dB(A) at other times.

(E4) In the event of a complaint about noise nuisance that the administering authority considers is not frivolous or vexatious then the holder of the environmental authority must prepare and submit a noise management plan to the administering authority within the reasonable and practicable timeframe specified in writing by the administering authority.

(E5) The noise management plan must address, but not be limited to, the following matters:

(a) identification of component noise sources and activities at the place(s) which impact on noise sensitive areas;
(b) the measured and/or predicted component and total level from Condition E5(a) at noise sensitive places;
(c) the reasonable and practicable control or abatement measures (including hours of operation) that can be undertaken to reduce identified intrusive noise sources;
(d) the level of noise at noise sensitive places that would be achieved from implementing these measures.
(e) the handling of future noise complaints;
(f) community liaison and consultation; and
(g) training of staff and contractors in noise management practices.

(E6 The holder of this environmental authority must commence implementation of the noise abatement measures recommended in the noise management plan not more that 30 days following its submission to the administering authority, accounting for any comments made by the administering authority within that time.

SCHEDULE F – AIR

(F1) Fuel burning or combustion equipment that is capable of burning at least 500kg of fuel in an hour must only release contaminants to the atmosphere as provided for in Schedule F – Table 1.

(F2) Contaminants must be directed vertically upwards.

Schedule F – Table 1 (release of contaminants)

Release point number		Minimum release height (meters)	Minimum velocity (m/sec)	Contaminant release	Maximum release limit[1] (g/sec)
A1	Node 1 compressor stack	8	25	NOx	0.25
A2	Node 1 compressor stack	8	25	NOx	0.25
A3	Node 1 compressor stack	8	25	NOx	0.25
A4*	Node 2 compressor stack	TBA	TBA	NOx	TBA
A5*	Node 3 compressor stack	TBA	TBA	NOx	TBA
A6*	Node 3 compressor stack	TBA	TBA	NOx	TBA
A7*	Node 3 compressor stack	TBA	TBA	NOx	TBA
A8*	Node 4 compressor stack	TBA	TBA	NOx	TBA
A9*	Node 4 compressor stack	TBA	TBA	NOx	TBA
A10	MGPF compressor stack	8	25	NOx	0.8
A11	MGPF compressor stack	8	25	NOx	0.8
A12	MGPF compressor stack	8	25	NOx	0.8
A13	MGPF compressor stack	8	25	NOx	0.8

* Planned at the date of authority issue

1 The NOx limits are applicable at all times except start-up, shut down and calibration of emission monitoring devices. The maximum start-up period allowed is 30 minutes

TBA Contaminant release parameters to be finalised and advised in the Annual return due October 2010.

(F3) The holder of this environmental authority must maintain a Register of Fuel Burning or Combustion Equipment that is capable of burning at least 500kg of fuel in an hour and must include, as a minimum, the following information for each item of equipment:

(a) fuel burning or combustion equipment name and location;
(b) stack emission height (metres);
(c) minimum efflux velocity (metres /sec); and
(d) mass emission rates (g/s) / contaminant concentrations (mg/Nm^3 @ 5% O_2).

(F4) The holder of this environmental authority must ensure that the information contained in the Register of Fuel Burning or Combustion Equipment is complete and current on any given day.

(F5) The holder of this environmental authority must make the Register of Fuel Burning or Combustion Equipment or information contained in the Register available to the administering authority on request.

[redacted]

SCHEDULE G – WASTE

General

(G1) All general waste must be removed from the site and sent to a recycling facility or disposal facility licensed to accept the waste.

(G2) All regulated waste must be removed from the site by a person who holds a current authority to transport such waste under the provisions of the *Environmental Protection Act 1994* and sent to a recycling facility or disposal facility licensed to accept the waste.

(G3) Waste must not be burned or allowed to be burned on the licensed site.

(G4) All waste fluids and muds resulting from drilling and exploration activities must be contained in a dam or containment structure for disposal, remediation or reuse where applicable.

(G5) Oil based drilling muds must not be used in the carrying out of the petroleum activity.

(G6) Synthetic based drilling muds must not be used in the carrying out of the petroleum activity other than with the written approval of the administering authority.

(G7) The holder of this environmental authority must ensure that coal seam gas water is contained, is not released to land or waters unless used for purposes specifically authorised:

(a) under this environmental authority; or
(b) under Section 186 of the *Petroleum and Gas (Production and Safety) Act 2004*; or
(c) under Section 86 of the *Petroleum Act 1923*; or
(d) under an approval of resource for beneficial use as provided for under the *Environmental Protection Act 1994.*

Coal seam gas water use for dust suppression

(G8) CSG water produced from the authorised petroleum activities may be used for dust suppression within tenures covered by this environmental authority, provided the water quality meets the limits specified in Schedule G, Table 1 – Road dust suppression water contaminant release limits for each of the water quality characteristics.

Schedule G, Table 1 – Road dust suppression water contaminant release limits.

Water Quality Characteristics	Unit	Limit	Limit Type
pH	pH Units	6.0 to 9.0	range
Total Suspended Solids	mg/L	30	maximum
Total Dissolved Salts	mg/L	2000	maximum
Total Petroleum Hydrocarbons	mg/L	10	maximum

(G9) Use of CSG water for dust suppression activities must be carried out in a manner that:

(a) vegetation is not damaged;
(b) soil erosion and soil structure damage is avoided;
(c) there is no surface damming of the CSG water;
(d) minimises deep drainage below the root zone of any vegetation;
(e) quality of shallow aquifers is not adversely affected; and
(f) there are no releases of CSG waters to any surface waters.

(G10) The holder of this environmental authority must ensure that the coal seam gas water to be used for domestic or stock purposes meets the ANZECC 2000 Water Quality Guidelines, or subsequent versions thereof, for stock and domestic purposes.

(G11) Coal seam gas water released to the environment in accordance with Condition G7 must not have any properties that could cause, nor contain any contaminants in concentrations that are capable of causing environmental harm.

Third Party Use

(G12) Wastewater generated from the authorised activities may be piped to Millennium Coal Mine ML70313 and ML7012 for use in coal washing and dust suppression.

(G13) The authority holder when discharging to Millennium Coal Mine must record daily the following details:

a) time and date of the discharge;

b) TDS and pH levels of the discharge; and

c) total volume discharged.

Water Release Reduction Strategy

(G14) As part of the Coal Seam Gas Water Management Plan ((CSGWMP) contained within the Environmental Management Plan)), the holder of the environmental authority must develop and implement an on-going Release Reduction Strategy to maximise CSG water use and minimise any release to waters . The strategy must address the following matters:

(a) implementation of schemes to achieve maximum use of the water;
(b) specific targets for achieving increased use of CSG water both treated and untreated;
(c) a market analysis at least every three (3) years to identify existing and future opportunities for water use;
(d) on-going review of emerging technologies and/or re-use options that could achieve significant reductions in mass loads of contaminants released to the environment;
(e) investigation of the feasibility of alternative options, practices and procedures to further minimise the volume and concentration of contaminants released to waters; and
(f) programs to implement feasible options to achieve increased water use and reduction in contaminant loads, including actions and timeframes for completion.

(G15) A progress report on the strategy required by Condition G14 is to be included in the Annual Return and address at least the following matters:

(a) details of the specific options, practices and procedures investigated;
(b) details of new practices, procedures and programs implemented since the last reporting period and targets met;
(c) where alternative options, practices and procedures are not considered feasible, the provision of justification to support that determination; and
(d) details of the option(s) yet to be implemented, including the timeframes for implementation, and justification for the chosen option(s).

(G16) Where any inconsistency exists between the conditions of this environmental authority and the Coal Seam Gas Water Management Plan, the conditions of this environmental authority prevail.

Salt Management

Brine Salt Reuse, Recycle or Off Site Disposal

(G17) Following cessation of petroleum activities, any residual brine or solid salt present in a CSG water dam must be removed and transported to a facility that can lawfully reuse, recycle or dispose of such waste.

[redacted]

SCHEDULE H – REHABILITATION

(H1) The holder of this environmental authority must not abandon any dam but must decommission each dam so as to prevent and/or minimise any environmental harm.

(H2) As a minimum, decommissioning must be conducted such that each dam either:

(a) becomes a stable landform similar to that of surrounding undisturbed areas, that no longer contains substances that will migrate into the environment, or
(b) is approved or authorised by the administering authority for use by the landholder following cessation of the petroleum activities.

(H3) Progressive rehabilitation of disturbed areas must commence as soon as practicable following the completion of any construction or operational works associated with the petroleum activity(ies).

(H4) As soon as practicable, but no later than twelve (12) months (or a longer period agreed in writing by the administering authority) after the end of petroleum activity(ies) causing significant disturbance to land, the holder of this environmental authority must:

(a) remediate contaminated land (e.g. dams containing salt);
(b) reshape all significantly disturbed land to a stable landform similar to that of surrounding undisturbed areas;
(c) on all significantly disturbed land, take all reasonable and practicable measures to:
i. re-establish surface drainage lines;
ii. reinstate the top layer of the soil profile; and
iii. promote establishment of vegetation.
(d) undertake rehabilitation in a manner such that any actual and potential acid sulfate soils in or on the site are either not disturbed, or submerged, or treated so as to not be likely to cause environmental harm; and
(e) decommission all inactive buried pipelines in accordance with the requirements of AS2885 and ensuring that there will not be any subsequent subsidence of land along the pipeline route.

(H5) All significantly disturbed land caused by the carrying out of the petroleum activity(ies) must be rehabilitated to:

(a) a stable landform and with a self-sustaining vegetation cover and species that are similar to adjoining undisturbed areas;
(b) ensure that all land is reinstated to the pre-disturbed land use and suitability class;
(c) ensure that the maintenance requirements for rehabilitated land is no greater than that required for the land prior to its disturbance by petroleum activities; and
(d) ensure that the water quality of any residual void or water bodies constructed by petroleum activities meets criteria for subsequent uses and does not have potential to cause environmental harm.

(H6) Maintenance of rehabilitated areas must take place to ensure and demonstrate:

(a) stability of landforms;
(b) erosion control measures remain effective;
(c) stormwater runoff and seepage from rehabilitated areas does not negatively affect the environmental values of any waters;
(d) plants show healthy growth and recruitment is occurring; and
(e) rehabilitated areas are free of any declared pest plants.

(H7) Rehabilitation can be considered successful when:

(a) the site can be managed for its designated land-use (e.g. similar to that of surrounding undisturbed areas);

(b) no greater management input than for other land in the area being used for a similar purpose is required and there is evidence that the rehabilitation has been successful for at least three (3) years;

(c) the rehabilitation is carried out in accordance with the goals, objectives indicators and completion criteria as specified in Schedule H, Table 1 – Planned rehabilitation specifications; or

(d) written agreement is obtained from the landowner/holder and administering authority.

[redacted]

Schedule H, Table 1 – Planned rehabilitation specifications

Petroleum activity feature	Relevant Resource Authority	Rehabilitation Goal	Rehabilitation objectives	Indicators	Completion criteria
All petroleum activity features	PL191 and PL196	1. Safe	Site safe for humans and animals	(a) Landform re-established	(a) No subsidence or major erosion gullies
		2. Non-polluting	Sediment and erosion control structures in place	(a) Sediment traps and design of erosion control measures	(a) Certification from suitably qualified and experience person and performance of control structures
			Storm water runoff does not pollute nearby watercourses	(b) Surface water monitoring	(b) Monitoring meeting release limits
			Encapsulated salt does not seep outside the monocell	(c) Groundwater monitoring	(c) Monitoring shows no adverse impacts on groundwater quality
		3. Stable	Minimise erosion	(a) Re-establish surface drainage lines	(a) no subsidence or areas of major erosion for at least 3 years
				(b) Vegetation cover	(b)(i) 50% cover (flat to sloping) and (b)(ii) 75% cover (moderate to steep slopes) consisting of vegetation similar to immediate surrounding area. (b)(iii) vegetation cover is equivalent to immediate surrounding area where land use is cultivation.

Petroleum activity feature	Relevant Resource Authority	Rehabilitation Goal	Rehabilitation objectives	Indicators	Completion criteria
		4. Self-sustaining	Describe post activity land use or land suitability or land capability	(a) Floral Species diversity	(a)(i) Evidence that 80% of the immediate surrounding species diversity is achieved and maintained for 3 years. (a)(ii) If soil can be demonstrated as being substantially different after operations, objective is to establish other vegetation which fulfils the function of the vegetation immediately surrounding the area.
				(b) Presence of key floral species	(b)(i) Evidence that 80% of key species in the immediate surrounding area are present and maintained for 3 years. (b)(ii) Where agriculture is the planned final land use, the species should be those commonly used for pasture or crops known to be successful in soils of similar texture, drainage, pH and fertility.

SCHEDULE I – MONITORING PROGRAMS

General

(I1) The holder of this environmental authority must develop and implement a monitoring program, the result of which will demonstrate compliance with the conditions of this environmental authority.

(I2) All monitoring under this environmental authority must be conducted by a suitably qualified person.

(I3) All instruments, equipment and measuring devices used for measuring or monitoring in accordance with any condition of this environmental authority must be calibrated, and operated and maintained effectively.

(I4) The method of water sampling required by this environmental authority must comply with the most recent edition of the Department of Environment and Resource Management – Water Quality Sampling Manual.

(I5) All determinations of water quality must be:

(a) performed by a person or body possessing appropriate experience and qualifications to perform the required measurements; and
(b) made in accordance with methods prescribed in the latest edition of the Department of Environment and Resource Management - Water Quality Sampling Manual; and
(c) carried out on representative samples.

(I6) All analyses and tests required to be conducted under this environmental authority must be carried out by a laboratory that has NATA certification for such analyses and tests, except as otherwise authorised by the administering authority.

(I7) If monitoring conducted in accordance with this environmental authority indicated a condition or contaminant level that has caused, or has potential to cause, environmental harm, the environmental authority holder must:

(d) as soon as is practicable, take the necessary actions to rectify the condition or contaminant level so as to avoid or minimise environmental harm; and
(e) notify the administering authority of the condition or contaminant level and the actions taken to rectify it.

(I8) Any management or monitoring plans, systems or programs required to be developed and implemented by a condition of this environmental authority must be reviewed for performance and amended if required on an annual basis.

(I9) The holder of this environmental authority must record, compile and keep for a minimum of five years all monitoring results required by this environmental authority and make available for inspection all or any of these records upon request by the administering authority.

(I10) An annual monitoring report must be prepared each year and presented to the administering authority when requested. This report shall include but not be limited to:

(a) a summary of the previous twelve (12) months monitoring results obtained under any monitoring programs required under this environmental authority and, a comparison of the previous twelve (12) months monitoring results to both the limits set in this environmental authority and to relevant prior results; and
(b) an evaluation/explanation of the data derived from any monitoring programs; and
(c) a summary of any record of quantities of releases required to be kept under this environmental authority; and

[redacted]

(d) an outline of actions taken or proposed to minimise the risk of environmental harm from any condition or elevated contaminant level identified by the monitoring or recording programs.

Groundwater Monitoring

(I11) The holder of this environmental authority must prepare and implement a groundwater monitoring program within 40 business days of this environmental authority taking effect.

(I12) The groundwater monitoring program must be developed and implemented by a person possessing appropriate qualifications and experience in the fields of hydrogeology and groundwater sampling design.

(I13) The groundwater monitoring program must be able to detect any significant risks and changes to groundwater quality caused by petroleum activity(ies) authorised under this environmental authority. As a minimum the program must include:

(a) a groundwater monitoring network designed and installed for the petroleum activities; and
(b) a sufficient number of monitoring sites to provide information on the following:
  (i) seepage to groundwater and surrounding soils from any regulated dam authorised under this environmental authority and its effect on groundwater and soils;
  (ii) background monitoring sites (i.e. groundwater quality in representative bore(s) that have not been affected by the activities authorised under this environmental authority).
(c) the location of monitoring points, parameters to be measured, frequency of monitoring, monitoring methodology used, trigger values; and
(d) the development of procedures to establish background ground water quality.

(I14) The groundwater monitoring program must provide for monitoring of groundwater quality as often as necessary to detect impacts of the petroleum activities authorised under this environmental authority, but not less frequently than biannually (every six months) for the first year of carrying out the petroleum activities and annually thereafter.

(I15) If groundwater contamination caused by the petroleum activities is encountered, the following must be considered to satisfy requirements under Condition I17.

(a) the level of environmental harm caused as a result of such contamination to soils and groundwater;
(b) the conduct of a geodetic survey of all monitoring bores to determine the relative water surface elevations of each bore and reported in metres relative to the Australian Height Datum; and
(c) the determination of groundwater flow direction, groundwater flow rate and hydraulic conductivity.

(I16) The holder of this environmental authority must ensure that the groundwater monitoring data gathered in accordance with this environmental authority is analysed and interpreted to assess the nature and extent of any environmental impact of the environmentally relevant activity. The data, analysis and assessment must be submitted to the administering authority with each Annual Return.

(I17) If groundwater monitoring indicates that any significant changes in groundwater quality caused by petroleum activities are detected, then information must be submitted to the administering authority within ten (10) business days of receipt of the analysis indicating these changes, including any proposed actions to mitigate the changes in groundwater quality.

Air Monitoring (Point Source)

(I18) The holder of this environmental authority must conduct a monitoring program of contaminants released to the atmosphere at each release point recorded in the Register of Fuel Burning or Combustion Equipment (Condition F3) for the contaminants and at the frequency listed in Schedule I – Table 1 – Monitoring Frequency for Contaminants.

Schedule I, Table 1 – Monitoring Frequency for contaminants

Contaminant	Monitoring frequency
NOx as Nitrogen Dioxide	Within 3 months after commissioning of the fuel burning equipment; and
Carbon monoxide	Twice a year for the first two (2) years of operation; and Thereafter, annually

(I19) The monitoring program must comply with the following:

(a) Monitoring provisions for the release points must comply with the most recent edition of AS4323.1 Stationary source emissions method 1: Selection of sampling provisions.
(b) The following tests must be performed for each sample taken at each release point specified in the Register of Fuel Burning or Combustion Equipment (Condition F3):
  i. Gas velocity, volume and mass flow rate.
  ii. Temperature.
  iii. Water vapour concentration (for non-continuous sampling).
(c) Samples taken must be representative of the contaminants discharged when operating under maximum operating conditions.
(d) During the sampling period the following additional information must be gathered:
  i. Production rate.
  ii. Plant status.
(e) Monitoring of contaminant release must be carried out in accordance with the latest edition of the administering authority's Air Quality Sampling Manual.

Noise Monitoring

(I20) The holder of this environmental authority must undertake noise monitoring when requested by the administering authority to investigate a complaint of environmental nuisance at a sensitive or commercial place within the reasonable and practicable timeframe nominated by the administering authority, and report the results to the administering authority within three (3) business days of completion of the monitoring.

(I21) Noise monitoring and recording must include the following descriptor, characteristics and matters:

(a) $L_{AN,T}$ (where N equals the statistical levels of 1, 10 and 90 and T = 15 mins);
(b) background noise $L_{A90,T}$;
(c) the level and frequency of occurrence of impulsive or tonal noise and any adjustment and penalties to statistical levels;
(d) atmospheric conditions including temperature, relative humidity and wind speed and directions;
(e) effects due to any extraneous factors such as traffic noise;
(f) location, date and time of monitoring;
(g) if the complaint concerns low frequency noise, Max $L_{PZ,15\,min}$; and
(h) if the complaint concerns low frequency noise, one third octave band measurements in dB(LIN) for centre frequencies in the 10 – 200 Hz range for both the noise source and the background noise in the absence of the noise source.

(I22) The method of measurement and reporting of noise levels and background sound pressure levels must comply with the latest edition of the administering authority's *Noise Measurement Manual* or the most recent version of AS1055 Acoustics – description and measurement of environmental noise.

Nuisance Monitoring (other than Noise)

(I23) When the administering authority advises the holder of this environmental authority of a complaint alleging nuisance other than noise, the holder must investigate the complaint and advise the administering authority in writing of the action proposed or undertaken to resolve the complaint.

[redacted]

(I24) When requested by the administering authority, the holder of this environmental authority must undertake monitoring as specified by the administering authority, within a reasonable and practical timeframe nominated by the administering authority to investigate any complaint of environmental harm at any sensitive or commercial place.

(I25) The results of the investigation (including an analysis and interpretation of the monitoring results) and abatement measures implemented must be provided to the administering authority within ten (10) business days of completion of the investigation, or receipt of the monitoring results, whichever is the latter.

(I26) If monitoring in accordance with Condition I24 and I25 indicates that emissions exceed the limits set in this environmental authority or are causing environmental nuisance, then the holder of this environmental authority must:

(a) address the complaint including the use of alternative dispute resolution services if required; and/or
(b) as soon as practicable implement abatement or attenuation measures so that light, dust, particulate or odour emissions from the authorised activities do not result in further environmental nuisance.

Annual Water Monitoring Reporting

(I27) The following information must be recorded in relation to all water monitoring required under the conditions of this environmental authority and submitted to the administering authority in the specified format with each annual return:

(a) the date on which the sample was taken;
(b) the time at which the sample was taken;
(c) the monitoring point at which the sample was taken;
(d) the measured or estimated daily quantity of the contaminants released from all release points;
(e) the release flow rate at the time of sampling for each release point;
(f) the results of all monitoring and details of any exceedances with the conditions of this environmental authority; and
(g) water quality monitoring data must be provided to the administering authority in the specified electronic format upon request.

SCHEDULE J – COMMUNITY ISSUES

(J1) The holder of this environmental authority must maintain a record of complaints and incidents causing environmental harm, and actions taken in response to the complaint or incident.

(J2) The holder of this environmental authority must record the following details for all complaints received and provide this information to the administering authority on request:

- (a) name, address and contact number for complainant;
- (b) time and date of complaint;
- (c) reasons for the complaint as stated by the complainant;
- (d) investigations undertaken in response to the complaint:
- (e) conclusions formed;
- (f) actions taken to resolve complaint;
- (g) any abatement measures implemented to mitigate the cause of the complaint; and
- (h) name and contact details of the person responsible for resolving the complaint.

(J3) The holder of this environmental authority must retain the record of complaints required by this condition for five (5) years.

[redacted]

SCHEDULE K - NOTIFICATION PROCEDURES

(K1) The holder of this environmental authority must telephone the administering authority's Pollution Hotline (1300 130 372) or local office and the landholder or their nominated representative within 24 hours of becoming aware of any release of contaminants not in accordance with the conditions of this environmental authority or any event where environmental harm has been caused or may be caused.

(K2) Subject to condition K1, the holder of this environmental authority is required to report in the case of uncontained spills of contaminants (including but not limited to hydrocarbon, CSG water or mixtures of both) of the following volumes or kind:

- (a) releases of any volume of contaminants to water; and
- (b) releases of volumes of contaminants greater than 200 litres of hydrocarbon, 2000 litres of brine or 10 000 litres of coal seam gas water to land; and
- (c) releases of any volumes of contaminants where potential serious or material environmental harm has occurred or may occur.

(K3) The notification of emergencies or incidents as required by Conditions K1 and K2 must include but not be limited to the following information:

- (a) the environmental authority number and name of the holder of this environmental authority;
- (b) the name and telephone number of the designated contact person;
- (c) the location of the emergency or incident;
- (d) the date and time of the release;
- (e) the time the holder of this environmental authority became aware of the emergency or incident;
- (f) the estimated quantity and type of any substances involved in the incident;
- (g) the actual or potential suspected cause of the release;
- (h) a description of the effects of the incident including any environmental harm that has occurred or may occur as a result of the release;
- (i) any sampling conducted or proposed, relevant to the emergency or incident; and
- (j) actions taken to prevent any further release and mitigate any environmental harm caused by the release.

(K4) Within ten (10) business days following the initial notification of an emergency or incident or receipt of monitoring results, whichever is the later, a written report must be provided to the administering authority, including the following:

- (a) results and interpretation of any samples taken at the time of the incident and analysed;
- (b) the outcomes of actions taken at the time of the incident to prevent or minimise environmental harm; and
- (c) proposed actions to prevent a recurrence of the emergency or incident.

(K5) As soon as practicable, but not more than six (6) weeks following the conduct of any environmental monitoring performed in relation to the emergency or incident, which results in the release of contaminants not in accordance, or reasonably expected to be not in accordance with the conditions of this environmental authority, a written report on the results of any such monitoring must be provided to the administering authority.

[redacted]

SCHEDULE L - DEFINITIONS

Note: *Where a term is not defined in this environmental authority the definition in the* Environmental Protection Act 1994, *its regulations and Environmental Protection Policies or the* Petroleum and Gas (Production and Safety) Act 2004 *and its regulations must be used in that order.*

"acid sulfate soils" means soil or sediment containing highly acidic soil horizons or layers affected by the oxidation of iron sulfides (*actual acid sulfate soils*) and/or soil or sediment containing iron sulfides or other sulfidic material that has not been exposed to air and oxidised (*potential acid sulfate soils*).

"associated works" in relation to a dam, means:

- operations of any kind and all things constructed, erected or installed for that dam; and
- any land used for those operations.

"background noise level" means the sound pressure level, measured in the absence of the noise under investigation, as the L A90,T being the A-weighted sound pressure level exceeded for 90 percent of the measurement time period T of not less than 15 minutes, using Fast response.

"bed and banks" for a watercourse or wetland means land over which the water of the watercourse or wetland normally flows or that is normally covered by the water, whether permanently or intermittently; but does not include land adjoining or adjacent to the bed or banks that is from time to time covered by floodwater.

"beneficial use" means

- with respect to dams, that the current or proposed owner of the land on which a dam stands, has found a use for that dam that is:
  - of benefit to that owner in that it adds real value to their business or to the general community,
  - in accordance with relevant provisions of the *Environmental Protection Act 1994*,
  - sustainable by virtue of written undertakings given by that owner to maintain that dam, and
  - the transfer and use have been approved or authorised under any relevant legislation. Or
- with respect to coal seam gas water, refer the DERM's Operational Policy *Management of water produced in association with petroleum activities (CSG water)* and *Notice of decision to approve a resource for beneficial use – CSG water* which can be accessed on DERM's website at www.derm.qld.gov.au.

"brine" means either saline water with a total dissolved solid concentration greater than 40 000mg/l or CSG water after it has been concentrated through water treatment processes and/or evaporation.

"bund or bunded" in relation to spill containment systems for fabricated or manufactured tanks or containers designed to a recognised standard means an embankment or wall of brick, stone, concrete or other impervious material which may form part or all of the perimeter of a compound and provides a barrier to retain liquid. Since the bund is the main part of a spill containment system, the whole system (or bunded area) is sometimes colloquially referred to within industry as the bund. The bund is designed to contain spillages and leaks from liquids used, stored or processed above ground and to facilitate clean-up operations. As well as being used to prevent pollution of the receiving environment, bunds are also used for fire protection, product recovery and process isolation.

"category A ESA" means any area listed in Section 25 of the *Environmental Protection Regulation 2008.*

"category B ESA" means any area listed in Section 26 of the *Environmental Protection Regulation 2008.*

"category C ESA" means any of the following areas:

- Nature Refuges as defined under the *Nature Conservation Act 1992*;
- Koala Habitat Areas as defined under the *Nature Conservation Act 1992*;
- State Forests or Timber Reserves as defined under the *Forestry Act 1959*;
- Declared catchment areas under the *Water Act 2000*;
- Resources reserves under the *Nature Conservation Act 1992*
- An area identified as "Essential Habitat" for a species of wildlife listed as endangered, vulnerable, rare or near threatened under the *Nature Conservation Act 1992*;
- Any wetland shown on the Map of Referable Wetlands available from DERM's website; or
- "Of concern" regional ecosystems identified in the database maintained by DERM called 'Regional ecosystem description database' containing regional ecosystem numbers and descriptions.

[redacted]

"certification or certified by a suitably qualified and experienced person" in relation to a design plan or an annual report regarding dams, means that a statutory declaration has been made by that person and, when taken together with any attached or appended documents referenced in that declaration, all of the following aspects are addressed and are sufficient to allow an independent audit at any time:

- exactly what is being certified and the precise nature of that certification.
- the relevant legislative, regulatory and technical criteria on which the certification has been based;
- the relevant data and facts on which the certification has been based, the source of that material, and the efforts made to obtain all relevant data and facts; and
- the reasoning on which the certification has been based using the relevant data and facts, and the relevant criteria.

"certified by a suitably qualified and experienced person" in relation to a hazard assessment of a dam, means that a statutory declaration has been made by that person and, when taken together with any attached or appended documents referenced in that declaration, all of the following aspects are addressed and are sufficient to allow an independent audit at any time:

- exactly what has been assessed and the precise nature of that assessment;
- the relevant legislative, regulatory and technical criteria on which the assessment has been based;
- the relevant data and facts on which the assessment has been based, the source of that material, and the efforts made to obtain all relevant data and facts; and
- the reasoning on which the assessment has been based using the relevant data and facts, and the relevant criteria.

"clearing" means:

- in relation to grass, scrub or bush—the removal of vegetation by disturbing root systems and exposing underlying soil (including burning), but does not include—
  - the flattening or compaction of vegetation by vehicles if the vegetation remains living; or
  - the slashing or mowing of vegetation to facilitate access tracks; or
  - the clearing of noxious or introduced plant species; and
- in relation to trees—cutting down, ringbarking, pushing over, poisoning or destroying in any way.

"commercial place" means a work place used as an office or for business or commercial purposes, which is not part of the petroleum activities and does not include employees accommodation or public roads.

"construction" in relation to a dam includes building a new dam and modifying or lifting an existing dam.

"CSG water" means groundwater that is necessarily or unavoidably brought to the surface in the process of coal seam gas exploration or production. CSG water typically contains significant concentrations of salts, has a high sodium adsorption ratio (SAR) and may contain other contaminants that have the potential to cause environmental harm if released to land or waters through inappropriate management. CSG water is a waste, as defined under s13 of the EP Act.

"CSG water concentrate" is the concentration of saline water waste stream from a water treatment process that does not exceed a total dissolved solid concentration of 40 000mg/L.

"CSG evaporation dams" is defined as an impoundment, enclosure or structure that is designed to be used to hold CSG water for evaporation.

"dam" means a land-based structure or a void that is designed to contain, divert or control flowable substances, and includes any substances that are thereby contained, diverted or controlled by that land-based structure or void and associated works. A dam does *not* mean a fabricated or manufactured tank or container, designed and constructed to an Australian Standard that deals with strength and structural integrity of that tank or container.

"design plan" means the documentation required to describe the physical dimensions of the dam, the materials and standards to be used for construction of the dam, and the criteria to be used for operating the dam. The documents must include design and investigation reports, specifications and certifications, together with the planned decommissioning and rehabilitation works and outcomes. A design plan may include 'as constructed' drawings.

"discharge area" means:

[redacted]

(a) that part of the land surface where groundwater discharge produces a net movement of water out of the groundwater; and
(b) identified by an assessment process consistent with the document: Salinity Management Handbook, Queensland Department of Natural Resources, 1997; or
(c) identified by an approved salinity hazard map held by the Department of Environment and Resource Management.

"ecosystem functioning" means the interactions between and within living and nonliving components of an ecosystem and generally correlates with the size, shape and location of an area of vegetation.

"end" means the stopping of the particular activity that has caused a significant disturbance in a particular area. It refers to, among other things, the end of a seismic survey or the end of a drilling operation. It does not refer to the end of all related activities such as rehabilitation. In other words, it does not refer to the 'completion' of the petroleum activity, the time at which the petroleum authority ends or the time that the land in question ceases to be part of an authority.

"equivalent person or EP" means an equivalent person under volume 1, section 2 of the *Guidelines for Planning and Design of Sewerage Schemes*, October 1991, published by the Water Resources Commission, Department of Primary Industries, Fisheries and Forestry.

"existing CSG dams" means Dam 1, Dam 2, Dam 3, Dam 4, Dam 5, Dam 6, Dam 7, Dam 9, Dam 10, Dam 11 and Dam 13.

"fill" means any kind of material in solid form (whether or not naturally occurring) capable of being deposited at a place but does not include material that forms a part of, or is associated with, a structure constructed in a watercourse, wetland or spring including a bridge, road, causeway, pipeline, rock revetment, drain outlet works, erosion prevention structure or fence.

"flowable substance" means matter or a mixture of materials which can flow under any conditions potentially affecting that substance. Constituents of a flowable substance can include water, other liquids fluids or solids, or a mixture that includes water and any other liquids fluids or solids either in solution or suspension.

"foreseeable future' means the period used for assessing the total probability of an event occurring. Permanent structures and ecological sustainability should be expected to still exist at the end of a 150 year foreseeable future with an acceptably low probability of failure before that time.

"hazard" in relation to a dam as defined, means the potential for environmental harm resulting from the collapse or failure of the dam to perform its primary purpose of containing, diverting or controlling flowable substances.

"hazard category" means a category, either low, significant or high, into which a dam is assessed as a result of the application of tables and other criteria in *DERM's Manual for Assessing Hazard Categories and Hydraulic Performance of Dams (Version 1.0, 2008)* or any updated version of the Manual that becomes available from time to time

"heritage place" means any place that may be of cultural heritage significance, or any place with potential to contain archaeological artefacts that are an important source of information about Queensland's history.

"high bank" means the defining terrace or bank or, if no bank is present, the point on the active floodplain, which confines the average annual peak flows in a watercourse.

"highly erodible soils" means very unstable soils that are generally described as Sodosols with hard – setting, fine sandy loam to silty clay loam surfaces (solodics, solodised solonetz and solonetz) or soils with a dispersible layer located less than 25cm deep or soils less than 25cm deep.

"hydraulic performance" means the capacity of a regulated dam to contain or safely pass flowable substances based on a probability (AEP) of performance failure specified for the relevant hazard category in the *Manual for Assessing Hazard Categories and Hydraulic Performance of Dams (Version 1.0, 2008)* published by DERM on its website.

"impulsive sound" means sound characterised by brief excursions of sound pressure (acoustic impulses) that significantly exceed the background sound pressure. The duration of a single impulsive sound is usually less than one second.

"infrastructure" means water storage dams, roads and tracks, equipment, buildings and other structures built for the purpose and duration of the conduct of the petroleum activities, but does not include other facilities required for the long term management of the impact of those activities or the protection of potential resources. Such other facilities include dams other than water storage dams (e.g. evaporation dams), pipelines and assets, that have been decommissioned, rehabilitated, and lawfully recognised as being subject to subsequent transfer with ownership of the land.

"itinerant activities" means activities that are carried out at various locations using transportable plant or equipment and carried out at one locati[redacted]r less than 14 consecutive days and on more than two occasions in each calendar year.

"lake" means:

(a) a lagoon, swamp or other natural collection of water, whether permanent or intermittent; and
(b) the bed and banks and any other element confining or containing the water.

"landfill monocell" means a specialised, isolated landfill facility where a single specific waste type is exclusively disposed (i.e. salt).

"leachate" means a liquid that has passed through or emerged from, or is likely to have passed through or emerged from, a material stored, processed or disposed of on site which contains soluble, suspended or miscible contaminants likely to have been derived from the said material.

"levee" means a dyke or bund that is designed only to provide for the containment and diversion of stormwater or flood flows from a contributing catchment, or containment and diversion of flowable materials resulting from unplanned releases from other works of infrastructure, during the progress of those stormwater or flood flows or those unplanned releases; and does not store any significant volume of water or flowable substances at any other times.

"limited petroleum activities mean activities including geophysical surveys (including seismic activities), well sites, well pads, sumps, flare pits, flow lines and supporting access tracks. Limited petroleum activities do not include the construction of production infrastructure for processing or storing petroleum or by-products, dams, compressor stations, campsites/workforce accommodation, power supplies, waste disposal or other supporting infrastructure for the project.

"material impact" for the purposes of Condition D37 means an increase in concentration of a chemical used in fracturing fluids on PL191 and PL196 of >10% above background, detection of a chemical that was not present in the background sample or a chemical present at a concentration in excess of drinking water quality guidelines.

"max $L_{PZ,15\,min}$" means the maximum value of the Z-weighted sound pressure level measured over 15 minutes.

"mg/L" means milligrams per litre.

"Oil based drilling muds"- Oil-based mud where the base fluid is a petroleum product such as diesel fuel.

"overland flow water" means water, including floodwater, flowing over land, otherwise than in a watercourse or lake:

- after having fallen as rain or in any other way; or
- after rising to the surface naturally from underground.

"permanent infrastructure" includes any infrastructure (roads, tracks, bridges, culverts, dams, bores, buildings, fixed machinery, hardstand areas, airstrips, helipads, pipelines etc), which is to be left by agreement with the landowner.

"pest" means species:
(a) declared under the *Land Protection (Pest and Stock route Management) Act 2002*;
(b) declared under Local Government model local laws; and
(c) which may become invasive in the future.

"regulated dam" means any dam in the significant or high hazard category as assessed using the *Manual for Assessing Hazard Categories and Hydraulic Performance of Dams (Version 1.0, 2008)* or any updated version of the Manual that becomes available from time to time

"rehabilitation" means the process of reshaping and revegetating land to restore it to a stable landform and in accordance with the acceptance criteria set out in this environmental authority and, where relevant, includes remediation of contaminated land

"remnant unit" means a continuous area of remnant vegetation representative of a single Regional Ecosystem type or a single heterogeneous unit (multiple Regional Ecosystem types that cannot be distinguished individually due to the scale of mapping).

"River Improvement Trust Asset Area" means an area within a River Improvement Area declared under the *River Improvement Trust Act 1940* that is or has been subject to restoration or flood mitigation works. The locations and details of these areas can be obtained from the relevant River Improvement Trust.

"sensitive place" means -

- a dwelling (including residential allotment, mobile home or caravan park, residential marina or other residential premises, motel, hotel or hostel; or
- a library, childcare centre, kindergarten, school, university or other educational institution;
- a medical centre, surgery or hospital; or
- a protected area; or
- a public park or garden that is open to the public (whether or not on payment of money) for use other than for sport or organised entertainment.

"significantly disturbed land or significant disturbance to land" means disturbance to land as defined in section 28 of the *Environmental Protection Regulation 2008*.

"site" means the petroleum authority(ies) to which the environmental authority relates.
"spring" means the land to which water rises naturally from below the ground and the land over which the water then flows.
"stable" in relation to land, means landform dimensions are or will be stable within tolerable limits now and in the foreseeable future. Stability includes consideration of geotechnical stability, settlement and consolidation allowances, bearing capacity (trafficability), erosion resistance and geochemical stability with respect to seepage, leachate and related contaminant generation.
"state heritage place" means a place entered in the Queensland heritage register under Part 4 of the *Queensland Heritage Act 1992.*
"suitably qualified person" means a person who has professional qualifications, training, skills or experience relevant to the nominated subject matter and can give authoritative assessment, advice and analysis to performance relative to the subject matter using the relevant protocols, standards, methods or literature.
"suitably qualified and experienced person" in relation to dams means one who is a Registered Professional Engineer of Queensland (RPEQ) under the provisions of the Professional Engineers Act 1988, OR registered as a National Professional Engineer (NPER) with the Institution of Engineers Australia, OR holds equivalent professional qualifications to the satisfaction of the administering authority for the Act; AND the administering authority for the Act is satisfied that person has knowledge, suitable experience and demonstrated expertise in relevant fields, as set out below:

- knowledge of engineering principles related to the structures, geomechanics, hydrology, hydraulics, chemistry and environmental impacts of dams; and
- a total of five years of suitable experience and demonstrated expertise in the geomechanics of dams with particular emphasis on stability, geology and geochemistry, and
- a total of five years of suitable experience and demonstrated expertise each, in three of the following categories:
    - investigation and design of dams.
    - Construction, operation and maintenance of dams.
    - hydrology with particular reference to flooding, estimation of extreme storms, water management or meteorology.
    - hydraulics with particular reference to sediment transport and deposition, erosion control, beach processes.
    - hydrogeology with particular reference to seepage, groundwater.
    - solute transport processes and monitoring thereof.
    - dam safety.

"Synthetic based drilling muds"- Synthetic-based fluid is a mud where the base fluid is a synthetic oil.
"third party auditor" means a suitably qualified person who is either a certified third party auditor or an internal auditor employed by the holder of the environmental authority and the person is independent of the day to day management and operation of activities covered by this environmental authority
"threatening processes" means processes, features and actions that can have a detrimental effect upon the health and viability of an area of vegetation. For example altered hydrology, land use practices, invasion by pest and weed species, land degradation, edge effects and fragmentation.
"Temporary petroleum activities" means a petroleum activity that does not involve permanent fixture of equipment or infrastructure and includes (but not limited to) drilling, fraccing, construction and decommissioning of infrastructure.

"tolerable limits" means a range of parameters regarded as being sufficient to meet the objective of protecting relevant environmental values. For example, a range of settlement for a tailings capping, rather than a single value, could still meet the objective of draining the cap quickly, preventing damage and limiting infiltration and percolation.
"topsoil" means the surface (top) layer of a soil profile, which is more fertile, darker in colour, better structured and supports greater biological activity than underlying layers. The surface layer may vary in depth depending on soil forming factors, including parent material, location and slope, but generally is not greater than about 300mm in depth from the natural surface.
"void" means any man-made, open excavation in the ground (includes borrow pits, drill sumps, frac pits, flare pits, cavitation pits and trenches).
"waters" includes all or any part of a creek, river, stream, lake, lagoon, dam, swamp, wetland, spring, unconfined surface water, unconfined water in natural or artificial watercourses, bed and bank of any waters, dams, non-tidal or tidal waters (including the sea), stormwater channel, stormwater drain, roadside gutter, stormwater run-off, and underground water.
"watercourse" means a river, creek or str[redacted]ich water flows permanently or intermittently:

(a) in a natural channel, whether artificially improved or not; or
(b) in an artificial channel that has changed the course of the watercourse;
but, in any case, only:
(c) unless a regulation under paragraph (d), (e) or (f) declares otherwise-at every place upstream of the point (point A) to which the high spring tide ordinarily flows and reflows, whether due to a natural cause or to an artificial barrier; or
(d) if a regulation has declared an upstream limit for the watercourse-the part of the river, creek or stream between the upstream limit and point A; or
(e) if a regulation has declared a downstream limit for the watercourse-the part of the river, creek or stream upstream of the limit; or
(f) if a regulation has declared an upstream and a downstream limit for the watercourse-the part of the river, creek or stream between the upstream and the downstream limits.

Watercourse includes the bed and banks and any other element of a river, creek or stream confining or containing water.

"wetland" means an area shown as a wetland on a 'Map of referable wetlands', a document approved by the chief executive (environment). A map of referable wetlands can be viewed at www.derm.qld.gov.au .

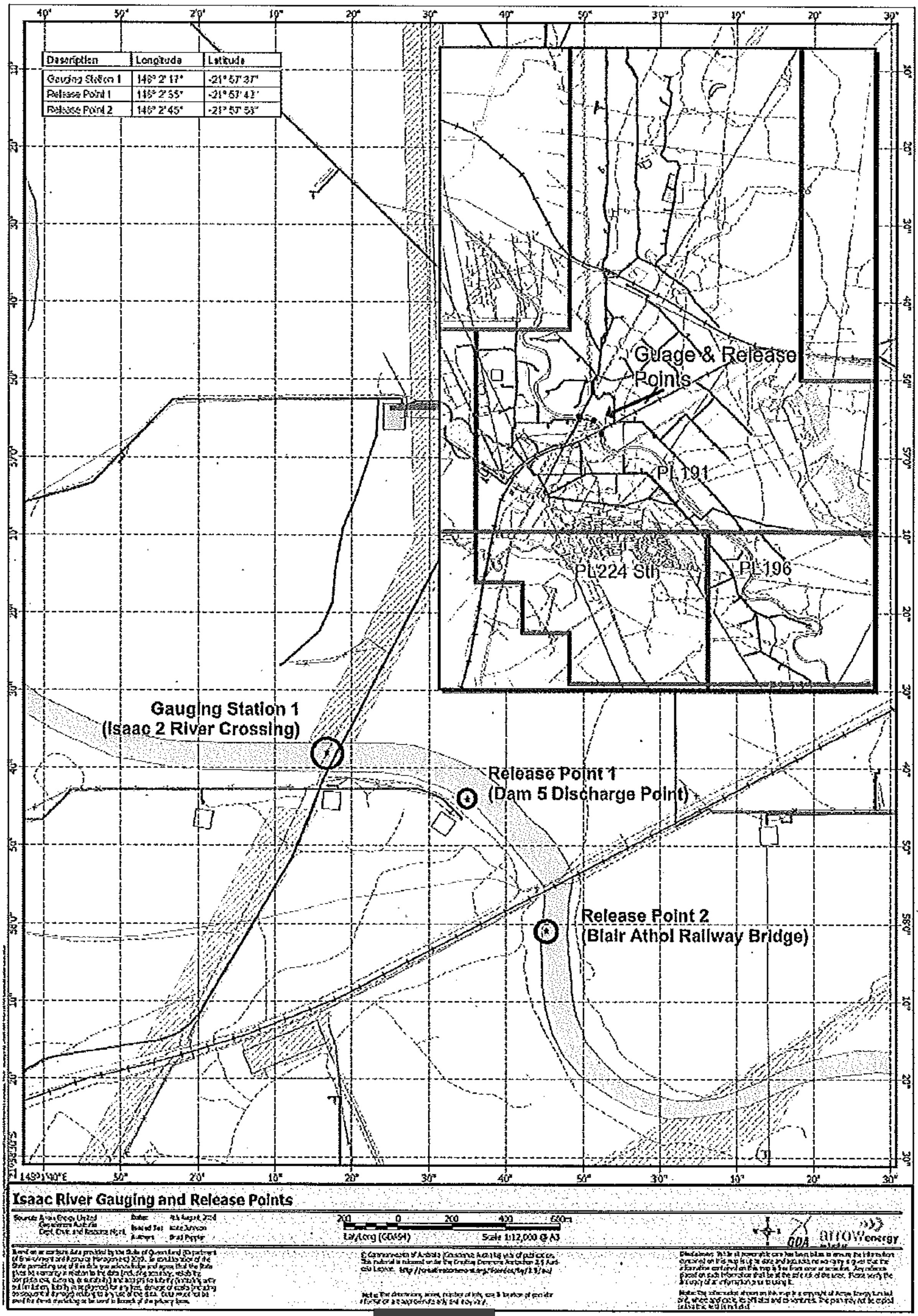
"wild river declaration" means a statutory instrument under the *Wild Rivers Act 2005*. A declaration lists the relevant natural values to be preserved and delineates certain parts of the wild river area and the different constraints that may apply in these areas. With reference to environmental authorities for petroleum, each declaration also specifies conditions to be included in a new authority if the activity is to be located within the wild river area.

"80th percentile release limits" means that not more than one (1) of the measured values is to exceed the stated release limit for any five (5) consecutive samples where:
(1) the consecutive samples are taken over a 5 month period; and
(2) the consecutive samples are taken at approximately equal periods.

End of Conditions

Figure 1 - Contaminant Release Points, Sources and Receiving Waters

ARROW ENERGY - MORANBAH GAS PROJECT



Description	Longitude	Latitude
Gauging Station 1	148° 2' 17"	-21° 57' 37"
Release Point 1	148° 2' 55"	-21° 57' 43"
Release Point 2	148° 2' 45"	-21° 57' 55"

[redacted]

arrow energy
go further

26 October 2010

Ref: ENV10-245

[redacted]
Manager, Petroleum and Gas Unit
Department of Environment & Resource Management
(sent via email 26 October 2010)

RE: Incident Notification - Threatened or Potential Environmental Harm

Dear [redacted]

On the behalf of Arrow Energy Limited (Arrow) I am providing notification of threatened or potential environmental harm on PL191/196 (under PEN100015907) - Moranbah Gas Project (MGP).

Date:
26 October 2010

Location:
Moranbah Gas Project PL191/196

Description:
The Design Storage Allowance (DSA) in Dam 1 has been exceeded. Production of gas and water from wells at the MGP has been curtailed to the point where net evaporation currently exceeds net coal seam water input. Arrow lacks sufficient storage in other dams to transfer sufficient water from Dam 1 to comply with the DSA prior to commissioning of Dam 11. Currently the forecast completion of Dam 11 is estimated to be early December.

Potential Impact:
Arrow will enter the early part of the wet season exceeding the DSA for Dam 1. At present other dams are below DSA levels.

Immediate Actions:
Production of gas and water from wells at the MGP has been curtailed to the point where net evaporation currently exceeds net coal seam water input. Arrow is currently considering a number of options to regain storage capacity. Any plans would be subject to detailed evaluation of safety implications and would comply with the requirements of the relevant Environmental Authority.

Regards,

[redacted]

Ben McMahon
Manager Compliance & Reporting

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ARROW ENERGY LTD ABN 73 078 521 936
LEVEL 19, AM-60, 42-60 ALBERT STREET BRISBANE QLD 4000
GPO BOX 5262 BRISBANE QLD 4001 ASX CODE AOE
info@arrowenergy.com.au arrowenergy.com.au

[redacted]

From: [redacted]
Sent: Wednesday, 27 October 2010 12:20 PM
To: bmcmahon@arrowenergy.com.au
Cc: [redacted]
Subject: further info for Dam 1, PL191

Dear [redacted]

DERM thanks you for your notification on 26 October 2010 regarding insufficient DSA in Dam 1 on PL191.

Can Arrow please provide the following information:

- Details of any landholders that could potentially be affected, including distance from Dam 1. ✓
- Distances from Dam 1 for the Moranbah Arrow Energy Office and the Arrow Energy Compressor Station and Camp. ✓
- Distance of Moranbah township from Dam 1. ✓
- Distances from any other sensitive receptors that could potentially be affected. ✓
- Photos of Dam 1 showing the current water level. ✓
- A hardcopy and an electronic copy of the 'as constructed' drawing together with the certification of a suitably qualified and experienced person for Dam 1. ✗

As discussed with you in a telephone conversation on 27 October 200, please submit the information by no later than Friday, 29 October 2010, COB.

Can you please confirm when Arrow first became aware that the DSA had been exceeded? ✗

Thank you very much and

kind regards

[redacted]
Principal Environmental Officer
Petroleum & Gas Team

Environment and Natural Resource Regulation
Department of Environment and Resource Management
Telephone No: [redacted]
Email: [redacted]

www.derm.qld.gov.au

Department of Environment and Resource Management
Level 7 400 George Street, BRISBANE, QLD 4000
G.P.O. BOX 2454, Brisbane, QLD 4001.

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go further

29 October 2010

Ref: ENV10-248

[redacted]

Manager, Petroleum and Gas Unit

Department of Environment & Resource Management

(sent via email 29 October 2010)

RE: Information request Dam 1 DSA on PL191

Dear [redacted]

I am writing on the behalf of Arrow Energy Limited (Arrow) in response to an information request in received on Wednesday 27 October 2010.

Dam 1 is located at Broadmeadows Rd Moranbah 4744. (L61 SP195395:GHPL 30/4123: Par BROADMEADOW). It is on property owned by Judith Flora Camm who resides at Wonga Plains Bowenville QLD 4404. The land is zoned Rural A and used for Cattle Breeding and Fattening. The dam is approximately:

- 1.6 km north east of the Moranbah camp
- 1.8 km north east of the MGPF
- 2 km north of the Thorpe street office
- 0.8 km from the railway; and
- 1.1 km south east from the Isaac River

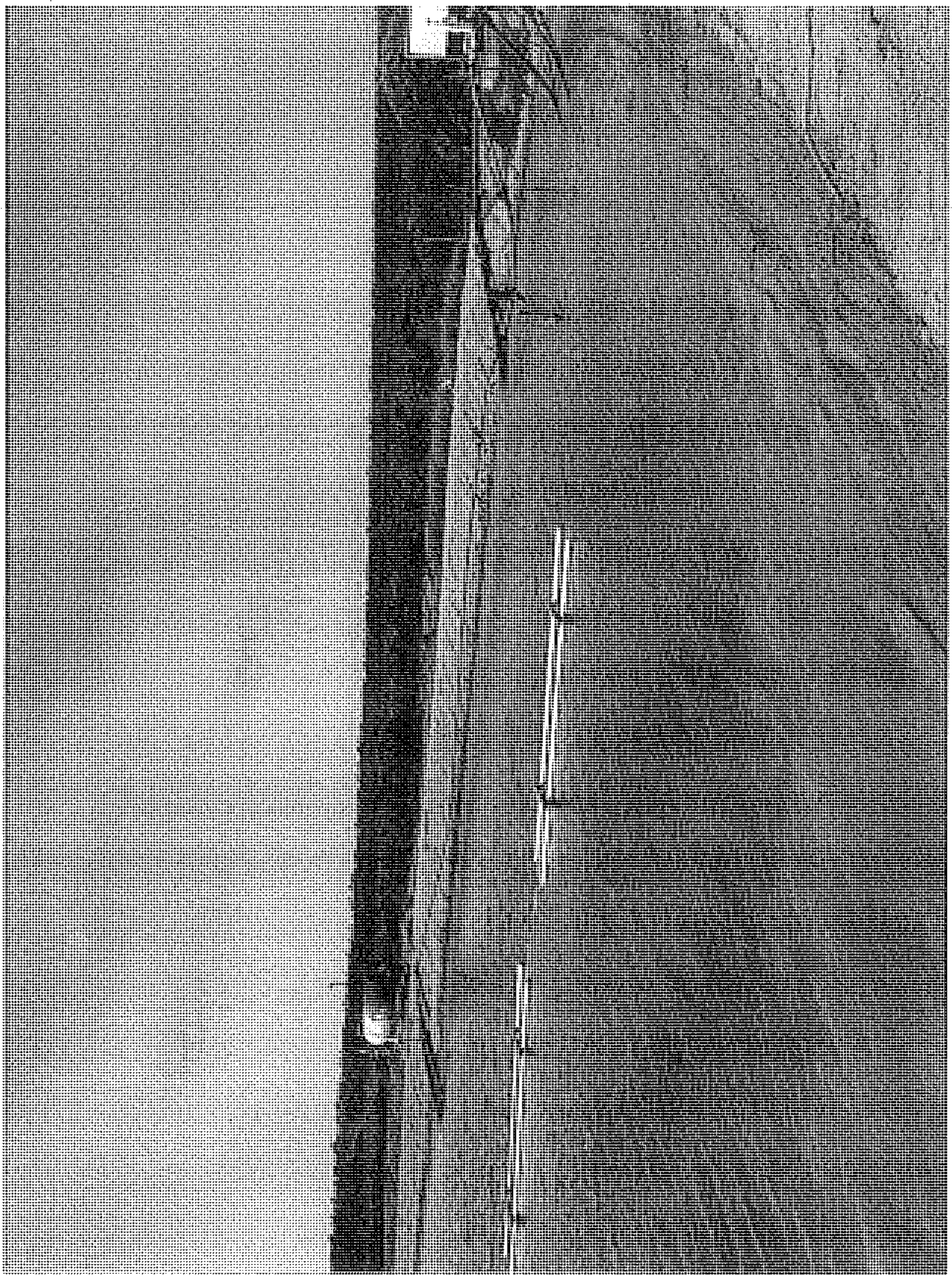
Dam 1 was constructed in 2004 prior to the new dam requirements, at present a 'certified as constructed' drawing is not available to submit. Attached is a recent photo taken on the 29 October 2010.

At present we are transferring water from Dam 1 to Dam 10 where we have identified remaining capacity. Arrow expect Dam 1 to be within the DSA level early next week.

Regards,

[redacted]

Ben McMahon
Manager Compliance & Reporting



20 November 2010

arrow energy
go further

Ref: ENV10-263

[redacted]

Manager, Petroleum and Gas Unit

Department of Environment & Resource Management

(sent via email 20 November 2010)

RE: Incident Notification - Threatened or Potential Environmental Harm

Dear [redacted]

I am writing on the behalf of Arrow Energy Limited to provide notification of threatened or potential environmental harm on Moranbah PL191/196 (under EA PEN100015907 grated 14^{th} September 2010).

Date:
20 November 2010

Location:
Moranbah Gas Project PL191/196

Description:
Following recent rainfall over the last week, Arrow currently exceeds the Design Storage Allowance (DSA) in Ponds 1, 2, 10, 4, 5 and 6.

Until Dam 11 is commissioned Arrow has no available storage to lower Ponds into compliance with the DSA. Current forecast completion of Dam 11.

Potential Impact:
Arrow will enter the early part of the wet season with inadequate storage capacity in the event of prolonged or heavy rainfall in contradiction to condition C3(n) of EA PEN100015907.

Immediate Actions:
Arrow continues to investigate options for managing storage capacity in line with the conditions of EA PEN100015907.

Regards,

[redacted]

Ben McMahon
Manager Compliance & Reporting

Queensland Government

Enquiries [redacted]
Telephone
Your reference PL191, PL196, PPL115, PPL116 / PEN100015907
Our reference BNE 36959 / 315517

Department of
Environment and Resource Management

24 November 2010

CH 4 Pty Ltd
AM-60
Level 19
42 Albert Street
BRISBANE QLD 4000

Attention: Ms [redacted]

Dear Ms [redacted]

Re: Coal Seam Gas (CSG) water dams authorised under environmental authority (EA) PEN100015907 on Petroleum Lease (PL) 191, PL196, Petroleum Pipeline Licence (PPL) 115 and PPL116 near the township of Moranbah.

I refer to an incident notification received from Arrow Energy Ltd (Arrow) regarding the exceedance of the Design Storage Allowance (DSA) for specified CSG water dams on PL191 and PL196. The incident notification was sent to the Department of Environment and Resource Management (DERM) by Arrow Energy Ltd (Arrow) via e-mail on 20 November 2010 and was followed up by Ben McMahon of Arrow via telephone on 22 November 2010.

To date, the following information has been provided by CH4 Pty Ltd regarding this matter:

- Following recent rainfall over the last week, CH4 Pty Ltd currently exceeds the DSA in Pond 1, 2, 4, 5, 6 and 10 (the notified dams).
- Until Dam 11 is commissioned CH4 Pty Ltd has no available storage to achieve compliance with the DSA in the notified dams.

- CH4 Pty Ltd will enter the early part of the wet season with inadequate storage capacity in the event of prolonged or heavy rainfall;
- CH4 Pty Ltd stated that they have contravened condition C3(n) of EA PEN100015907:

The holder of this environmental authority must maintain a Register of Regulated Dams, that must include, as a minimum, the following information on each regulated dam:
(n) dates on which the dam was inspected for the purpose of annually ascertaining the available storage capacity on the 1 November each year.

- CH4 Pty Ltd is investigating options for managing storage capacity in line with the conditions of EA PEN100015907.

On 22 November 2010, Ben McMahon of Arrow stated in a telephone conversation to DERM that:

- The notified dams hold between 3 – 4 megalitres each and feed into the main Pond 1, which has a holding capacity of approx. 100 megalitres;
- the notified dam levels are currently between 40 to 60 millimetres above DSA;
- the construction of Dam 11 is experiencing delays due to wet weather;
- Dam 11 is ultimately needed to provide additional CSG water storage;
- Dam 11 has been excavated, but completion is not expected until late December 2010 / early 2011;
- a map be provided to DERM showing the location of the dams by 24 November 2010; and
- CH4 Pty Ltd would like to meet with DERM to discuss the future CSG water management options on PL191 and PL196.

Based on the information provided by CH4 Pty Ltd to date, DERM has determined that the exceedance of the DSA constitutes a contravention of the following EA condition:

(C23) *An assessment of the adequacy of the available storage in each Regulated Dam is to be made, based on an actual dam level observed in the month of October in each year, and the resultant estimate of the level in that dam as at 1 November in each year must be equal or less than the design storage allowance for the dam.*

You must immediately take all measures necessary to ensure compliance with the conditions of your EA. A breach of conditions is a serious offence for which there are heavy penalties.

I draw your attention to Section 430 of the *Environmental Protection Act 1994* which states that it is an offence to contravene a condition of an EA. Queensland environmental legislation provides for a number of enforcement tools to address offences, ranging from the giving of a warning notice, requesting certain actions be undertaken or ceased, issuance of a fine, or prosecution. This section of the legislation has been attached for your reference. A person who wilfully contravenes a condition of their EA can be prosecuted by DERM in court. The court can impose a maximum penalty of 2000 penalty units, i.e. $200,000.00 or two years imprisonment. If a person contravenes a condition of their EA, the court may impose a maximum penalty of 1665 penalty units, i.e. $166,500.00.

Alternatively, DERM can exercise its discretion to issue an Infringement Notice for the offence that requires the payment of a set fine. The Infringement Notice penalty for contravention of a condition of a development approval is $2000.00. You should note that an Infringement Notice can be issued for each condition of an environmental authority that has been contravened.

Additional Information

DERM requests that CH4 Pty Ltd provide the following information:

1. A scaled A3 map in colour showing Pond 1, 2, 4, 5 ,6 and 10 in relation to any Environmentally Sensitive Areas, essential habitat, and any other applicable sensitive receptors including residences by no later than **24 November 2010** as agreed to in a telephone conversation between Ben Mc Mahon of Arrow and Christine Juergensen of DERM in a telephone conversation on 22 November 2001;

2. Information on all affected landholders and confirmation that CH4 Pty Ltd has notified the landholders of the DSA exceedance;

3. Provide for each notified dam how much the DSA has been exceeded;

4. Provide for each notified dam how much storage capacity (in litres) is left before it overflows;

5. Provide data on the water quality in each notified dam; and

6. Identify the potential environmental impacts should the notified dams overflow.

DERM requests that this information be submitted to DERM by no later than **29 November 2010.**

DERM requests further information regarding the following conditions on environmental authority PEN100070507, granted on 14 September 2010:

7. Confirm compliance with Condition (C3) to (C6) for all applicable dams.

8. Provide a Register of Regulated Dams addressing requirements under Condition (C3) as a hardcopy and on CD as required under Condition (C7).

9. Confirm compliance with Condition (C11) to (C12) for all applicable dams.

10. Confirm compliance with Conditions (C17) for all applicable dams.

11. Provide information as required under Conditions (C20) for all notified dams; i.e. how CH4 Pty Ltd is going to minimise any actual or potential environmental harm associated with the DSA exceedances.

12. Confirm compliance with Conditions (C21) to (C26) for all applicable dams.

I recommend that you take immediately all reasonable and practical measures to rectify the above issues and to comply with your general environmental duty.

DERM requests that you provide information on

- the compliance status of the above listed conditions as required under Item 7 to 12;
- any dams that are not complying with any of the above listed conditions and the reasons why;
- how CH4 Pty Ltd intends to address the non-compliances identified; and
- dates by which CH4 Pty Ltd will be able to action these non-compliances

by no later than **7 December 2010**. Failure to comply with this request may result in DERM taking enforcement action. If you have any further queries regarding this matter, please do not hesitate to contact Parma Nand on telephone (07) [redacted]

Yours sincerely

[redacted]

Parma Nand
Manager
Petroleum & Gas Unit

Department of Environment and Resource Management
Petroleum and Gas Unit
Level 7, 400 George Street Brisbane QLD
GPO Box 2454 BRISBANE QLD 4001
Ph. (07) [redacted]
Fax. (0[redacted]

Department of Environment and Resource Management

Application form

Environmental Protection Act

OFFICIAL USE ONLY

DATE RECEIVED

FILE REF

PROJECT REF

COMPLETE FORM ☐ CORRECT AA ☐

ENTERED BY (SIGNATURE)

DATE

Program notice of relevant event

This form is to be used where a person wishes to provide a program notice under section 350 of the *Environmental Protection Act 1994* of an act or omission that has caused or threatened environmental harm.

Program notice details

1. Provider of program notice of relevant event

CH4 Pty Ltd

2. Responsible person

Tim Dean

3. Current registration certificate or environmental authority number (if applicable)

PEN100015907

A relevant event is an act or omission that has caused or threatened environmental harm in the carrying out of an activity by the person, and is lawful apart from the *Environmental Protection Act 1994*.

4. When did the relevant event occur?

The period between October 2010 to present

For example, you might provide details of the general activities that you were undertaking at the time, the act or omission and how it occurred, and any further action that was taken.

5. Description of the relevant event

Rainfall has recently contributed to the elevation of existing dam levels in the area covered by the relevant EA. If dam levels continue to rise, this will result in an overflow of untreated coal seam gas water to land. Arrow is seeking permission to discharge directly to the Isacc River.

The rainfall has caused construction delays which has prevented Arrow from making additional storage available via the completion of Dam 11. This has exacerbated the potential for dam breaches.

6. Location of relevant event

NAME OR TYPE OF PLACE	Petroluem Lease 191/196
STREET ADDRESS	via Lot 9 Thorpe Street Moranbah QLD 4744
LOT(S)	L61 SP195395 L1 SP216414 L1 SP216414 L1 SP192459
PLAN(S)	SP195395 SP216414 SP216414 SP192459
LOCAL GOVERNMENT	Moranbah Regional Council

For example, you might provide details of the proximity of the relevant event to sensitive places (e.g. parks or nearby waterways).

7. Description of the nature and extent of environmental harm caused or threatened as a direct or indirect result of the relevant event

Arrow has insuffìcent water storage to cope with such rainfall events, until dam 11 is completed.

At this point there have been no dam overflows (and associated environmental impacts), however potential impacts could result if heavy rainfall continues, leading to overflow event/s.

Impacts associated with dam breaches could include erosion and sedimentation (through physical flow effects) and contamination of land and waterways (through introduction of salt and other chemicals).

8. What action has been taken to contain, clean up, rehabilitate and restore the environmental impact in relation to the relevant event?

The construction of Dam 11 is a key component of our water statergy in developing additional storage until benefitial uses are developed for our coal seam water

Arrow is also in the process of modifying any non compliant dams to achieve compliance with relevant EA conditions. This includes achieving compliance with the Manual for Assessing the Hazard Category and Hydaulic Performance of Dams.

With respect to the potential event (the subject of this notice), DERM have been notified as required under the conditions of our Environment Authority PEN100015907. Potentially affected landholders within the tenure area will also be notified of any likely breach of the dam Design Storage Allowance (DSA).

Arrow intends to submit a transitional environmental program with respect to achieving dam compliance under PEN100015907.

9. Declaration

Note: If you have not told the truth in this application you may be liable for prosecution under the relevant Acts or Regulations.

- I am aware that section 351 of the *Environmental Protection Act 1994* states:

  "(1) If the relevant event stated in the program notice constitutes an offence against this Act (the "original offence"), the giving of the program notice, the program notice and any documents submitted with it are not admissible in evidence against the person in a prosecution for the original offence.

  "(2) Subsection (1) does not prevent other evidence obtained because of the giving of the program notice, the program notice or any documents submitted with it being admitted in any legal proceeding against the person."

- I will prepare and submit to the administering authority a transitional environmental program in accordance with section 333 of the *Environmental Protection Act 1994* for the relevant event.
- I do solemnly and sincerely declare that the information provided is true and correct to the best of my knowledge. I understand that it is an offence under s480 of the EP Act to give to the administering authority or an authorised person a document containing information that I know is false, misleading or incomplete in a material particular.
- I understand that all information supplied on or with this application form may be disclosed publicly in accordance with the *Right to Information Act 2009* and the *Evidence Act 1977.*

APPLICANTS SIGNATU[redacted]	
APPLICANTS NAME Tim Dean	DATE 02/12/2010

10. Provider checklist

☒ Notice completed and signed

☒ Supporting information attached (if applicable), including

- ☐ Reports
- ☐ Analysis and monitoring results

Please return your completed application to:

Permit and Licence Management
Implementation Support Unit
Department of Environment and Resource Management
GPO Box 2454
Brisbane Queensland 4001.

Enquiries: **1300 130 372**
Facsimile: (07)[redacted]
Email:[redacted]

arrow energy
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15 December 2010

Ref: ENV10-285

[redacted]

Manager, Petroleum and Gas Unit

Department of Environment & Resource Management

(sent via email15 December 2010)

RE: MGP Discharge

Dear Rod

I am writing on the behalf of Arrow Energy Limited (Arrow) to address the concerns raised by DERM in the meeting held Tuesday afternoon (14 December 2010) and detailed in subsequent email correspondence and phone conversions between DERM and Arrow.

Arrow wishes to advise that discharge to the Isaac River has ceased as of 17:42 14 December 2010. In total 2.6 ML was discharged. Arrow is working to expedite further information – particularly the water quality as discussed. Arrow will provide this additional information to DERM as a priority.

At present the water from dam 2 is being directed to dam 10, we expect dam to exceed its Mandatory Reporting Limit at some point today. We will to continue to keep you informed of our plans to manage this issue.

Regards,

Tim Dean

Asset General Manager - North

T +61 [redacted]
F +61

ARROW ENERGY LTD
ABN 73 078 521 936

LEVEL 19, AM-60, 42-60 ALBERT STREET
BRISBANE QLD 4000

GPO BOX 5262 BRISBANE QLD 4001
ASX CODE AOE

info@arrowenergy.com.au
arrowenergy.com.au

Coal Seam Gas Water Management Plan

Bowen Basin

A	26/07/11	ISSUED FOR COMMENT	BW	SS	CC
B	27/7/11	ISSUED FOR REVIEW	BW/AP		
0	29/7/11	ISSUED TO DERM	AP/BW	CC	CC
REV	DATE	DESCRIPTION	PREPARED	CHECKED	APPROVED

Contents

1. Introduction

1.1. Purpose and Scope

The purpose of this Coal Seam Gas (CSG) Water Management Plan (the Plan) is to define and communicate Arrow Energy's strategy for the current and future management of CSG water in the Bowen Basin. Bowen Basin activities addressed by this plan include gas exploration, appraisal, and production interests for the domestic market.

This document has been developed in accordance with relevant legislation, government guidelines and Policy (further discussed in Section 2, below).

Under the *Environmental Protection Act 1994*, a revised (CSG) environmental management plan is required for environmental authorities (EA) in force prior to 5 July 2010. This revised (CSG) environmental management plan (the Plan) has been submitted to fulfil this requirement and addresses the following Level 1 EAs within the Bowen Basin.

Table 1: EA's addressed in the plan

EA	Applicable Tenures
PEN100015907	PL191, PL196
PEN100251408	PL224
PEN100317009	PL223

1.2. Objectives

In addition to fulfilling relevant legislative and policy requirements, the objectives of this Plan are to:

- Define the hierarchy of options for the disposal of CSG water from appraisal and production activities;
- Establish a management framework for each CSG water disposal option;
- Identify the environmental values potentially affected by activities addressed by the Plan as well as mechanisms for protection (e.g. established procedures);
- Ensure salt will be disposed of in accordance with the Plan; and

- Ensure action is taken, if any of the measurement criteria are not satisfied.

This plan is to be utilised in conjunction with Arrow's CSG Water Management Strategy.

1.3. Report Structure

The main body of this report describes existing activities, water characteristics, and Arrow's water management strategies in a basin wide context. Specific information with respect to infrastructure, water characteristics and management on each Bowen Basin tenement (and associated EA) is provided in the attached Appendices.

2. Legislative and Policy Requirements

This Plan has been developed in accordance with relevant provisions of the *Environmental Protection Act 1994* (EP Act) (including Section 310 D), as well as the *Queensland Government's CSG Water Management Policy 2010*[1]. The plan has also considered the Department of Environment and Resource Management (DERM) guideline *Preparing an environmental management plan for coal seam gas activities*[2] (The Guideline), as well as requirements specified in correspondence received by Arrow from DERM on 20 May 2011, with respect to associated obligations under the EP Act.

Table 1 provides a list of key information requirements (as specified in the Guideline and addressing Section 310D of the EP Act), with reference to where this information is addressed in the Plan.

[1] http://www.derm.qld.gov.au/environmental_management/coal-seam-gas/pdf/water-management-policy.pdf
[2] http://www.derm.qld.gov.au/environmental_management/land/documents/csg-environmental-management-plan.pdf

Table 2: Key information requirements and corresponding sections of the Plan where addressed.

REQUIREMENT	SECTION
Provide an estimate of the quantity of CSG water produced annually over the life of the project.	5 and Appendix 1
Provide an estimate of the flow rate at which the CSG water will be generated.	5 and Appendix 1
Describe the quality of CSG water, including changes in the water quality that may be reasonably expected to occur whilst conducting the activity.	5.3
Describe how and where the CSG water will be produced, aggregated, stored and kept separate from other waters until it is used, treated, distributed or disposed of.	6, 7.3
Describe how the CSG water will be dealt with in accordance with the CSG water management hierarchy, including a description of the estimated amount of CSG water that will be dealt with under the preferred water management options in category 1 and the water management options that are not preferred in category 2.	7.1
Where CSG water is to be treated, describe: • The treatment process; • How and where the treated water will be stored and used; and • How and where the waste generated by the treatment process will be stored, used and/or disposed of.	0, 7.3
If any CSG water is proposed for direct disposal as waste, provide information sufficient to demonstrate that legislative, environmental, technological, economic and social requirements have all been evaluated and taken into consideration in deciding that disposal as waste is the only feasible option.	Table 5
Describe the detail of any pilot programs or trials for CSG water solutions, including: • Objectives of project; • Quantity and quality of CSG water applied; • Location/area; and • Duration of activity.	4.2,, 6.2 and 7.5
Describe the characteristics of any receiving environment.	7.6
Describe the control measures that will be implemented for each water management option (aggregation, storage, treatment, use, or disposal) to prevent or control the release of a contaminant or waste to the environment.	7.7, 7.8

Describe the measurable criteria against which the performance of the CSG water management practices will be assessed. Criteria must include: • The quantity and quality of water used, treated, stored or disposed of; • Protection of the environmental values affected by the relevant CSG activity; • The disposal of waste, including for example, salt, generated from the management of the water.	7.9
Describe a monitoring program sufficient for the prediction and early detection of any detrimental impacts on the receiving environment from CSG water management practices.	7.8
Describe the procedures that will be adopted to regularly review the monitoring program and to report to management and DERM should unforeseen or non-compliant monitoring results be recorded.	7.8
Describe the procedures that will be implemented to prevent unauthorised environmental harm from unforeseen or non-compliant monitoring results.	7.7
Describe procedures for dealing with accidents, spills, failure of containment structures, and other incidents that may arise in the course of the CSG water management practices and result in the unexpected release of contaminants or waste to the environment.	7.7, 7.9
Describe the procedures used to identify and implement strategies that minimise the quantity of CSG water generated at the surface of the land, promote efficiency in the use of CSG water as a resource through direct use and treatment, improve the water management practices employed where non preferred management options are being used, and minimise the total area of land disturbed by water aggregation and storage structures.	7.8 and 7.10

3. Bowen Basin Tenements

Arrow's gas exploration and production acreage in the Bowen Basin is centred around the town of Moranbah, approximately 400 km south of Townsville and 170 km west of Mackay (Figure 1). Bowen Basin tenements are shown in Table 3.

Table 3: Bowen Basin Tenements

Current Tenements	
Authority to Prospect (ATP)	**Petroleum Lease (PL)**
716	191
748	196
751	223
753	224
759	
787	
831	
1103	

The development of tenements within the Bowen Basin primarily involves drilling wells and constructing the required infrastructure to extract, compress and transport gas, and to transport, store and treat associated water.

Production and appraisal activities currently undertaken on the above tenures are further described below.

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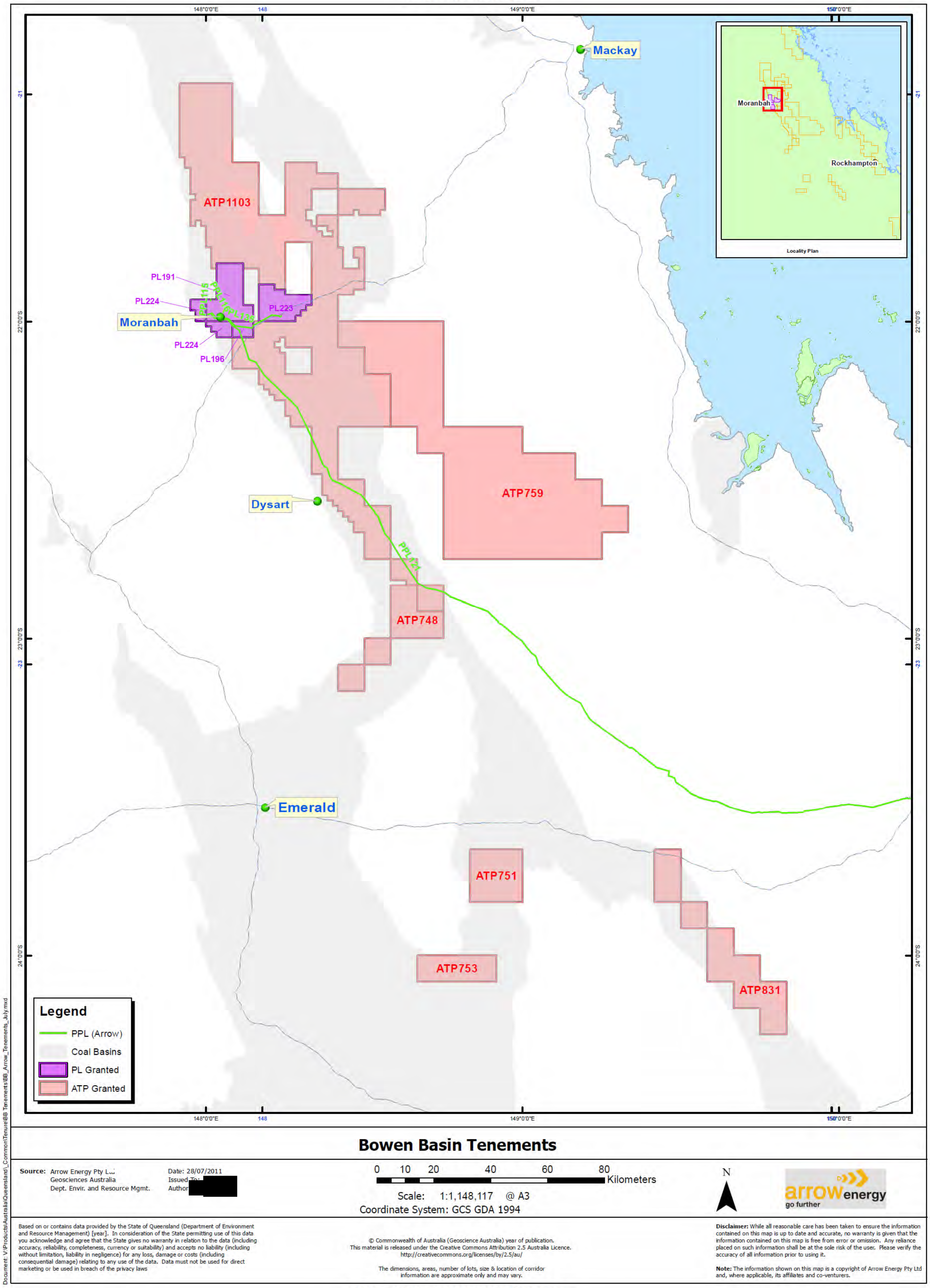


NOT FOR CONSTRUCTION

Figure 1: Bowen Basin Tenements

4. Bowen Basin Activities

4.1. Production

The Moranbah Gas Project (MGP), constitutes the majority of Arrow production activities in the Bowen Basin. The MGP produces from 169 production wells across three production leases (PL191, PL196 and PL224.) with a current production capacity of 40 TJ/d.

Production is set due to increase significantly by year end 2011, increasing the total MGP production target to 77 TJ/d. This production target includes a longer term plan to increase utilisation of the Townsville Power Station. Expansion to this production capacity will involve drilling of over 160 additional production wells between 2011 and 2016 and will incorporate associated gas compression and water treatment facilities. Arrow plans to consolidate many of its Bowen Basin tenures (including PL191, PL196, PL223 and PL224) under a single MGP project EA, to achieve consistency in approval conditions and associated management regimes.

A key component of Arrow's production water treatment infrastructure is the establishment of a reverse osmosis (RO) water treatment facility on PL191 (The RO Plant). The RO plant will have a maximum output of 580 ML/yr and will facilitate the treatment and beneficial use of a significant proportion of Arrow's production water in the MGP. The RO plant is use is further described in Section 7.2.2, while other specific Bowen Basin production infrastructure is described in the Environmental Management Plan (EM Plan) associated with each tenure. The production water characteristics for each PL (where known) are described in the attached Appendices.

4.2. Exploration and Appraisal

The exploration and appraisal program being undertaken by Arrow across the Bowen Basin will reduce the uncertainty in subsurface parameters that underpin the modelled rate of gas and expected water volumes. Exploration wells are being drilled to increase certainty in coal depth, thickness and data quality across the basin.

The appraisal program comprises a number of pilot production tests, conducted across the basin, to give a better understanding of dynamic behaviour on a large scale. Each pilot test consists of four to six wells spaced approximately 200m apart in a diamond shaped layout. The pilot tests generally run for three to six months. The exploration and appraisal data will provide the basis for field development planning work.

Arrow's CSG water management activities covered by this plan will incorporate the current production and field development scheduled to meet domestic gas contracts. Specific exploration and appraisal infrastructure is further described in the EM Plan associated with each tenure.

5. Estimated Water Generation Characteristics

5.1. Production Water Volumes

Water volumes and quality vary considerably with location, well spacing and coal seam depth. Table 1 shows the cumulative water generation forecast for current domestic contracts. The water production will peak at over 3ML/day, with an average (over current forecast) of approximately 2.0ML/day. Figure 2 shows the MGP production volumes over five years.

5.2. Estimated pilot volumes

An Authority to Prospect (ATP) is granted under the Petroleum and Gas (Production and Safety) Act 2004 or Petroleum Act 1923 and authorises the holder to explore for petroleum (including coal seam gas) in Queensland. The purpose of exploration is to obtain information about the coal seam including the volume of water that may be produced.

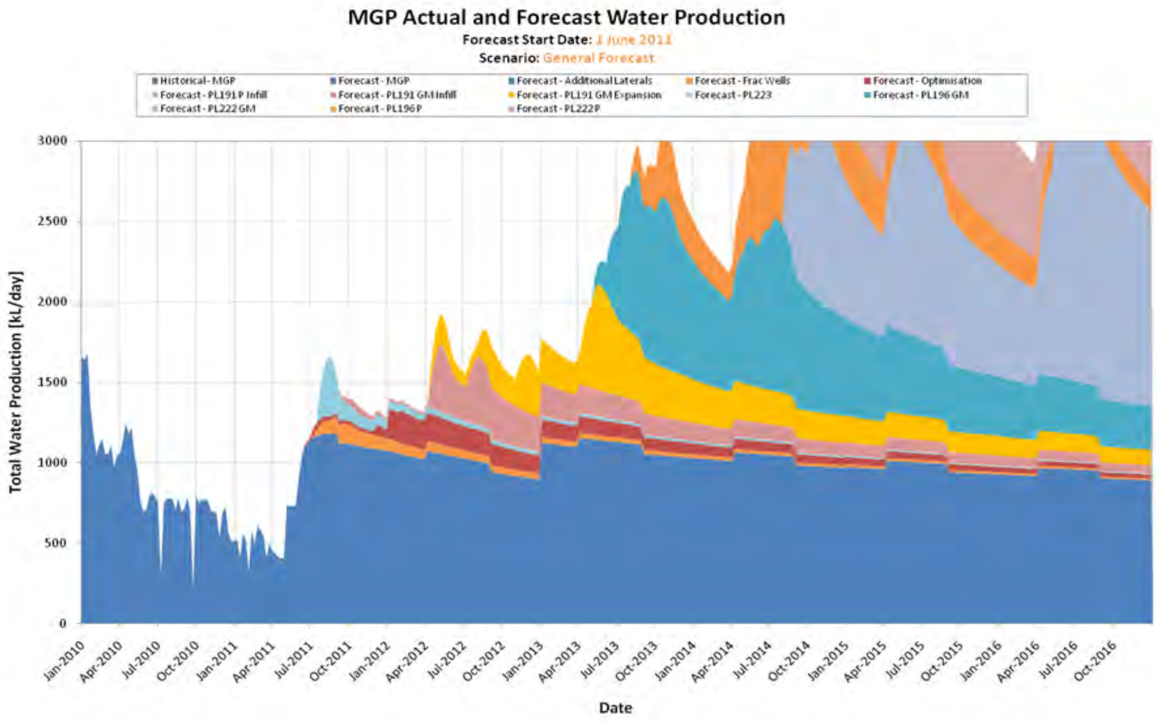


Figure 2: Moranbah Gas Project Water Production

Due to the nature of exploration, the water quantity and quality that will be generated is uncertain and to a large extent unpredictable. However, in some circumstances it is possible to estimate the quantity from previous experience and to extrapolate from exploration activities in close proximity. The CSG water generation curve over time for a typical pilot in the Bowen Basin is illustrated in

Figure **3**.

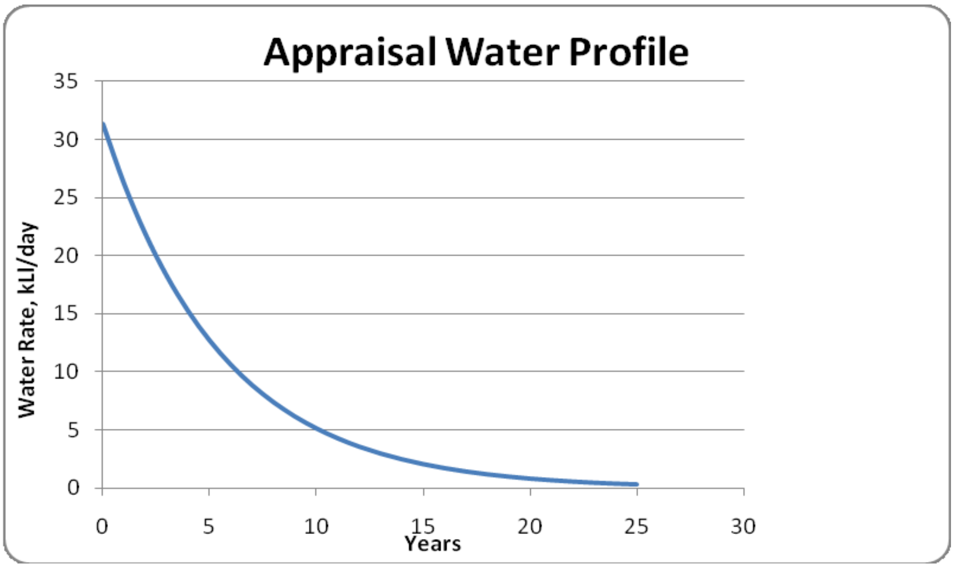


Figure 3 Predicted CSG water production rate over time for a typical pilot

At this stage in exploration Arrow has assumed that all production pilots in the Bowen exploration acreage will produce a similar quantity of water. This translates to an average production of approximately 5 -10 kL/day per site with an anticipated peak production of 30 kL/day at each location in the early dewatering phase.

5.3. Water Quality Characteristics

CSG water extracted from most seams in Australia is saline with Total Dissolved Solids (TDS) typically falling in the range 2,500-8,500 mg/l. Previous exploration in this region indicates a range of 1000 – 11000 mg/l TDS (EC 4000-14000 µs/cm) is a reasonable expectation. The CSG water quality range across Arrow's Bowen Basin tenements is shown in Table 4.

Table 4: Water quality values for Arrow Northern tenements

Bowen Basin Wells						
Parameter	Unit	Min	P10	Median	P90	Max
pH		7.2	7.7	8.1	8.5	8.8
TDS	mg/L	115	2740	4300	7758	10700
Conductivity	uS/cm	4500	5270	9930	12520	13900
TSS	mg/L	9	11	99	381	466
Turbidity	NTU	19	26	55	83	90
Alkalinity (BiCarb)	mg/L	26	291	873	1738	2860
Alkalinity (Carb)	mg/L	1	13	104	440	540
Alkalinity (Hyd)	mg/L	<1	<1	<1	<1	<1
Alkalinity (Total)	mg/L	26	293	951	1877	2860
SO4	mg/L	1	1	1	2	2
Cl	mg/L	15	649.2	1690	4218	5360
Ca	mg/L	1	3.1	11.5	61.9	275
Mg	mg/L	1	2	5	27	72
Na	mg/L	15	1110	1655	2898	3620
K	mg/L	3	4	8	25	59
Al	mg/L	0.01	0.02	0.1	0.32	0.69
Fe	mg/L	0.07	0.79	3.31	14.60	35.50
F	mg/L	0.1	0.6	1.55	2.64	3.1
Ba	mg/L	0.6	0.7	1.1	1.9	2.4
Sr	mg/L	2.2	2.2	2.4	5.3	6.4
Si	mg/L	6.2	7.0	7.9	9.2	9.4
SiO2	mg/L	13.2	15.0	17.0	19.7	20.2

6. Process flow of CSG water generation, aggregation and storage

CSG water[3] is water extracted from coal seams in order to release CSG from the coal.

Water produced from all wells is aggregated and stored in CSG water aggregation dams designed and constructed in accordance with the *DERM Guideline for Regulated Dams in Environmentally Relevant Activities*[4] and *Manual for Assessing Hazard Categories and Hydraulic Performance of Dams*.

The following subsections describe the process of water generation aggregation and storage associated with production and appraisal wells.

6.1. Production wells

CSG water produced from individual production wells within a field is transferred by gathering lines to water management facilities through high density polyethylene (HDPE) gathering lines. Following aggregation in a dam, water undergoes a treatment process to allow the removal of any suspended solids and dissolved ions.

The current treatment process employed by Arrow incorporates micro filtration and reverse osmosis (RO). The RO process produces a high quality permeate (treated water) and a concentrated salt stream (brine). These two product streams, permeate and concentrate, are stored in fit for purpose water storage facilities in line with EA requirements.

The water collection and treatment process is an integral part of the water management and gas production strategy, and is illustrated below in Figure 4.

3 http://www.derm.qld.gov.au/factsheets/pdf/water/w195.pdf
4 NB: This guideline and has yet to be finalised or published.

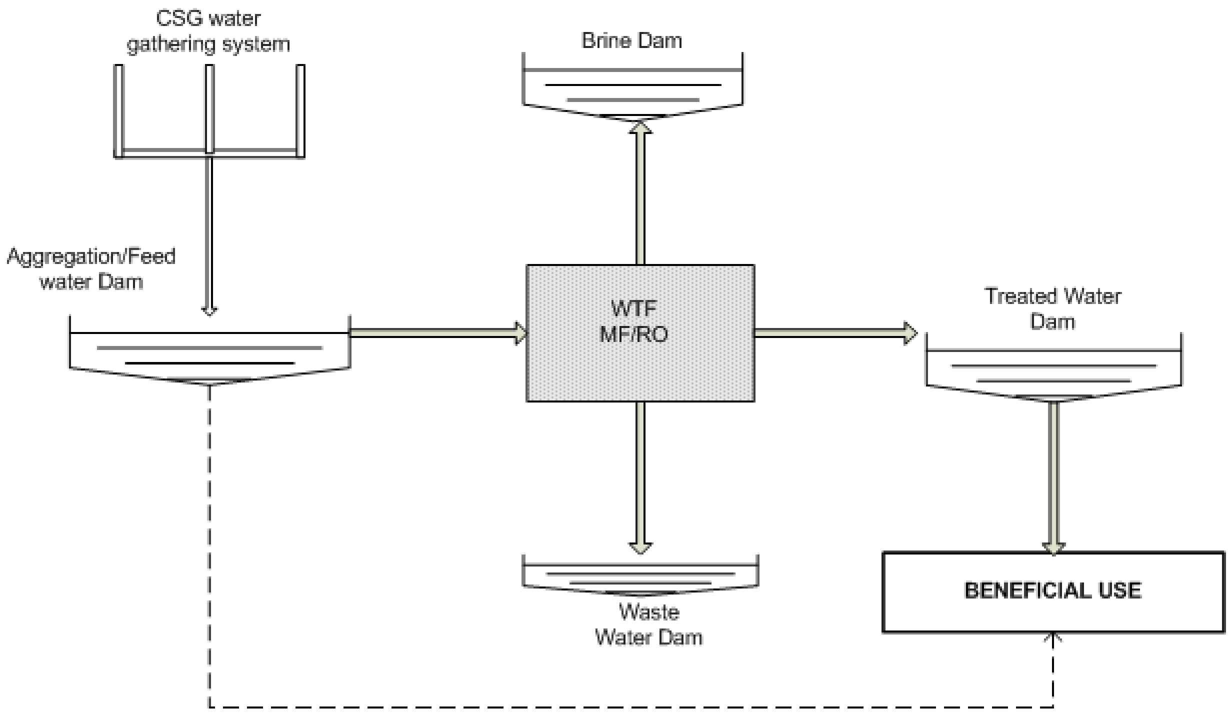


Figure 4: Bowen Basin CSG water management scheme

A third stream is also created through the cleaning and backwash operations of the treatment plant. The volumes associated with this waste are minimal and are accumulated in a suitably designed utility dam and periodically transported to a regulated waste facility when required.

6.2. Exploration/Pilot Wells

Pilot wells assist in determining the viability of the CSG resource. Until the appraisal project phase is complete it remains uncertain as to whether each area will be developed to production stage. Therefore, a key determinant of appropriate water management practices for pilot wells is proximity to existing water infrastructure.

Arrow considers that the construction of small aggregation dams (2 – 10 ML) is preferable to pre-development investment in pipelines and the construction of larger centralised water storages, each of which would create a larger environmental footprint than is necessary. However, such dams will be connected to a water gathering network where possible during the exploration/appraisal phase of field development.

The conceptual strategy for the treatment of CSG water for exploration is as follows:-

- Water produced from the pilot program will be aggregated in local associated water dams;
- If pilots are successful and the project moves into the production phase (following an EIS process), dams will be connected to the northern water treatment network. This will involve:
  - Construction of pipelines connecting dams to Reverse Osmosis (RO) Facilities (e.g. the RO facility to be situated on PL191);
  - Transport of water to where it will be treated to a quality enabling beneficial reuse for industrial, agricultural and urban purposes (refer to Section 7.4 for Arrow BU processes currently approved or under investigation). The decision tree in Figure 6 will be applied when determining the most appropriate beneficial use or disposal option for the CSG water;
  - Relevant land access and approval processes (including route assessments, ecological surveys, compensation agreements, development approvals and Beneficial use applications) as required, prior to undertaking the above;
  - Current investigations into mobile treatment units are progressing. This will potentially facilitate the decreased reliance on dams and treatment of all pilot and appraisal generated water for beneficial reuse. Viability is yet to be determined; and
  - The associated water dams may become part of the long term Northern domestic operations.

- In the event that any of the pilots deem an area not viable (and a production phase is not pursued), Arrow will decommission and rehabilitate dams as per Arrow's decommissioning and rehabilitation plan (which will accompany the specific dam operating plan). Arrow considers that the rehabilitation of individual dam sites will have a less significant environmental and social impact than rehabilitation of a network of pipelines over large distances.

7. CSG WATER MANAGEMENT

7.1. COAL SEAM WATER MANAGEMENT HIERARCHY

The EP Act provides for the *Environmental Protection (Waste Management) Policy 2000*[5] (EPP Waste) to deal specifically with environmental values relating to waste management. It does this by establishing a preferred waste management hierarchy and various principles as the basis for waste management. The environmental values to be enhanced or protected under this policy includes human health and safety, more effective use of resources and avoiding remediation costs.

In accordance with the EPP (Waste), waste management (including CSG water from exploration) will be based on the following hierarchy:

- Waste avoidance- Preventing the generation of waste or reducing the amount of waste generated- Re-using waste, without first substantially changing its form;
- Waste re-use- Treating waste that is no longer useable in its present form and using it to produce new products;
- Waste recycling;
- Energy recovery- Recovering and using energy generated from waste; and
- Waste disposal- Disposing of waste, or treating and disposing of waste, in a way that causes the least harm to the environment.

DERM have adopted two categories of preferred options for management of CSG water. With regard to DERM's CSG water management hierarchy and preferred options, Arrow's approach is shown in Table 5.

[5] http://www.legislation.qld.gov.au/LEGISLTN/CURRENT/E/EnvProtWaMP00.pdf

Table 5: Water management hierarchy of preferred options

DERM CSG Water Management Preferred Options			Arrow's Approach[6]
Category	**Option**	**Description**	**Option implemented / investigated**
1	Injection where detrimental impact is unlikely	Involves injecting either treated CSG water, untreated CSG water or brine into a natural underground reservoir, or aquifer, where the injection is unlikely to have a detrimental impact on the identified environmental values and water quality objectives of the waters in the target formation or surrounding environment	To determine the feasibility of CSG injection, Arrow's commitments, actions and milestones include the following: ***Commitments***: • To further investigate the potential for CSG injection as part of a risk managed portfolio of CSG water options for the Bowen Basin • To work in close collaboration with other CSG operators and in conjunction with Regulatory agencies to assess injection options ***Actions***: • Establishment of a targeted water injection specialist role within Arrow (position filled May 2011) • Currently investigating opportunities for site based injection trials in the Bowen Basin through a targeted scoping study • Ongoing discussions with local irrigators and government with respect to a substitution allocation or BU schemes ***Milestones*** (and anticipated dates) • Clarification of approval requirements with DERM to facilitate injection (**Nov. 2011**) • Relevant approvals secured to undertake injection trials (**June 2012)** • Completion of approved aquifer injection trials **(June 2013)** • Development of an internal water injection strategy on satisfactory completion of investigations and trials **(Nov. 2013)** (refer to section 7.5 for further details regarding scoping study)
1	Untreated Use	Involves using the CSG water without	Arrow is currently investigating a range of

[6] Refer to section 2.2 for period of implementation of management scheme.

DERM CSG Water Management Preferred Options			Arrow's Approach[6]
Category	**Option**	**Description**	**Option implemented / investigated**
		first substantially changing its composition. Under a Specific Beneficial Use[7] or General Beneficial Use[8] approval issued by DERM the following uses are considered as an option for untreated CSG water: • - Irrigation and general use • - Livestock drinking water • - Dust suppression • - Landscaping and revegetation • - Power station cooling • - Coal washing • - Feedlots • - Urban use	options for untreated use, and has an existing water supply licence for mine site beneficial use (refer to section 7.4) Arrow will identify further beneficial reuse opportunities through continued community and surrounding stakeholder engagement Arrow will actively develop practicable agreements with the relevant entity/s.
1	Treatment and Use	Includes treatment of CSG water through a process to remove or reduce contaminants to make the water suitable for a desired end use. Under a Specific Beneficial Use[9] or General Beneficial Use[10] approval issued by DERM the following uses are considered as an option for treated CSG water management under this plan: • aquaculture and human consumption of aquatic foods • coal washing • dust suppression • industrial use • irrigation • livestock watering	Arrow is currently investigating a range of BU options for irrigation and industrial use of treated water (refer to Section 7.4 for details). Arrow is constructing a 2ML/day MF/RO plant in PL 191 to facilitate BUs and sustainable discharge in emergency scenarios. Containerised RO treatment facilities have been investigated for the purpose of treating the CSG water produced by pilot wells. Currently, this option has been deemed to possess an increased environmental impact compared to the current strategy of aggregating water for future linkage to the treatment system. This is associated with the generation of brine and additional footprint related to the infrastructure requirements of the RO facility and brine and treated water dams.

[7] http://www.derm.qld.gov.au/environmental_management/land/documents/csg-water-beneficial-use-approval.pdf
[8] http://www.derm.qld.gov.au/register/p02281aa.pdf
[9] http://www.derm.qld.gov.au/environmental_management/land/documents/csg-water-beneficial-use-approval.pdf
[10] http://www.derm.qld.gov.au/register/p02281aa.pdf

DERM CSG Water Management Preferred Options			Arrow's Approach[6]
Category	**Option**	**Description**	**Option implemented / investigated**
			Similarly, pumping CSG water to the nearest treatment facility by the installation of pipeline, involves substantial environmental (~15m easement for construction) and financial implications, and is best undertaken in the production stage.
1	Direct supply via pipeline to a water supply dam managed by a water service provider[11]	This option involves the supply of water of a suitable quality via a pipeline to a water supply dam managed by a water service provider	This option has not been considered under this plan, as Arrow's preference is for the CSG water to remain within the area it is produced. Further, no service providers operate practicable infrastructure within the tenement area and Arrow does not hold approvals to construct pipelines off lease. Issues associated with the transport of regulated waste off tenement (including approval requirements and potential environmental impacts) are an additional impediment to this approach.
2	Disposal via evaporation dams	Evaporation dams are no longer to be used as the primary method for disposal of CSG water. In some circumstances, where a company can demonstrate that there is no feasible alternative for using, treating, storing or disposing of CSG water, evaporation dams may be authorised on application to DERM.	Arrow may propose to use evaporation dams for the exploration phase, where there is no feasible alternative for managing CSG water. An approval will be sought from DERM for specific instances. Arrow is currently constructing the MGP UF/RO plant concurrently with developing and investigating all possible BU options as an alternative to evaporation dam usage.
2	Disposal via injection where a detrimental impact is likely	This option involves injection of CSG water.	This has not been considered as an option for CSG water management under this plan. Arrow's injection studies will initially focus on outcomes which will not result in detrimental impact
2	Disposal to surface waters	The disposal of any CSG water (treated or untreated) directly to surface waters.	Continuous or long term discharge has not been considered as an option for CSG water management under this plan. Arrow will actively pursue opportunities for beneficial use, but will seek to retain approvals for emergency wet weather discharge when the

[11] http://www.derm.qld.gov.au/water/regulation/service_provider_list.html

DERM CSG Water Management Preferred Options			Arrow's Approach[6]
Category	**Option**	**Description**	**Option implemented / investigated**
			water may not be able to be used. This approval will be sought through the relevant EA.
2	Disposal to land	The disposal of any CSG water (treated or untreated) directly to land.	This has not been considered as an option for CSG water management under this plan.

7.2. Water Treatment

7.2.1. Treatment process

Arrow currently treats CSG water through a process of micro filtration (MF) and reverse osmosis (RO). MF is a microporous membrane separation process with selectivity on the basis of size. Most MF membranes are screen filters with the feed inlet pressure serving as the driving force for filtration. The membranes allow the removal of turbidity, bacteria, cysts and particulates from the water to sizes of 0.1 to 3 µm. Following MF, water is treated using RO to remove dissolved salts. RO is significantly more complex than MF and involves the separation of salts from solution through a semi permeable microporous membrane under elevated hydrostatic pressure.

7.2.2. Treatment infrastructure

As described in Section 4.1, Arrow plans to construct a water treatment (RO) facility on PL191. The facility will have a treatment capability of 2ML/day, with a maximum output of approximately 580 ML/yr, based on actual recovery and availability rates. The plant will operate at a recovery between 75 – 85% (dependent on feed source). Pre-treatment will consist of activated carbon filtration to remove the residual organics that have been identified in the feed supply. The RO facility is scheduled to commence construction in October 2011.

Arrow initially installed RO plants in the Surat Basin at Daandine (12ML/day) and a trial plant at Glenelg for aquifer injection trials (on PL230). Additionally, the Tipton West MF/RO plant (12ML/day) on PL 198, is due for commissioning in early 2012. Through the design and operation of these plants (and associated 'lessons learnt'), Arrow has significantly bolstered its experience and capabilities in water treatment and waste reduction technologies. Arrow will continue its investigations into long-term industry-wide solutions and alternative technologies for efficient water treatment and waste management.

7.2.3. TREATED WATER QUALITY

Table 6 shows predicted parameters for the water treatment facility on PL191, as an indicator of likely water qualities achieved through the RO Process. Due to the significant presence of sodium and low levels of calcium and magnesium in the treated water, ionic amendment will be required to lower the sodium absorption ratio (SAR) to make beneficial use possible. The amendment facility will utilise calcium chloride for SAR adjustment and will be designed and constructed in accordance with the beneficial use quality requirements for each use.

Treated water quality (permeate) will be continuously monitored for the available in situ parameters (pH, EC), and the remaining parameters sampled frequently to ensure compliance with the relevant approval conditions, supply agreements and process stability.

Table 6: RO treated water stream water qualities[12]

RO Pass Streams (mg/L)			
Parameter	**Feed**	**Concentrate**	**Permeate**
TDS	6734	44084	72.22
pH	8.6	7.65	5.99
Na	2100	13879	21.65
Mg	20	133	0.05
Ca	17	113	0.05
Sr	6	39	0.02
Ba	4	26	0.01
CO3	55	1000	0.00
HCO3	2989	18491	31.66
NO3	0.00	0.00	0.00
Cl	1500.	10139	15.40
F	2	13	0.03
SO4	2	13	0.00
SiO2	17	115	0.29
Boron	1	8	0.51
CO2	6	213	49.65

[12] Projected parameters taken from ROSA (*Dow Water and Process Solutions*) modelling for MGP WTF

7.3. STORAGE, USE AND / OR DISPOSAL OF TREATED CSG WATER AND BRINE

As described in section 6, prior to usage and /or disposal, treated CSG water and brine will be segregated and stored in purpose built dams, designed and constructed in accordance with the *Manual for Assessing Hazard Categories and Hydraulic Performance of Dam,* and relevant EA conditions. Refer to Appendix 1 for specific details provided regarding Bowen Basin Dams.

Treated CSG water will be used according to the management hierarchy described in Section 7.1, of which BU approvals are a current focus, pending the realisation of injection opportunities.

With respect to brine and residual solid salts through the water treatment and evaporation process, the following hierarchy will be used to determine appropriate management strategies:

1. Waste reuse/recycling through chemically processing/treating brine or salt residues to create useable/saleable products such as soda ash;
2. Waste disposal through:
   - disposal of brine to an ocean/estuarine environment, then
   - disposal of salt into an existing licensed regulated waste disposal facility, then
   - disposal of salt into a purpose built regulated waste disposal facility (landfill mono cell) on freehold land owned by the tenure holder;
3. Injection of brine if the target formation is:
   - a single geological unit that is not regionally consistent and extensive.
   - isolated above and below by an aquitard or aquicludes within the hydraulic impact zone; and
   - not an aquifer that does or could supply water for potable, agricultural, industrial and commercial purposes.

Currently, the brine disposal strategy relies on evaporation and concentration until technologies for crystallisation have been fully investigated and trialled over the next two years. The proposed solution will potentially create marketable salts such as soda ash and sodium chloride. Arrow is currently collaborating with other CSG proponents to take advantage of economies of scale and reduce infrastructure requirements and footprints for brine management. Alternatively, as a last report, salt will be concentrated, dried and transported to a licensed and regulated landfill (Figure 5).

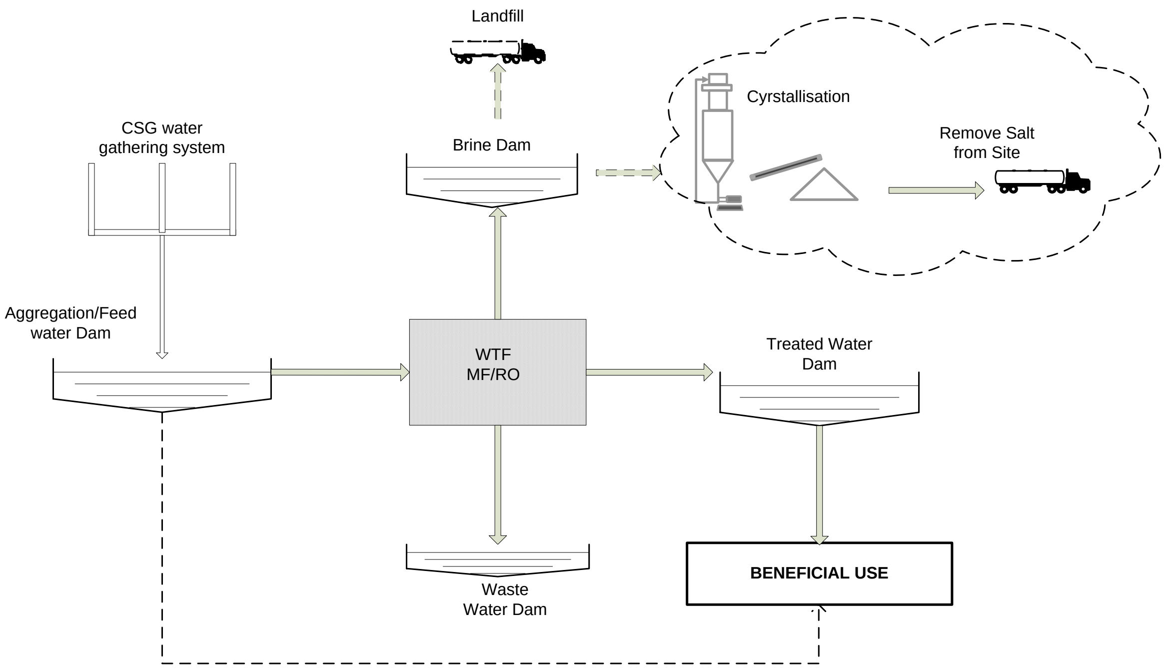


Figure 5: Bowen Water and Salt Management Strategy

7.4. Current and Proposed Beneficial Use

Arrow currently possesses a water supply licence (under renewal) for the use of untreated water for industrial beneficial use at Millenium Mine. The water is planned for use in coal washing activities in the approved quantity of 500 ML/yr. Due to the recent protracted wet season, and higher than average rainfall, this agreement has been under utilised.

Arrow is currently investigating a range of additional beneficial use options, in accordance with the following prescribed activities specified in DERM's guideline for beneficial use:[13]:

- irrigation
- industrial use

[13] http://www.derm.qld.gov.au/environmental_management/land/documents/csg-water-beneficial-use-approval.pdf

- dust suppression
- aquaculture and human consumption of aquatic foods
- livestock watering
- coal washing

The decision tree in Figure 6 shows Arrow's process for determining the most appropriate beneficial use or disposal option for CSG water.

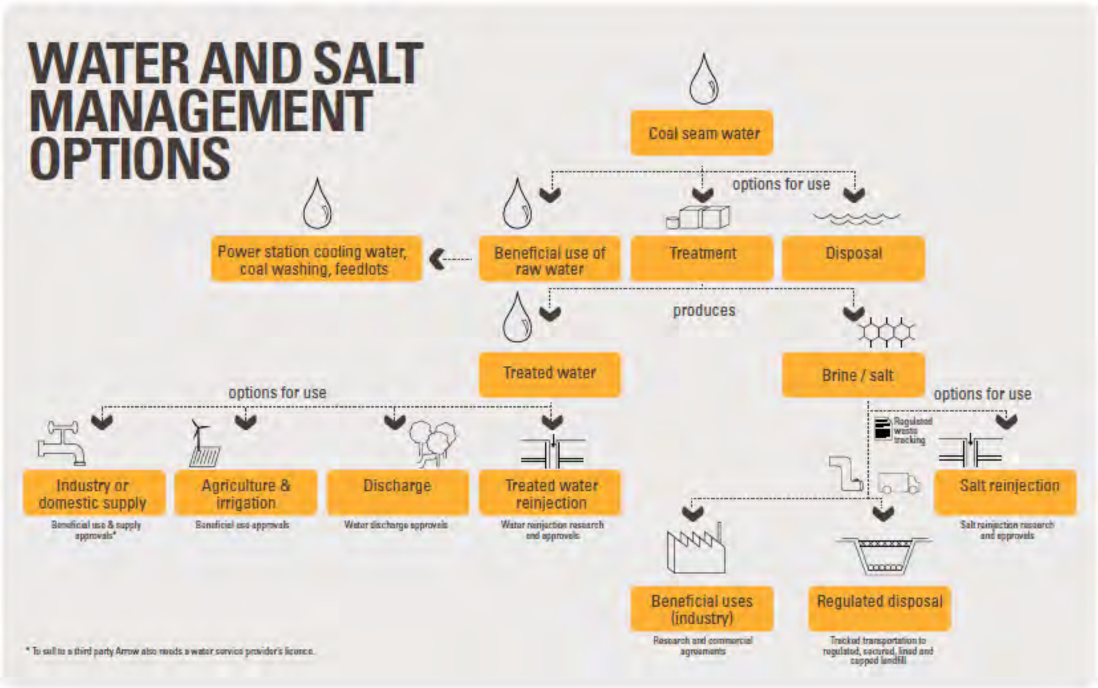


Figure 6: Decision tree for determining beneficial use or disposal options[14].

Due to the uncertainty of industrial off-takes, Arrow is currently preparing a BU application for an irrigation scheme on PL224 (refer to Section 7.5 for further information regarding BU trials on PL224). Investigations and assessment of the suitability of the nominated field are nearing completion. Submission of the BU application is scheduled to occur by late 2011, with project implementation expected by late 2012 (given anticipated approval and contractual timeframes).

Further negotiations are also currently progressing for additional industrial use, coinciding with the commissioning of the MGP water treatment facility. The overall BU scheme for the

[14] http://www.arrowenergy.com.au/icms_docs/73090_Water_and_salt_management_brochure.pdf

MGP will aim to encompass numerous off-take options and contingencies, to ensure water disposal balances or exceeds water generation, removing the reliance on evaporation.

Error! Reference source not found. shows the current Bowen Basin water disposal profile in comparison to the proposed off-takes that are being developed for the beneficial use scheme. It clearly reveals the diminishing reliance on evaporation to maintain the site's water balance.

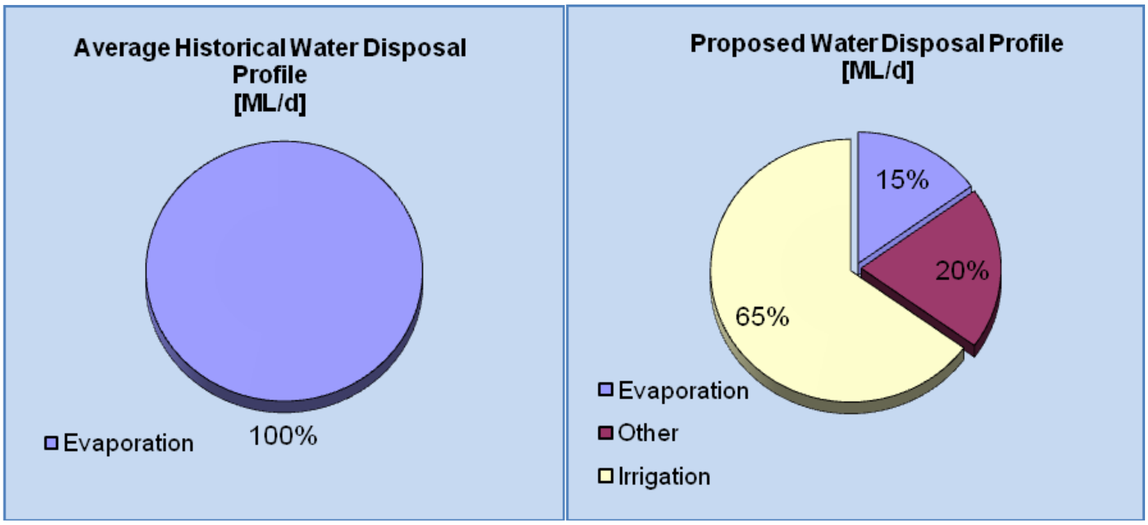


Figure 7 Bowen Basin Water Disposal Profile

7.5. INVESTIGATIONS INTO CSG WATER MANAGEMENT

Arrow is currently undertaking the following investigations to further develop options for management of CSG water:

- **Injection feasibility study (scheduled to commence late 2011);**
  - Objective is to assess the feasibility of injection in the Bowen basin as part of a risk managed portfolio of CSG water options for the Bowen Basin;
  - The study will involve:
    - A review of technical water characteristics and basin properties (both geophysical and chemical);
    - Identification of target aquifers and estimation of injectibility and containment;

    - Quantification of predicted water generation volumes and water quality;
    - Data gap analysis (including literature review);
    - Generation of an initial static model (identifying all geological formations);
    - Environmental risk assessment activities with respect to identified water quality and geological formation characteristics; and
    - Assessment of non technical risks and issues (including approvals implications, stakeholder management, land access and cost implications).
  - Further to the scoping study and depending on the outcomes, Arrow will undertake a data acquisition program to increase certainty around the feasibility of the aquifer injection which may include drilling (core, log), well testing, seismic and possibly injection/production tests;
  - The aquifer injection investigation will be undertaken in conjunction with Arrow's groundwater monitoring and modelling program. Arrow is also committed to work in close relationship with the other CSG proponents and in conjunction with interested government agencies; and
  - A targeted water injection specialist role has been created and filled within Arrow to manage the injection investigation and implementation process;

- **Brine crystallisation trial:**
  - Arrow is currently in negotiations with other CSG proponents to commence brine management pilot trials early 2012. This will incorporate brine concentration and preferential crystallisation to obtain marketable salt products; and
  - Additionally, Arrow will (as part of the LNG project) conduct separate brine concentration and salt production trials as a base case for salt management, moving towards the Arrow LNG project.

- **PL224 Irrigation Trial**
  - The objective of this trial is to assess the viability of long term crop irrigation in the area;
  - The trail will involve irrigation of a 92 hectare plot under a BU approval;
  - Technical investigations are nearing completion and the BU application is planned for submission in late 2011; and

- If successful, the irrigation project is expected to operate indefinitely and will form an integral part of the BU scheme for the Bowen Basin.

7.6. Receiving environment

The receiving environment, relevant to each CSG water management activity in the Bowen Basin, will be documented in the associated approval applications and management plans that are generated under specific conditions of the respective approvals (e.g. EAs, discharges approved under the EA, BUs and recycled water management plans).

7.7. Control measures and procedures

Arrow has clearly defined environmental management responsibilities as required under relevant approvals (including EAs and BU approvals) that govern the undertaking of petroleum activities on Arrow tenures.

As part of these environmental management responsibilities, Arrow implements a range of control measures and procedures, which include (but are not limited to) the following:

7.7.1. Control measures

Aggregation and Storage

Key control measures include:

- All wells have the ability to be 'shut in' to cease water flow if required;
- All aggregation gathering systems are designed, constructed and tested to industry standard as a minimum;
- Gathering systems are frequently monitored and automated process control allows for prompt identification of any imminent issue; and
- Storage dams will be engineered and constructed to a standard that meets all legislative and EA requirements (as described in Section 8). All dams will be inclusive of leak detection systems and monitoring programs (as described in each specific dam operating plans) to ensure unacceptable seepage and/or contaminant release is identified and promptly actioned.

Treatment

Any water treatment facility constructed and operated by Arrow will incorporate best practice design and process controls. This will include:

- civil structures that will not allow any spill or contaminant to be released from the water treatment bunded areas;
- process controls that will trigger level shutdown and/or diversions for out of specification water quality;
- sufficient number of process monitoring points to enable additional sampling and analysis by third party laboratories This will allow tighter process control, advanced operational analysis/optimisation and troubleshooting;
- development of standard operating procedures (SOP) to ensure safe and robust procedures are standardised to reduce risk of operating error; and
- regular monitoring to assess functionality and performance.

Use/Disposal

Arrow will comply with all requirements specified in BU and EA approval conditions as a minimum. All delivery networks and/or equipment will be designed and constructed to industry standards in conjunction with Arrow emergency procedures for any operational incident response and recovery.

7.7.2. PROCEDURES

A range of procedures have been developed by Arrow to prevent or to control the release of a contaminant or waste to the environment. These include:

- 99-H-PR-0010 (5) Incident Reporting Recording and Investigation Procedure
- 99-H-PR-0016 (1) Chemical Management Procedure
- 99-V-PR-0018 (1) Waste Management Procedure
- 99-V-PR-0019 (1) Water Management Procedure

In addition, targeted environmental management and control measures, specific to relevant water infrastructure, are described in a range of documents including:

- Dam Operating Plans,

- Standard Operating Procedures for water treatment facilities, and
- Sampling and monitoring plans

Furthermore, all wells have the ability to be shut if water flow prevention was required. The dams are also operated and designed to have the capability to contain any contaminant of concern and redirected to supplementary treatment or disposal.

7.8. Monitoring programs

7.8.1. Groundwater

Monitoring sufficient for the prediction and early detection of any detrimental impacts on the receiving environment from CSG water management practices includes a Groundwater Monitoring Program and Annual Water Monitoring Report, as per the requirements of the relevant EA.

The groundwater monitoring network will detect any detrimental impacts on the receiving environment resulting from activities regulated by an Environmental Authority or BU through:

- regular monitoring of groundwater quality in the immediate vicinity of regulated dams,
- monitoring of background sites,
- monitoring of dam water quality,
- establishment of site-specific environmental values for the shallow groundwater system,
- development of site-specific trigger values,
- ongoing monitoring of groundwater to identify environmental impacts, and
- implementation of management actions in the event of environmental impact.

The Groundwater Monitoring Program required under the EA includes monitoring bores installed in close proximity to the dam. The exact location of these bores is guided by geotechnical investigations to identify the direction in which in groundwater impact is likely to travel. Background sites are also installed at distances of 500m to 1,500m (where access allows) both up and down gradient of the dams.

Samples are collected to establish background conditions (i.e. un-impacted by regulated activities) prior to commissioning of the dam, and over a 12 month period (from background bores). This data is used to establish what the environmental values (including current and maximum beneficial use) of the shallow groundwater resource area.

Site-specific trigger levels are developed by considering the background groundwater quality, established trigger levels (such as ANZECC water quality criteria), and the potential impacts of seepage from regulated dams. Ongoing monitoring is then used to identify whether, and to what extent, environmental impacts, with reference to the aforementioned criteria, are occurring. Where unacceptable impacts have occurred, management actions are initiated to remedy these.

7.8.2. SURFACE WATER AND TREATMENT

The surface water monitoring program will detect any detrimental impacts on the receiving environment resulting from water discharge activities regulated by EAs through:

- regular monitoring of dam water quality,
- regular monitoring of treatment performance and process parameters,
- monitoring of any potential receiving waters,
- development of specific trigger values, and
- implementation of management actions in the event of environmental impact.

Arrow is currently undertaking a Bowen Basin water characterisation study to establish CSG water quality and to understand any geographical variations associated with the well distribution across the basin. This will facilitate the prediction and any additional management preferences necessary for treatment requirements/optimisation and/or preventative operation to allow for varying water quality. On site monitoring programs are also being developed to monitor chemical parameters and document any seasonal, operational variations.

Baseline data will then be established to create site-specific trigger levels by considering the water quality, treatment parameters and reporting requirements. Ongoing monitoring will then be utilised to identify whether, and to what extent, any environmental or treatment impacts may occur.

7.8.3. Reporting

If any contaminant levels are identified as having caused, or have the potential to cause environmental harm, this will be reported to DERM as per the EP Act and EA requirements. An annual monitoring report will be developed and made available to the administering authority upon request. Subsequent to the annual submission of the monitoring report, a review of the procedures, assets and sampling frequencies will be undertaken to ensure all relevant requirements are being met.

7.9. Measurable criteria for key CSG water management activities

The following table describes measurable criteria for the management of key CSG water infrastructure and processes in the Bowen Basin. Criteria described in this table are not exhaustive but provide an indication of the currently anticipated measurable management techniques to be employed by Arrow. These will be further refined and documented through an iterative process as Arrow's development planning progresses and water management requirements are further defined.

Table 7: Measurable Criteria for Key CSG Water Activities

Objectives	Environmental value to be protected	Task / Action	Key Performance Indicators
Transmission of CSG water via pipelines			
• Effective containment of water throughout transmission activities (i.e. from source to point of storage, treatment, usage or disposal)	• Surface and groundwater quality to sustain surrounding agricultural and domestic use, and ecological processes • Soil quality (including structure and chemical properties) of surrounding areas able to support pre existing land use and ecological processes	• Maintain shut in capability of wells • Regular monitoring in accordance with relevant procedures and programs (including groundwater monitoring program, field infrastructure inspections and audits) • Regular maintenance in accordance with set programs and schedules • Effective planning and clearance activities to site flowlines in areas of low impact and in accordance with EA conditions	• Recommendations for any repairs or remediation are closed out appropriately • Any complaints from landholders received with respect to flowline leakage are resolved • No evidence of soil erosion from flowline construction activities • No evidence of weed proliferation from flowline maintenance activities
Storage of untreated and treated **CSG water** in dams			
• Effective storage and containment of CSG water in relevant dams • The quality and quantities of stored water are maintained within relevant approval thresholds	• Surface and groundwater quality to sustain surrounding land for agricultural and domestic uses, and ecological processes • Soil quality of surrounding areas able to support pre existing land use and ecological processes	• Regular dam integrity inspections (annually) • Regular monitoring in accordance with relevant procedures and programs (including groundwater monitoring programs) • Maintenance of infrastructure and facilities necessary to effectively contain water and monitor leakage	• Records indicate regular inspections and maintenance as per planned schedules • Where dam levels reach mandatory reporting levels, appropriate actions are implemented within required timeframes (as per relevant EA conditions and dam operating plans) • Recommendations for any repairs or remediation are closed out appropriately
Beneficial use			
• Maximise use of CSG water (generated and treated through petroleum activities) for beneficial use • Undertake BU	• Surface and groundwater quality to sustain surrounding agricultural and domestic uses, and ecological processes • Soil quality of	• Regular monitoring of water quality and quantities in accordance with BU and EA conditions of approval • Regular inspections of BU infrastructure to	• Inspection reports indicate compliance with relevant EA and BU approval conditions (including water quality) • Records indicate that all required maintenance has

Objectives	Environmental value to be protected	Task / Action	Key Performance Indicators
activities that aim to return water to the source catchment or basin • Water quality and quantities, as specified under relevant BU Approvals, are maintained	surrounding areas able to support pre existing land use and ecological processes	ensure optimum operability	been actioned in a timely manner • Any complaints with respect to BU stakeholders are appropriately actioned
Management and disposal of any wastes (including brine and salt)			
• Waste materials are managed in accordance with relevant hierarchies, legislation and policies • The community is not adversely affected by Arrow's waste generation and management	• Human health and safety • Land use capability, having regard to economic considerations • Surface and ground water quality to sustain surrounding land for agricultural and domestic uses, and ecological processes • Soil quality of surrounding areas able to support pre existing land use	• Relevant control measures to detect leakages of brine from containment dams are regularly inspected and maintained • Storage of Hazardous wastes in is undertaken in accordance with relevant legislation and standards (including AS 1940). • Regular inspections of waste storage and transport infrastructure are undertaken to ensure optimum operability	• Any complaints with respect to waste management are appropriately actioned • Records indicate that all required maintenance has been actioned in a timely manner • No changes to baseline water quality remains unchanged

Should any of the above criteria not be met, actions to enable the criteria to be satisfied in future include:

- evaluation (including route cause analysis) of the underlying cause of the criteria not being met;
- implementation of corrective actions to address underlying cause (including engineering solutions and amendments to plans and procedures as required);
- review of relevant procedures, protocols and management plans to determine actions necessary to prevent further non conformance;
- implementation of training and awareness programs to prevent further non conformance.

7.10. Release Reduction Strategy

Arrow is currently developing a Release Reduction Strategy which will be a continual initiative to realise and execute opportunities to minimise CSG water generated at the surface, maximise reuse and minimise ground disturbance through the establishment of CSG infrastructure. Specific activities that will be addressed by the Strategy include:

- A market analysis study to identify existing and future water management technologies;
- A feasibility assessment of BU opportunities for CSG water;
- On-going review of drilling technologies to minimise water generation; and
- optimisation of existing transport and treatment processes.

8. Dams

All Arrow dams (treated, untreated and brine) associated with the management of CSG water will be designed, constructed, operated and authorised in accordance with legislative requirements[15]. This includes completing a hazard assessment for all dams that hold CSG water to determine if they are a Low, Significant or High hazard dam in accordance with DERMs *Manual for Assessing Hazard Categories and Hydraulic Performance of Dams*.

Dams that are assessed as being in the low hazard category will be designed and operated in accordance with accepted engineering standards and for dams that are assessed as being in the significant or high hazard category, Arrow will lodge a third party certified *Dam Design Report* to DERM for review prior to construction. Details of significant or high hazard dams will be maintained in Arrow's *Regulated Dam Register*.

All MGP water networks and storage facilities are located on PL191, PL223 and PL224. A list of tenure related dams are listed in the Appendices.

Arrow has implemented a dam upgrade project (currently being undertaken by specialist consultants) to identify any upgrade requirements for existing regulated dams to comply with current EA conditions and DERM water management guidelines. This will be

[15] http://203.210.126.185/dsdweb/v4/apps/web/secure/docs/4382.pdf

completed by 1 October 2011, and will include detailed design plans and recommendations to address any upgrades required to meet legislated standards.

9. APPENDIX 1

Water management infrastructure of producing Bowen Basin tenures

Tenure	Water Management Strategy and Infrastructure Characteristics				
PL191	Beneficial use of CSG water will be realised through the treatment of all produced water and use for farm irrigation, industrial use and stock watering. Piping and pumping station infrastructure will be installed to allow for compliance upgrades and/or the decommissioning and rehabilitation of existing evaporation dams. All CSG water gathered from PL191, PL196, PL223 and PL224 will be treated at the MGP water treatment facility where the water (after any amendment requirements) will be made available for beneficial reuse.				
	Activity	**Size/Capacity**	**Status**	**Purpose**	**Description**
	Water Treatment Facility	2ML/day	Under Construction	Water Treatment	UF/RO
	Regulated Dam	<400ML	Active	Evaporation	Moranbah Dam 1
	Regulated Dam	<400ML	Active	Evaporation	Moranbah Dam 2
	Regulated Dam	<400ML	Active	Aggregation	Moranbah Dam 3
	Regulated Dam	<400ML	Active	Aggregation	Moranbah Dam 4
	Regulated Dam	<400ML	Active	Aggregation	Moranbah Dam 5
	Regulated Dam	<400ML	Active	Aggregation	Moranbah Dam 6
	Regulated Dam	<400ML	Active	Aggregation	Moranbah Dam 7
	Regulated Dam	<400ML	Active	Aggregation	Moranbah Dam 9
	Regulated Dam	<400ML	Active	Evaporation	Moranbah Dam 10
	Regulated Dam	<400ML	Active	WTF Brine Storage	Moranbah Brine Dam 11
	Regulated Dam	<400ML	Active	Condensate Storage	MGP CGPF Oily Water Dam
	Regulated Dam	<400ML	Planned	WTF Treated Water Storage	Moranbah Dam 14
	Regulated Dam	<400ML	Active	Sewage Storage	MGP Camp Sewage Treatment Dam
	Water Licences	500ML/ys	Granted	Industrial	Millenium Coal

<table>
<tr><th>Tenure</th><th colspan="5">Water Management Strategy and Infrastructure Characteristics</th></tr>
<tr><td>PL 196</td><td colspan="5">All CSG water from PL 196 will be gathered and transported to MGP WTF for treatment and beneficial reuse.</td></tr>
<tr><td rowspan="3">PL 223</td><td colspan="5">Currently, PL223 is in development with construction of a nodal compressor and associated oily water dam. All CSG water from PL 223 will be gathered and transported to MGP WTF for treatment and beneficial reuse.</td></tr>
<tr><td>Activity</td><td>Size/Capacity</td><td>Status</td><td>Purpose</td><td>Description</td></tr>
<tr><td>Regulated Dam</td><td><400ML</td><td>Active</td><td>Containment</td><td>Oily Water Dam</td></tr>
<tr><td rowspan="4">PL224</td><td colspan="5">The reuse of all CSG water will be realised through the operation of a water treatment facility on PL191 to produce water that can be beneficially reused for irrigation, stock and industrial use such as coal washing.

PL224 is the planned location for the Moranbah Brine Dam 12, which will be transported from the WTF and will be designed in accordance with all relevant guidelines and legislation.</td></tr>
<tr><td>Activity No</td><td>Size/Capacity</td><td>Status</td><td>Purpose</td><td>Description</td></tr>
<tr><td>Regulated Dam</td><td><400ML</td><td>Active</td><td>Aggregation</td><td>Moranbah Dam 8</td></tr>
<tr><td>Regulated Dam</td><td><400ML</td><td>Scheduled</td><td>Brine</td><td>Moranbah Dam 12</td></tr>
</table>

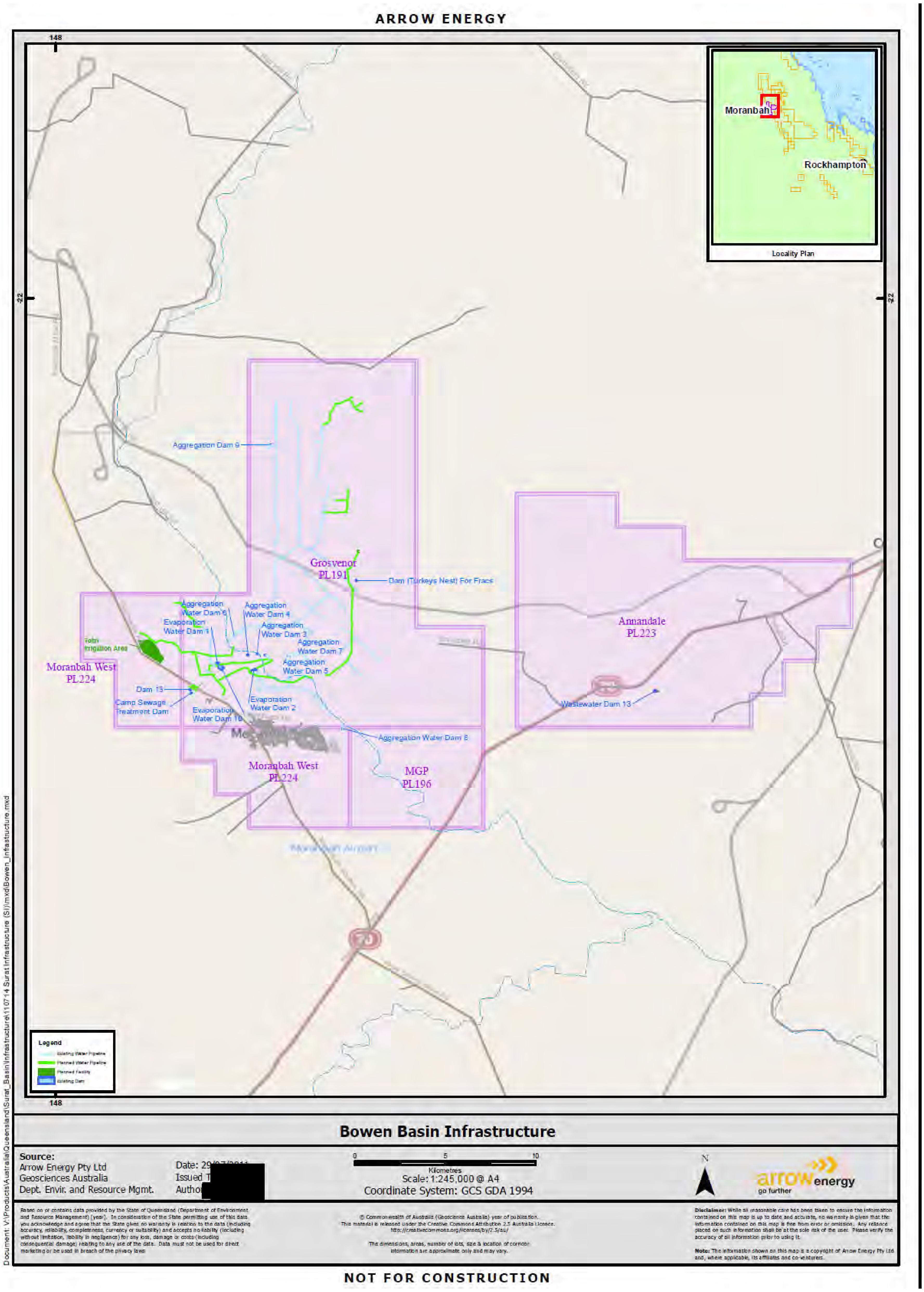


Figure 8: Bowen Basin Water Infrastructure

arrow energy
go further

20 December 2010

Mr [redacted]
Director, Gas and Petroleum Unit
Environment and Natural Resource Regulation
Department of Environment and Resource Management

Attention: Mr [redacted]

Dear Mr [redacted]

RE: Contravention of Environmental Authority PEN100015907
Notice of Intended Discharge of CSG Water due to Unavoidable Circumstances

We refer to recent discussions (including today) between CH4 Pty Ltd ("CH4") and DERM with respect to the current rain events being experienced in the Moranbah region, and the impact this is having on water levels within dams on Petroleum Lease 191.

The current situation on site is that we are concerned there is the risk that sustained rain events overnight tonight could result in the water levels in Dam 10 reaching the spillway, and overflowing into the local environment.

We have considered the risk to the local environment as a result of an overflow, against the risk to the broader environment in the region if we were to pump water from Dam 10 to Dam 5, and then from Dam 5 directly into the Isaac River.

Where water is pumped directly into the Isaac River, it will be subject to dilution with the existing river flow. As the river is currently swollen as a result of the extended rain conditions, based on a pump rate of up to 5 megalitres per day our rough estimate is that the water will be subject to dilution in order of magnitude of 400:1, as discussed earlier today. We have received preliminary laboratory results indicating that the water does not contain any traces of BTEX chemicals. We have yet to receive laboratory results indicating the presence of heavy metals, but historical testing has not identified health concerns in this regard.

We note our continuing general environmental duty, and we are concerned that if we do not take action the CSG water could overflow, and impact the local environment in an undiluted form. The salt levels in the CSG water could impact on local vegetation, prior to the water draining to the Isaac River approximately 1.5 km away in any event.

In relation to Dam 2, we are continuing to pump water from Dam 2 to Dam 10, to ensure that the water level remains at an acceptable level. This is adding to the levels within Dam 10 itself.

With these factors in mind, we have decided to start pumping from Dam 10 (through Dam 5) to the Isaac River tonight, after we send this letter and call you by mobile to let you know. We will of course stop immediately if directed to do so by DERM.

We will closely monitor pumping on a daily basis, and will stop pumping on any day where we are satisfied that an overflow event at Dam 10 is unlikely to occur within the following 24 hour period.

In addition, we will be sending through our proposed Temporary Environment Program tomorrow morning, with a view to bringing these actions into compliance as soon as possible. We will also let you know

T +61 7 3012 4000 F +61 7 3012 4001 ARROW ENERGY PTY LTD ABN 73 078 521 936 LEVEL 19, AM-60, 42-60 ALBERT STREET BRISBANE QLD 4000 GPO BOX 5262 BRISBANE QLD 4001 info@arrowenergy.com.au arrowenergy.com.au

immediately once we have the results of the heavy metal testing of the CSG water, and if any changes in the situation occur otherwise.

Please be assured that we are taking this matter extremely seriously, and are doing everything we can to minimise any negative environmental harm arising out of the extremely high levels of rain experienced in the Moranbah region. To the best of our knowledge, after consideration over the last few days we believe the action outlined in this letter to achieve that effect.

Regards,

[redacted]

Environment Manager

[redacted]

VP Legal

Department of Environment
and Resource Management

Notice

Environmental Protection Act

Notice requiring relevant information

This statutory notice is issued by the administering authority pursuant to section 451 of the Environmental Protection Act 1994, *to advise you of a decision or action.*

CH4 Pty Ltd
Level 19, AM-60
42-60 Albert St
BRISBANE QLD 4000

Your reference : PL191; PL196; PL224; PL223
Our reference : PEN100015907; PEN100251408; PEN100317009

Attention: [redacted]

Re: Information required by administering authority for revised Bowen Basin CSG EM Plan.

Under section 451 of the *Environmental Protection Act 1994* (the Act) this notice requires you to provide the information set out below, relevant to the administration or enforcement of the Act.

You are required to provide the following information by 30 September 2011 to the Department of Environment and Resource Management (DERM) situated at 400 George Street, Brisbane.

The required information is a revised Bowen Basin Coal Seam Gas Water Management Plan including the information outlined in Attachment 1.

The purpose of this information is to ensure CH4 Pty Ltd accurately meets the statutory obligations in the Act for Coal Seam Gas Water Management Plans.

It is an offence under the Act to fail to comply with this notice unless you have a reasonable excuse for not complying with it.

You may apply to DERM for a review of this decision within 10 business days of receiving this notice. You may also appeal against this decision to the Planning and Environment Court.

Information outlining the review and appeal process under the *Environmental Protection Act 1994 is included with this notice.* This information is intended as a guide only. You may have other legal rights and obligations.

The administering authority gives notice relating to this application to all the applicants by giving it to the principal applicant.

Should you have any queries in relation to this Notice, please contact Janet Menzies of the Department of Environment and Resource Management on telephone (07) [redacted].

Signature	Date
[redacted]	30 August 2011

[redacted]
Delegate of Administering Authority
Environmental Protection Act 1994

Enquiries:
Petroleum & Gas Unit
Department of Environment and Resource Management
Floor 7, 400 George Street
BRISBANE QLD 4000
GPO Box 2454
BRISBANE QLD 4001
Ph:(07) [redacted]
Fax. (07[redacted]

Attachment 1- Information request for the Bowen Basin CSG WMP

Water Balance

1. A graph indicating the expected volumes of CSG water generated for each year, grouped by activity and provide a table (e.g. as an appendix) displaying data for graph.

2. Volumes of water produced each year by each tenure

3. A graph indicating the flow rates for each year grouped by activity and provide a table (e.g. as an appendix) displaying data for graph.

4. Description of how volumes will change over life of project and the capacity of water management system to respond to changes in production temporally and spatially.

5. Quantity of CSG water to be dealt with under each management option including but not limited to:
   a. volumes of CSG water stored in each dams
   b. estimated volume of rainfall captured by each dam each month and the estimated evapporation of each dam each month. This should be presented in a graph (with accompanying data in a table) followed by a text description.

6. Justification for the point at which the emergency surface water discharge will be utilised demonstrating in accordance with best practice environmental management that there is no feasible alternative to discharge to surface waters for managing waters at that time.

7. Confirm if quantities are maximum or guaranteed i.e. state the seasonal and timing issues associated with the beneficial reuses and contingencies (e.g. storage arrangements when unable to irrigate due to saturated soils)

8. Demonstration that all reasonable measures have been considered to minimise footprint of infrastructure

Water quality

1. Water quality of produced water for:
   a. temp;
   b. dissolved oxygen
   c. arsenic, barium, borate(boron), cadmium, chromium III, copper, lead, manganese, mercury, nickel, selenium, silver, tin and zinc.
   d. total phosphorus
   e. ammonia, nitrate, nitrite as nitrogen
   f. total petroleum hydrocarbons
   g. BTEX
   h. polycyclic aromatic hydrocarbons
   i. gross alpha + gross beta or radionuclides by gamma spectroscopy
   j. biological, carcinogenic, mutagenic or toxic properties of the water

2. Explanation of the variation of chemical concentrations as a result of chemical reactions over time.

3. Quality of water for each beneficial use or anticipated range if still investigating and provide justification that the quality is fit for purpose

4. state the contaminants of concern expected to be present at critical control points across the water management system.

Dams

1. Latitude and longitude coordinates for the boundary of each dam and details on containment standards.

2. A plan for decommissioning or converting the two evaporation dams on PL191 to aggregation dams.

3. Details on the annual re-evaluation of each evaporation dam which will be undertaken to determine if water management practices can be improved and if any preferred management options in the CSG water management hierarchy can be employed.

Injection

1. Discuss the further scope for virtual injection- will this be included as objective in injection feasibility study?

2. Discuss how will the BUA and its expiry link with the injection feasibility study

Beneficial use

1. Identify sensitive receptors that could be potentially impacted by the RO plant

2. Outline the key project deliverables for the BUA irrigation projects

3. Assessment of environmental impacts (for beneficial uses not already assessed by EA application or BUA) and the sustainability of the proposed use in the receiving environment

4. Demonstrate how the beneficial use will be carried out so environmental impacts will be prevented

Salt/brine management

1. For the two brine crystallisation trials, provide:
   (a) objectives of project
   (b) key deliverables of the project
   (c) project timelines
   (d) quantity and quality of CSG water to be used
   (e) location/area
   (f) duration of pilot program/trial
   (g) discussion around authorisation requirements in existing EAs

2. Demonstrate why more desirable options are not feasible e.g. why waste disposal over injection- does this rely on injection feasibility study?

3. Further justification on management options chosen and relate to stage of development/activity type e.g. exploration. How does the brine quality affect this (e.g. high Na, Cl and TDS)

Measurable criteria

1. Measurable criteria for discharge to surface water

2. Details on contaminants expected to be present at critical control points across the water management system

3. Environmental values for discharge to surface water

4. Revise performance indicators where they are not auditable i.e. not quantitative

5. Describe how performance indicators are assessed

DRAFT TRANSITIONAL ENVIRONMENTAL PROGRAM UNDER SECTION 333 OF THE *ENVIRONMENTAL PROTECTION ACT 1994*

Principal Holder:	CH4 Pty Ltd **AM-60** Level 19 42 Albert Street Brisbane QLD 4000
EA Number:	PEN100015907
Title:	**Coal Seam Water Management Moranbah Gas Project**
Date:	23 December 2010
Finish Date:	31 May 2011

Introduction

As previously indicated in correspondence to DERM (dated 25 October 2010) and subsequent responses to information requests and the program notice documentation submitted by Arrow (dated 3 December 2010), the Moranbah Gas Project lacks sufficient water storage capacity. This has been caused by an early start to the wet season contributing to existing dam levels and causing construction delays. This has prevented Arrow from making additional storage available via the completion of dam 11. The synthetic lining for the dam cannot be installed during periods of rainfall; the civil engineering also requires careful control of the moisture content of the construction materials to achieve the required specifications.

Dam 11 has been designed and is being constructed in line with the most current dam standards stipulated by DERM and contained in the previously submitted and assessed dam design report. It is a large lined dam – intended to provide sufficient storage until Arrow can complete the planned development of the Reverse Osmosis water treatment facility, beneficial uses and the upgrade of existing infrastructure to the new standards. Basically dam 11 is the key early component in a scheme that is consistent with the conditions of the new Environmental Authority and intent of the relevant DERM policies.

The continued rain has delayed the completion of dam 11. This has put Arrow in a position where it cannot comply with the current EA conditions. Arrow intends to employ this transitional environmental program (TEP) as defined in Chapter 7, Part 4 of the *Environmental Protection Act 1994 to bring our operation back into compliance with its current Environmental Authority*. In initiating this process Arrow intends to work with DERM to minimise the potential for environmental harm.

Background

Arrow currently employs a network of 10 dams across PL191 and PL196. Dams 1 through to 7 are shown in the attached drawing (Appendix C). Dams 8 and 9 in the network are SW of the main area depicted in the provided drawing. Approximately 90% of the total storage capacity for coal seam water is held between dams 1, 2 and 10. The other dams are employed to move water between groups of remote wells. An important feature of the petroleum lease is the Isaac River which divides the lease along a NW to SE axis and its tributary Teviot Brook. Isaac River is an ephemeral river; during periods of high flow it limits access to infrastructure on the north eastern side of the petroleum lease via river crossings.

Situation

Based on our risk assessment (refer to Appendix A), our strategy is to maintain DSA level in the older and less accessible dams (particularly dams 5,6,7, 8 and 9) by moving water to dams 1 and 10. Dam 10 is our most recently constructed dam and has an engineered spillway, dam 1 is in reasonable condition and adjacent to dam 10 which allows water to be transferred readily between dams.

Our risk assessment process has identified particular concerns with the integrity of dam 2. This program includes an independent engineering evaluation of dam 2. Arrow has concerns regarding the condition of dam 2 – it is scheduled to be brought out of service on the completion of Dam 11. Based on a precautionary approach we intend to lower the level of water in Dam 2 to 500mm below DSA unless otherwise informed by an independent engineering assessment as a component of this TEP. The goal of this strategy is to maintain pond integrity and minimise discharge to the environment.

Arrow believes that a controlled discharge during high flow conditions in the Isaac River via the existing infrastructure would result in the least environmental impact whilst preserving the integrity of the existing dams. This option prevents the overland flow of untreated coal seam water reaching the Isaac River and minimises the risk of damaging older dams which are built prior to the new standards and lack spillways. When the facility was developed the water management scheme included a wet weather discharge, which required different infrastructure to that necessary to comply with the conditions of the current Environmental Authority

Our system of dams has an area of 125,100 m^2, this equates to a gain of 0.125ML per mm of rainfall. The system is designed to transfer water to the major storage dams 1, 2 and 10 this contribute to the catchments of these structures, each 1 mm of rainfall will cause an increase in dam height of 1.6 mm in dams 1, 2 and 10. When all the input rainfall is directed to dam 10 each 1 mm of rainfall causes an increase in dam height of 2.7 mm in dam 10.

Table 1 Key Dam Variables Dams 1, 2 and 10

Dam		1	2	10
Volume at Spill level	ML	119.66	92.64	203.70
Spillway		No	No	Yes
Liner type		CCL	CCL	1.5mm HDPE
Hydraulic height	n	5.60	5.50	4.75
MRL	m	5.25	5.15	4.40
DSA	m	4.75	4.65	3.90
Target dam fill height	m	4.75	4.15	3.90
Volume to discharge	ML	11.8	15.6	16
Current level (below MRL)[a]	mm	**90**	**300**	**-110**
Remaining capacity	ML	14	17	16
Remaining rainfall *(to spill)*	mm	271	400	148

[a] Levels at 10am 20 December 2010, negative denotes level above MRL

[b] Rainfall based on approximate catchment ratio of 1.6 (based on total catchment area including transfer dams)

[c] Target dam fill height is DSA for dams 1 and 10. Current target height for Dam 2 is based on internal arrow assessment

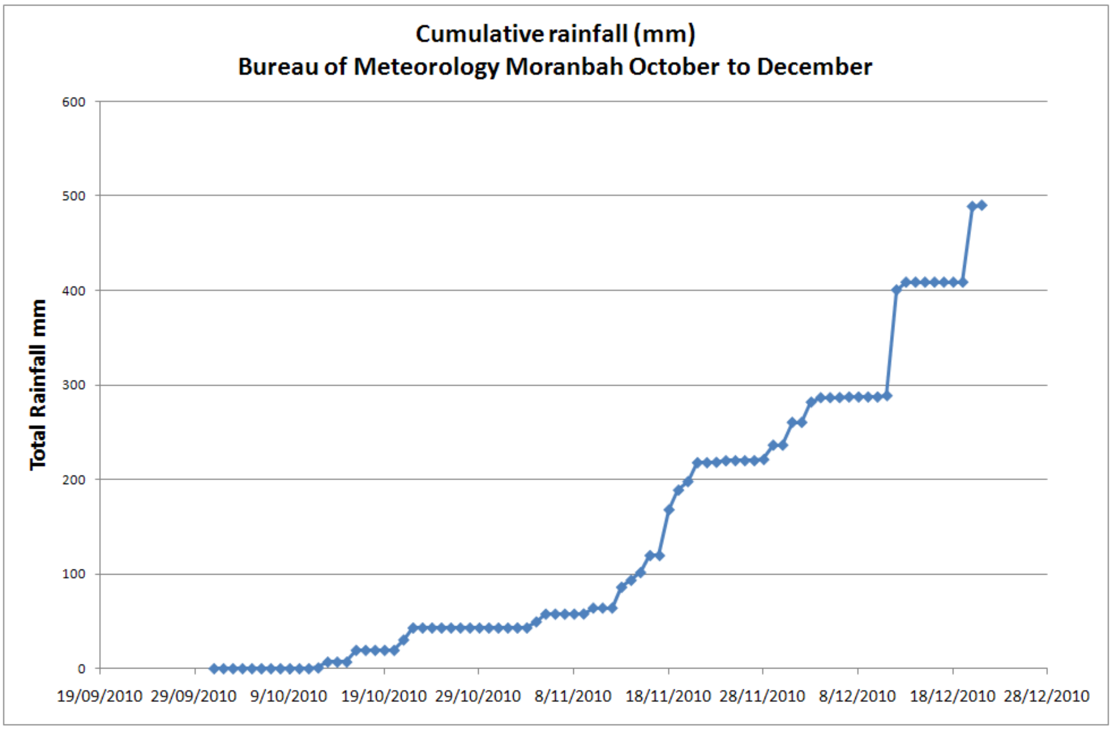


Figure 1 Cumulative rainfall between October to December Moranbah

Future water levels will be a product of the rainfall, coal seam water production and evaporation. Our goal is to maintain dams 1 and 10 at DSA levels by employing a discharge to the Isaac River. Dam 2 will be lowered to a level determined by independent third party engineering risk assessment.

Arrow has evaluated 2 scenarios for water requiring discharge from the storage system:

- Scenario 1 – Mean rainfall until end of wet season
- Scenario 2 – 95th percentile rainfall until end of wet season

Rainfall to date is very close to the 95th percentile rainfalls on average from October through to December. We have had a cumulative total of 490mm from the 1st of October to date (Figure 1), 95th percentile cumulative rainfall for the period from the start of October to the end of December totals 522mm. At present with one week remaining in December the cumulative total is 30mm short of the 95th percentile. Given the current progress of the wet season Arrow believes that the next few months will produce above average rainfall. Long range forecasts from the Bureau of Meteorology give a 55% chance of rainfall at or above the 95% percentile values. In determining the water balance for the facility has evaluated 2 scenarios – mean and 95th Percentile rainfall (refer to Table 2).

Table 2 Discharge scenarios

Scenario	Volume to reach DSA (ML)	Additional removal from Dam 2 (ML) [b]	Expected Net [a] Water to Storage (ML)	Total (ML)	Required Discharge Rate (ML/d)[c]
Mean Rainfall	69	7	54.5	130.5	2.2
95th Percentile	69	7	130	206	3.5

[a] *Net water to storage is produced water, less evaporation plus expected rainfall.*
[b] *This is based on a dam 2 target of 500mm below DSA. This target will to be informed via third party engineering evaluation.*
[c] *Calculated discharge is based on continuous flow this TEP proposes discharge based on Isaac River flow at a specified dilution rate.*

Arrow proposes a discharge of up to 7.5ML/day to commence when the Isaac River is at least 1000 m^3/day measured upstream at the Goonyella river gauge (operated by DERM). Discharge will be maintained at a 400:1 dilution ratio on the basis of maintaining Australian drinking water guidelines (NHMRC,2004) downstream of the discharge. Based on a predicted salinity impact as detailed in Appendix B. This discharge rate and the dilution factor will be reviewed thoughout the TEP in consultation with DERM and informed on the basis of the upstream/downstream river monitoring.

Sampling will be conducted in line with the conditions detailed in this TEP under the procedure attached as Appendix D. Appendix A contains detailed results of the sampling completed to date to characterise the coal seam water to be discharged.

Supporting Information

Consideration of the management hierarchy for the management of coal seam water at the MGP

Evaluation as per the management hierarchy of preferred procedures from Environmental Protection (Water) Policy 2009:

Step 1—evaluate water conservation measures to reduce the use of water and the production of waste water or contaminants;
Water is not employed in the coal seam gas production process but must be removed from the coal seam to allow the gas to be extracted. Water conservation measures will not reduce the amount of coal seam water associated with the gas extracted.

Step 2—evaluate waste prevention options and implement appropriate waste prevention measures;
The key waste prevention measure employed is maximisation of the coal seam gas to water ratio. The coal seams targeted by MGP have relatively low ratios of water to gas in comparison to other fields. In an effort to manage our recent water storage constraints Arrow has shut in a large number of wells, targeting the wells with high water to gas ratios to minimise the production of coal seam water associated with our operations.

Whilst this has reduced our coal seam water production, shutting in further wells will yield limited benefits in terms of water reduction but will cause significant reduction in gas output.

Use of dam 11 in its current uncompleted, unlined state has been investigated. The pipe work and major civil infrastructure is complete but the floor of the dam is incomplete – as discussed (in our meeting on the 1st of December) it lacks its intended second liner, more importantly the clay liner has not been sufficiently compacted to allow its use. Key elements of the pipework connecting dam 11 to the rest of the network remain incomplete. Employing dam 11 would require its use for an extended period to allow subsequent emptying and upgrade of the existing dam infrastructure.

Step 3—if waste prevention does not, or is not likely to, eliminate the release of waste water or contaminants to waters, evaluate treatment and recycling options and implement appropriate treatment and recycling;
The construction of Dam 11 is the first component of our coal seam water management strategy. It is a large lined dam, intended to provide sufficient storage until Arrow can complete the planned development of the Reverse Osmosis water treatment facility, beneficial uses and the upgrade of existing infrastructure to the new standards. Basically dam 11 is the key early component in a scheme that is consistent with the conditions of the new Environmental Authority and intent of the relevant DERM policies. Rainfall is delaying the construction of dam 11 and contributing to the current water storage problems.

Installation of water treatment (such as a mobile RO plant) is limited by the logistics (such as civil engineering, chemical storage and power supply), cost and the challenges posed during current wet conditions. Another option considered was employing water entitlements to dilute the untreated coal seam water to the current environmental authority specification. This option was ruled out since a large quantity of good quality water would be required to dilute and dispose of a limited amount of coal seam water from our dams.

Step 4—if treatment and recycling does not, or is not likely to, eliminate the release of waste water or contaminants to waters, evaluate the following options
for waste water or contaminants, in the order in which they are listed—
(i) appropriate treatment and release to a waste facility or sewer;
(ii) appropriate treatment and release to land;
(iii) appropriate treatment and release to surface waters or ground waters.

I) We cannot practically truck water from the dams given the large quantities and the lack of disposal options. Wet weather is likely to complicate trucking of water by limiting access to some points within the MGP. Infrastructure does not exist to process this water via sewer or other industrial water treatment options. Our landholders have expressed concern of minimising truck movements during the wet season.
II) Until our water treatment management strategy is implemented we cannot treat the water to a standard that is suitable for use on land.

III) We consider the water in its current state is suitable for discharge into the Isaac – this was the water management strategy employed by the facility until earlier EA conditions were amended, we are seeking permission from DERM to allow this discharge as previously authorised until we can implement our water management strategy for the MGP. We consider a temporary discharge to the Isaac river during high flow conditions to be compliant with section 51 of the Environmental Protection Regulation 2008.

Objectives

To achieve compliance with the Environmental Authority with respect to coal seam water management and dam standards by April 2011.

This will be achieved in the short term by the release of water to the Isaac River. This measure will protect the integrity of our storage infrastructure and is consistent with the operational philosophy that our existing infrastructure was designed to accommodate.

In the medium term compliance with the new EA will be achieved by the completion of Dam 11. Completion of dam 11 will require Arrow energy to utilise the cleared area north of dam 11.

In the long term, compliance with our EA will be achieved by completion of water treatment facilities that allow beneficial use and disposal within Arrows Environmental Authority conditions. Arrow is to provide DERM with a detailed plan concerning future water management for approval.

Table 3 – Achieving TEP objectives

OBJECTIVE	ACTION	RESPONSIBILITY	TIME FRAME	PERFORMANCE INDICATOR
Evaluate existing dam integrity	Engineer to evaluate current dam integrity	Third party contractor URS has been engaged to complete this evaluation	31st December 2011	Submission of evaluation report to DERM
Gain sufficient storage to implement water strategy	Complete Dam 11	Arrow	31st March 2011	Completion and authorisation of Dam 11 for use
Develop an approved plan to bring storage into line with new Environmental Authority requirements	Complete water management plan for submission to DERM	Arrow	31st March 2011	Submission of water strategy plan to DERM

Monitoring

Table 4 Contaminant release points, sources and receiving waters

Release point (TEP RP)	Easting (GDA94)	Northing (GDA94)	Contaminant source and location	Monitoring point	Receiving waters
TEP RP 1	148° 2’ 35”	-21° 57’ 42”	untreated CSG water from PL191/196	Discharge point – end of pipe	Isaac River – Dam 5 discharge point
				Upstream from discharge – Isaac River Crossing	
				Downstream from discharge – Blair Athol Bridge	

Table 5 Contaminant release monitoring points

Monitoring point (TEP MP)	Easting (GDA94)	Northing (GDA94)	Contaminant source and location	Monitoring point location	Receiving waters
TEP MP 1	148° 2’ 35”	-21° 57’ 42”	untreated CSG water from PL191	Discharge point – end of pipe	Isaac River – Dam 5 discharge point
TEP MP 2	Refer to appendix C		Downstream from discharge – Blair Athol Bridge	Blair Athol Railway Bridge	na
TEP MP 3			Upstream from discharge	Isaac River Crossing	
TEP MP 4			Dams 1,2,5 or 10		

Table 6 Contaminant release limits

Quality characteristic	Release Limit	Monitoring Frequency	Sample Type	Monitoring Point
Electrical conductivity (uS/cm)	13000	Daily during release (the first sample must be taken within 2 hours of commencement of release)	*In situ*[1]	TEP MP 1
			Samples require laboratory analysis[2]	TEP MP 1
pH (pH Unit)	6.5 (minimum) 9.5 (maximum)	Daily during release (the first sample must be taken within 2 hours of commencement of release)	*In situ*[1]	TEP MP 1
				TEP MP 2
				TEP MP 3
			Samples require laboratory analysis[2]	TEP MP 1
				TEP MP 2
				TEP MP 3
Turbidity (NTU)	500	Daily during release (the first sample must be taken within 2 hours of commencement of release)	Samples require laboratory analysis[2] Samples require laboratory analysis[2]	TEP MP 1
				TEP MP 2
				TEP MP 3

[1] In situ samples can be taken using electronic sampling equipment.
[2] Samples are required to be analysed at a NATA accredited facility in accordance with this Transitional Environmental Program.

Table 7 Downstream contaminant trigger investigation levels

Quality characteristic	Trigger levels (μg/L)	Monitoring frequency	Monitoring Point
Aluminium	55	Commencement of release and thereafter weekly during release	TEP MP 1 TEP MP 2 TEP MP 3
Arsenic	13		
Cadmium	0.2		
Chromium	1.0		
Copper	2.0		
Iron	300		
Lead	10		
Mercury	0.2		
Nickel	11		
Zinc	8.0		
Boron	370		
Cobalt	90		
Manganese	1900		
Molybdenum	34		
Selenium	10		
Silver	1.0		
Uranium	1.0		
Vanadium	10		
Ammonia	900		
Nitrate	1100		
Petroleum hydrocarbons (C6-C9)	20		
Petroleum hydrocarbons (C10-C36)	100		
Fluoride (total)	2000		

Table 8 Contaminant release during flow events

Receiving waters	Release point (TEP RP)	Gauging station description	Easting (GDA94)	Northing (GDA94)	Minimum flow in receiving water required for a release event	Flow recording frequency
Isaac River	TEP RP1	Goonyella Gauging station	-147° 58' 21"	21° 51' 20"	= > 11.5 m^3/sec[1]	Continuous (minimum daily)

[1] Equivalent to 1000ML/day, release rate will be adjusted to ensure 400:1 dilution ratio is maintained

Table 9 Receiving water downstream monitoring points

Monitoring points (TEP MP)	Receiving waters location description	Easting (GDA94)	Northing (GDA94)
TEP MP 2	Blair Athol Bridge 500 metres downstream of RP1 1	148° 57' 37"	-21° 2' 45"

Conditions

In carrying out this Transitional Environmental Program, CH4 Ltd (Arrow Energy) will undertake all activities in accordance with the following conditions.

Undertaking the release of untreated coal seam methane water

1 Contaminants that will, or have the potential to cause environmental harm must not be released directly or indirectly released to any waters except as permitted under this Transitional Environmental Approval.

2 The release of contaminants to waters must only occur from the release points specified in Table 4 and depicted in Appendix C attached to this Transitional Environmental Program.

3 The release of contaminants to waters must not exceed the release limits stated in Table 6 at the monitoring points specified in Table 5 and Table 6 of this Transitional Environmental Program.

4 The release of contaminants to waters from the release points must be monitored at the locations specified in Table 5 and Table 9 for each quality characteristic and at the frequency specified in Table 7 and Table 8 of this Transitional Environmental Program.

5 If quality characteristics of the release exceed any of the trigger levels specified in Table 7 during a release event, the Transitional Environmental Program holder must compare the downstream results in the receiving waters identified in Table 9 to the trigger values specified in Table 7and:

a) where the trigger values are not exceeded then no action is to be taken

b) where the downstream results exceed the trigger values specified Table 7 for any quality characteristic, compare the results of the downstream site to the data from background monitoring sites and

i) if the result is less than the background monitoring site data, then no action is to be taken or

ii) if the result is greater than the background monitoring site data, complete an investigation in accordance with the ANZECC & ARMCANZ 2000 methodology, into the potential for environmental harm and provide a written report to the administering authority in the next annual return, outlining

- details of the investigations carried out
- actions taken to prevent environmental harm.

6 If an exceedance in accordance with condition 5(a)(ii)(2) is identified, the holder of the Transitional Environmental Program must notify the administering authority within 24 hours of receiving the result. The notification must include written verification of the exceedance forwarded to the administering authority either via facsimile.

Contaminant Release Events

7 The release of coal seam water will not occur until flow in the Isaac River flow reaches 11.5 m^3/s (at Goonyella Gauging Station).

8 Notwithstanding any other condition of this Transitional Environmental Program, the release of contaminants to waters must only take place during periods of natural flow events specified as minimum flow in Table 8 for the contaminant release point(s) specified in Table 4.

9 Contaminant release flow rate must not exceed 0.25% of receiving water flow rate.

10 The daily quantity of contaminants released from each release point must be measured and recorded at the monitoring points in Table 4

11 The daily quantity of contaminants is not to exceed 7.5ML/day in total.

12 Releases to waters must be undertaken so as not to cause erosion of the bed and banks of the receiving waters, or cause a material build up of sediment in such waters.

Notification of Release Events

12 The Transitional Environmental Program holder must notify the administering authority within 24hours of having commenced releasing coal seam water to the receiving environment. Notification must include the submission of written verification to the administering authority of the following information:

a) release commencement date/time
b) expected release cessation date/time
c) release point/s
d) release volume (estimated)
e) receiving water/s including the natural flow rate
f) any details (including available data) regarding likely impacts on the receiving water(s).

13 The Transitional Environmental Program holder must provide the administering authority daily during the release of coal seam water, the following information:

a) all in situ monitoring data for that day

b) the receiving water flow rate

c) the release flow rate.

14 The Transitional Environmental Program holder must notify the administering authority as soon as practicable, (no later than within 24 hours after cessation of a release) of the cessation of a release notified under condition 12 and within 28 days provide the following information in writing:

a) release cessation date/time
b) natural flow volume in receiving water
c) volume of water released
d) details regarding the compliance of the release with the conditions of this Transitional Environmental Program (i.e. contamination limits, natural flow, discharge volume)
e) all in-situ water quality monitoring results
f) any other matters pertinent to the water release event.

Notification of release event exceedence

15 If the release limits defined in Table 6 are exceeded, the holder of the Transitional Environmental Program must notify the administering authority within 24 hours of receiving the results.

16 The Transitional Environmental Program holder must, within 28 days of a release that exceeds the conditions of this Transitional Environmental Program, provide a report to the administering authority detailing:

a) the reason for the release
b) the location of the release
c) all water quality monitoring results
d) any general observations
e) all calculations
f) any other matters pertinent to the water release event.

Requirements to cease the release of coal seam water

17 The coal seam water discharge must cease immediately if any water quality limit as specified in Table 6 is exceeded.

18 The Department of Environment and Resource Management may require CH4 Pty to cease discharge if the department's water monitoring stations detect any water quality limit exceedance.

19 The release of coals seam water must cease immediately if identified that the release of coal seam waters is causing erosion of the bed and banks of the receiving waters, or is causing a material build up of sediment in such waters.

20 The release of coal seam water must cease immediately if holder of this Transitional Environmental Program is directed to do so by the administering authority.

21 The release of coal seam water will cease immediately if Isaac River flow decreases below 11.5 m^3/s (at Goonyella Gauging Station).

Monitoring Requirements

22 Where monitoring is a requirement of this Transitional Environmental Program, ensure that a competent person(s) conducts all monitoring.

23 Monitoring will occur on a daily basis during release event and two days subsequent to cessation of release at monitoring points described in Table 5.

24 All monitoring undertaken as a requirement of this Transitional Environmental Program must be undertaken in accordance with the administering authority's Water Sampling Manual.

Notification of emergencies, incidents and exceptions

25 As soon as practicable after becoming aware of any emergency or incident which results in the release of contaminants not in accordance, or reasonably expected to be not in accordance with the conditions of this Transitional Environmental Program, the administering authority must be notified of the release by telephone, facsimile or email.

26 The notification of emergencies or incidents must include but not be limited to the following:

a) the holder of the Transitional Environmental Program
b) the location of the emergency or incident
c) the number of the Transitional Environmental Program
d) the name and telephone number of the designated contact person
e) the time of the release

f) the time the holder of the Transitional Environmental Program became aware of the release
g) the suspected cause of the release
h) the environmental harm caused, threatened, or suspected to be caused by the release, and
i) actions taken to prevent any further release and mitigate any environmental harm caused by the release.

27 Not more than fourteen days following the initial notification of an emergency or incident, written advice must be provided of the information supplied to the administering authority in relation to:

a) proposed actions to prevent a recurrence of the emergency or incident, and
b) outcomes of actions taken at the time to prevent or minimise environmental harm.

Appendix A
ALS & Qld Health water sampling results

Client Reference	Collected Date	Received Date	Aluminium	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmiun	Chromium	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Molybdenum
			mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Isaac_2	14-Dec-10	17-Dec-10	3.8	< 0.0001	0.0011	0.076	< 0.0001	0.05	< 0.0001	0.0027	0.0011	0.003	1.7	0.0013	0.056	< 0.0001	0.0007
Discharge_Point	14-Dec-10	17-Dec-10	0.18	< 0.0001	0.0012	4.5	< 0.0001	1.1	< 0.0001	0.0003	0.0002	0.002	0.08	0.0004	0.0046	< 0.0001	0.0019
Pond_2a	16-Dec-10	17-Dec-10	0.1	< 0.0001	0.0015	6.1	< 0.0001	1	< 0.0001	0.0002	0.0003	0.001	0.066	< 0.0001	0.007	< 0.0001	0.0013
Pond_2	16-Dec-10	17-Dec-10	0.09	< 0.0001	0.0014	6	< 0.0001	1	< 0.0001	0.0002	0.0003	< 0.001	0.044	< 0.0001	0.0065	< 0.0001	0.0012
POND1_1	17-Dec-10	20-Dec-10	0.37	< 0.0001	0.0021	5.8	< 0.0001	1.5	< 0.0001	0.0008	0.0005	0.001	0.18	< 0.0001	0.0057	< 0.0001	0.0028
POND1_2	17-Dec-10	20-Dec-10	0.43	< 0.0001	0.0023	6	< 0.0001	1.5	< 0.0001	0.0008	0.0005	0.001	0.2	0.0002	0.0065	< 0.0001	0.0031
POND10_1	17-Dec-10	20-Dec-10	0.2	< 0.0001	0.0018	7.7	< 0.0001	1.7	< 0.0001	0.0003	0.0003	< 0.001	0.069	< 0.0001	0.0039	< 0.0001	0.0031
POND10_2	17-Dec-10	20-Dec-10	0.18	< 0.0001	0.0019	7.6	< 0.0001	1.7	< 0.0001	0.0003	0.0003	< 0.001	0.067	< 0.0001	0.0041	< 0.0001	0.0034

Client Reference	Collected Date	Received Date	Nickel	Selenium	Silver	Stronium	Thallium	Titanium	Uranium	Vanadium	Zinc	Benzene	Toluene	Ethylbenzone	Meta&Para-Xylenes	Ortho-Xylene
			mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Isaac_2	14-Dec-10	17-Dec-10	0.0031	< 0.0010	< 0.001	0.2	< 0.0001	0.14	0.0002	0.012	0.003	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Discharge_Point	14-Dec-10	17-Dec-10	0.0008	< 0.0010	< 0.001	7.3	< 0.0001	0.006	0.0003	0.0029	0.013	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Pond_2a	16-Dec-10	17-Dec-10	0.0012	< 0.0010	< 0.001	9.6	< 0.0001	0.003	0.0003	0.0051	0.006	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Pond_2	16-Dec-10	17-Dec-10	0.0011	< 0.0010	< 0.001	9.4	< 0.0001	0.002	0.0003	0.005	0.004	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
POND1_1	17-Dec-10	20-Dec-10	0.0008	< 0.0010	< 0.001	10	< 0.0001	0.017	0.0009	0.0059	0.004	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
POND1_2	17-Dec-10	20-Dec-10	0.0008	< 0.0010	< 0.001	11	< 0.0001	0.015	0.0009	0.0062	0.004	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
POND10_1	17-Dec-10	20-Dec-10	0.0005	< 0.0010	< 0.001	12	< 0.0001	0.026	0.0008	0.0071	0.005	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
POND10_2	17-Dec-10	20-Dec-10	0.0005	< 0.0010	< 0.001	12	< 0.0001	0.01	0.0007	0.0071	0.005	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1

ALS	21/12/2010	Sample	ID 1	DAM 1	DAM 10	DAM 4	DAM 3	D1	D2	DAM 5	DAM2	TRIP BLANK
			ID 2									
ES1025292	Results		Date Sampled	6/12/2010	6/12/2010	6/12/2010	6/12/2010	6/12/2010	6/12/2010	6/12/2010	6/12/2010	6/12/2010
Analyte	**CAS #**	**Units**	**LOR**	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
EA005: pH												
pH Value		pH Unit	0.01	9.17	9.28	9.34	9.38	9.4	9.42	9.27	9.15	-
EA010P: Conductivity by PC Titrator												
Electrical Conductivity @ 25°C		µS/cm	1	12600	14000	16400	25900	25800	26100	10700	10600	-
EG020T: Total Metals by ICP-MS												
Arsenic	7440-38-2	mg/L	0.001	0.003	0.003	0.002	<0.001	0.004	0.004	<0.001	0.002	-
Barium	7440-39-3	mg/L	0.001	6.54	8.33	4.35	1.93	1.92	1.98	6.4	9.31	-
Beryllium	7440-41-7	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-
Cadmium	7440-43-9	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	-
Cobalt	7440-48-4	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	-
Chromium	7440-47-3	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	-
Copper	7440-50-8	mg/L	0.001	0.002	0.002	0.002	0.002	0.002	0.002	0.003	0.004	-
Manganese	7439-96-5	mg/L	0.001	0.008	0.003	0.002	0.001	0.001	0.003	0.002	0.038	-
Nickel	7440-02-0	mg/L	0.001	0.001	<0.001	0.001	0.002	0.002	0.002	<0.001	0.003	-
Lead	7439-92-1	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-
Vanadium	7440-62-2	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-
Zinc	7440-66-6	mg/L	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.008	-
EG035T: Total Recoverable Mercury by FIMS												
Mercury	7439-97-6	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	-
EK055G: Ammonia as N by Discrete Analyser												
Ammonia as N	7664-41-7	mg/L	0.01	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-
EK057G: Nitrite as N by Discrete Analyser												
Nitrite as N		mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-
EK058G: Nitrate as N by Discrete Analyser												
Nitrate as N	14797-55-8	mg/L	0.01	0.02	0.01	0.02	0.01	0.01	0.02	0.01	0.03	-
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser												
Nitrite + Nitrate as N		mg/L	0.01	0.02	0.01	0.02	0.01	0.01	0.02	0.01	0.03	-
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser												
Total Kjeldahl Nitrogen as N		mg/L	0.1	1.7	0.5	0.5	1	1.1	1	0.9	1.2	-
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser												
Total Nitrogen as N		mg/L	0.1	1.7	0.5	0.5	1	1.1	1	0.9	1.2	-
EK067G: Total Phosphorus as P by Discrete Analyser												
Total Phosphorus as P		mg/L	0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-
EP080: BTEX												
Benzene	71-43-2	µg/L	1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Toluene	108-88-3	µg/L	2	<5	<5	<5	<5	<5	<5	<5	<5	<5
Ethylbenzene	100-41-4	µg/L	2	<2	<2	<2	<2	<2	<2	<2	<2	<2
meta- & para-Xylene	108-38-3 106-42-3	µg/L	2	<2	<2	<2	<2	<2	<2	<2	<2	<2
ortho-Xylene	95-47-6	µg/L	2	<2	<2	<2	<2	<2	<2	<2	<2	<2
EP080S: TPH(V)/BTEX Surrogates												
1.2-Dichloroethane-D4	17060-07-0	%	surrogate	113	111	103	112	105	110	110	106	106
Toluene-D8	2037-26-5	%	surrogate	110	106	103	109	105	106	107	103	102
4-Bromofluorobenzene	460-00-4	%	surrogate	106	99.7	97.9	104	97.1	98.6	101	97	101

Appendix B
Dilution calculation basis

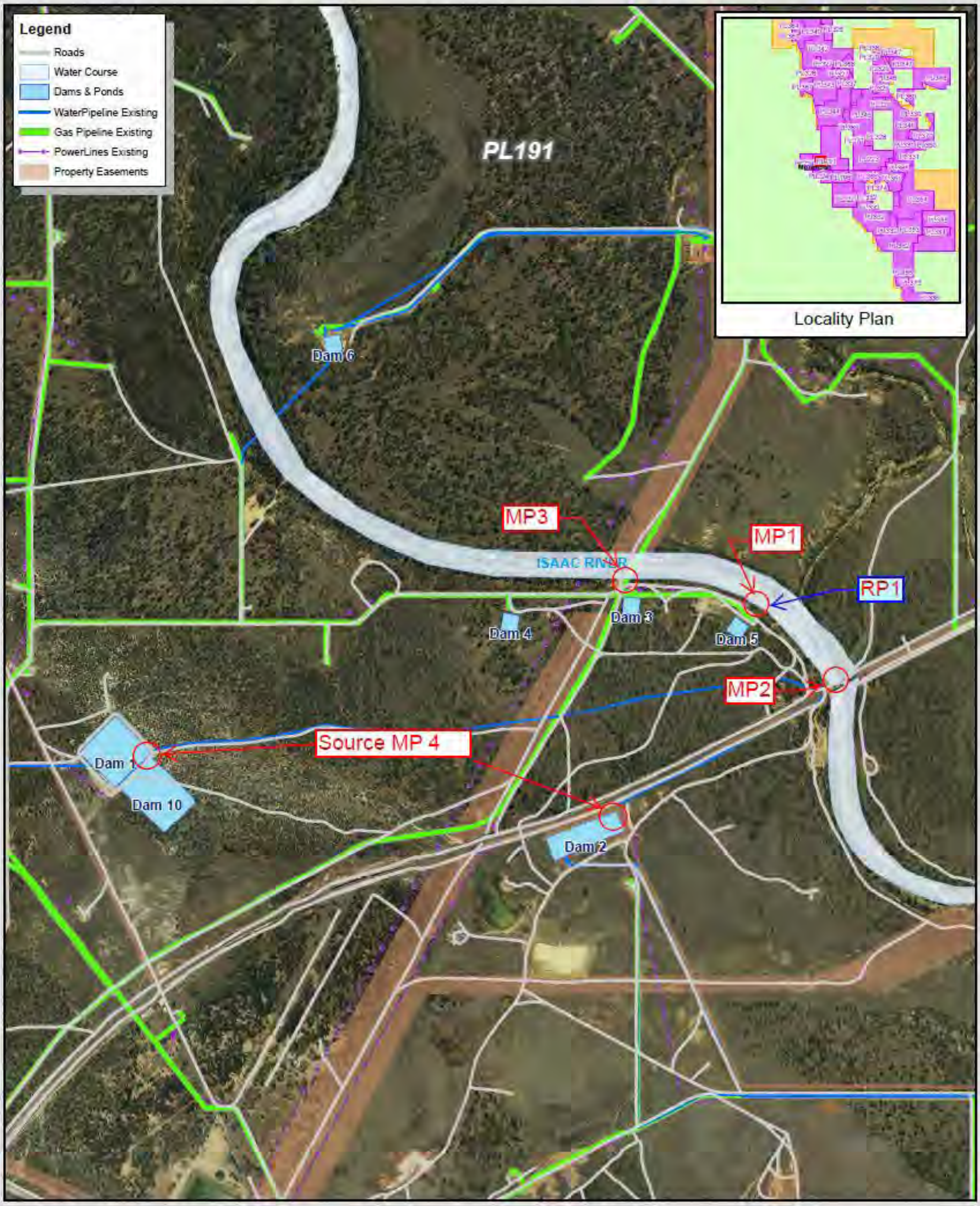
Table 10 Dilution calculation at 400:1 release

Parameter	Unit	Surface Water Concentration	Concentration of Discharge	Dilution X:1	Surface Concentration after dilution	Guideline[1]
EC	µs/cm	250	10600	400	276.5	746
Sodium	mg/L	65	2970	400	72.4	180
Chloride	mg/L	80	4280	400	90.7	250

[1] Australian drinking water guidelines (NHMRC,2004)
Sodium and Chloride based on EC, common soil quality (run off) and historical data from upstream

Appendix C
Mapping showing PL191 and location of key Dams

ARROW ENERGY - BOWEN BASIN GAS PROJECT



Moranbah Gas Project - Dam 5

Source:
Arrow Energy Limited
Geosciences Australia
Dept. Envir. and Resource Mgmt.

Date: 23/12/2010
Issue[redacted]
Auth[redacted]

0 0.5 1
Kilometres
Scale: 1:19,762 @ A4
Coordinate System: GDA 1994 MGA Zone 55

N

arrow energy
go further

NOT FOR CONSTRUCTION

Appendix D
Sampling Procedure

SUMMARY

1.1	This procedure outlines general sampling protocols and work practices to be followed during the sampling of surface water, during the discharge of untreated CSG well water to the Isaac River. This procedure includes details on: ▪ Sampling equipment requirements; ▪ Surface water sampling techniques; ▪ Quality control requirements. ▪ Sample locations (Figure 1) ▪ Analytical requirements

EQUIPMENT

2.1	▪ Documentation o Sampling and analysis plan. o Health and safety plan o Personal protective equipment (PPE) as identified in the HSP, inc. Life Jacket and other specialised PPE, as per the HSP. ▪ Water sampling equipment o sample collection device, (Swing Arm Sampler/extension sampler) o decontamination solution (e.g. Decon 90™) or use new sample collection container in the swing arm sampler at each location. o Calibrated water quality meter (ensure parameter ranges are suitable for the water being tested), o laboratory supplied sample containers, o Chilled ice chest. o Field sample Record Sheet o Chain of Custody Form (Attached).

3.0 REFERENCES & PROFORMA

3.1	▪ AS NZS 5667.1-1998 *Water quality - Sampling - Guidance on the design of sampling programs sampling techniques* ▪ AS NZS 5667.4-1998 *Water quality - Sampling - Guidance on sampling from lakes natural and man-made* ▪ AS NZS 5667.6-1998 *Water quality - Sampling - Guidance on sampling of rivers and streams* ▪ Monitoring and Sampling Manual 2009 Environmental Protection (Water) Policy 2009, *Monitoring and Sampling Manual 2009*, Version 2 September 2010

4.0 PROCEDURE

4.1	**Safety**
	Unless specifically required, the following general safety requirements should be noted: 1. Appropriate personal protective equipment should be worn as specified in the Health and Safety Plan (HSP). When working in or around water bodies, a life jacket is required to be worn and a minimum of two persons to be present should be assessed. 2. Assess hidden hazards (eg. trip hazards, snakes, leeches, etc.). 3. Assess risks from slippery or unstable banks. 4. Assess whether the water body / drain may constitute a confined space. 5. Assess the likelihood that surface conditions within and around the water body may change rapidly in the event of heavy rainfall or tidal change.

4.2	Sampling
	1. The sampling frequency during and following discharge to the Isaac River shall be as follows: • daily during discharge; and • daily for two days following discharge stopping. 2. The sampling sequence should commence where the lowest likely contaminant concentrations are expected (e.g. downstream and work upstream), to reduce the risk of cross contamination between samples. On this basis, the samples shall be collected at the following locations (in order): (See **Figure 1** for sampling locations) I. **River crossing** (upstream), (One **primary sample (S1)**, plus **one duplicate sample (QC1)**) II. **Blair Athol Bridge** (downstream), One **primary sample (S2)**, plus **one duplicate sample (QC2)**) III. At the **Discharge Point**, One **primary sample (S3)**, plus **one duplicate sample (QC3)**) IV. At the **Source (Dam)** One **primary sample (S4)**, plus **one duplicate sample (QC4)**) V. QC samples – Field/Trip Blank **(QC5)** and rinsate blank **(QC6)** (if required) 3. At each location, a water sample should be collected for standard field parameters using a calibrated water quality meter. The following parameters should be recorded: a. pH, b. conductivity, c. dissolved oxygen, d. redox potential, e. temperature and f. turbidity. Notes: • Follow the manufacturer's instructions for use and calibration of instruments to measure water parameters. A calibration record must be kept. • When recording dissolved oxygen readings, it is important to note whether the results are reported as % saturation or ppm. • With conductivity, record whether units are mS or µS.

4. Based on the nature of the sampling locations, heterogeneous distribution of potential contaminants in the water samples is considered likely. Therefore, the following Quality Control Samples should be collected and analysed for this program:
    a. One duplicate sample per sample location for TPH, BTEX and 8 Metals analysis **(QC1 – QC4).**
    b. One Blank Sample per esky (laboratory prepared DI Water for TPH (C6 – C9) and BTEX analysis) **(QC5)**.
5. One rinsate sample per day (unless using new sample collection medium between sample locations i.e. a new container in the swing arm sampler) for TPH (C6 – C9) and BTEX analysis) **(QC6)**.
6. At each location sample bottles should be filled based on a decreasing order of potential volatility (i.e. VOCs, BTEX and TPH first, followed by metals and other inorganic samples).
7. Note: **DO NOT** field filter samples for total metals. Perform field filtering for dissolved metals samples only.
8. When sampling shallow waters, contamination from bottom sediments should be avoided. Samples should be collected by submerging a clean sample collection container (up-side down) into the water and to approximately 100mm below the surface, rotate the container to allow it to fill.
9. The sampling location should be as representative as possible of the event being monitored. i.e. do not sample stagnant water at the edge, attempt to sample .
10. Record the appearance of the water body, i.e. colour, turbidity, odour, surface crusts, films or floating material, algae, water velocity, etc. In addition, record the weather conditions at the time of sampling and note any other relevant observations, e.g. dead or distressed flora/fauna, surface rubbish, spills, etc.
11. All measurements and field notes should be documented on the field sheet (**Attachment A**)

5.0 ANALYTICAL/SAMPLE CONTAINER REQUIREMENTS

5.1	1. The analytical suite includes the following: a. pH, EC, TDS, Turbidity b. Ions: Magnesium, Calcium, Sodium, Sulphate, Chloride, Ammonia, Nitrate, Fluoride (total). c. Metals, Aluminium, Arsenic, Cadmium, Chromium, Copper, Iron, Lead, Mercury, Nickel, Zinc, Boron, Cobalt, Manganese, Molybdenum, Selenium, Silver, Uranium, Vanadium. d. Organics: BTEX, PAH, TPH 2. Each Sample Requires the following containers: a. 60ml Plastic Bottle for metals (with red and green striped label border) (tick 'Total Metals') b. 500ml Plastic Bottle for anions/cations (with green label border) c. 250ml Amber Glass Bottle (with purple label border) d. One pair of BTEX vials (40 mL glass cylindrical containers with purple label border).
	Notes: • The selection of sample containers depends on the laboratories being used. The above list is based on ALS requirements only. When ultra trace analysis is being requested, additional sample volume may be required. Always check with the laboratory prior to submitting samples to the laboratory. • When filling the vials it is important that they are filled to the top with no air space remaining. • Use new sample gloves between sample locations.
5.2	1. Place samples immediately in a chilled ice chest 2. Complete sample request form and include in sealed bag in the cooler 3. Courier samples to the receiving laboratory.

12			Surface Water Sampling						Form
Site					Sampling Method:				
Job Number					Local Air Temperature:				
Date:		Time:			Wind Force:				
Weather:			Cloudiness %		Direction of Wind:				
Location	**Sample No.**	**Water Flow (l/s)**	**Field Readings**				**Depth (m)**		**Comments: including turbidity (plankton and/or sediment), colour, water plants, weather conditions, etc**
			pH	**Conductivity**	**Temperature**	**Dissolved Oxygen**			

Comments concerning treatment of samples, especially preservation:

Name: **Signed:** **Project Manager:** adapted from AS 5667.4

Analytes

Quality characteristic	
pH	
EC	Ammonia
Turbidity	Nitrate
Magnesium	Fluoride (total)
Calcium	BTEX
Sodium	PAH
Sulphate	TPH
Chloride	
Aluminium	
Arsenic	
Cadmium	
Chromium	
Copper	
Iron	
Lead	
Mercury	
Nickel	
Zinc	
Boron	
Cobalt	
Manganese	
Molybdenum	
Selenium	
Silver	
Uranium	
Vanadium	

URS

24 December 2010
Project No. TBD

Arrow Energy Limited
Level 19, AM60
42 - 60 Albert Street
Brisbane Queensland 4000

Attention: [redacted]
Water and Salt Coordinator

Dear Mr. [redacted]

Subject: Moranbah Gas Facility Pond 2 Site Visit by URS

URS Australia Pty Ltd (URS) is pleased to submit this letter of findings for Pond 2 located at the Moranbah Gas Facility. This letter provides a description of the project, scope of work completed by URS, identification of risks associated with the current condition of Pond 2 and recommendations to mitigate these risks in short-term and long-term.

1 Introduction

1.1 Background

The Moranbah Gas Facility (MGF) is located in the Bowen Basin, approximately 170km west of Mackay and approximately 10 kilometres north of Moranbah, Queensland. Pond 2 is one of several ponds used for storing saline water produced from coal seam gas (CSG) extraction and is believed to have been in operation for approximately five years. Arrow Energy Limited (AEL) retained URS to inspect Pond 2 for seepage and stability concerns. Based on the information provided by AEL[1] it is our understanding that Pond 2, along with all other AEL dams nearby, are running close to capacity due to recent heavy rainfall. Due to dam safety concerns, a decision was made to pump water from the dam into the Isaac River. Arrow Energy does not hold a licence to discharge and was subsequently instructed by DERM (Department of Environment Resource Management) to cease discharge. It is also understood that Pond 2 does not have a spillway and no outlet works.

1.2 Site Visit

A site visit was performed by a URS Geotechnical Engineer (Shaun Vemuri) on 22 December, 2010 to evaluate the current condition of Pond 2. Upon reaching the site, the URS Geotechnical Engineer met with AEL employees (Dane Donnelly and Cameron Barrett) to discuss the scope of work and subsequently underwent a visitor's induction. The URS Engineer was onsite from 8:45AM to 2:45PM on 22 December, 2010.

[1] Memo from Thane Richardt (with AEL) to Mike Philips (URS) dated 17 December, 2010

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2 Scope of Work

The objective of the site visit was to evaluate various components of the dam including (i) the upstream slopes, (ii) the crest and shoulders, and (iii) the downstream slopes to identify potential deficiencies. The focus was on noting deficiencies related to seepage, cracking, instability, depressions and maintenance concerns. In addition, the objective of the site visit was to characterise the foundation materials underlying the dam using test pits. However, due to insufficient time for clearance of underground utilities and not having access to an excavator, it was decided by AEL personnel to withhold excavation of the test pits. Hence, the URS Engineer was unable to evaluate the foundation materials underlying Pond 2.

3 Observations

3.1 Dam Orientation

Pond 2 is oriented in a northeast to southwest direction (see Figure 1). The pond is bordered by a railway track on the north and open land on the other sides. The pond crest can be accessed using a ramp located at the northeast corner.

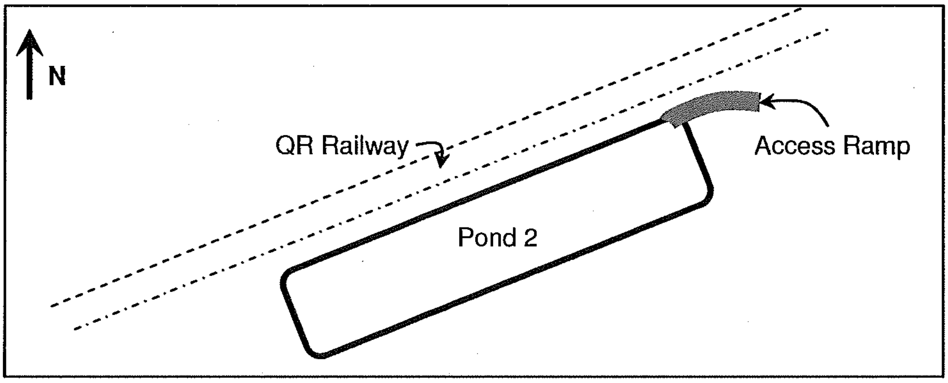

Figure 1: Sketch of Pond 2 in relation to surroundings

3.2 Upstream Slopes

3.2.1. **Wave Action Erosion**: The action of waves on the upstream slope has resulted in wave action erosion (beaching) and degradation of the slopes (see Photos 1 and 2). The wave action has eroded the embankment material significantly in several locations. Portions of the upstream slopes have been eroded due to wave action reducing the overall width of the crest.

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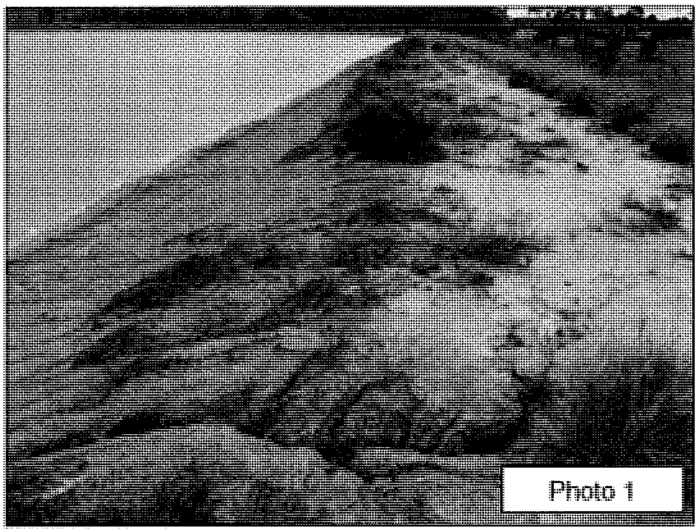
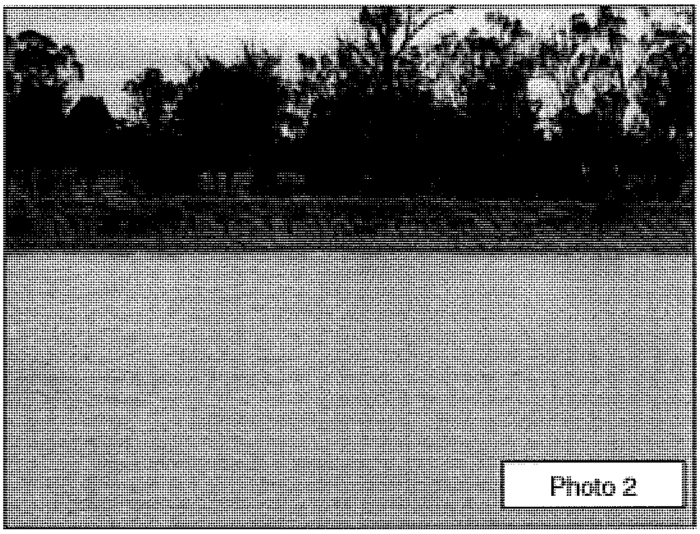
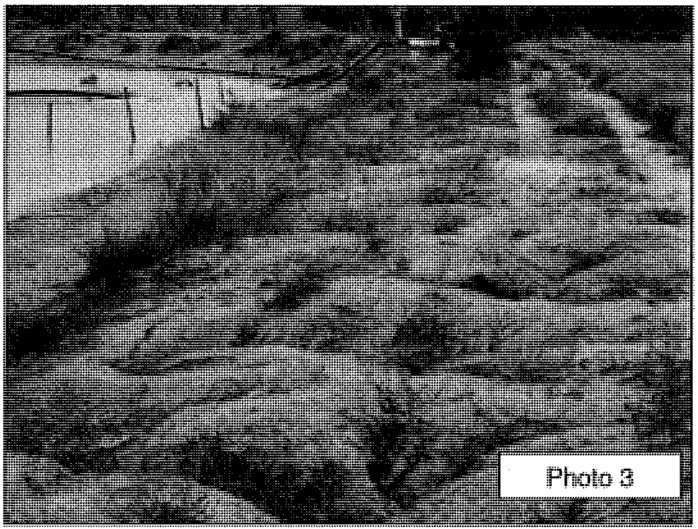




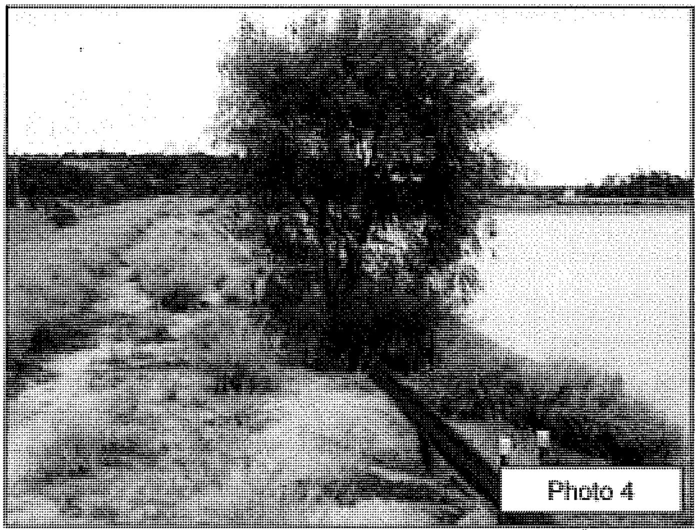
3.2.2. **Degradation**: Degradation of the upstream slopes appears to have been accelerated due to recent heavy rainfalls. Increased wave action from strong winds may also have caused the upstream slopes to erode into the crest, especially along the east side crest.

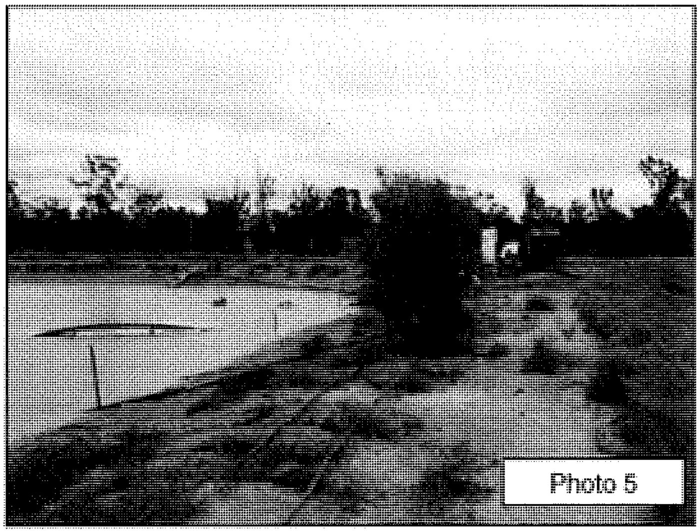
3.2.3. **Gullies:** Surface run-off has caused formation of gullies in several areas effectively reducing the cross-sectional area of the dam (see Photo 3). It is possible that the recent heavy rainfall has exacerbated the formation of gullies.



3.3 Crest and Shoulders

3.3.1. **Vegetative Growth**: Excessive vegetative growth was noted along the crest with deep-rooted vegetation (trees) in two locations (See Photos 4 and 5). Two trees approximately 200 millimetres in diameter were noted along the crest.





3.3.2. **Desiccation Cracking**: Honeycomb pattern (desiccation) cracking was noted at several locations along the crest. Surface runoff is collecting in desiccation cracks reducing the strength of the underlying embankment material.

3.3.3. **Transverse Cracking:** No clearly visible signs of transverse cracking (cracking perpendicular to the dam axis) were noted with Pond 2 crest. However, three (3) areas were noted along the crest where the crest surface was lower than surrounding areas (localised depressions) (See Figure 2). Specifically, one area was located north of the access ramp, one immediately south of the access ramp and one along the north side crest. The widest depression was approximately 10 meters in width and located approximately 1/3rd of the distance along the north side crest from north east corner (See Photo 6).

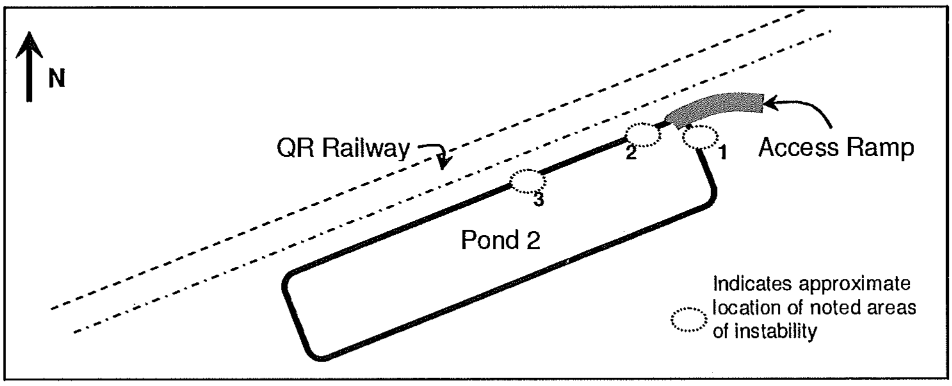


Figure 2: Noted areas of instability

3.3.4. **Longitudinal Cracking:** Signs of longitudinal cracking (parallel to the dam axis) were noted in the same three areas as mentioned in article 3.2.3. Longitudinal cracking in these areas appear to be the beginning scarps of unstable slopes downstream (See Photo 6).

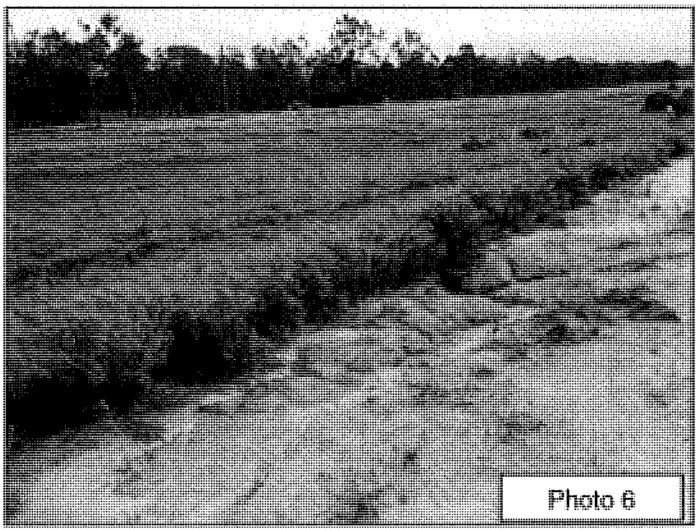


Photo 6

3.3.5. **Depressions:** Localised settlement in the crest surface was noted at several areas along the crest and this may be due to poor compaction and/or surface erosion. (See Photo 7).

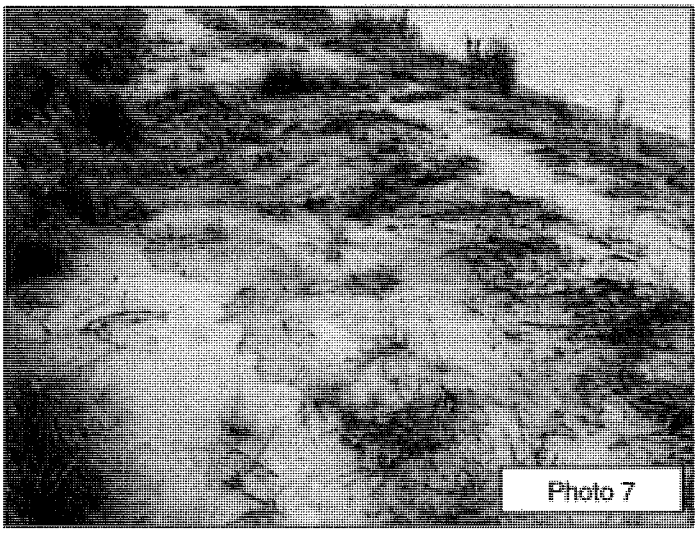
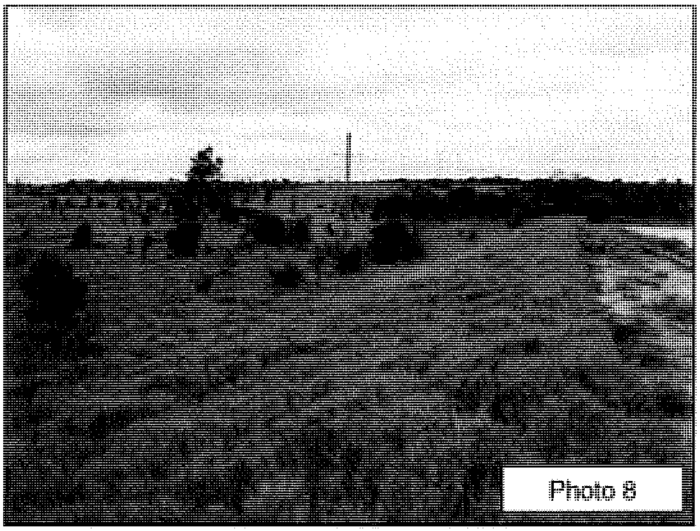


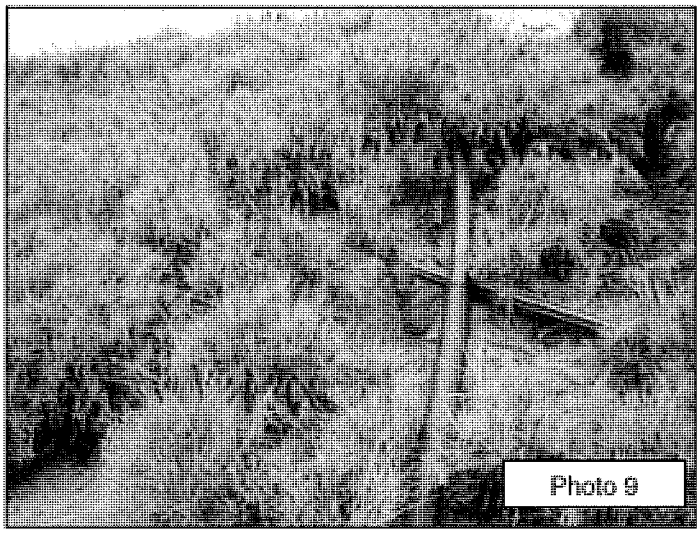
Photo 7

3.4 Downstream Slopes

3.4.1. **Thick Vegetation**: Thick vegetation significantly hindered the visual inspection of the downstream slopes (see Photo 8). It is possible that several signs of instability such as bulges, cracks and slides were obscured by vegetation and thus limiting the scope of inspection.



3.4.2. **Slope instability:** Slope instability was noted in three (3) areas shown in Figure 2. The scarps in these areas have extended to the downstream crest reducing the effective width of the crest. The slides near Area 1 and Area 2 appear to be fairly deep seated and significantly deep cracks (see Photo 9).



3.4.3. **Poor Compaction:** Downstream slopes appear to have significantly higher number of erosion rills, gullies and uneven surface than normally expected for such dams. Due to thick vegetation, the underlying surface was mostly obscured. However, the unevenness noted while walking the slopes, indicates that the slopes are rarely uniform. It is possible that inadequate compaction of embankment material has resulted in erosion and surficial sloughing. No records of construction were available for URS review at the time of this writing.

3.4.4. **Internal Erosion**: Internal erosion can occur when seepage flows along established pathways such as poorly compacted layer interfaces and cracks. Given that the dam is showing signs of poorly compacted material, it is possible that internal erosion is occurring to some level along the downstream slopes. However, internal erosion cannot be confirmed until the slopes are cleared of vegetation. A visible sign of internal erosion was noted at the southwest corner of the dam (see Photo 10).

3.4.5. **Piping**: Piping is a significant risk to Pond 2. Piping occurs when the reservoir water moves through the pores of the dam with enough tractive force to remove soil particles at the exit point. Good indicators of piping are sand boils. While no sand boils were noted during the visual inspection, it is highly possible that the signs of seepage were obscured by thick vegetation.

3.4.6. **Sampling:** URS obtained soil samples from Area 2 for laboratory tests including soil classification and particle size analysis. Information from laboratory tests will be used for designing emergency response measures such as a reverse graded filter.

4 Conclusions and Recommendations

The following preliminary conclusions and recommendations are provided based on the observations made during the site visit. These conclusions and recommendations will need to be reviewed as further information is obtained regarding the nature of the embankment and based on further discussions with AEL.

4.1. **Dam Safety**: Given that there are three areas of potential instability on the downstream face of the embankment and the observed reduction in the effective crest width due to erosion, Pond 2 is considered to have an unacceptably high risk of embankment failure. Measures need to be implemented as a matter of priority to mitigate the risk of embankment failure.

4.2. **Short Term**: It is recommended that the water in Pond 2 be lowered to below the level of the observed instability on the downstream slopes. While no survey has been undertaken across the embankments, it is estimated that the water level will need to be lowered a minimum of four (4) meters below the Design Storage Allowance (DSA). Lowering the water level will reduce the short term seepage risk until further action is taken regarding the future use of the dam. It is important that the water level be lowered immediately in preparation for the ongoing wet season.

4.3. **Daily Surveillance**: URS recommends daily surveillance of the embankment in the short term. AEL personnel inspecting the embankment must take photos on a daily basis for comparison and complete a record of each inspection noting the condition of the embankment and any observed changes.

4.3 **Slope instability:** URS has observed three (3) marginally stable areas that need further evaluation. It is recommended that vegetation be removed in these areas immediately to facilitate a second site visit during which the initially planned geotechnical investigations could be undertaken. If Pond 2 is completely dewatered in the short-term, further evaluation of these areas can be postponed until future use of the dam is determined.

4.4. **Spillway**: It is to be noted that Pond 2 does not have a spillway. This increases the risk of overtopping in the event of heavy rainfall. It is recommended that AEL maintain the water elevation in Pond 2 at least four (4) meters below the DSA (Design Storage Allowance) in short term. At the time of URS site visit, the pond water level was 405 mm below MRL (Mandatory Reporting Level).

4.5. **Downstream Slopes**: The URS Engineer could not fully inspect the downstream slopes of the embankment due to thick vegetation. It is recommended that AEL personnel mow the downstream slopes and shoulders as soon as possible to facilitate further inspection. If AEL decides to completely dewater the pond in short-term, mowing is not necessary until the future use of the dam is determined.

4.6. **Long Term Options**: Based on the information presented here, the following long term options need to be discussed with AEL to improve the safety of Pond 2.

- Option 1 would be to decommission the pond.
- Option 2 would be to lower the water level in the dam and maintain it at least four (4) meters below DSA until remedial measures are under taken. Remedial measures could include a range of measures to stabilise the embankments. However the scope of these works must also consider other key design issues such as provision of a spillway and the environmental impacts related to seepage from the dam.
- Option 3 would be to rebuild the dam completely.

5 Limitations

URS Australia Pty Ltd (URS) has prepared this memo in accordance with the usual care and thoroughness of the consulting profession for the use of Arrow Energy Limited and only those third parties who have been authorised in writing by URS to rely on the memo. It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this memo.

The methodology adopted and sources of information used by URS are outlined in this memo. URS has made no independent verification of this information beyond the agreed scope of work and URS assumes no responsibility for any inaccuracies or omissions. No indications were found that information contained in this memo as provided to URS was false.

URS

This memo was prepared based on the information reviewed at the time of preparation. URS disclaims responsibility for any changes that may have occurred after this time. This memo should be read in full. No responsibility is accepted for use of any part of this memo in any other context or for any other purpose or by third parties. This memo does not purport to give legal advice. Legal advice can only be given by qualified legal practitioners.

Where conditions encountered at the site are subsequently found to differ significantly from those anticipated in this memo, URS must be notified of any such findings and be provided with an opportunity to review the recommendations of this memo. The contractor must recognise that the memo or drawings do not purport to show completely the existing conditions, nor does URS warrant the correctness of the designations given in the memos, or the correctness of any interpretation, deduction or conclusion shown in the memos or on the drawings.

Whilst to the best of our knowledge information contained in this report is accurate at the date of issue, subsurface conditions, including groundwater levels can change in a limited time. Therefore this document and the information contained herein should only be regarded as valid at the time of the evaluation unless otherwise explicitly stated in this report.

Yours faithfully
URS Australia Pty Ltd

[redacted]
Senior Geotechnical Engineer

[redacted]
Senior Principal

DRAFT TRANSITIONAL ENVIRONMENTAL PROGRAM UNDER SECTION 333 OF THE *ENVIRONMENTAL PROTECTION ACT 1994*

Principal Holder:	CH4 Pty Ltd **AM-60** Level 19 42 Albert Street Brisbane QLD 4000
EA Number:	PEN100015907
Title:	**Coal Seam Water Management Moranbah Gas Project**
Date:	31 December 2010
Finish Date:	31 May 2011

Introduction

The Moranbah Gas Project lacks sufficient water storage capacity as previously indicated in correspondence to DERM (dated 25 October 2010) and subsequent responses to information requests and the program notice documentation submitted by Arrow (dated 3 December 2010). This has been caused by an early start to the wet season contributing to existing dam levels and causing construction delays. This has prevented Arrow from making additional storage available via the completion of dam 11. The synthetic lining for the dam cannot be installed during periods of rainfall; the civil engineering also requires careful control of the moisture content of the construction materials to achieve the required specifications.

Dam 11 has been designed and is being constructed in line with the most current dam standards stipulated by DERM and contained in the previously submitted and assessed dam design report. It is a large lined dam – intended to provide sufficient storage until Arrow can complete the planned development of the Reverse Osmosis water treatment facility, develop beneficial uses and the upgrade of existing infrastructure to the new standards. Basically dam 11 is the key early component in a scheme that is consistent with the conditions of the new Environmental Authority and intent of the relevant DERM policies.

The continued rain has delayed the completion of dam 11. This has put Arrow in a position where it cannot comply with the current EA conditions. Arrow intends to employ this transitional environmental program (TEP) as defined in Chapter 7, Part 4 of the *Environmental Protection Act 1994 to bring our operation back into compliance with its current Environmental Authority*. In initiating this process Arrow intends to work with DERM to minimise the potential for environmental harm.

Background

Arrow currently employs a network of 10 dams across PL191 and PL196. Dams 1 through to 7 are shown in the attached drawing (Appendix C). Dams 8 and 9 in the network are SW of the main area depicted in the provided drawing. Approximately 90% of the total storage capacity for coal seam water is held between dams 1, 2 and 10. The other dams are employed to move water between groups of remote wells dam 3 is employed to store more concentrated brine. An important feature of the petroleum lease is the Isaac River which divides the lease along a NW to SE axis and its tributary Teviot Brook. Isaac River is an ephemeral river; during periods of high flow it limits access to infrastructure on the north eastern side of the petroleum lease via river crossings.

Situation

Based on our risk assessment (refer to Appendix A), our strategy is to maintain DSA level in the older and less accessible dams (particularly dams 5,6,7, 8 and 9) by moving water to dams 1 and 10. Dam 10 is our most recently constructed dam and has an engineered spillway, dam 1 is in reasonable condition and adjacent to dam 10 which allows water to be transferred readily between dams.

Our risk assessment process and an independent third party geotechnical evaluation by URS has identified particular concerns with the integrity of dam 2 (refer to Appendix E). Arrow has concerns regarding the condition of dam 2 – it is scheduled to be brought out of service on the completion of Dam 11. Based on geotechnical evaluation we intend to lower the level of water in Dam 2 to 4m below DSA. The goal of this strategy is to maintain pond integrity and minimise discharge to the environment.

Arrow believes that a controlled discharge during high flow conditions in the Isaac River via the existing infrastructure would result in the least environmental impact whilst preserving the integrity of the existing dams. This option prevents the overland flow of untreated coal seam water reaching the Isaac River and minimises the risk of damaging older dams which are built prior to the new standards and lacking engineered spillways. When the facility was originally developed the water management scheme was significantly different to now and included a wet weather discharge. At present our existing infrastructure is not sufficient to comply with the conditions of the current Environmental Authority particularly during extended wet periods.

Our system of dams has an area of 125,100 m^2, this equates to a gain of 0.125ML per mm of rainfall. The system is designed to transfer water to the major storage dams 1, 2 and 10 this contribute to the catchments of these structures, each 1 mm of rainfall will cause an increase in dam height of 1.6 mm in dams 1, 2 and 10. When all the input rainfall is directed to dam 10 each 1 mm of rainfall causes an increase in dam height of 2.7 mm in dam 10.

Table 1 Key Dam Variables Dams 1, 2 and 10

Dam		**1**	**2**	**10**
Volume at Spill level	ML	119.66	92.64	203.70
Spillway		No	No	Yes
Liner type		CCL	CCL	1.5mm HDPE
Hydraulic height	n	5.60	5.50	4.75
MRL	m	5.25	5.15	4.40
DSA	m	4.75	4.65	3.90
Target dam fill height [b]	m	4.75	0.65	3.90
Current level (below MRL) [a]	mm	**90**	**300**	**-110**
Remaining capacity	ML	14	17	16
Remaining rainfall *(to spill)* [c]	mm	271	400	148

[a] Levels at 10am 20 December 2010, negative denotes level above MRL

[b] Target dam fill height is DSA for dams 1 and 10, 4m below DSA for dam 2. Current target height for dam 2 is based on 3rd party civil engineering assessment completed by URS.

[c] Rainfall based on approximate catchment ratio of 1.6 (based on total catchment area including transfer dams)

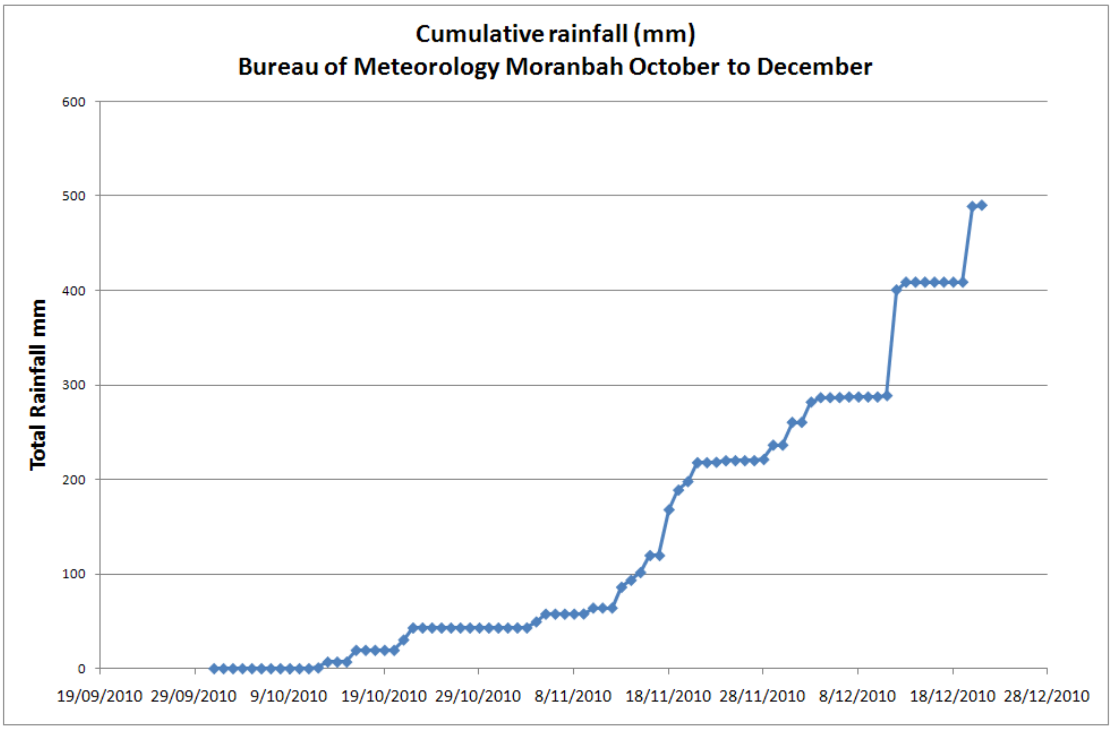


Figure 1 Cumulative rainfall between October to December Moranbah

Future water levels will be a product of the rainfall, coal seam water production and evaporation. Our goal is to maintain dams 1 and 10 at DSA levels by employing a discharge to the Isaac River. Dam 2 will be lowered to a level determined by independent third party engineering risk assessment.

Arrow has evaluated 2 scenarios for water requiring discharge from the storage system:

- Scenario 1 – Mean rainfall until end of wet season
- Scenario 2 – 95th percentile rainfall until end of wet season

Rainfall to date is very close to the 95th percentile rainfalls on average from October through to December. We have had a cumulative total of 490mm from the 1st of October to date (Figure 1), 95th percentile cumulative rainfall for the period from the start of October to the end of December totals 522mm. At present with one week remaining in December the cumulative total is 30mm short of the 95th percentile. Given the current progress of the wet season Arrow believes that the next few months will produce above average rainfall. Long range forecasts from the Bureau of Meteorology give a 55% chance of rainfall at or above the 95% percentile values. In determining the water balance for the facility has evaluated 2 scenarios – mean and 95th Percentile rainfall (refer to Table 2).

Table 2 Discharge scenarios

Scenario	Volume to reach DSA (ML)	Additional removal from Dam 2 (ML) [b]	Expected Net [a] Water to Storage (ML)	Total (ML)
Mean Rainfall	69	75	54.5	198.5
95th Percentile	69	75	130	274

[a] *Net water to storage is produced water, less evaporation plus expected rainfall.*
[b] *This is based on a dam 2 target of 4000mm below DSA.*

Arrow proposes a discharge of up to 7.5ML/day to commence when the Isaac River is at least 1090 m^3/day measured upstream at the Goonyella river gauge (operated by DERM). Discharge will be maintained at a 400:1 dilution ratio on the basis of maintaining Australian drinking water guidelines (NHMRC,2004) downstream of the discharge. Based on a predicted salinity impact as detailed in Appendix B. This discharge rate and the dilution factor will be reviewed thoughout the TEP in consultation with DERM and informed on the basis of the upstream/downstream river monitoring in line with the proposed conditions detailed within this document.

Sampling will be conducted in line with the conditions detailed in this TEP under the procedure attached as Appendix D. Appendix A contains detailed results of the sampling completed to date to characterise the coal seam water to be discharged.

Supporting Information

Consideration of the management hierarchy for the management of coal seam water at the MGP

Evaluation as per the management hierarchy of preferred procedures from Environmental Protection (Water) Policy 2009:

Step 1—evaluate water conservation measures to reduce the use of water and the production of waste water or contaminants;
Water is not employed in the coal seam gas production process but must be removed from the coal seam to allow the gas to be extracted. Water conservation measures will not reduce the amount of coal seam water associated with the gas extracted.

Step 2—evaluate waste prevention options and implement appropriate waste prevention measures;
The key waste prevention measure employed is maximisation of the coal seam gas to water ratio. The coal seams targeted by MGP have relatively low ratios of water to gas in comparison to other fields. In an effort to manage our recent water storage constraints Arrow has shut in a large number of wells, targeting the wells with high water to gas ratios to minimise the production of coal seam water associated with our operations.

Whilst this has reduced our coal seam water production, shutting in further wells will yield limited benefits in terms of water reduction but will cause significant reduction in gas output.

Use of dam 11 in its current uncompleted, unlined state has been investigated. The pipe work and major civil infrastructure is complete but the floor of the dam is incomplete – as discussed (in our meeting on the 1st of December) it lacks its intended second liner, more importantly the clay liner has not been sufficiently compacted to allow its use. Key elements of the pipework connecting dam 11 to the rest of the network remain incomplete. Employing dam 11 would require its use for an extended period to allow subsequent emptying and upgrade of the existing dam infrastructure.

Step 3—if waste prevention does not, or is not likely to, eliminate the release of waste water or contaminants to waters, evaluate treatment and recycling options and implement appropriate treatment and recycling;
The construction of Dam 11 is the first component of our coal seam water management strategy. It is a large lined dam, intended to provide sufficient storage until Arrow can complete the planned development of the Reverse Osmosis water treatment facility, beneficial uses and the upgrade of existing infrastructure to the new standards. Basically dam 11 is the key early component in a scheme that is consistent with the conditions of the new Environmental Authority and intent of the relevant DERM policies. Rainfall is delaying the construction of dam 11 and contributing to the current water storage problems.

Installation of water treatment (such as a mobile RO plant) is limited by the logistics (such as civil engineering, chemical storage and power supply), cost and the challenges posed during current wet conditions. Another option considered was employing water entitlements to dilute the untreated coal seam water to the current environmental authority specification. This option was ruled out since a large quantity of good quality water would be required to dilute and dispose of a limited amount of coal seam water from our dams.

Step 4—if treatment and recycling does not, or is not likely to, eliminate the release of waste water or contaminants to waters, evaluate the following options
for waste water or contaminants, in the order in which they are listed—
(i) appropriate treatment and release to a waste facility or sewer;
(ii) appropriate treatment and release to land;
(iii) appropriate treatment and release to surface waters or ground waters.

I) We cannot practically truck water from the dams given the large quantities and the lack of disposal options. Wet weather is likely to complicate trucking of water by limiting access to some points within the MGP. Infrastructure does not exist to process this water via sewer or other industrial water treatment options. Our landholders have expressed concern of minimising truck movements during the wet season.

II) Until our water treatment management strategy is implemented we cannot treat the water to a standard that is suitable for use on land.

III) We consider the water in its current state is suitable for discharge into the Isaac – this was the water management strategy employed by the facility until earlier EA conditions were amended, we are seeking permission from DERM to allow this discharge as previously authorised until we can implement our water management strategy for the MGP. We consider a temporary discharge to the Isaac river during high flow conditions to be compliant with section 51 of the Environmental Protection Regulation 2008.

Objectives

To achieve compliance with the Environmental Authority with respect to coal seam water management and dam standards by April 2011.

This will be achieved in the short term by the release of water to the Isaac River. This measure will protect the integrity of our storage infrastructure and is consistent with the operational philosophy that our existing infrastructure was designed to accommodate.

In the medium term compliance with the new EA will be achieved by the completion of Dam 11. Completion of dam 11 will require Arrow energy to utilise the cleared area north of dam 11.

In the long term, compliance with our EA will be achieved by completion of water treatment facilities that allow beneficial use and disposal within Arrows Environmental Authority conditions. Arrow is to provide DERM with a detailed plan concerning future water management for approval.

Table 3 – Achieving TEP objectives

OBJECTIVE	ACTION	RESPONSIBILITY	TIME FRAME	PERFORMANCE INDICATOR
1. Lower dam levels	Manage via discharge to Isaac river	Arrow site personnel	Immediate	Manage dams within appropriate levels as detailed in Tables 1 and 2. Discharge is to be subject to monitoring and reporting requirements detailed under Monitoring
2. Discharge monitoring	Monitor discharge as per stipulated below	Arrow site personnel	During discharge	Lab results to be reported to DERM within 10 business days of collection.
3. Evaluate existing dam integrity	Engineer to evaluate current dam integrity	Third party contractor URS has been engaged to complete this evaluation	31st Dec 2010	Submission of evaluation report to DERM
4. Cease discharge	Cease discharge to Isaac river under TEP	Arrow	31 March 2011	Cease discharge to Isaac river
5. TEP report submission	Provide DERM with final TEP report detailing how the objectives of this TEP have been met	Arrow	31 May 2011	Submission of TEP report to DERM

Monitoring

Table 4 Contaminant release points, sources and receiving waters

Release point (TEP RP)	Easting (GDA94)	Northing (GDA94)	Contaminant source and location	Monitoring point	Receiving waters
TEP RP 1	148° 2' 35"	-21° 57' 42"	untreated CSG water from PL191/196	Discharge point – end of pipe	Isaac River – Dam 5 discharge point
				Upstream from discharge – Isaac River Crossing	
				Downstream from discharge – Blair Athol Bridge	

Table 5 Contaminant release monitoring points

Monitoring point (TEP MP)	Easting (GDA94)	Northing (GDA94)	Contaminant source and location	Monitoring point location	Receiving waters
TEP MP 1	148° 2' 35"	-21° 57' 42"	Untreated CSG water from PL191	Discharge point – end of pipe	Isaac River – Dam 5 discharge point
TEP MP 2	148° 2' 46"	-21° 57' 55"	Downstream from discharge – Blair Athol Bridge	Blair Athol Railway Bridge	na
TEP MP 3	148° 2' 20"	-21° 57' 41"	Upstream from discharge	Isaac River Crossing	
TEP MP 4	Refer to appendix C		Dams 1,2,5 or 10		

Table 6 Contaminant release limits

Quality characteristic	Release Limit	Monitoring Frequency	Sample Type	Monitoring Point
Electrical conductivity (uS/cm)	13000	Daily during release (the first sample must be taken within 2 hours of commencement of release)	*In situ*[1]	TEP MP 1
			Samples require laboratory analysis[2]	TEP MP 1
pH (pH Unit)	6.5 (minimum) 9.5 (maximum)	Daily during release (the first sample must be taken within 2 hours of commencement of release)	*In situ*[1]	TEP MP 1
				TEP MP 2
				TEP MP 3
			Samples require laboratory analysis[2]	TEP MP 1
				TEP MP 2
				TEP MP 3
Turbidity (NTU)	500	Daily during release (the first sample must be taken within 2 hours of commencement of release)	Samples require laboratory analysis[2]	TEP MP 1
				TEP MP 2
				TEP MP 3
Benzene, Toluene and Xylene	Below Drinking water guideline value			

[1] *In situ samples can be taken using electronic sampling equipment.*
[2] *Samples are required to be analysed at a NATA accredited facility in accordance with this Transitional Environmental Program.*

Table 7 Downstream contaminant trigger investigation levels

Quality characteristic	Trigger levels (μg/L)	Monitoring frequency	Monitoring Point
Aluminium	55	Commencement of release and thereafter weekly during release	TEP MP 2 TEP MP 3
Arsenic	13		
Cadmium	0.2		
Chromium	1.0		
Copper	2.0		
Iron	300		
Lead	10		
Mercury	0.2		
Nickel	11		
Zinc	8.0		
Boron	370		
Cobalt	90		
Manganese	1900		
Molybdenum	34		
Selenium	10		
Silver	1.0		
Uranium	1.0		
Vanadium	10		
Ammonia	900		
Nitrate	1100		
Petroleum hydrocarbons (C6-C9)	20		
Petroleum hydrocarbons (C10-C36)	100		
Fluoride (total)	2000		

Table 8 Contaminant release during flow events

Receiving waters	Release point (TEP RP)	Gauging station description	Easting (GDA94)	Northing (GDA94)	Minimum flow in receiving water required for a release event	Flow recording frequency
Isaac River	TEP RP1	Goonyella Gauging station	-147° 58’ 21”	21° 51’ 20”	1090ML/day	Continuous (minimum daily)

Table 9 Receiving water downstream monitoring points

Monitoring points (TEP MP)	Receiving waters location description	Easting (GDA94)	Northing (GDA94)
TEP MP 2	Blair Athol Bridge 500 metres downstream of RP1 1	148° 57' 37"	-21° 2' 45"

Conditions

In carrying out this Transitional Environmental Program, CH4 Ltd (Arrow Energy) will undertake all activities in accordance with the following conditions.

Undertaking the release of untreated coal seam methane water

1 Contaminants that will, or have the potential to cause environmental harm must not be released directly or indirectly released to any waters except as permitted under this Transitional Environmental Approval.

2 The release of contaminants to waters must only occur from the release points specified in Table 4 and depicted in Appendix C attached to this Transitional Environmental Program.

3 The release of contaminants to waters must not exceed the release limits stated in Table 6 at the monitoring points specified in Table 5 and Table 6 of this Transitional Environmental Program.

4 The release of contaminants to waters from the release points must be monitored at the locations specified in Table 5 and Table 9 for each quality characteristic and at the frequency specified in Table 7 and Table 8 of this Transitional Environmental Program.

5 If quality characteristics of the release exceed any of the trigger levels specified in Table 7 during a release event, the Transitional Environmental Program holder must compare the downstream results in the receiving waters identified in Table 9 to the trigger values specified in Table 7 and:

a) where the trigger values are not exceeded then no action is to be taken

b) where the downstream results exceed the trigger values specified Table 7 for any quality characteristic, compare the results of the downstream site to the data from the upstream monitoring sites (MP3)

i) if the result is less than that recorded at Monitoring Point 3 (MP3), then no action is to be taken or

ii) if the result is greater than the background monitoring site data, complete an investigation in accordance with the ANZECC & ARMCANZ 2000 methodology, into the potential for environmental harm and provide a written report 20 business days after receiving results, outlining

- details of the investigations carried out
- actions taken to prevent environmental harm.

6 If an exceedance in accordance with condition 5(b)(ii) is identified, the holder of the Transitional Environmental Program must notify the administering authority within 2 business days of receiving the result. The notification must include written verification of the exceedance forwarded to the administering authority.

Contaminant Release Events

7 The release of coal seam water will not occur until flow in the Isaac River flow reaches 1090 ML/day (at Goonyella Gauging Station).

8 Notwithstanding any other condition of this Transitional Environmental Program, the release of contaminants to waters must only take place during periods of natural flow events specified as minimum flow in Table 8 for the contaminant release point(s) specified in Table 4.

9 Contaminant release flow rate must not exceed 1:400 (0.25%) of receiving water flow rate.

10 The daily quantity of contaminants released from each release point must be measured and recorded at the monitoring points in Table 4

11 The daily quantity of contaminants is not to exceed 7.5ML/day in total.

12 Releases to waters must be undertaken so as not to cause erosion of the bed and banks of the receiving waters, or cause a material build up of sediment in such waters.

Notification of Release Events

13 The Transitional Environmental Program holder must notify the administering authority within 24hours of having commenced releasing coal seam water to the receiving environment. Notification must include the submission of written verification to the administering authority of the following information:

a) release commencement date/time
b) expected release cessation date/time
c) release point/s

d) release volume (estimated)
e) receiving water/s including the natural flow rate
f) any details (including available data) regarding likely impacts on the receiving water(s).

14 The Transitional Environmental Program holder must provide the administering authority daily during the release of coal seam water, the following information:
a) all in situ monitoring data for that day
b) the receiving water flow rate
c) the release flow rate.

15 The Transitional Environmental Program holder must notify the administering authority as soon as practicable, (no later than within 24 hours after cessation of a release) of the cessation of a release notified under condition 12 and within 15 business days provide the following information in writing:
a) release cessation date/time
b) natural flow volume in receiving water
c) volume of water released
d) details regarding the compliance of the release with the conditions of this Transitional Environmental Program (i.e. contamination limits, natural flow, discharge volume)
e) all in-situ water quality monitoring results
f) any other matters pertinent to the water release event.

Notification of release event exceedence

16 If the release limits defined in Table 6 are exceeded, the holder of the Transitional Environmental Program must notify the administering authority within 2 business days of receiving the results.

17 The Transitional Environmental Program holder must, within 28 days of a release that exceeds the conditions of this Transitional Environmental Program, provide a report to the administering authority detailing:
a) the reason for the release
b) the location of the release
c) all water quality monitoring results
d) any general observations

e) all calculations
f) any other matters pertinent to the water release event.

Requirements to cease the release of coal seam water

18 The coal seam water discharge must cease immediately if any water quality limit as specified in Table 6 is exceeded.

19 The Department of Environment and Resource Management may require CH4 Pty to cease discharge if the department's water monitoring stations detect any water quality limit exceedance.

20 The release of coals seam water must cease immediately if identified that the release of coal seam waters is causing erosion of the bed and banks of the receiving waters, or is causing a material build up of sediment in such waters.

21 The release of coal seam water must cease immediately if holder of this Transitional Environmental Program is directed to do so by the administering authority.

22 The release of coal seam water will cease immediately if Isaac River flow decreases below 11.5 m^3/s (at Goonyella Gauging Station).

Monitoring Requirements

23 Where monitoring is a requirement of this Transitional Environmental Program, ensure that a competent person(s) conducts all monitoring.

24 Monitoring will occur on a daily basis during release event and two days subsequent to cessation of release at monitoring points described in Table 5.

25 All monitoring undertaken as a requirement of this Transitional Environmental Program must be undertaken in accordance with the administering authority's Water Sampling Manual.

Notification of emergencies, incidents and exceptions

26 As soon as practicable after becoming aware of any emergency or incident which results in the release of contaminants not in accordance, or reasonably expected to be not in accordance with the conditions of this Transitional Environmental Program, the administering authority must be notified of the release by telephone, facsimile or email.

27 The notification of emergencies or incidents must include but not be limited to the following:

a) the holder of the Transitional Environmental Program
b) the location of the emergency or incident
c) the number of the Transitional Environmental Program
d) the name and telephone number of the designated contact person
e) the time of the release
f) the time the holder of the Transitional Environmental Program became aware of the release
g) the suspected cause of the release
h) the environmental harm caused, threatened, or suspected to be caused by the release, and
i) actions taken to prevent any further release and mitigate any environmental harm caused by the release.

29 Not more than 10 business days following the initial notification of an emergency or incident, written advice must be provided of the information supplied to the administering authority in relation to:

a) proposed actions to prevent a recurrence of the emergency or incident, and
b) outcomes of actions taken at the time to prevent or minimise environmental harm.

Appendix A
ALS & Qld Health water sampling results

Client Reference	Collected Date	Received Date	Aluminium	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmiun	Chromium	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Molybdenum
			mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Isaac_2	14-Dec-10	17-Dec-10	3.8	< 0.0001	0.0011	0.076	< 0.0001	0.05	< 0.0001	0.0027	0.0011	0.003	1.7	0.0013	0.056	< 0.0001	0.0007
Discharge_Point	14-Dec-10	17-Dec-10	0.18	< 0.0001	0.0012	4.5	< 0.0001	1.1	< 0.0001	0.0003	0.0002	0.002	0.08	0.0004	0.0046	< 0.0001	0.0019
Pond_2a	16-Dec-10	17-Dec-10	0.1	< 0.0001	0.0015	6.1	< 0.0001	1	< 0.0001	0.0002	0.0003	0.001	0.066	< 0.0001	0.007	< 0.0001	0.0013
Pond_2	16-Dec-10	17-Dec-10	0.09	< 0.0001	0.0014	6	< 0.0001	1	< 0.0001	0.0002	0.0003	< 0.001	0.044	< 0.0001	0.0065	< 0.0001	0.0012
POND1_1	17-Dec-10	20-Dec-10	0.37	< 0.0001	0.0021	5.8	< 0.0001	1.5	< 0.0001	0.0008	0.0005	0.001	0.18	< 0.0001	0.0057	< 0.0001	0.0028
POND1_2	17-Dec-10	20-Dec-10	0.43	< 0.0001	0.0023	6	< 0.0001	1.5	< 0.0001	0.0008	0.0005	0.001	0.2	0.0002	0.0065	< 0.0001	0.0031
POND10_1	17-Dec-10	20-Dec-10	0.2	< 0.0001	0.0018	7.7	< 0.0001	1.7	< 0.0001	0.0003	0.0003	< 0.001	0.069	< 0.0001	0.0039	< 0.0001	0.0031
POND10_2	17-Dec-10	20-Dec-10	0.18	< 0.0001	0.0019	7.6	< 0.0001	1.7	< 0.0001	0.0003	0.0003	< 0.001	0.067	< 0.0001	0.0041	< 0.0001	0.0034

Client Reference	Collected Date	Received Date	Nickel	Selenium	Silver	Stronium	Thallium	Titanium	Uranium	Vanadium	Zinc	Benzene	Toluene	Ethylbenzone	Meta&Para-Xylenes	Ortho-Xylene
			mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Isaac_2	14-Dec-10	17-Dec-10	0.0031	< 0.0010	< 0.001	0.2	< 0.0001	0.14	0.0002	0.012	0.003	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Discharge_Point	14-Dec-10	17-Dec-10	0.0008	< 0.0010	< 0.001	7.3	< 0.0001	0.006	0.0003	0.0029	0.013	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Pond_2a	16-Dec-10	17-Dec-10	0.0012	< 0.0010	< 0.001	9.6	< 0.0001	0.003	0.0003	0.0051	0.006	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Pond_2	16-Dec-10	17-Dec-10	0.0011	< 0.0010	< 0.001	9.4	< 0.0001	0.002	0.0003	0.005	0.004	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
POND1_1	17-Dec-10	20-Dec-10	0.0008	< 0.0010	< 0.001	10	< 0.0001	0.017	0.0009	0.0059	0.004	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
POND1_2	17-Dec-10	20-Dec-10	0.0008	< 0.0010	< 0.001	11	< 0.0001	0.015	0.0009	0.0062	0.004	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
POND10_1	17-Dec-10	20-Dec-10	0.0005	< 0.0010	< 0.001	12	< 0.0001	0.026	0.0008	0.0071	0.005	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
POND10_2	17-Dec-10	20-Dec-10	0.0005	< 0.0010	< 0.001	12	< 0.0001	0.01	0.0007	0.0071	0.005	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1

ALS	21/12/2010	Sample	ID 1	DAM 1	DAM 10	DAM 4	DAM 3	D1	D2	DAM 5	DAM2	TRIP BLANK
			ID 2									
ES1025292	Results		Date Sampled	6/12/2010	6/12/2010	6/12/2010	6/12/2010	6/12/2010	6/12/2010	6/12/2010	6/12/2010	6/12/2010
Analyte	**CAS #**	**Units**	**LOR**	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
EA005: pH												
pH Value		pH Unit	0.01	9.17	9.28	9.34	9.38	9.4	9.42	9.27	9.15	-
EA010P: Conductivity by PC Titrator												
Electrical Conductivity @ 25°C		µS/cm	1	12600	14000	16400	25900	25800	26100	10700	10600	-
EG020T: Total Metals by ICP-MS												
Arsenic	7440-38-2	mg/L	0.001	0.003	0.003	0.002	<0.001	0.004	0.004	<0.001	0.002	-
Barium	7440-39-3	mg/L	0.001	6.54	8.33	4.35	1.93	1.92	1.98	6.4	9.31	-
Beryllium	7440-41-7	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-
Cadmium	7440-43-9	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	-
Cobalt	7440-48-4	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	-
Chromium	7440-47-3	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	-
Copper	7440-50-8	mg/L	0.001	0.002	0.002	0.002	0.002	0.002	0.002	0.003	0.004	-
Manganese	7439-96-5	mg/L	0.001	0.008	0.003	0.002	0.001	0.001	0.003	0.002	0.038	-
Nickel	7440-02-0	mg/L	0.001	0.001	<0.001	0.001	0.002	0.002	0.002	<0.001	0.003	-
Lead	7439-92-1	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-
Vanadium	7440-62-2	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-
Zinc	7440-66-6	mg/L	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.008	-
EG035T: Total Recoverable Mercury by FIMS												
Mercury	7439-97-6	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	-
EK055G: Ammonia as N by Discrete Analyser												
Ammonia as N	7664-41-7	mg/L	0.01	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-
EK057G: Nitrite as N by Discrete Analyser												
Nitrite as N		mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-
EK058G: Nitrate as N by Discrete Analyser												
Nitrate as N	14797-55-8	mg/L	0.01	0.02	0.01	0.02	0.01	0.01	0.02	0.01	0.03	-
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser												
Nitrite + Nitrate as N		mg/L	0.01	0.02	0.01	0.02	0.01	0.01	0.02	0.01	0.03	-
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser												
Total Kjeldahl Nitrogen as N		mg/L	0.1	1.7	0.5	0.5	1	1.1	1	0.9	1.2	-
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser												
Total Nitrogen as N		mg/L	0.1	1.7	0.5	0.5	1	1.1	1	0.9	1.2	-
EK067G: Total Phosphorus as P by Discrete Analyser												
Total Phosphorus as P		mg/L	0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-
EP080: BTEX												
Benzene	71-43-2	µg/L	1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Toluene	108-88-3	µg/L	2	<5	<5	<5	<5	<5	<5	<5	<5	<5
Ethylbenzene	100-41-4	µg/L	2	<2	<2	<2	<2	<2	<2	<2	<2	<2
meta- & para-Xylene	108-38-3 106-42-3	µg/L	2	<2	<2	<2	<2	<2	<2	<2	<2	<2
ortho-Xylene	95-47-6	µg/L	2	<2	<2	<2	<2	<2	<2	<2	<2	<2
EP080S: TPH(V)/BTEX Surrogates												
1.2-Dichloroethane-D4	17060-07-0	%	surrogate	113	111	103	112	105	110	110	106	106
Toluene-D8	2037-26-5	%	surrogate	110	106	103	109	105	106	107	103	102
4-Bromofluorobenzene	460-00-4	%	surrogate	106	99.7	97.9	104	97.1	98.6	101	97	101

Appendix B
Dilution calculation basis

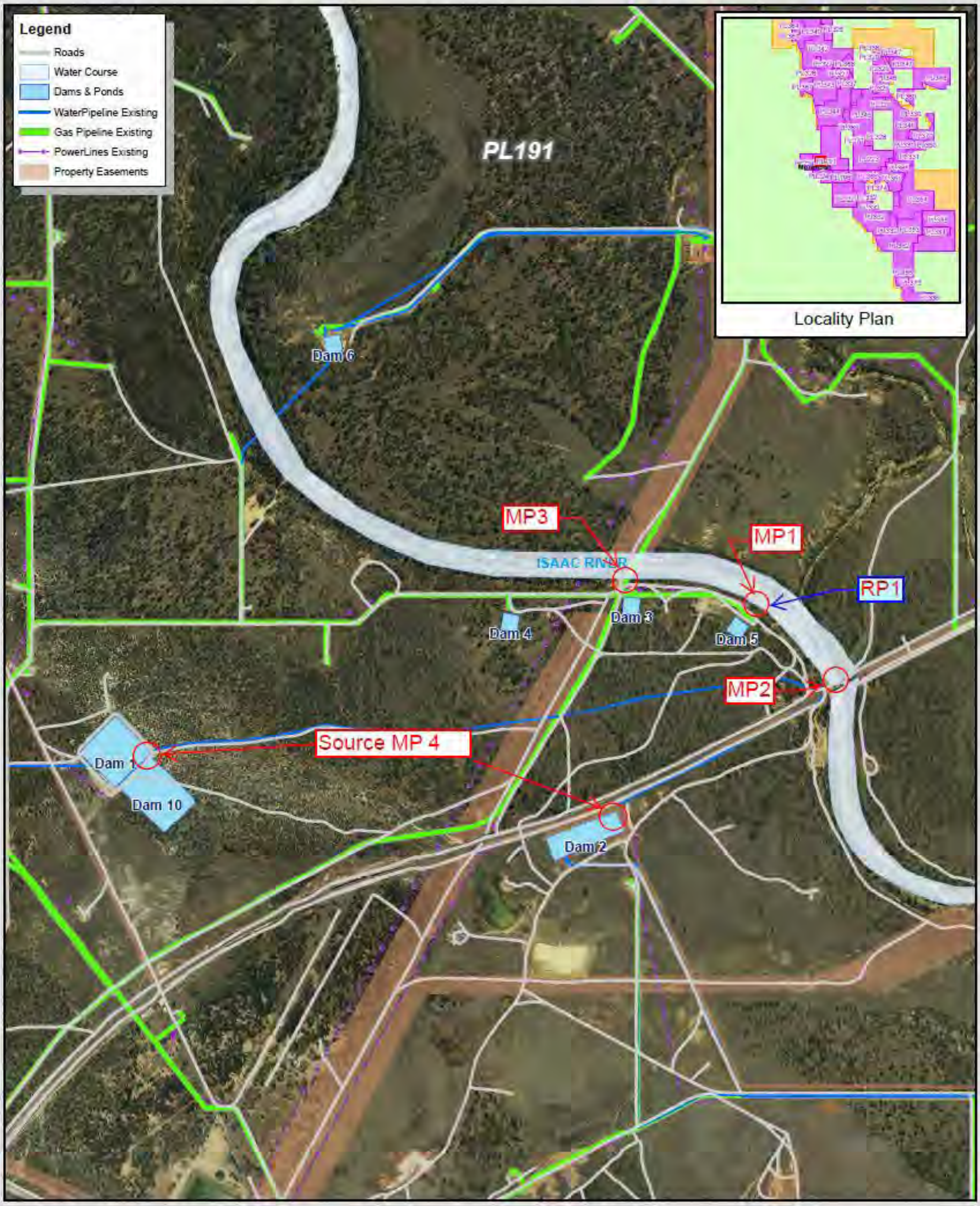
Table 10 Dilution calculation at 400:1 release

Parameter	Unit	Surface Water Concentration	Concentration of Discharge	Dilution X:1	Surface Concentration after dilution	Guideline[1]
EC	µs/cm	250	10600	400	276.5	746
Sodium	mg/L	65	2970	400	72.4	180
Chloride	mg/L	80	4280	400	90.7	250

[1] *Australian drinking water guidelines (NHMRC,2004)*
Sodium and Chloride based on EC, common soil quality (run off) and historical data from upstream

Appendix C
Mapping showing PL191 and location of key Dams

ARROW ENERGY - BOWEN BASIN GAS PROJECT



Moranbah Gas Project - Dam 5

Source:
Arrow Energy Limited
Geosciences Australia
Dept. Envir. and Resource Mgmt.

Date: 23/12/2010
Issue[redacted]
Auth[redacted]

0 0.5 1
Kilometres
Scale: 1:19,762 @ A4
Coordinate System: GDA 1994 MGA Zone 55

N

arrow energy go further

NOT FOR CONSTRUCTION

Appendix D
Sampling Procedure

SUMMARY

1.1	This procedure outlines general sampling protocols and work practices to be followed during the sampling of surface water, during the discharge of untreated CSG well water to the Isaac River. This procedure includes details on: ▪ Sampling equipment requirements; ▪ Surface water sampling techniques; ▪ Quality control requirements. ▪ Sample locations (Figure 1) ▪ Analytical requirements

EQUIPMENT

2.1	▪ Documentation o Sampling and analysis plan. o Health and safety plan o Personal protective equipment (PPE) as identified in the HSP, inc. Life Jacket and other specialised PPE, as per the HSP. ▪ Water sampling equipment o sample collection device, (Swing Arm Sampler/extension sampler) o decontamination solution (e.g. Decon 90^{TM}) or use new sample collection container in the swing arm sampler at each location. o Calibrated water quality meter (ensure parameter ranges are suitable for the water being tested), o laboratory supplied sample containers, o Chilled ice chest. o Field sample Record Sheet o Chain of Custody Form (Attached).

3.0 REFERENCES & PROFORMA

3.1	▪ AS NZS 5667.1-1998 *Water quality - Sampling - Guidance on the design of sampling programs sampling techniques* ▪ AS NZS 5667.4-1998 *Water quality - Sampling - Guidance on sampling from lakes natural and man-made* ▪ AS NZS 5667.6-1998 *Water quality - Sampling - Guidance on sampling of rivers and streams* ▪ Monitoring and Sampling Manual 2009 Environmental Protection (Water) Policy 2009, *Monitoring and Sampling Manual 2009*, Version 2 September 2010

4.0 PROCEDURE

4.1	**Safety**
	Unless specifically required, the following general safety requirements should be noted: 1. Appropriate personal protective equipment should be worn as specified in the Health and Safety Plan (HSP). When working in or around water bodies, a life jacket is required to be worn and a minimum of two persons to be present should be assessed. 2. Assess hidden hazards (eg. trip hazards, snakes, leeches, etc.). 3. Assess risks from slippery or unstable banks. 4. Assess whether the water body / drain may constitute a confined space. 5. Assess the likelihood that surface conditions within and around the water body may change rapidly in the event of heavy rainfall or tidal change.

4.2	**Sampling**
	1. The sampling frequency during and following discharge to the Isaac River shall be as follows: • daily during discharge; and • daily for two days following discharge stopping. 2. The sampling sequence should commence where the lowest likely contaminant concentrations are expected (e.g. downstream and work upstream), to reduce the risk of cross contamination between samples. On this basis, the samples shall be collected at the following locations (in order): (See **Figure 1** for sampling locations) I. **River crossing** (upstream), (One **primary sample (S1)**, plus **one duplicate sample (QC1)**) II. **Blair Athol Bridge** (downstream), One **primary sample (S2)**, plus **one duplicate sample (QC2)**) III. At the **Discharge Point**, One **primary sample (S3)**, plus **one duplicate sample (QC3)**) IV. At the **Source (Dam)** One **primary sample (S4)**, plus **one duplicate sample (QC4)**) V. QC samples – Field/Trip Blank **(QC5)** and rinsate blank **(QC6)** (if required) 3. At each location, a water sample should be collected for standard field parameters using a calibrated water quality meter. The following parameters should be recorded: a. pH, b. conductivity, c. dissolved oxygen, d. redox potential, e. temperature and f. turbidity. Notes: • Follow the manufacturer's instructions for use and calibration of instruments to measure water parameters. A calibration record must be kept. • When recording dissolved oxygen readings, it is important to note whether the results are reported as % saturation or ppm. • With conductivity, record whether units are mS or μS.

4. Based on the nature of the sampling locations, heterogeneous distribution of potential contaminants in the water samples is considered likely. Therefore, the following Quality Control Samples should be collected and analysed for this program:
   a. One duplicate sample per sample location for TPH, BTEX and 8 Metals analysis **(QC1 – QC4).**
   b. One Blank Sample per esky (laboratory prepared DI Water for TPH (C6 – C9) and BTEX analysis) **(QC5)**.
5. One rinsate sample per day (unless using new sample collection medium between sample locations i.e. a new container in the swing arm sampler) for TPH (C6 – C9) and BTEX analysis) **(QC6)**.
6. At each location sample bottles should be filled based on a decreasing order of potential volatility (i.e. VOCs, BTEX and TPH first, followed by metals and other inorganic samples).
7. Note: **DO NOT** field filter samples for total metals. Perform field filtering for dissolved metals samples only.
8. When sampling shallow waters, contamination from bottom sediments should be avoided. Samples should be collected by submerging a clean sample collection container (up-side down) into the water and to approximately 100mm below the surface, rotate the container to allow it to fill.
9. The sampling location should be as representative as possible of the event being monitored. i.e. do not sample stagnant water at the edge, attempt to sample .
10. Record the appearance of the water body, i.e. colour, turbidity, odour, surface crusts, films or floating material, algae, water velocity, etc. In addition, record the weather conditions at the time of sampling and note any other relevant observations, e.g. dead or distressed flora/fauna, surface rubbish, spills, etc.
11. All measurements and field notes should be documented on the field sheet (**Attachment A**)

5.0 ANALYTICAL/SAMPLE CONTAINER REQUIREMENTS

5.1	1. The analytical suite includes the following: a. pH, EC, TDS, Turbidity b. Ions: Magnesium, Calcium, Sodium, Sulphate, Chloride, Ammonia, Nitrate, Fluoride (total). c. Metals, Aluminium, Arsenic, Cadmium, Chromium, Copper, Iron, Lead, Mercury, Nickel, Zinc, Boron, Cobalt, Manganese, Molybdenum, Selenium, Silver, Uranium, Vanadium. d. Organics: BTEX, PAH, TPH 2. Each Sample Requires the following containers: a. 60ml Plastic Bottle for metals (with red and green striped label border) (tick 'Total Metals') b. 500ml Plastic Bottle for anions/cations (with green label border) c. 250ml Amber Glass Bottle (with purple label border) d. One pair of BTEX vials (40 mL glass cylindrical containers with purple label border).
	Notes: • The selection of sample containers depends on the laboratories being used. The above list is based on ALS requirements only. When ultra trace analysis is being requested, additional sample volume may be required. Always check with the laboratory prior to submitting samples to the laboratory. • When filling the vials it is important that they are filled to the top with no air space remaining. • Use new sample gloves between sample locations.
5.2	1. Place samples immediately in a chilled ice chest 2. Complete sample request form and include in sealed bag in the cooler 3. Courier samples to the receiving laboratory.

12 **Surface Water Sampling** **Form**

Site				Sampling Method:					
Job Number				Local Air Temperature:					
Date:		Time:		Wind Force:					
Weather:			Cloudiness %	Direction of Wind:					
Location	**Sample No.**	**Water Flow (l/s)**	**Field Readings**				**Depth (m)**	**Comments: including turbidity (plankton and/or sediment), colour, water plants, weather conditions, etc**	
			pH	**Conductivity**	**Temperature**	**Dissolved Oxygen**			

Comments concerning treatment of samples, especially preservation:

Name: **Signed:** **Project Manager:** adapted from AS 5667.4

Analytes

Quality characteristic	
pH	
EC	Ammonia
Turbidity	Nitrate
Magnesium	Fluoride (total)
Calcium	BTEX
Sodium	PAH
Sulphate	TPH
Chloride	
Aluminium	
Arsenic	
Cadmium	
Chromium	
Copper	
Iron	
Lead	
Mercury	
Nickel	
Zinc	
Boron	
Cobalt	
Manganese	
Molybdenum	
Selenium	
Silver	
Uranium	
Vanadium	

Appendix E
URS Dam 2 Assessment

DRAFT TRANSITIONAL ENVIRONMENTAL PROGRAM UNDER SECTION 333 OF THE *ENVIRONMENTAL PROTECTION ACT 1994*

Principal Holder:	CH4 Pty Ltd **AM-60** Level 19 42 Albert Street Brisbane QLD 4000
EA Number:	PEN100015907
Title:	**Coal Seam Water Management Moranbah Gas**
Project	**Moranbah Gas Project PL191/196**
Program notice submitted:	3 December 2010
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Finish Date:	31 May 2011

Introduction

The Moranbah Gas Project lacks sufficient water storage capacity as previously indicated in correspondence to DERM (dated 25 October 2010) and subsequent responses to information requests and the program notice documentation submitted by Arrow (dated 3 December 2010). This has been caused by an early start to the wet season contributing to existing dam levels and causing construction delays. This has prevented Arrow from making additional storage available via the completion of dam 11. The synthetic lining for the dam cannot be installed during periods of rainfall; the civil engineering also requires careful control of the moisture content of the construction materials to achieve the required specifications.

Dam 11 has been designed and is being constructed in line with the most current dam standards stipulated by DERM and contained in the previously submitted and assessed dam design report. It is a large lined dam – intended to provide sufficient storage until Arrow can complete the planned development of the Reverse Osmosis water treatment facility, develop beneficial uses and the upgrade of existing infrastructure to the new standards. Basically dam 11 is the key early component in a scheme that is consistent with the conditions of the new Environmental Authority and intent of the relevant DERM policies.

The continued rain has delayed the completion of dam 11. This has put Arrow in a position where it cannot comply with the current EA conditions. Arrow intends to employ this transitional environmental program (TEP) as defined in Chapter 7, Part 4 of the *Environmental Protection Act 1994 to bring our operation back into compliance with its current Environmental Authority*. In initiating this process Arrow intends to work with DERM to minimise the potential for environmental harm.

Background

Arrow currently employs a network of 10 dams across PL191 and PL196. Dams 1 through to 7 are shown in the attached drawing (Appendix C). Dams 8 and 9 in the network are SW of the main area depicted in the provided drawing. Approximately 90% of the total storage capacity for coal seam water is held in Arrow's major storage dams 1, 2 and 10. The other dams are employed to move water between groups of remote wells and the major storage dams. Dam 3 is employed to store more concentrated brine. An important feature of the petroleum lease is the Isaac River which divides the lease along a NW to SE axis and its tributary Teviot Brook. Isaac River is an ephemeral river; during periods of high flow it limits access to infrastructure on the north eastern side of the petroleum lease via river crossings.

Situation

Our strategy is to maintain low levels in the older and less accessible dams (particularly dams 6,7, 8 and 9) by moving water to dams 1 and 10. Dam 10 is our most recently constructed dam and has an engineered spillway, dam 1 is in reasonable condition and adjacent to dam 10 which allows water to be transferred readily between dams.

Our risk assessment process and an independent third party geotechnical evaluation by URS has identified particular concerns with the integrity of dam 2 (refer to Appendix E). Arrow has concerns regarding the condition of dam 2 – it is scheduled to be brought out of service on the completion of Dam 11. Based on geotechnical evaluation we intend to lower the level of water in Dam 2 to 4m below DSA. The goal of this strategy is to maintain pond integrity and minimise discharge to the environment when a suitable plan to restore the operational integrity of dam 2 is developed or the dam is retired from operational duty.

Arrow believes that a controlled discharge during high flow conditions in the Isaac River via the existing infrastructure would result in the least environmental impact whilst preserving the integrity of the existing dams. This option prevents the overland flow of untreated coal seam water reaching the Isaac River and minimises the risk of damaging older dams which are built prior to the new standards and lacking engineered spillways. When the facility was originally developed the water management scheme was significantly different to now and included a wet weather discharge. At present our existing infrastructure is not sufficient to comply with the conditions of the current Environmental Authority particularly during extended wet periods.

Our system of dams has an area of 125,100 m^2, this equates to a gain of 0.125ML per mm of rainfall. The system is designed to transfer water to the major storage dams 1, 2 and 10 this contribute to the catchments of these structures, each 1 mm of rainfall will cause an increase in dam height of 1.6 mm in dams 1, 2 and 10. When all the input rainfall is directed to dam 10 each 1 mm of rainfall causes an increase in dam height of 2.7 mm in dam 10.

Table 1 Key Dam Variables Dams 1, 2, 5 and 10

Dam		1	2	5	10
Volume at Spill level	ML	119.66	92.64	7.64	203.70
Spillway		No	No	No	Yes
Liner type		CCL	CCL	0.5mm HDPE	1.5mm HDPE
Hydraulic height	m	5.60	5.50	3.5	4.75
MRL	m	5.25	5.15	3.15	4.40
DSA	m	4.75	4.65	2.65	3.90
Target dam fill height [b]	m	4.75	0.65	2.65	3.90
Current level (below MRL) [a]	mm	**100**	**870**	**Varies** [c]	**40**
Remaining rainfall *(to spill)* [d]	mm	281	762	>800	244

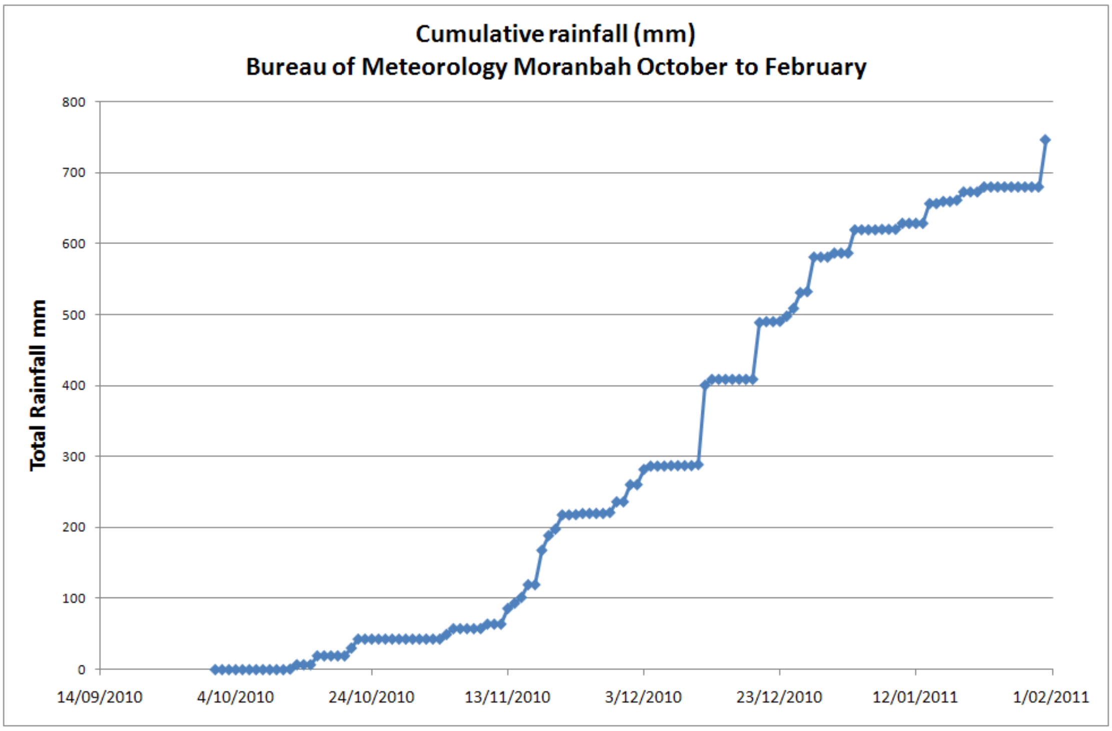
[a] Levels 27 January 2010, negative denotes level above MRL

[b] Target dam fill height is DSA for dams 1 and 10, 4m below DSA for dam 2. Current target height for dam 2 is based on 3rd party civil engineering assessment completed by URS.

[c] This dam is much smaller than the major storage dams its level can change rapidly during operations

[d] Rainfall based on approximate catchment ratio of 1.6 (based on total catchment area including transfer dams)

Figure 1 Cumulative rainfall between October to December Moranbah



Future water levels will be a product of the rainfall, coal seam water production and evaporation. Our goal is to maintain dams 1 and 10 at DSA levels by employing a discharge to the Isaac River. Dam 2 will be lowered to a level determined by independent third party engineering risk assessment.

Arrow has evaluated 2 scenarios for water requiring discharge from the storage system:

- Scenario 1 – Mean rainfall until end of wet season
- Scenario 2 – 95th percentile rainfall until end of wet season

Rainfall to date is very close to the 95th percentile rainfalls on average from October through to December. We have had a cumulative total of 586mm from the 1st of October to end of December (Figure 1), 95th percentile cumulative rainfall for the period from the start of October to the end of December totals 522mm.

Based on the current progress of the wet season Arrow believes that the next few months will produce above average rainfall. Long range forecasts from the Bureau of Meteorology give a 55% chance of rainfall at or above the 95% percentile values. In determining the water balance for the facility has evaluated 2 scenarios – mean and 95th Percentile rainfall (refer to Table 2).

Table 2 Discharge scenarios

Scenario	Volume to reach DSA (ML)	Additional removal from Dam 2 (ML) [b]	Expected Net [a] Water to Storage (ML)	Total (ML)
Mean Rainfall	69	75	54.5	198.5
95th Percentile	69	75	130	274

[a] Net water to storage is produced water, less evaporation plus expected rainfall.
[b] This is based on a dam 2 target of 4000mm below DSA.

Arrow proposes a discharge of up to 7.5ML/day when dams are above the target dam fill height shown in Table 1. The release will commence when the Isaac River is flowing above 12.6m^3/s (at this starting flow only 2.4ML/day could be discharged) measured upstream at the Goonyella river gauge (operated by DERM). Discharge will be maintained at a 400:1 dilution ratio on the basis of maintaining Australian drinking water guidelines (NHMRC,2004) downstream of the discharge. Based on a predicted salinity impact as detailed in Appendix B. This discharge rate and the dilution factor will be reviewed throughout the TEP in consultation with DERM and informed on the basis of the upstream/downstream river monitoring in line with the proposed conditions detailed within this document.

Sampling will be conducted in line with the conditions detailed in this TEP under the procedure attached as Appendix D. Appendix A contains indicative water quality to characterise the coal seam water to be discharged.

Supporting Information

Consideration of the management hierarchy for the management of coal seam water at the MGP

Evaluation as per the management hierarchy of preferred procedures from Environmental Protection (Water) Policy 2009:

Step 1—evaluate water conservation measures to reduce the use of water and the production of waste water or contaminants;
Water is not employed in the coal seam gas production process but must be removed from the coal seam to allow the gas to be extracted. Water conservation measures will not reduce the amount of coal seam water associated with the gas extracted.

Step 2—evaluate waste prevention options and implement appropriate waste prevention measures;
The key waste prevention measure employed is maximisation of the coal seam gas to water ratio. The coal seams targeted by MGP have relatively low ratios of water to gas in comparison to other fields. In an effort to manage our recent water storage constraints Arrow has shut in a large number of wells, targeting the wells with high water to gas ratios to minimise the production of coal seam water associated with our operations.

Whilst this has reduced our coal seam water production, shutting in further wells will yield limited benefits in terms of water reduction but will cause significant reduction in gas output.

Use of dam 11 in its current uncompleted, unlined state has been investigated. The pipe work and major civil infrastructure is complete but the floor of the dam is incomplete – as discussed (in our meeting on the 1st of December) it lacks its intended second liner, more importantly the clay liner has not been sufficiently compacted to allow its use. Key elements of the pipework connecting dam 11 to the rest of the network remain incomplete. Employing dam 11 would require its use for an extended period to allow subsequent emptying and upgrade of the existing dam infrastructure.

Step 3—if waste prevention does not, or is not likely to, eliminate the release of waste water or contaminants to waters, evaluate treatment and recycling options and implement appropriate treatment and recycling;
The construction of Dam 11 is the first component of our coal seam water management strategy. It is a large lined dam, intended to provide sufficient storage until Arrow can complete the planned development of the Reverse Osmosis water treatment facility, beneficial uses and the upgrade of existing infrastructure to the new standards. Basically dam 11 is the key early component in a scheme that is consistent with the conditions of the new Environmental Authority and intent of the relevant DERM policies. Rainfall is delaying the construction of dam 11 and contributing to the current water storage problems.

Installation of water treatment (such as a mobile RO plant) is limited by the logistics (such as civil engineering, chemical storage and power supply), cost and the challenges posed during current wet conditions. Another option considered was employing water entitlements to dilute the untreated coal seam water to the current environmental authority specification. This option was ruled out since a large quantity of good quality water would be required to dilute and dispose of a limited amount of coal seam water from our dams.

Step 4—if treatment and recycling does not, or is not likely to, eliminate the release of waste water or contaminants to waters, evaluate the following options
for waste water or contaminants, in the order in which they are listed—
(i) appropriate treatment and release to a waste facility or sewer;
(ii) appropriate treatment and release to land;
(iii) appropriate treatment and release to surface waters or ground waters.

I) We cannot practically truck water from the dams given the large quantities and the lack of disposal options. Wet weather is likely to complicate trucking of water by limiting access to some points within the MGP. Infrastructure does not exist to process this water via sewer or other industrial water treatment options. Our landholders have expressed concern of minimising truck movements during the wet season.
II) Until our water treatment management strategy is implemented we cannot treat the water to a standard that is suitable for use on land.

III) We consider the water in its current state is suitable for discharge into the Isaac – this was the water management strategy employed by the facility until earlier EA conditions were amended, we are seeking permission from DERM to allow this discharge as previously authorised until we can implement our water management strategy for the MGP. We consider a temporary discharge to the Isaac river during high flow conditions to be compliant with section 51 of the Environmental Protection Regulation 2008.

Objectives

To achieve compliance with the Environmental Authority with respect to coal seam water management and dam standards by April 2011.

This will be achieved in the short term by the release of water to the Isaac River. This measure will protect the integrity of our storage infrastructure and is consistent with the operational philosophy that our existing infrastructure was designed to accommodate.

In the medium term compliance with the new EA will be achieved by the completion of Dam 11. Completion of dam 11 will require Arrow energy to utilise the cleared area north of dam 11.

In the long term, compliance with our EA will be achieved by completion of water treatment facilities that allow beneficial use and disposal within Arrows Environmental Authority conditions. Arrow is to provide DERM with a detailed plan concerning future water management for approval.

Table 3 – Achieving TEP objectives

OBJECTIVE	ACTION	RESPONSIBILITY	TIME FRAME	PERFORMANCE INDICATOR
1. Lower dam levels for (dams 1, 2, 5, 10) to below the 'Target dam fill height" as shown in Table 1.	Manage via discharge (RP1) to Isaac river	Arrow site personnel	Immediate	Manage dams within appropriate levels as detailed in Tables 1 and 2. Discharge is to be subject to monitoring and reporting requirements
2. Monitor Discharge	Monitor discharge in accordance with Table 5, for the contaminants listed in Table 6 and Table 7	Arrow site personnel	During discharge	Lab results to be reported to DERM within 10 business days of collection.
3. Pond 2	Develop management plan to restore dam integrity or remove from service	Arrow	15 March 2010	Submission of management plan to DERM
4. Cease discharge	Cease discharge to Isaac river under TEP	Arrow	31 March 2011	Cease discharge to Isaac river
5. TEP report submission	Provide DERM with final TEP report detailing how the objectives of this TEP have been met	Arrow	31 May 2011	Submission of TEP report to DERM

Monitoring

Table 4 Contaminant release points, sources and receiving waters

Release point (TEP RP)	Easting (GDA94)	Northing (GDA94)	Contaminant source and location	Monitoring point	Receiving waters
TEP RP 1	148° 2' 35"	-21° 57' 41"	untreated CSG water from PL191/196	Discharge point – end of pipe	Isaac River – Dam 5 discharge point
				Upstream from discharge – Isaac River Crossing	
				Downstream from discharge – Blair Athol Bridge	

Table 5 Contaminant release monitoring points

Monitoring point (TEP MP)	Easting (GDA94)	Northing (GDA94)	Contaminant source and location	Monitoring point location	Receiving waters
TEP MP 1	148° 2' 35"	-21° 57' 41"	Untreated CSG water from PL191	Discharge point – end of pipe	Isaac River – Dam 5 discharge point
TEP MP 2	148° 2' 46"	-21° 57' 55"	Downstream from discharge – Blair Athol Bridge	Blair Athol Railway Bridge	na
TEP MP 3	148° 2' 20"	-21° 57' 41"	Upstream from discharge	Isaac River Crossing	
TEP MP 4	148° 1' 10"	-21° 58' 00"	Untreated CSG water dam 1	Dam 1	
TEP MP 5	148° 2' 8"	-21° 58' 01"	Untreated CSG water dam 2	Dam 2	
TEP MP 6	148° 2' 32"	-21° 57' 44"	Untreated CSG water dam 5	Dam 5	
TEP MP 7	148° 1' 14"	-21° 58' 4"	Untreated CSG water dam 10	Dam 10	

Table 6 Contaminant release limits

Quality characteristic	Release Limit	Monitoring Frequency	Sample Type	Monitoring Point
Electrical conductivity (uS/cm)	13000	Daily during release (the first sample must be taken within 2 hours of commencement of release)	*In situ*[1]	TEP MP 1 TEP MP2 TEPMP3
			Samples require laboratory analysis[2]	TEP MP 1 TEP MP2 TEPMP3
pH (pH Unit)	6.5 (minimum) 9.5 (maximum)	Daily during release (the first sample must be taken within 2 hours of commencement of release)	*In situ*[1]	TEP MP 1
				TEP MP 2
				TEP MP 3
			Samples require laboratory analysis[2]	TEP MP 1
				TEP MP 2
				TEP MP 3
Turbidity (NTU)	500	Daily during release (the first sample must be taken within 2 hours of commencement of release)	Samples require laboratory analysis[2]	TEP MP 1
				TEP MP 2
				TEP MP 3
BTEX Benzene, Ethylbenzene, Toluene and Xylene (mg/L)	Benzene 0.001 Ethylbenzene 0.3 Toluene 0.8 Xylene 0.02	Daily during release (the first sample must be taken within 2 hours of commencement of release)	Samples require laboratory analysis[2]	TEP MP 1
				TEP MP 2
				TEP MP 3

[1] In situ samples can be taken using electronic sampling equipment.
[2] Samples are required to be analysed at a NATA accredited facility in accordance with this Transitional Environmental Program.

Table 7 Downstream contaminant trigger investigation levels

Quality characteristic	Trigger levels (µg/L)	Monitoring frequency	Monitoring Point
Aluminium	55	Commencement of release and thereafter weekly during release	TEP MP 2 TEP MP 3
Arsenic	10		
Cadmium	0.2		
Chromium	1.0		
Copper	2.0		
Iron	300		
Lead	10		
Mercury	0.2		
Nickel	11		
Zinc	8.0		
Boron	370		
Cobalt	90		
Manganese	500		
Molybdenum	34		
Selenium	10		
Silver	1.0		
Uranium	1.0		
Vanadium	10		
Ammonia	900		
Nitrate	1100		
Petroleum hydrocarbons (C6-C9)	20		
Petroleum hydrocarbons (C10-C36)	100		
Fluoride (total)	1500		
EC	350µs/cm		
Chloride	250mg/L		
Sodium	180mg/L		

Table 8 Contaminant release during flow events

Receiving waters	Release point (TEP RP)	Easting (GDA94)	Northing (GDA94)	Minimum flow in receiving water required for a release event	Flow recording frequency
Isaac River	TEP RP1	148° 2’ 35”	-21° 57’ 41”	1090ML/day	Twice Daily from Goonyella Gauging station

Table 9 Receiving water downstream monitoring points

Monitoring points (TEP MP)	Receiving waters location description	Easting (GDA94)	Northing (GDA94)
TEP MP 2	Blair Athol Bridge 500 metres downstream of RP1	148° 2' 46"	-21° 57' 55"

Conditions

In carrying out this Transitional Environmental Program, CH4 Ltd (Arrow Energy) will undertake all activities in accordance with the following conditions.

Undertaking the release of untreated coal seam methane water

1. Contaminants that will, or have the potential to cause environmental harm must not be released directly or indirectly released to any waters except as permitted under this Transitional Environmental Approval.
2. The release of contaminants to waters must only occur from the release points specified in Table 4 and depicted in Appendix C attached to this Transitional Environmental Program.
3. The release of contaminants to waters must not exceed the release limits stated in Table 6 at the monitoring points specified in Table 5 and Table 6 of this Transitional Environmental Program.
4. The release of contaminants to waters from the release points must be monitored at the locations specified in Table 5 and Table 9 for each quality characteristic and at the frequency specified in Table 7 and Table 8 of this Transitional Environmental Program.
5. If quality characteristics of the release exceed any of the trigger levels specified in Table 7 during a release event, the Transitional Environmental Program holder must compare MP2 to the trigger values specified in Table 7 and:
   a) where the trigger values are not exceeded then no action is to be taken
   b) where the downstream results exceed the trigger values specified Table 7 for any quality characteristic, compare the results of the downstream site to the data from the upstream monitoring sites (MP3)
      i) if the result is less than that recorded at Monitoring Point 3 (MP3), then no action is to be taken or

ii) if the result is greater than the background monitoring site data, complete an investigation in accordance with the ANZECC & ARMCANZ 2000 methodology, into the potential for environmental harm and provide a written report 20 business days after receiving results, outlining

- details of the investigations carried out
- actions taken to prevent environmental harm.

6 If an exceedance in accordance with condition 5(b)(ii) is identified, the holder of the Transitional Environmental Program must notify the administering authority within 24 hours of receiving the result. The notification must include written verification of the exceedance forwarded to the administering authority.

Contaminant Release Events

7 The release of coal seam water from the release point shown in Table 4 will not occur until -

a) - flow in the Isaac River flow reaches 1090 ML/day as shown in Table 8 (at Goonyella Gauging Station); and

b) – At least one dam in Table 1 has exceeded the 'Target Dam Fill Height' shown in Table 1; and

c) – A dilution of at least 400 parts river flow to 1 part discharge can be maintained at all times (0.25% of receiving flow).

8 The daily quantity of contaminants released from each release point must be measured and recorded at the monitoring points in Table 4

9 The daily quantity of contaminants is not to exceed 7.5ML/day in total.

10 Releases to waters must be undertaken so as not to cause erosion of the bed and banks of the receiving waters, or cause a material build up of sediment in such waters.

Notification of Release Events

11 The Transitional Environmental Program holder must notify the administering authority within 24hours of having commenced releasing coal seam water to the receiving environment. Notification must include the submission of written verification to the administering authority of the following information:

a) release commencement date/time
b) expected release cessation date/time
c) release point/s
d) release volume (estimated)

e) receiving water/s including the natural flow rate
f) any details (including available data) regarding likely impacts on the receiving water(s).

12 The Transitional Environmental Program holder must provide the administering authority daily during the release of coal seam water, the following information:
a) all in situ monitoring data for that day
b) the receiving water flow rate
c) the release flow rate.

13 The Transitional Environmental Program holder must notify the administering authority as soon as practicable, (no later than within 24 hours after cessation of a release) of the cessation of a release notified under condition 11 and within 15 business days provide the following information in writing:
a) release cessation date/time
b) natural flow volume in receiving water
c) volume of water released
d) details regarding the compliance of the release with the conditions of this Transitional Environmental Program (i.e. contamination limits, natural flow, discharge volume)
e) all in-situ water quality monitoring results
f) any other matters pertinent to the water release event.

Notification of release event exceedence

14 If the release limits defined in Table 6 are exceeded, the holder of the Transitional Environmental Program must notify the administering authority within 2 business days of receiving the results.

15 The Transitional Environmental Program holder must, within 28 days of a release that exceeds the conditions of this Transitional Environmental Program, provide a report to the administering authority detailing:
a) the reason for the release
b) the location of the release
c) all water quality monitoring results
d) any general observations
e) all calculations

f) any other matters pertinent to the water release event.

Requirements to cease the release of coal seam water

16 The coal seam water discharge must cease immediately if any water quality limit as specified in Table 6 is exceeded or if a dilution of 400 parts river flow to 1 part discharge (0.25% of receiving flow) cannot be achieved.

17 The Department of Environment and Resource Management may require CH4 Pty to cease discharge if the department's water monitoring stations detect any water quality limit exceedance.

18 The release of coals seam water must cease immediately if identified that the release of coal seam waters is causing erosion of the bed and banks of the receiving waters, or is causing a material build up of sediment in such waters.

19 The release of coal seam water will cease immediately if Isaac River flow decreases below 1090ML/day (at Goonyella Gauging Station).

20 The release of coal seam water will cease immediately from any dam in Table 1 once the dams level is more than 100mm lower than the 'Target Dam Fill Height' shown in Table 1.

Monitoring Requirements

21 Where monitoring is a requirement of this Transitional Environmental Program, ensure that a competent person(s) conducts all monitoring.

22 Monitoring will occur at the frequencies identified in Table 6 and Table

23 All monitoring undertaken as a requirement of this Transitional Environmental Program must be undertaken in accordance with the administering authority's Water Sampling Manual.

Notification of emergencies, incidents and exceptions

24 As soon as practicable after becoming aware of any emergency or incident which results in the release of contaminants not in accordance, or reasonably expected to be not in accordance with the conditions of this Transitional Environmental Program, the administering authority must be notified of the release by telephone, facsimile or email.

25 The notification of emergencies or incidents must include but not be limited to the following:

a) the holder of the Transitional Environmental Program
b) the location of the emergency or incident
c) the number of the Transitional Environmental Program
d) the name and telephone number of the designated contact person
e) the time of the release
f) the time the holder of the Transitional Environmental Program became aware of the release
g) the suspected cause of the release
h) the environmental harm caused, threatened, or suspected to be caused by the release, and
i) actions taken to prevent any further release and mitigate any environmental harm caused by the release.

26 Not more than 10 business days following the initial notification of an emergency or incident, written advice must be provided of the information supplied to the administering authority in relation to:

a) proposed actions to prevent a recurrence of the emergency or incident, and
b) outcomes of actions taken at the time to prevent or minimise environmental harm.

Appendix A
ALS & Qld Health water sampling results

Client Reference	Collected Date	Received Date	Aluminium	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmiun	Chromium	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Molybdenum
			mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Isaac_2	14-Dec-10	17-Dec-10	3.8	< 0.0001	0.0011	0.076	< 0.0001	0.05	< 0.0001	0.0027	0.0011	0.003	1.7	0.0013	0.056	< 0.0001	0.0007
Discharge_Point	14-Dec-10	17-Dec-10	0.18	< 0.0001	0.0012	4.5	< 0.0001	1.1	< 0.0001	0.0003	0.0002	0.002	0.08	0.0004	0.0046	< 0.0001	0.0019
Pond_2a	16-Dec-10	17-Dec-10	0.1	< 0.0001	0.0015	6.1	< 0.0001	1	< 0.0001	0.0002	0.0003	0.001	0.066	< 0.0001	0.007	< 0.0001	0.0013
Pond_2	16-Dec-10	17-Dec-10	0.09	< 0.0001	0.0014	6	< 0.0001	1	< 0.0001	0.0002	0.0003	< 0.001	0.044	< 0.0001	0.0065	< 0.0001	0.0012
POND1_1	17-Dec-10	20-Dec-10	0.37	< 0.0001	0.0021	5.8	< 0.0001	1.5	< 0.0001	0.0008	0.0005	0.001	0.18	< 0.0001	0.0057	< 0.0001	0.0028
POND1_2	17-Dec-10	20-Dec-10	0.43	< 0.0001	0.0023	6	< 0.0001	1.5	< 0.0001	0.0008	0.0005	0.001	0.2	0.0002	0.0065	< 0.0001	0.0031
POND10_1	17-Dec-10	20-Dec-10	0.2	< 0.0001	0.0018	7.7	< 0.0001	1.7	< 0.0001	0.0003	0.0003	< 0.001	0.069	< 0.0001	0.0039	< 0.0001	0.0031
POND10_2	17-Dec-10	20-Dec-10	0.18	< 0.0001	0.0019	7.6	< 0.0001	1.7	< 0.0001	0.0003	0.0003	< 0.001	0.067	< 0.0001	0.0041	< 0.0001	0.0034

Client Reference	Collected Date	Received Date	Nickel	Selenium	Silver	Stroniu m	Thallium	Titani um	Uranium	Vanadium	Zinc	Benzen e	Toluene	Ethylbenzon e	Meta&Para-Xylenes	Ortho-Xylene
			mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Isaac_2	14-Dec-10	17-Dec-10	0.0031	< 0.0010	< 0.001	0.2	< 0.0001	0.14	0.0002	0.012	0.003	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Discharge_Point	14-Dec-10	17-Dec-10	0.0008	< 0.0010	< 0.001	7.3	< 0.0001	0.006	0.0003	0.0029	0.013	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Pond_2a	16-Dec-10	17-Dec-10	0.0012	< 0.0010	< 0.001	9.6	< 0.0001	0.003	0.0003	0.0051	0.006	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Pond_2	16-Dec-10	17-Dec-10	0.0011	< 0.0010	< 0.001	9.4	< 0.0001	0.002	0.0003	0.005	0.004	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
POND1_1	17-Dec-10	20-Dec-10	0.0008	< 0.0010	< 0.001	10	< 0.0001	0.017	0.0009	0.0059	0.004	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
POND1_2	17-Dec-10	20-Dec-10	0.0008	< 0.0010	< 0.001	11	< 0.0001	0.015	0.0009	0.0062	0.004	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
POND10_1	17-Dec-10	20-Dec-10	0.0005	< 0.0010	< 0.001	12	< 0.0001	0.026	0.0008	0.0071	0.005	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
POND10_2	17-Dec-10	20-Dec-10	0.0005	< 0.0010	< 0.001	12	< 0.0001	0.01	0.0007	0.0071	0.005	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1

ALS	21/12/2010	Sample	ID 1	DAM 1	DAM 10	DAM 4	DAM 3	D1	D2	DAM 5	DAM2	TRIP BLANK
			ID 2									
ES1025292	Results		Date Sampled	6/12/2010	6/12/2010	6/12/2010	6/12/2010	6/12/2010	6/12/2010	6/12/2010	6/12/2010	6/12/2010
Analyte	**CAS #**	**Units**	**LOR**	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER	WATER
EA005: pH												
pH Value		pH Unit	0.01	9.17	9.28	9.34	9.38	9.4	9.42	9.27	9.15	-
EA010P: Conductivity by PC Titrator												
Electrical Conductivity @ 25°C		µS/cm	1	12600	14000	16400	25900	25800	26100	10700	10600	-
EG020T: Total Metals by ICP-MS												
Arsenic	7440-38-2	mg/L	0.001	0.003	0.003	0.002	<0.001	0.004	0.004	<0.001	0.002	-
Barium	7440-39-3	mg/L	0.001	6.54	8.33	4.35	1.93	1.92	1.98	6.4	9.31	-
Beryllium	7440-41-7	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-
Cadmium	7440-43-9	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	-
Cobalt	7440-48-4	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	-
Chromium	7440-47-3	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	-
Copper	7440-50-8	mg/L	0.001	0.002	0.002	0.002	0.002	0.002	0.002	0.003	0.004	-
Manganese	7439-96-5	mg/L	0.001	0.008	0.003	0.002	0.001	0.001	0.003	0.002	0.038	-
Nickel	7440-02-0	mg/L	0.001	0.001	<0.001	0.001	0.002	0.002	0.002	<0.001	0.003	-
Lead	7439-92-1	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-
Vanadium	7440-62-2	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-
Zinc	7440-66-6	mg/L	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.008	-
EG035T: Total Recoverable Mercury by FIMS												
Mercury	7439-97-6	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	-
EK055G: Ammonia as N by Discrete Analyser												
Ammonia as N	7664-41-7	mg/L	0.01	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-
EK057G: Nitrite as N by Discrete Analyser												
Nitrite as N		mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-
EK058G: Nitrate as N by Discrete Analyser												
Nitrate as N	14797-55-8	mg/L	0.01	0.02	0.01	0.02	0.01	0.01	0.02	0.01	0.03	-
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser												
Nitrite + Nitrate as N		mg/L	0.01	0.02	0.01	0.02	0.01	0.01	0.02	0.01	0.03	-
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser												
Total Kjeldahl Nitrogen as N		mg/L	0.1	1.7	0.5	0.5	1	1.1	1	0.9	1.2	-
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser												
Total Nitrogen as N		mg/L	0.1	1.7	0.5	0.5	1	1.1	1	0.9	1.2	-
EK067G: Total Phosphorus as P by Discrete Analyser												
Total Phosphorus as P		mg/L	0.01	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-
EP080: BTEX												
Benzene	71-43-2	µg/L	1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Toluene	108-88-3	µg/L	2	<5	<5	<5	<5	<5	<5	<5	<5	<5
Ethylbenzene	100-41-4	µg/L	2	<2	<2	<2	<2	<2	<2	<2	<2	<2
meta- & para-Xylene	108-38-3 106-42-3	µg/L	2	<2	<2	<2	<2	<2	<2	<2	<2	<2
ortho-Xylene	95-47-6	µg/L	2	<2	<2	<2	<2	<2	<2	<2	<2	<2
EP080S: TPH(V)/BTEX Surrogates												
1.2-Dichloroethane-D4	17060-07-0	%	surrogate	113	111	103	112	105	110	110	106	106
Toluene-D8	2037-26-5	%	surrogate	110	106	103	109	105	106	107	103	102
4-Bromofluorobenzene	460-00-4	%	surrogate	106	99.7	97.9	104	97.1	98.6	101	97	101

Appendix B
Dilution calculation basis

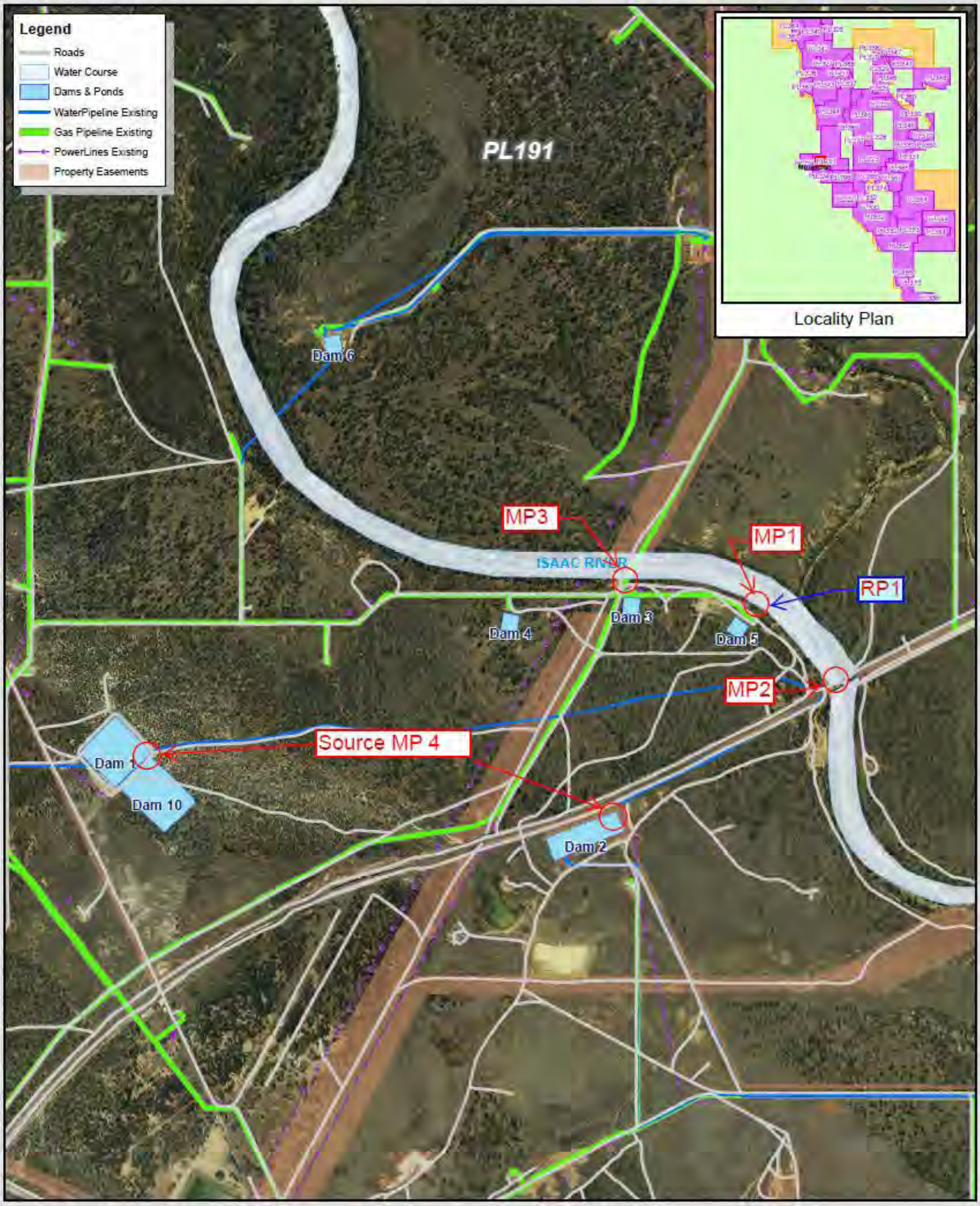
Table 10 Dilution calculation at 400:1 release

Parameter	Unit	Surface Water Concentration	Concentration of Discharge	Dilution X:1	Surface Concentration after dilution	Guideline[1]
EC	µs/cm	250	13000	400	282.5	746
Sodium	mg/L	65	2970	400	72.4	180
Chloride	mg/L	80	4280	400	90.7	250

[1] Australian drinking water guidelines (NHMRC,2004)
Sodium and Chloride based on EC, common soil quality (run off) and historical data from upstream

Appendix C
Mapping showing PL191 and location of key Dams

ARROW ENERGY - BOWEN BASIN GAS PROJECT



Moranbah Gas Project - Dam 5

Source:
Arrow Energy Limited
Geosciences Australia
Dept. Envir. and Resource Mgmt.

Date: 23/12/2010
Issued [redacted]
Auth

0 0.5 1
Kilometres
Scale: 1:19,762 @ A4
Coordinate System: GDA 1994 MGA Zone 55

N

arrow energy
go further

The dimensions, areas, number of lots, size & location of corridor information are approximate only and may vary.

NOT FOR CONSTRUCTION

Appendix D
Sampling Procedure

SUMMARY

1.1	This procedure outlines general sampling protocols and work practices to be followed during the sampling of surface water, during the discharge of untreated CSG well water to the Isaac River. This procedure includes details on: ▪ Sampling equipment requirements; ▪ Surface water sampling techniques; ▪ Quality control requirements. ▪ Sample locations (Figure 1) ▪ Analytical requirements

EQUIPMENT

2.1	▪ Documentation o Sampling and analysis plan. o Health and safety plan o Personal protective equipment (PPE) as identified in the HSP, inc. Life Jacket and other specialised PPE, as per the HSP. ▪ Water sampling equipment o sample collection device, (Swing Arm Sampler/extension sampler) o decontamination solution (e.g. Decon 90™) or use new sample collection container in the swing arm sampler at each location. o Calibrated water quality meter (ensure parameter ranges are suitable for the water being tested), o laboratory supplied sample containers, o Chilled ice chest. o Field sample Record Sheet o Chain of Custody Form (Attached).

3.0 REFERENCES & PROFORMA

3.1	▪ AS NZS 5667.1-1998 *Water quality - Sampling - Guidance on the design of sampling programs sampling techniques* ▪ AS NZS 5667.4-1998 *Water quality - Sampling - Guidance on sampling from lakes natural and man-made* ▪ AS NZS 5667.6-1998 *Water quality - Sampling - Guidance on sampling of rivers and streams* ▪ Monitoring and Sampling Manual 2009 Environmental Protection (Water) Policy 2009, *Monitoring and Sampling Manual 2009*, Version 2 September 2010

4.0 PROCEDURE

4.1	**Safety**
	Unless specifically required, the following general safety requirements should be noted: 1. Appropriate personal protective equipment should be worn as specified in the Health and Safety Plan (HSP). When working in or around water bodies, a life jacket is required to be worn and a minimum of two persons to be present should be assessed. 2. Assess hidden hazards (eg. trip hazards, snakes, leeches, etc.). 3. Assess risks from slippery or unstable banks. 4. Assess whether the water body / drain may constitute a confined space. 5. Assess the likelihood that surface conditions within and around the water body may change rapidly in the event of heavy rainfall or tidal change.

4.2	**Sampling**
	1. The sampling frequency during and following discharge to the Isaac River shall be as follows: • daily during discharge; and • daily for two days following discharge stopping. 2. The sampling sequence should commence where the lowest likely contaminant concentrations are expected (e.g. downstream and work upstream), to reduce the risk of cross contamination between samples. On this basis, the samples shall be collected at the following locations (in order): (See **Figure 1** for sampling locations) I. **River crossing** (upstream), (One **primary sample (S1)**, plus **one duplicate sample (QC1)**) II. **Blair Athol Bridge** (downstream), One **primary sample (S2)**, plus **one duplicate sample (QC2)**) III. At the **Discharge Point**, One **primary sample (S3)**, plus **one duplicate sample (QC3)**) IV. At the **Source (Dam)** One **primary sample (S4)**, plus **one duplicate sample (QC4)**) V. QC samples – Field/Trip Blank **(QC5)** and rinsate blank **(QC6)** (if required) 3. At each location, a water sample should be collected for standard field parameters using a calibrated water quality meter. The following parameters should be recorded: a. pH, b. conductivity, c. dissolved oxygen, d. redox potential, e. temperature and f. turbidity. Notes: • Follow the manufacturer's instructions for use and calibration of instruments to measure water parameters. A calibration record must be kept. • When recording dissolved oxygen readings, it is important to note whether the results are reported as % saturation or ppm. • With conductivity, record whether units are mS or µS.

4. Based on the nature of the sampling locations, heterogeneous distribution of potential contaminants in the water samples is considered likely. Therefore, the following Quality Control Samples should be collected and analysed for this program:
    a. One duplicate sample per sample location for TPH, BTEX and 8 Metals analysis **(QC1 – QC4).**
    b. One Blank Sample per esky (laboratory prepared DI Water for TPH (C6 – C9) and BTEX analysis) **(QC5)**.
5. One rinsate sample per day (unless using new sample collection medium between sample locations i.e. a new container in the swing arm sampler) for TPH (C6 – C9) and BTEX analysis) **(QC6)**.
6. At each location sample bottles should be filled based on a decreasing order of potential volatility (i.e. VOCs, BTEX and TPH first, followed by metals and other inorganic samples).
7. Note: **DO NOT** field filter samples for total metals. Perform field filtering for dissolved metals samples only.
8. When sampling shallow waters, contamination from bottom sediments should be avoided. Samples should be collected by submerging a clean sample collection container (up-side down) into the water and to approximately 100mm below the surface, rotate the container to allow it to fill.
9. The sampling location should be as representative as possible of the event being monitored. i.e. do not sample stagnant water at the edge, attempt to sample .
10. Record the appearance of the water body, i.e. colour, turbidity, odour, surface crusts, films or floating material, algae, water velocity, etc. In addition, record the weather conditions at the time of sampling and note any other relevant observations, e.g. dead or distressed flora/fauna, surface rubbish, spills, etc.
11. All measurements and field notes should be documented on the field sheet (**Attachment A**)

5.0 ANALYTICAL/SAMPLE CONTAINER REQUIREMENTS

5.1	1. The analytical suite includes the following: a. pH, EC, TDS, Turbidity b. Ions: Magnesium, Calcium, Sodium, Sulphate, Chloride, Ammonia, Nitrate, Fluoride (total). c. Metals, Aluminium, Arsenic, Cadmium, Chromium, Copper, Iron, Lead, Mercury, Nickel, Zinc, Boron, Cobalt, Manganese, Molybdenum, Selenium, Silver, Uranium, Vanadium. d. Organics: BTEX, PAH, TPH 2. Each Sample Requires the following containers: a. 60ml Plastic Bottle for metals (with red and green striped label border) (tick ‘Total Metals’) b. 500ml Plastic Bottle for anions/cations (with green label border) c. 250ml Amber Glass Bottle (with purple label border) d. One pair of BTEX vials (40 mL glass cylindrical containers with purple label border).
	Notes: • The selection of sample containers depends on the laboratories being used. The above list is based on ALS requirements only. When ultra trace analysis is being requested, additional sample volume may be required. Always check with the laboratory prior to submitting samples to the laboratory. • When filling the vials it is important that they are filled to the top with no air space remaining. • Use new sample gloves between sample locations.
5.2	1. Place samples immediately in a chilled ice chest 2. Complete sample request form and include in sealed bag in the cooler 3. Courier samples to the receiving laboratory.

12 **Surface Water Sampling** **Form**

Site			Sampling Method:	
Job Number			Local Air Temperature:	
Date:	Time:		Wind Force:	
Weather:		Cloudiness %	Direction of Wind:	

Location	**Sample No.**	**Water Flow (l/s)**	**Field Readings**				**Depth (m)**	**Comments: including turbidity (plankton and/or sediment), colour, water plants, weather conditions, etc**
			pH	**Conductivity**	**Temperature**	**Dissolved Oxygen**		

Comments concerning treatment of samples, especially preservation:

Name: **Signed:** **Project Manager:** adapted from AS 5667.4

Analytes

Quality characteristic	
pH	
EC	Ammonia
Turbidity	Nitrate
Magnesium	Fluoride (total)
Calcium	BTEX
Sodium	PAH
Sulphate	TPH
Chloride	
Aluminium	
Arsenic	
Cadmium	
Chromium	
Copper	
Iron	
Lead	
Mercury	
Nickel	
Zinc	
Boron	
Cobalt	
Manganese	
Molybdenum	
Selenium	
Silver	
Uranium	
Vanadium	

Appendix E
URS Dam 2 Assessment

Department of Environment
and Resource Management

Notice

Environmental Protection Act

Decision to grant an approval for a draft transitional environmental program

This statutory notice is issued by the administering authority pursuant to section 340 of the Environmental Protection Act 1994, *to advise you of a decision or action.*

Your reference :
Our reference : CH4 Moranbah TEP

[redacted]
CH4 Pty Ltd
AM-60
42 Albert Street
Brisbane QLD 4000

Attention: [redacted]

Re: Application for an approval for a transitional environmental program for management and release of produced coal seam gas water at the Moranbah Gas Project site located on tenures PL191 and PL196.

Thank you for your application for an approval for a transitional environmental program.

Your application, which was received by this office on 23 December 2010, has been approved.

A copy of the certificate of approval is attached.

Fees apply for the assessment of a draft transitional environmental program and any subsequent annual returns. The fees are outlined in the attached operational policy *Transitional Environmental Program (TEP) fees.*

The Department will calculate this fee and invoice CH4 Pty Ltd during February 2011.

Decision notice regarding a transitional environmental program

Should you have any queries in relation to this notice, contact Rod Kent of the Department of Environment and Resource Management on telephone [redacted].

[redacted]	4/02/2011
SIGNATURE	DATE

[redacted]
Manager Coal Seam Gas Assessment
Department of Environment and Resource Management
Delegate of the administering authority
Environmental Protection Act 1994

Enquiries:
Department of Environment and Resource Management
GPO Box 2454
BRISBANE QLD 4001
Pho[redacted]
Fax:[redacted]

28 March 2010

Ref: ENV11-043

[redacted]
Environmental Officer
Department of Environment & Resource Management
(sent via email 28 March 2010)

RE: Discharge notification

Dear Jamal

I am writing on the behalf of Arrow Energy Limited to request an extension to objective 4 in the TEP relating to Moranbah PL191/196 granted 4 February 2011 (under EA PEN100015907 grated 14th September 2010).

Current Dam levels

Dam 10 is at MRL
Dam 2 is currently 1435mm below MRL – the target level is to be <4000mm
Dam 1 is 120mm below MRL
Dam 5 is 2550mm below MRL

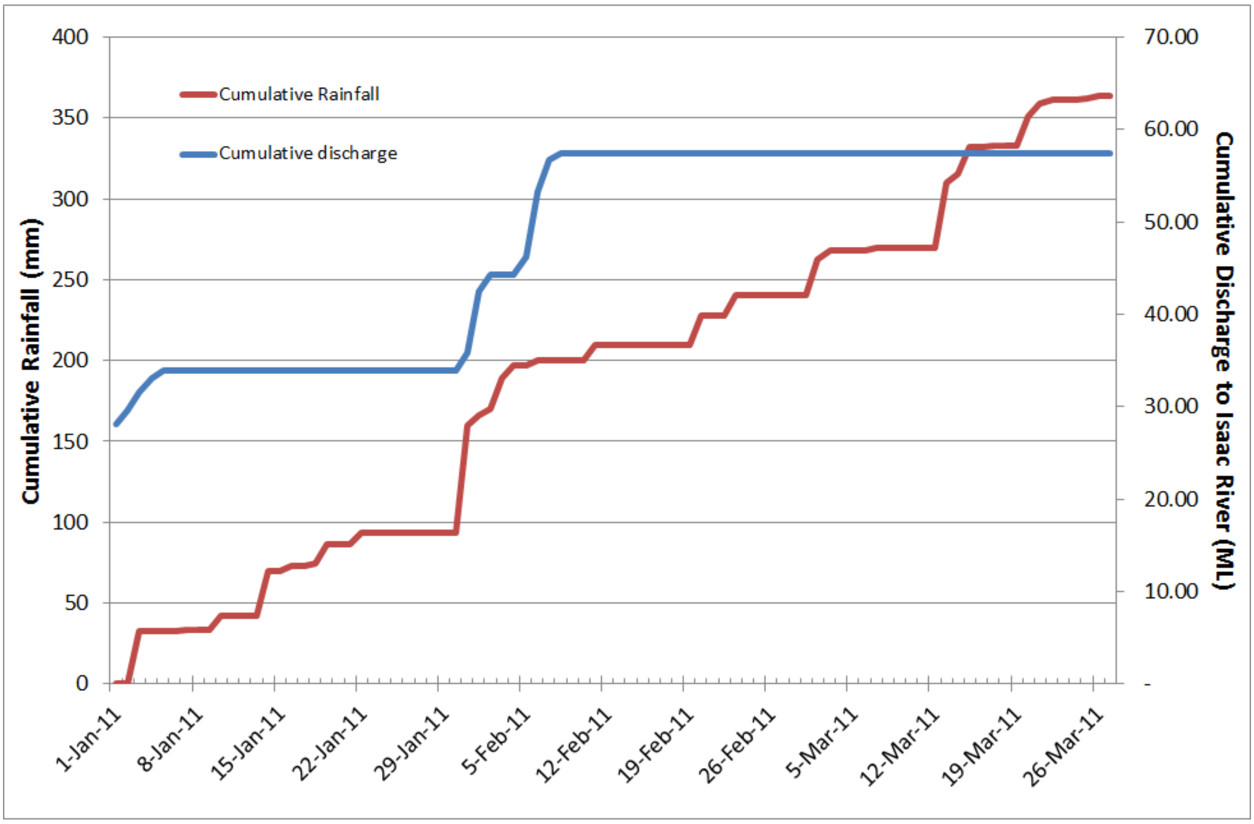


Figure 1 Cumulative rainfall to date Moranbah treatment plant (BOM station 034038)

Discharge details
In complying with the flow and dilution constraints within the TEP approximately 57.5 ML has been discharged to date (refer to blue line in Figure 1) during two major discharge events (commencing late December and late January) , from the facility under this TEP against projections of approximately 200ML based on mean rainfall. Rainfall has continued to fall at the Moranbah site over February and March but not in the upstream Isaac catchment adding to dam levels but not contributing to flow in the Isaac River.

The solution to managing our water in the medium term remains the completion of Dam 11. We have sufficient storage available to operate the facility under dry conditions. Arrow wishes to maintain the authorisation to discharge as a contingency in the event of heavy rainfall. At present the TEP conditions regarding flows in the Isaac River and dilution requirement prevent discharge under other circumstances.

Dam 11 progress
Work on Dam 11 has been delayed by intermittent rainfall over the past two months which has prevented the finalisation of the HDPE lining. Dam 11 is currently projected for completion in late April but is dependent upon weather conditions. We require long spell of relatively dry weather to finalise the HDPE lining installation. The figure above shows the significant rainfall events since the start of this year have been frequent and contributed to delays.

Alternatives
The situation regarding available alternative water disposal options remains largely unchanged as described by the TEP until Dam 11 in completed. At this stage the only practical alternative is discharge to the Isaac River.

Regards,

[redacted]

Ben McMahon
Manager Compliance & Reporting

Queensland Health comments on Arrow TEP for its Moranbah gas field

The following are our comments on the draft TEP for Arrow Energy's Moranbah Gas Project. We are not able to endorse the TEP, as we do not have enough information to adequately characterise the risk to public health from the cumulative impacts of CSG water and releases of other coal-impacted water, nor to assess the contribution from Arrow Energy. However, we believe that the current flow rates in the Isaac River provide a significant opportunity to release CSG water from the Moranbah with lower impact than would arise once flows diminish, and we do not wish to see the TEP unnecessarily delayed.

Flow and discharge rates

- Based on the information given on p.4, which states: "Arrow proposes a discharge of up to 7.5 ML/day to commence when the Isaac River is at least 1090 m3/day measured upstream at the Goonyella river gauge (operated by DERM). Discharge will be maintained at a 400:1 dilution ratio on the basis of maintaining Australian drinking water guidelines (NHMRC 2004) downstream of the discharge."
- The units on the flow rate are incorrect, and should be ML/day as stated elsewhere in the document.
- Our reading of this is that they can start releasing when river is at 1090 ML/day upstream, and continue to release at a dilution ratio of 400:1, up to a maximum of 7.5 ML/day, providing other parameters are within limits.
- To maintain the release rate of 7.5 ML/day, the flow rate in the river needs to be around 3000 ML/day.
- At a flow rate around 1090 ML/day, and a dilution of 400:1, only around 2.5 ML/day could be released.
- Condition 22 of the TEP states that release will cease if Isaac River flow falls below 11.5 m^3/sec at Goonyella Gauging Station. Is this based on hourly data? Otherwise it should be the same as the flow rate for commencement of discharge, and expressed in the same units.
- 14 day flow rates for Isaac at Goonyella (ML/day) (note that no flow information was temporarily unavailable online on Monday 3/1/11)

3	3551
2	2119
1	2656
31	4272
30	6680
29	6738
28	334400
27	8415
26	15316
25	8469
24	6285
23	1477
22	2538

21	4809

Other Limits:

- Electrical conductivity. We note that in the data we have received so far, this proposed limit (13,000 µS/cm) is exceeded in some dams. We understand that the intention is to shandy the water to meet this release condition. In this situation, the EC in the dam being used for the shandying should probably be monitored more frequently (e.g. 6 hourly).
- We consider that conductivity should also be monitored at MP2 and MP3.

	Electrical Conductivity @ 25°CµS/cm
DAM 1	12600
DAM 10	14000
DAM 4	16400
DAM 3	25900
D1	25800
D2	26100
DAM 5	10700
DAM2	10600

Arsenic, Manganese and Fluoride,

- The values in Table 7 are based on the ANZGFMW for 95 percentile species protection. The values for three chemicals – arsenic, manganese and fluoride are higher than the ADWG values. We consider that the lower ADWG values should be substituted for these chemicals;

Chemical	ADWG (µg/L)	ANZGFMW (µg/L)
Arsenic	10	13
Manganese	500	1900
Fluoride	1500	2000

Sodium and Chloride

- There does not appear to be any data provided for concentrations of these parameters.

Conditions:

We suggest that the response to breaches of release limits in condition 5 b ii for contaminants in Table 7 should be the same as for Table 6 (i.e. cessation of discharge). Results for parameters listed in Table 6, mostly on-site or bench-top tests are generally available daily. Samples for parameters in Table 7 are taken weekly, require wet chemistry and QHFSS, and may take one week to process. Therefore, an exceedance may have been occurring for several days before being detected. It is not appropriate therefore to wait a further 20 days for a written report before ceasing discharge.

- On page 9, Table 7, change ‘trigger investigation levels’ to ‘cease discharge levels’
- On page 10, condition 3, should also apply to Table 7.
- On page 11, condition 5 b ii should include that the discharge should cease pending the written report.

Prevention of catastrophic failure

Notwithstanding any of the above, if any action taken by the company to comply with the TEP results in an unacceptable risk of catastrophic failure of one of their dams, the company should ensure that the risk of failure is given priority over compliance with discharge limits. Queensland Health believes that catastrophic failure of a storage dam is a greater risk to public health and safety than minor exceedances of long term health values so Arrow's risk management approach should reflect this.

From: [redacted]
Sent: Friday, 7 January 2011 11:25 AM
To [redacted]
Cc: [redacted]
Subject: RE: Fw: Revised draft TEP for MGP

[redacted]

Yes we would like to have sodium and chloride included in the monitoring shown in Table 7, and we would also like to have levels for these parameters from any of the ponds they are discharging directly from.

[redacted]

Dr. [redacted]
Director, Water Quality Unit
Environmental Health Branch
Queensland Health
Ph. (07) [redacted]
Fax (07) [redacted]
Mob. 0402-898-651
[redacted]
http://www.health.qld.gov.au/
Level 1, Building 1
Corporate Office Facility (CHO)
15 Butterfield Street,
Herston, 4029
PO Box 2368, Fortitude Valley BC, 4006

>>> [redacted] <[redacted]> 6/01/2011 2:10 pm >>>

[redacted]

Thanks for these comments. We are currently collating them with those from [redacted]

I note your comment that no data on sodium and chloride have been provided for any dams.

From your view would you please advise if this data must be obtained before any TEP assessment is finalised?

I note your comments that Q Health does not wish to see the approval of the TEP unnecessarily delayed. In this regard the lack of a TEP has not prevented Arrow from discharging in breach of their EA since the 20 December (an enforcement issue which will be later investigated), so if there is a need to obtain further lab data (which we would ordinarily require of another operator) I have no concerns seeking further information prior to approving the TEP.

At this stage any TEP that is approved for Arrow will only relate to discharge of water from their dams which we have seen water quality data we are satisfied with – hence my question about sodium and chloride.

No data has been provided by Arrow for dams 6 and 7 so releases from these dams (which have likely occurred under their pumping and unauthorised discharge since 20 Dec) will not be authorised under the TEP unless certified data is received.

Regards

[redacted]

From: [redacted] [mailto:GregP[redacted]
Sent: Tuesday, 4 January 2011 4:51 PM
To: [redacted]
Cc: [redacted]
Subject: Re: Fw: Revised draft TEP for MGP

[redacted]
Here are our comments. They include comments from [redacted] and [redacted] in Central Qld.

Regards

[redacted]

Dr. [redacted]
Director, Water Quality Unit
Environmental Health Branch
Queensland Health
Ph. (07) 3328 9345
Fax (07) 3328 9354
Mob. [redacted] 98-651
[redacted]
http://www.health.qld.gov.au/
Level 1, Building 1
Corporate Office Facility (CHO)
15 Butterfield Street,
Herston, 4029

PO Box 2368, Fortitude Valley BC, 4006

>>> [redacted] <[redacted].qld.gov.au> 2/01/2011 11:09 am >>>
Hi all - this has been resubmitted. Given arrow have been discharging since the week before xmas unauthorised I have questions for them around volumes discharged and their current sampling results/ mixing etc. In the interim please look over the document and provide comments back to me. I will be in contact tues 4th to arrange meeting if needed on wed 5.

Regards

----- Original Message -----
From: Ben McMahon <bmcmahon[redacted]>
To: jamal.alam.[redacted] <jamal.alam.[redacted]d[redacted] [redacted]
<ccollins[redacted]; Tim Dean <tdean[redacted]>[redacted]
<bwilson[redacted]>
Cc: [redacted] <jhoch[redacted]; [redacted] mgordo[redacted]>
Sent: Fri Dec 31 16:20:59 2010
Subject: Revised draft TEP for MGP

Hi [redacted]

I hope that you have had a good Christmas break and are enjoying the sunshine.

Please find attached a revised TEP in relation to the MGP.

I have put together a table of comments provided so far from DERM with Arrow responses. Hopefully this makes everything clear but if you have any further queries please do not hesitate to contact me.

Best regards

[redacted]

DERM comment Arrow Response
1 Our modelling has shown that given other discharges Arrows discharge should not commence until a Min flow of 1090ML/day is reached. The value has been increased to 1090ML/day.
2 Table 1 - the footnotes b and c are not used in the table?. Corrected to refer to appropriate table items
3 ALS sample results show Dam 3 at 25 900 ec, D1 (what is this?) at 25 800ec and D2 (again what is this?) at 26 100ec. My question is will water from these dams be pumped to where they will be discharged?? If so how will Arrow ensure that EC levels are appropriate at discharge point? How will the 'shandy' mix be made to ensure EC limits are met given dams are linked.? Is this where the EC of 13000 as release limit came from? D1 and D2 are duplicates of Dam 3. If required this dam would be transferred to Dam 10 prior to discharge of a shandy mix. If this was to take place this would be managed by monitoring of discharge and dam 10 salinity levels
4 Page 4 para 1 states '1000m3/day', then table 8 refers to '11.5m3/sec' which is stated as equal to '1000ML/day' in the table footnote - please use consistent terminology through out for flow Terminology has been updated to be consistent throughout and to reflect the DERM modelling as described in

comment 1
5 What is DSA for older and less accessible dams? Only dams 1,2 and 10 are listed in TEP. Are you also using water from other dams for release?? These dams are connected to dam 1, 2 and 10 via a network of pipes. Coal Seam Water and rainwater is transferred continuously from these dams to the major storage dams. The major storage dams 1,2 and 10 contain water transferred via these dams. This influent water is covered by the discharge monitoring requirements of this TEP
6 Include an Objective re discharge linked to table 1 (volume to discharge) and/or table 2 discharge scenarios - note the volumes are different. Which volume is be sought for discharge under TEP?? Only from 1,2 or 10 as shown in table 1 or from all dams as alluded by Table 2 - if all dams my point about water quality changes is important. Table 2 indicates total volume is 69ML plus 7ML (pond 2 extra) so I assume total approval is sought for 76ML discharge under TEP??? The objectives have been updated, volumes sort have been cleared (table 2), water quality will be managed by regular sampling at the discharge point
7 Number all objectives for ease of reference Objectives have been numbered
8 Objective re monitoring and monitoring submissions - link to your table and commit to timeframes for getting results to DERM - 10BD should be achievable Added to objectives
9 Objective for final report submission - should be a reasonable timeframe Added to objectives
10 Objective re Final discharge date or prediction? Added to objectives
11 Objective re reporting back on samples in 10bd - ALS delays is not a reasonable excuse to not meet this . Added to objectives (objective 2) ALS comment noted
12 Objectives re dam 11 not needed under TEP and should be removed. Approval already exists to construct dam 11. The unapproved clearing cannot be authorised long term under a TEP. DERM has determined that the veg type was such that if Arrow had of applied at the time, approval would have been granted to clear this veg. I recommend dam 11 be included in background to TEP but not in objectives/conditions. Arrow can apply for amendment in 2011 to authorise use of cleared area. PIN may still result for original technical breach of the clearing though. Arrows recent response will be considered. Dam 11 objective removed. Arrow has been unclear as to the mechanism for the EA amendment to authorise use of cleared area. The original reason for inclusion was in response to DERM correspondence to cease activity in the area north of Dam 11 can DERM issue formal advise regarding this comment. PIN status noted
13 Table 5 - include easting and northings in table Table updated
14 Table 6 - these should be listed also BTEX list at no detect levels or drinking water guideline value. Other contaminants may need to be included here such as fluoride, sodium - further advice is coming from Office of water supply/Q Health on this
15 Table 7 and list of analytes to be consistent. This list should be broader rather than narrower. If you test for it there should be a link to a trigger. Table 7 is based on the list supplied to Arrow by DERM on the 10 December. Analyses in the procedure include these analytes. If there is addition lab work required we need specific guidance since this is our current understanding of the sampling requirement
16 Table 7 - isn't MP1 end of pipe? If so how will triggers be met?? Should MP1 be deleted? Yes our understanding is that condition 5 is based on release comparison with trigger values, where values exceed there is then a comparison of upstream and downstream monitoring values. In effect we are doubling up on sampling by sampling the discharge and the content of the dams to be discharged
17 Table 8 - flow rate needs to be consistent. Given column heading no need for => reference Changed to be consistent
18 Condition 5b - rather than background sites, just list the points as referred to in table 5 for clarity Changed as suggested
19 Condition 5b (ii) point 2 - report to be submitted 20bd after final release. Changed to 20 bd after gaining result

20 Condition 6 - there is no 5a(ii) (2). Do you mean 5b?? Yes there was a slight change in numbering which has been corrected
21 Condition 7 - use consistent flow rate as stated above. Updated to be consistent
22 Condition 9 - uses 0.25% but elsewhere you use 400 to one. For consistency please use either ratio or percentage not both Updated to be consistent
23 Condition 11 states daily max flow is 7.5ML. Please amend to include total release modelled - i.e. my point above about 69ML plus 7ML (pond 2 extra) what is max volume sought?? The maximum volume is described in table 2
24 Condition 12 and 13 - notification should be via our 1300 number. Emails should also be sent to me. Noted - this is consistent with the requirements of our EA and current practice
25 Condition 14 - 28 days is too long for these details be submitted in writing. You should be able to arrange for a lab to turn around samples in 10BD, so this should be able to be submitted to DERM in 15bd. Changed again these were the conditions as supplied to Arrow from DERM
26 Condition 16 - should be 10bd as if there is monitoring and it shows the exceedence then you already have and don't need to wait for samples Noted
27 Condition 21 - consistent flow term pls Updated to be consistent
28 Condition 27 - change to BD is you change other day refs to BD.

Ben McMahon
Manager Compliance & Reporting

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Final TEP Report PEN100015907

B	*06/06/2011*	*WATER QUALITY SAMPLING MANUAL*	*GC*	*JH*	*GC*
Rev	Date	**Water Quality Sampling Specifications**	PREPARED	CHECKED	APPROVED

REPORT

TRANSITIONAL ENVIRONMENTAL PROGRAM UNDER SECTION 333 OF THE ENVIRONMENTAL PROTECTION ACT 1994

Principal Holder: CH4 Pty Ltd

AM-60

Level 19

42 Albert Street

Brisbane QLD 4000

EA Number: PEN100015907

Title: Coal Seam Water Management Moranbah Gas Project

Project: Moranbah Gas Project – PL191/196

Date: 10 January 2011

Finish Date: 31 May 2011

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Attachments

1 INTRODUCTION

This TEP was applied for on the basis that the Moranbah Gas Project lacked sufficient water storage capacity due to an extended wet season, which contributed to raising dam levels to above the design storage allowance (DSA) and causing delays in the construction of a new large, fully lined Dam (Dam 11). Consequently, Arrow was put in a position where it did not comply with the current EA conditions and were forced to assess options for emergency dam management control.

Arrow applied for this transitional environmental program (TEP) as defined in Chapter 7, Part 4 of the Environmental Protection Act 1994 to bring the operation at the MGP back into compliance with its Environmental Authority.

This report is intended to provide the Department of Environment and Resource Management (DERM) with the details of how the objectives of the TEP have been met.

1.1 Objectives

The objective of the TEP was to achieve compliance with the Environmental Authority with respect to coal seam water management and dam standards. To achieve this objective, short term release of untreated CSG water to the Isaac River was required. This measure was undertaken to protect the integrity of the existing storage infrastructure and was consistent with the operational philosophy that the existing infrastructure was designed to accommodate.

In the medium term, compliance with the new EA was to also be achieved by completing the construction of Dam 11.

In the long term, compliance with our EA will be achieved by completion of water treatment facilities that allow beneficial use and disposal within Arrows Environmental Authority conditions. Arrow will provide DERM with a detailed plan concerning future water management for approval.

The detailed objectives of the TEP are provided in the following Table (**Table 1**) with further reference to Tables 2 – 7.

Table 1 –TEP Objectives

OBJECTIVE	ACTION	RESPONSIBILITY	TIME FRAME	PERFORMANCE INDICATOR
1. Lower dam levels for (dams 1, 2, 5, 10) to below the 'Target dam fill height" (as shown in Table 2 below).	Manage via discharge (RP1) to Isaac river	Arrow site personnel	Immediate	Manage dams within appropriate levels as detailed in Tables 2 and 3 below. Discharge was to be subject to monitoring and reporting requirements as fulfilled throughout the monitoring program.
2. Monitor Discharge	Monitor discharge in accordance with at the locations detailed in Table 4 and 5, for the contaminants listed in Table 6 and Table 7	Arrow site personnel	During discharge	Lab results to be reported to DERM within 10 business days of collection.

OBJECTIVE	ACTION	RESPONSIBILITY	TIME FRAME	PERFORMANCE INDICATOR
3. Pond 2	Develop management plan to restore dam integrity or remove from service	Arrow	15 March 2010	Submission of management plan to DERM
4. Cease discharge	Cease discharge to Isaac river under TEP	Arrow	31 March 2011 (extended)	Cease discharge to Isaac river
5. TEP report submission	Provide DERM with final TEP report detailing how the objectives of this TEP have been met	Arrow	31 May 2011	Submission of TEP report to DERM

Table 2 Key Dam Variables Dams 1, 2, 5 and 10

Dam		1	2	5	10
Volume at Spill level	ML	119.66	92.64	7.64	203.70
Spillway		No	No	No	Yes
Liner type		CCL	CCL	0.5mm HDPE	1.5mm HDPE
Hydraulic height	m	5.60	5.50	3.5	4.75
MRL	m	5.25	5.15	3.15	4.40
DSA	m	4.75	4.65	2.65	3.90
Target dam fill height [b]	m	4.75	0.65	2.65	3.90

[b] Target dam fill height is DSA for dams 1 and 10, 4m below DSA for dam 2. Current target height for dam 2 is based on 3rd party civil engineering assessment completed by URS.

Table 3 Discharge scenarios

Scenario	**Volume to reach DSA (ML)**	**Additional removal from Dam 2 (ML)** [b]	**Expected Net** [a] **Water to Storage (ML)**	**Total (ML)**
Mean Rainfall	69	75	54.5	198.5
95th Percentile	69	75	130	274

[a] Net water to storage is produced water, less evaporation plus expected rainfall.

[b] This is based on a dam 2 target of 4000mm below DSA.

Table 4 Contaminant release points, sources and receiving waters

Release point (TEP RP)	Easting (GDA94)	Northing (GDA94)	Contaminant source and location	Monitoring point	Receiving waters
TEP RP 1	148° 2' 35"	-21° 57' 41"	untreated CSG water from PL191/196	Discharge point – end of pipe	Isaac River – Dam 5 discharge point
				Upstream from discharge – Isaac River Crossing	
				Downstream from discharge – Blair Athol Bridge	

Table 5 Contaminant release monitoring points

Monitoring point (TEP MP)	Easting (GDA94)	Northing (GDA94)	Contaminant source and location	Monitoring point location	Receiving waters
TEP MP 1	148° 2' 35"	-21° 57' 41"	Untreated CSG water from PL191	Discharge point – end of pipe	Isaac River – Dam 5 discharge point
TEP MP 2	148° 2' 46"	-21° 57' 55"	Downstream from discharge – Blair Athol Bridge	Blair Athol Railway Bridge	
TEP MP 3	148° 2' 20"	-21° 57' 41"	Upstream from discharge	Isaac River Crossing	

Table 6 Contaminant release limits

<table>
<tr><th>Quality characteristic</th><th>Release Limit</th><th>Monitoring Frequency</th><th>Sample Type</th><th>Monitoring Point</th></tr>
<tr><td rowspan="2">Electrical conductivity (uS/cm)</td><td rowspan="2">13000</td><td rowspan="2">Daily during release (the first sample must be taken within 2 hours of commencement of release)</td><td>In situ[1]</td><td>TEP MP 1</td></tr>
<tr><td>Samples require laboratory analysis[2]</td><td>TEP MP 1</td></tr>
<tr><td rowspan="6">pH (pH Unit)</td><td rowspan="6">6.5 (minimum)
9.5 (maximum)</td><td rowspan="6">Daily during release (the first sample must be taken within 2 hours of commencement of release)</td><td rowspan="3">In situ[1]</td><td>TEP MP 1</td></tr>
<tr><td>TEP MP 2</td></tr>
<tr><td>TEP MP 3</td></tr>
<tr><td rowspan="3">Samples require laboratory analysis[2]</td><td>TEP MP 1</td></tr>
<tr><td>TEP MP 2</td></tr>
<tr><td>TEP MP 3</td></tr>
<tr><td rowspan="3">Turbidity (NTU)</td><td rowspan="3">500</td><td rowspan="3">Daily during release (the first sample must be taken within 2 hours of commencement of release)</td><td rowspan="3">Samples require laboratory analysis[2]</td><td>TEP MP 1</td></tr>
<tr><td>TEP MP 2</td></tr>
<tr><td>TEP MP 3</td></tr>
<tr><td rowspan="3">BTEX
Benzene, Ethylbenzene, Toluene and Xylene (mg/L)</td><td rowspan="3">Benzene 0.001
Ethylbenzene 0.3
Toluene 0.8
Xylene 0.02</td><td rowspan="3">Daily during release (the first sample must be taken within 2 hours of commencement of release)</td><td rowspan="3">Samples require laboratory analysis[2]</td><td>TEP MP 1</td></tr>
<tr><td>TEP MP 2</td></tr>
<tr><td>TEP MP 3</td></tr>
</table>

[1] *In situ samples can be taken using electronic sampling equipment.*

[2] *Samples are required to be analysed at a NATA accredited facility in accordance with the Transitional Environmental Program.*

Table 7 Downstream contaminant trigger investigation levels

Quality characteristic	Trigger levels (µg/L)	Monitoring frequency	Monitoring Point
Aluminium	55	Commencement of release and thereafter weekly during release	TEP MP 2 TEP MP 3
Arsenic	13		
Cadmium	0.2		
Chromium	1.0		
Copper	2.0		
Iron	300		
Lead	10		
Mercury	0.2		
Nickel	11		
Zinc	8.0		
Boron	370		
Cobalt	90		
Manganese	1900		
Molybdenum	34		
Selenium	10		
Silver	1.0		
Uranium	1.0		
Vanadium	10		
Ammonia	900		
Nitrate	1100		
Petroleum hydrocarbons (C6-C9)	20		
Petroleum hydrocarbons (C10-C36)	100		
Fluoride (total)	2000		

2 TEP CONDITIONS -

A total of 29 conditions were included in the TEP, under the following headings:

- Undertaking the release of untreated coal seam methane water (6 Conditions).
- Contaminant Release Events (6 Conditions)
- Notification of Release Events (3 Conditions)
- Notification of release event exceedence (2 Conditions)
- Requirements to cease the release of coal seam water (5 Conditions)
- Monitoring Requirements (3 Conditions)
- Notification of emergencies, incidents and exceptions (3 Conditions)

The following is a brief description of Arrow met each condition of the TEP.

1 Contaminants that will, or have the potential to cause environmental harm must not be released directly or indirectly released to any waters except as permitted under the Transitional Environmental Approval.

The results of the sampling and analysis program were released to DERM as soon as possible following the release of the results from the analysing laboratory. All results were assessed against the released limits and reported to DERM.

2 The release of contaminants to waters must only occur from the release point specified in Table 4 and depicted in Appendix C attached to the Transitional Environmental Program.

The release point remained consistent throughout all release events.

3 The release of contaminants to waters must not exceed the release limits stated in Table 6 at the monitoring points specified in Table 5 and Table 6 of this Transitional Environmental Program.

All results were assessed against the released limits and background water quality and reported to DERM.

4 The release of contaminants to waters from the release points must be monitored at the locations specified in Table 5 Table 5and Table 6 (of the TEP) for each quality characteristic and at the frequency specified in

Table 7Table 7 and Table 8 of the Transitional Environmental Program.

Monitoring was undertaken for the duration of the release events. Initially, monitoring was subject to the availability of sample collection medium, however, once the draft TEP was finalised, appropriate equipment was made available for the sampling and analysis program. The laboratory has released a letter describing difficulties in getting sample collection equipment to the site during the time that areas of Queensland was subject to flooding (Attachment A: Laboratory Correspondence). Results tables are attached.

5 If quality characteristics of the release exceed any of the trigger levels specified in Table 7 during a release event, the Transitional Environmental Program holder must compare MP2 to the trigger values specified in Table 7 and:

a) where the trigger values are not exceeded then no action is to be taken

b) where the downstream results exceed the trigger values specified Table 7 for any quality characteristic, compare the results of the downstream site to the data from the upstream monitoring sites (MP3)

   i) if the result is less than that recorded at Monitoring Point 3 (MP3), then no action is to be taken or

   ii) if the result is greater than the background monitoring site data, complete an investigation in accordance with the ANZECC & ARMCANZ 2000 methodology, into the potential for environmental harm and provide a written report 20 business days after receiving results, outlining

   - details of the investigations carried out
   - actions taken to prevent environmental harm.

Ongoing assessment of the results was undertaken for the duration of the program. A brief summary report was provided to DERM on Tuesday 8 March 2011 via email, formalising discussions around the reported results.

6 If an exceedance in accordance with condition 5(b)(ii) is identified, the holder of the Transitional Environmental Program must notify the administering authority within 24 hours of receiving the result. The notification must include written verification of the exceedance forwarded to the administering authority.

The results of the sampling and analysis program were released to DERM as soon as possible following the release of the results from the analysing laboratory. All results were assessed against the released limits and reported to DERM.

7 The release of coal seam water will not occur until flow in the Isaac River flow reaches 1090 ML/day (at Goonyella Gauging Station).

The Goonyella Gauging Station was monitored closely during all release events. At no time did discharge occur when the Issac River was reported to be flowing at less than 1090 ML/day. Discharge rates were altered pending water flow in the Isaac.

8 Notwithstanding any other condition of this Transitional Environmental Program, the release of contaminants to waters must only take place during periods of natural flow events specified as minimum flow in the Table for the contaminant release point(s) specified in Table 4.

The Goonyella Gauging Station was monitored closely prior to any release event. Where the flow in the Isaac met the 1090 ML/day trigger, but flow conditions were considered to be unpredictable, Arrow used precautionary principles in and did not undertake a release event until such a time that it was considered highly unlikely that the flow would fall below 1090 ML/day. At no time did discharge occur when the Issac River was reported to be flowing at less than 1090 ML/day.

9 Contaminant release flow rate must not exceed 1:400 (0.25%) of receiving water flow rate.

Pump rates were altered throughout the release event to ensure that a 1:400 dilution rate was met.

10 The daily quantity of contaminants released from each release point must be measured and recorded at the monitoring points in Table 4.

Daily records of release volumes were recorded.

11 The daily quantity of contaminants is not to exceed 7.5ML/day in total.

All release events were maintained to below 7.5 ML.

12 Releases to waters must be undertaken so as not to cause erosion of the bed and banks of the receiving waters, or cause a material build up of sediment in such waters.

The discharge location was monitored for erosion for the duration of the TEP. Due to flood waters washing out the banks and crossings on the Isaac River (up-stream and down-

stream of the discharge location), no significant erosion was observed from any discharge event.

13 The Transitional Environmental Program holder must notify the administering authority within 24hours of having commenced releasing coal seam water to the receiving environment. Notification must include the submission of written verification to the administering authority of the following information:

a) release commencement date/time
b) expected release cessation date/time
c) release point/s
d) release volume (estimated)
e) receiving water/s including the natural flow rate
f) any details (including available data) regarding likely impacts on the receiving water(s).

The administrating authority was appropriately notified prior to each release event via email.

14 The Transitional Environmental Program holder must provide the administering authority daily during the release of coal seam water, the following information:

a) all in situ monitoring data for that day

b) the receiving water flow rate

c) the release flow rate.

The administrating authority was appropriately notified daily during each release event via email.

15 The Transitional Environmental Program holder must notify the administering authority as soon as practicable, (no later than within 24 hours after cessation of a release) of the cessation of a release notified under condition 12 and within 15 business days provide the following information in writing:

a) release cessation date/time
b) natural flow volume in receiving water
c) volume of water released
d) details regarding the compliance of the release with the conditions of this Transitional Environmental Program (i.e. contamination limits, natural flow, discharge volume)

e) all in-situ water quality monitoring results
f) any other matters pertinent to the water release event.

The administrating authority was appropriately notified at the cessation of each release event via email.

16 If the release limits defined in Table 6 are exceeded, the holder of the Transitional Environmental Program must notify the administering authority within 2 business days of receiving the results.

The release limits detailed in Table 6 of the TEP were not exceeded throughout the discharge events.

17 The Transitional Environmental Program holder must, within 28 days of a release that exceeds the conditions of this Transitional Environmental Program, provide a report to the administering authority detailing:

a) the reason for the release
b) the location of the release
c) all water quality monitoring results
d) any general observations
e) all calculations
f) any other matters pertinent to the water release event.

The release limits detailed in Table 6 of the TEP were not exceeded throughout the discharge events.

18 The coal seam water discharge must cease immediately if any water quality limit as specified in Table 6 is exceeded.

The release limits detailed in Table 6 of the TEP were not exceeded throughout the discharge events.

19 The Department of Environment and Resource Management may require CH4 Pty to cease discharge if the department's water monitoring stations detect any water quality limit exceedence.

Arrow were not required to cease discharge due to the department's water monitoring stations detecting any water quality limit exceedence.

20 The release of coals seam water must cease immediately if identified that the release of coal seam waters is causing erosion of the bed and banks of the receiving waters, or is causing a material build up of sediment in such waters.

Arrow were not required to cease discharge due to erosion of the bed and banks of the receiving water or causing a material build up of sediment in such waters.

21 The release of coal seam water must cease immediately if holder of this Transitional Environmental Program is directed to do so by the administering authority.

Arrow was not directed to cease discharge by the administrating authority.

22 The release of coal seam water will cease immediately if Isaac River flow decreases below 1090ML/day (at Goonyella Gauging Station).

The Goonyella Gauging Station was monitored closely for the duration of all release events. Where the flow in the Isaac appeared to be approaching 1090 ML/day, or the flow was considered to be unpredictable, Arrow used precautionary principles and ceased release events where required, or altered the rate of pumping until such a time that it was considered highly unlikely that the flow would fall below 1090 ML/day. At no time did discharge occur when the Isaac River was reported to be flowing at less than 1090 ML/day.

23 Where monitoring is a requirement of this Transitional Environmental Program, ensure that a competent person(s) conducts all monitoring.

All personnel conducting the monitoring program have been trained on Arrow's monitoring requirements and followed the sampling analysis plan prepared for the monitoring program.

24 Monitoring will occur at the frequencies identified in Table 6 and Table 7.

With the exception of monitoring that was undertaken at the beginning of the discharge program, (i.e. throughout various revisions of the draft TEP and until the appropriate analytical suite was agreed and) the duration of when the

25 All monitoring undertaken as a requirement of this Transitional Environmental Program must be undertaken in accordance with the administering authority's Water Sampling Manual.

Arrow undertakes all monitoring programs in accordance with relevant guidelines and Australian Standards. Arrow's water sampling manual meets these requirements and the sampling and analysis program that was prepared for the monitoring program consi9dered the guideline and the Australian Standards during preparation.

26 As soon as practicable after becoming aware of any emergency or incident which results in the release of contaminants not in accordance, or reasonably expected to be not in accordance with the conditions of this Transitional Environmental Program, the administering authority must be notified of the release by telephone, facsimile or email.

No emergency situation or incident related to this TEP occurred during the operation of the program.

27 The notification of emergencies or incidents must include but not be limited to the following:

a) the holder of the Transitional Environmental Program
b) the location of the emergency or incident
c) the number of the Transitional Environmental Program
d) the name and telephone number of the designated contact person
e) the time of the release
f) the time the holder of the Transitional Environmental Program became aware of the release
g) the suspected cause of the release
h) the environmental harm caused, threatened, or suspected to be caused by the release, and
i) actions taken to prevent any further release and mitigate any environmental harm caused by the release.

No emergency situation or incident related to this TEP occurred during the operation of the program.

29 Not more than 10 business days following the initial notification of an emergency or incident, written advice must be provided of the information supplied to the administering authority in relation to:

a) proposed actions to prevent a recurrence of the emergency or incident, and

b) outcomes of actions taken at the time to prevent or minimise environmental harm.

No emergency situation or incident related to this TEP occurred during the operation of the program.

3 MEETING THE OBJECTIVES OF THE TEP

As described in Section 1.1, a total of five (5) objectives, including objective (5), which requires that DERM is provided with a Final TEP report, detailing how the objectives of the TEP were met. This section is intended to meet this requirement. The following objectives were required to be met, and are discussed below.

1) Lower dam levels for (dams 1, 2, 5, 10) to below the 'Target dam fill height" (as shown in Table 2 in the TEP).
2) Monitor Discharge
3) Pond 2
4) Cease discharge
5) TEP report submission

1) The TEP provided assistance in managing Dam levels for the duration of the limited release events during and following rainfall events, as permitted by the TEP. Due to the limitations of the release events, a combination of management strategies were undertaken to control the Dam Levels, including limiting production, pumping between dams, and fast-tracking the construction of Dam 11. Current Dam conditions, including those of Dam 11 are provided in the following table:

Table 8 Key Dam Variables Dams 1, 2, 10 and 11

Dam		1	2	5	10	11
Volume at Spill level	ML	119.66	92.64	7.64	203.70	419
Spillway		No	No	No	Yes	Yes
Liner type		CCL	CCL	0.5mm HDPE	1.5mm HDPE	1.5mm HDPE x 2
Hydraulic height	n	5.60	5.50	3.5	4.75	6.6
MRL	m	5.25	5.15	3.15	4.40	5.4
DSA	m	4.75	4.65	2.65	3.90	5.0
Target dam fill height [b]	m	4.75	0.65	2.65	3.90	-
Current level at approved date TEP 4/2/2011Version 4 (below MRL) [a]	mm	**100**	**870**	**Varies**	**40**	**-**
Current level 31/5/2011		380	1970	3830	690	5200
Remaining rainfall *(to spill)* [c]	mm	281	762	>800	244	-

2) Monitoring was undertaken for the duration of the discharge events and for two days following the discharge events for the duration of the approved TEP. Tables of results, assessed against the discharge limits in the TEP are provided below, as per the tables provided to DERM for the duration of the TEP. Certificates of Analysis and Chain of Custody Records will be provided separately. Minor QA/QC issues were identified during the sampling program and the findings of these issues were addressed by the analysing laboratory, with the findings provided to DERM.

3) A management plan was prepared for Dam 2, as attached at the rear of this report.

4) Water discharging ceased on 5 April 2011, as per the TEP discharging extension agreed with DERM. Monitoring in the Isaac River continued for 2 days following this release event. All release volumes and the results of any monitoring programs were provided to DERM as the information became available throughout the program.

5) This report details how the objectives of the TEP have been met.

Attachments

Attachment A: Laboratory Correspondence
Attachment B – Table of Results
Attachment C – Certificates of Analysis and Chain of Custody Records (Provided Separately)

01 March 2011

Arrow Energy Pty Ltd
Level 19, AM-60, 42-60 Albert St,
Brisbane Qld 4000

Attention: Graham Cordingley
Senior Environmental Operations Coordinator

Dear Graham,

RE: Analytical Capacity

As discussed, the ALS Brisbane Environmental Laboratory has recently been inundated with an extraordinary volume of samples for analysis, which accompanied with multiple set-backs due to localized and national flooding has resulted in ALS struggling to comply with standard and contractually agreed result reporting timeframes. The reason for these delays in reporting of results is threefold.

Firstly, the months leading into Christmas are usually the busiest months of the year for any commercial laboratory due to a typical "end of year rush" where regular clients rush to complete projects before they go on Christmas leave. As a result of this, and the Christmas / New Year holiday period at the end of December, the laboratory is essentially required to carry out what would normally be four very busy weeks worth of work in only three weeks. The consecutive public holiday's in the last week of December also mean that many samples collected in the preceding weeks are at risk of breaching regulatory holding times on one of the public holidays. The laboratory is therefore obliged to concentrate on the analysis of these high risk samples prior to Christmas, often at the expense of other samples that may not be in risk of breaching holding time.

The associated delays experienced due to the large number of samples received late last year were compounded by the second reason for the delayed reporting, the unprecedented amount of rainfall that was experienced across the whole eastern seaboard of Australia in January. While the ALS Brisbane laboratory regularly experiences an increase in sample flow every year with the onset of the northern wet season, the very high amount of rainfall and resultant flooding this year has led to far greater sample

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numbers that ever before. Sample numbers received in Brisbane throughout November, December and January have been up to 50% higher than the same period last year. Under these extreme circumstances, ALS would normally call upon the assistance of our sister laboratories in Sydney and Melbourne to "loadshed" excess work. Unfortunately, due the similar rainfall events and flooding in both NSW and Victoria, each of these laboratories were also at or above capacity and have only been able to offer limited assistance to the Brisbane laboratory.

Thirdly, although the Brisbane laboratory was not directly affected by flood, indirectly, many delays in freight and the absence of staff over this tough period foresaw an increasing backlog of samples. ALS has processed the sample backlog over the previous five (5) weeks and service delivery is expected to increase dramatically as the wet season comes to an end.

As a result of this unprecedented weather and resultant sample flow, our obligation to preferentially process samples for holding times and the limited contingency available through our sister labs, the ALS Brisbane laboratory is in an unfortunate position of *not providing our best possible service*. Please be rest assured that ALS is on the road to recovery and increases in service delivery over the coming weeks should be apparent.

Do not hesitate to contact me for further information.

Kind regards,

[redacted]

[redacted]
Business Development Officer
ALS Environmental Division

ALS			Analyte	Aluminium	Arsenic	Cadmium	Chromium	Copper	Iron	Lead	Nickel	Zinc	Boron	Silver	Uranium	Vanadium
ALS Sample ID	Lab ID	Monitoring Point	Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
			Date Sampled/LOR	0.01	0.01-0.001	0.005 - 0.0001	0.01-0.001	0.01-0.001	0.05	0.01-0.001	0.01-0.001	0.01-0.005	0.1-0.05	0.001	0.001	0.01
Draft TEP Trigger Investigation Level				**0.055**	**0.013**	**0.0002**	**0.001**	**0.002**	**0.3**	**0.01**	**0.011**	**0.008**	**0.37**	**0.001**	**0.001**	**0.01**
DISCHARGE POINT		Discharge Point (MP1)	21/12/2010	15.6	<0.01	<0.005	0.04	0.02	23.5	0.01	0.03	0.04	<0.1		<0.001	0.06
ISAAC 1		Up Stream (MP3)	21/12/2010	13.3	<0.01	<0.005	0.04	0.02	29	0.01	0.03	0.03	<0.1		<0.001	0.06
ISAAC 2		Downstream (MP2)	21/12/2010	18.1	0.02	<0.005	0.03	0.02	28.1	<0.01	0.03	0.05	<0.1		<0.001	0.05
DISCHARGE POINT			21/12/2010	-	-	-	-	-	-	-	-	-	-	-	-	-
ISAAC 1			21/12/2010	-	-	-	-	-	-	-	-	-	-	-	-	-
ISSAC 2		Downstream (MP2) QC	21/12/2010	12.8	<0.01	<0.005	0.02	0.02	20.1	<0.01	0.02	0.03	<0.1		<0.001	0.04
DISCHARGE POINT		Discharge Point (MP1)	23/12/2010	-	0.001	<0.0001	0.012	0.009	-	0.006	0.014	0.022	-	-	-	
Downstream		Downstream (MP2)	23/12/2010	-	0.002	<0.0001	0.013	0.009	-	0.006	0.015	0.018	-	-	-	
ISAAC 2		Downstream (MP2) QC	23/12/2010	-	0.001	<0.0001	0.013	0.01	-	0.006	0.015	0.019	-	-	-	
ISAAC 1-S1	EB1100019	Up Stream (MP3)	24/12/2010	15.2	<0.001	<0.0001	0.012	0.015	10.7	0.006	0.013	0.016	<0.05	<0.001	-	0.02
ISAAC 1-QC1	EB1100019	Up Stream (MP3) QC	24/12/2010	9.18	0.001	<0.0001	0.012	0.009	10.9	0.006	0.013	0.02	<0.05	<0.001	-	0.02
ISAAC 2- S2	EB1100019	Downstream (MP2)	24/12/2010	16.4	0.002	<0.0001	0.017	0.012	19.7	0.009	0.02	0.034	<0.05	<0.001	-	0.03
ISAAC 2- QC2	EB1100019	Downstream (MP2) QC	24/12/2010	11.1	0.002	<0.0001	0.017	0.013	15.6	0.007	0.016	0.026	<0.05	<0.001	-	0.03
DISCHARGE-S3	EB1100019	Discharge Point (MP1)	24/12/2010	10.9	0.001	<0.0001	0.021	0.011	13.4	0.007	0.016	0.021	<0.05	<0.001	-	0.03
DISCHARGE-QC3	EB1100019	Discharge Point (MP1) QC	24/12/2010	11	0.002	<0.0001	0.023	0.016	12.8	0.007	0.016	0.019	<0.05	<0.001	-	0.02
QC 5	EB1100019		24/12/2010													
S5	EB1100019		25/12/2010													
ISAAC 1-S1	EB1100019	Up Stream (MP3)	24/12/2010	8.83	<0.001	<0.0001	0.012	0.01	10	0.006	0.014	0.017	<0.05	<0.001	<0.001	0.02
ISAAC 1-QC1	EB1100019	Up Stream (MP3) QC	24/12/2010	9.16	0.001	<0.0001	0.012	0.01	10.5	0.006	0.014	0.018	<0.05	<0.001	<0.001	0.02
ISAAC 2- S2	EB1100019	Downstream (MP2)	24/12/2010	11.9	0.002	<0.0001	0.017	0.012	14.4	0.007	0.017	0.034	<0.05	<0.001	<0.001	0.03
ISAAC 2- QC2	EB1100019	Downstream (MP2) QC	24/12/2010	11.1	0.001	<0.0001	0.016	0.011	13.5	0.007	0.016	0.056	<0.05	<0.001	<0.001	0.03
DISCHARGE-S3	EB1100019	Discharge Point (MP1)	24/12/2010	10.1	0.001	<0.0001	0.014	0.011	11.9	0.007	0.016	0.02	<0.05	<0.001	<0.001	0.02
DISCHARGE-QC3	EB1100019	Discharge Point (MP1) QC	24/12/2010	11	0.001	<0.0001	0.015	0.011	12.8	0.007	0.016	0.02	<0.05	<0.001	<0.001	0.03
ISAAC 1-S1	EB1100019	Up Stream (MP3)	25/12/2010	15.2	0.002	<0.0001	0.021	0.015	18.4	0.009	0.023	0.03	<0.05	<0.001	<0.001	0.04
ISAAC 1-QC1	EB1100019	Up Stream (MP3) QC	25/12/2010	15.2	0.001	<0.0001	0.021	0.016	17.5	0.009	0.023	0.035	<0.05	<0.001	<0.001	0.03
ISAAC 2- S2	EB1100019	Downstream (MP2)	25/12/2010	16.4	0.002	<0.0001	0.023	0.016	19.7	0.009	0.024	0.055	<0.05	<0.001	<0.001	0.04
ISAAC 2- QC2	EB1100019	Downstream (MP2) QC	25/12/2010	16.2	0.002	<0.0001	0.023	0.016	19.5	0.009	0.024	0.03	<0.05	<0.001	<0.001	0.04
DISCHARGE-S3	EB1100019	Discharge Point (MP1)	25/12/2010	15.1	0.001	<0.0001	0.021	0.015	17.7	0.008	0.022	0.027	0.17	<0.001	<0.001	0.04
DISCHARGE-QC3	EB1100019	Discharge Point (MP1) QC	25/12/2010	16.3	0.002	<0.0001	0.023	0.016	19.1	0.009	0.023	0.029	0.16	<0.001	<0.001	0.04
ISAAC 1-S1	EB1100019	Up Stream (MP3)	27/12/2010	9.41	0.002	<0.0001	0.012	0.01	10.7	0.006	0.013	0.016	0.05	<0.001	<0.001	0.02
ISAAC 1-QC1	EB1100019	Up Stream (MP3) QC	27/12/2010	9.18	0.001	<0.0001	0.012	0.009	10.9	0.006	0.013	0.02	<0.05	<0.001	<0.001	0.02
ISAAC 2- S2	EB1100019	Downstream (MP2)	27/12/2010	14.3	0.002	<0.0001	0.019	0.014	17.5	0.009	0.02	0.08	<0.05	<0.001	<0.001	0.03
ISAAC 2- QC2	EB1100019	Downstream (MP2) QC	27/12/2010	12.7	0.001	<0.0001	0.017	0.013	15.6	0.009	0.018	0.026	<0.05	<0.001	<0.001	0.03
DISCHARGE-S3	EB1100019	Discharge Point (MP1)	27/12/2010	10.9	0.001	<0.0001	0.014	0.011	13.4	0.007	0.016	0.021	<0.05	<0.001	<0.001	0.03

ALS			Analyte	Aluminium	Arsenic	Cadmium	Chromium	Copper	Iron	Lead	Nickel	Zinc	Boron	Silver	Uranium	Vanadium
ALS Sample ID	**Lab ID**	**Monitoring Point**	**Units**	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
			Date Sampled/LOR	0.01	0.01-0.001	0.005 - 0.0001	0.01-0.001	0.01-0.001	0.05	0.01-0.001	0.01-0.001	0.01-0.005	0.1-0.05	0.001	0.001	0.01
Draft TEP Trigger Investigation Level				**0.055**	**0.013**	**0.0002**	**0.001**	**0.002**	**0.3**	**0.01**	**0.011**	**0.008**	**0.37**	**0.001**	**0.001**	**0.01**
DISCHARGE-QC3	EB1100019	Discharge Point (MP1) QC	27/12/2010	9.76	0.001	<0.0001	0.012	0.01	11.7	0.006	0.014	0.019	<0.05	<0.001	<0.001	0.02
TRIP-S5			29/12/2010													
S5			25/12/2010													
QC 5			24/12/2010													
QC 5			25/12/2010													
ISAAC1-S1	ES1100200	Up Stream (MP3)	29/12/2010	-	<0.001	<0.0001	0.009	0.008	-	0.004	0.011	0.015	-	-	-	0.02
ISAAC1-QC1	ES1100200	Up Stream (MP3)QC	29/12/2010	-	<0.001	0.0002	0.008	0.008	-	0.004	0.01	0.014	-	-	-	0.02
ISAAC2-S2	ES1100200	Downstream (MP2)	29/12/2010	-	<0.001	0.0001	0.01	0.009	-	0.005	0.012	0.017	-	-	-	0.02
ISAAC2-QC2	ES1100200	Downstream (MP2) QC	29/12/2010	-	<0.001	<0.0001	0.008	0.008	-	0.004	0.01	0.013	-	-	-	0.02
DISCHARGE-S3	ES1100200	Discharge Point (MP1)	29/12/2010	-	0.003	<0.0001	<0.001	0.002	-	<0.001	0.001	<0.005	-	-	-	<0.01
DISCHARGE-QC3	ES1100200	Discharge Point (MP1) QC	29/12/2010	-	0.002	<0.0001	<0.001	0.002	-	<0.001	0.001	<0.005	-	-	-	<0.01
TRIP-QC5			29/12/2010													
TRIP-S5			29/12/2010													
DISCHARGE POINT	ES1100200	Discharge Point (MP1)	31/12/2010	-	<0.001	<0.0001	<0.001	0.002	-	<0.001	0.002	0.007	-	-	-	<0.01
ISAAC 1	ES1100200	Up Stream (MP3)	31/12/2010	-	<0.001	<0.0001	0.008	0.006	-	0.004	0.009	0.014	-	-	-	0.01
ISAAC 2	ES1100200		31/12/2010	-	0.001	<0.0001	0.009	0.007	-	0.004	0.011	0.016	-	-	-	0.02
TRIP 1 2	ES1100200		31/12/2010													
Issac 1 - s1	EB1100132	Up Stream (MP3)	02/01/2011	7.94	0.002	<0.0001	0.011	0.005	10.2	0.012	0.206	0.02	0.09	<0.01	<0.001	<0.001
Issac 2 - s2	EB1100132	Downstream (MP2)	02/01/2011	6.96	0.001	<0.0001	0.01	0.004	9.2	0.012	0.208	0.02	<0.05	<0.01	<0.001	<0.001
Discharge point - s3	EB1100132	Discharge Point (MP1)	02/01/2011	0.14	0.002	<0.0001	0.001	<0.001	0.16	<0.001	0.008	<0.01	1.15	<0.01	<0.001	<0.001
Issac 1 - qc1	EB1100132	Up Stream (MP3) QC	02/01/2011	7.25	0.001	<0.0001	0.011	0.004	9.65	0.012	0.199	0.02	0.09	<0.01	<0.001	<0.001
Issac 2 - qc2	EB1100132	Downstream (MP2)QC	02/01/2011	6.94	0.001	<0.0001	0.01	0.005	9.23	0.012	0.209	0.02	<0.05	<0.01	<0.001	<0.001
Discharge point = qc3	EB1100132	Discharge Point (MP1) QC	02/01/2011	0.17	0.002	<0.0001	0.001	<0.001	0.19	0.001	0.008	<0.01	1.17	<0.01	<0.001	<0.001
Trip - QC5			02/01/2011	-	-	-	-	-	-	-	-	-	-	-	-	-
Issac 1 - s1	EB1100130	Up Stream (MP3)	03/01/2011	7.07	0.001	<0.0001	0.017	0.006	9.96	0.015	0.186	0.02	0.05	<0.01	<0.001	<0.001
Issac 2 - s2	EB1100130	Downstream (MP2)	03/01/2011	8.48	0.001	<0.0001	0.022	0.008	13.7	0.019	0.233	0.03	<0.05	<0.01	<0.001	<0.001
Discharge point - s3	EB1100130	Discharge Point (MP1)	03/01/2011	0.14	0.002	<0.0001	<0.001	<0.001	0.14	0.001	0.01	<0.01	1.06	<0.01	<0.001	<0.001
Issac 1 - qc1	EB1100130	Up Stream (MP3) QC	03/01/2011	8.47	0.001	<0.0001	0.023	0.008	13.6	0.019	0.226	0.03	0.06	<0.01	<0.001	<0.001
Issac 2 - qc2	EB1100130	Downstream (MP2)QC	03/01/2011	9.04	0.001	<0.0001	0.022	0.008	14.3	0.02	0.237	0.03	<0.05	<0.01	<0.001	<0.001
Discharge point - qc3	EB1100130	Discharge Point (MP1) QC	03/01/2011	0.13	0.002	<0.0001	<0.001	<0.001	0.15	0.001	0.01	<0.01	1.12	<0.01	<0.001	<0.001
Trip - QC5			03/01/2011	-	-	-	-	-	-	-	-	-	-	-	-	-
Isaac 1 - s1	EB1100282	Up Stream (MP3)	04/01/2011	8.18	0.002	<0.0001	0.015	0.008	11.2	0.005	0.014	0.015	0.08	<0.001	<0.001	0.02
Isaac 2 - s2	EB1100282	Downstream (MP2)	04/01/2011	7.1	0.002	<0.0001	0.013	0.007	9.41	0.004	0.011	0.012	0.06	<0.001	<0.001	0.02
Discharge point - s3	EB1100282	Discharge Point (MP1)	04/01/2011	0.08	0.002	<0.0001	<0.001	0.002	0.12	<0.001	<0.001	<0.005	1.39	<0.001	<0.001	<0.01
Isaac 1 - qc1	EB1100282	Up Stream (MP3) QC	04/01/2011	8.57	0.002	<0.0001	0.016	0.009	11.7	0.005	0.014	0.017	0.08	<0.001	<0.001	0.02

ALS			Analyte	Aluminium	Arsenic	Cadmium	Chromium	Copper	Iron	Lead	Nickel	Zinc	Boron	Silver	Uranium	Vanadium
ALS Sample ID	**Lab ID**	**Monitoring Point**	**Units**	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
			Date Sampled/LOR	0.01	0.01-0.001	0.005 - 0.0001	0.01-0.001	0.01-0.001	0.05	0.01-0.001	0.01-0.001	0.01-0.005	0.1-0.05	0.001	0.001	0.01
Draft TEP Trigger Investigation Level				**0.055**	**0.013**	**0.0002**	**0.001**	**0.002**	**0.3**	**0.01**	**0.011**	**0.008**	**0.37**	**0.001**	**0.001**	**0.01**
Isaac 2 - qc2	EB1100282	Downstream (MP2)QC	04/01/2011	8.13	0.002	<0.0001	0.015	0.008	10.3	0.006	0.012	0.014	0.06	<0.001	<0.001	0.02
Discharge point - s3	EB1100282	Discharge Point (MP1) QC	04/01/2011	0.09	0.002	<0.0001	<0.001	0.002	0.12	<0.001	<0.001	<0.005	1.33	<0.001	<0.001	<0.01
Trip - s5			04/01/2011	-	-	-	-	-	-	-	-	-	-	-	-	-
Isaac 1 - s1	EB1100279	Up Stream (MP3)	05/01/2011	6.07	0.001	<0.0001	0.009	0.006	7.64	0.004	0.009	0.011	0.05	<0.001	<0.001	0.02
Isaac 2 - s2	EB1100279	Downstream (MP2)	05/01/2011	6.44	0.001	<0.0001	0.009	0.006	7.91	0.004	0.009	0.012	<0.05	<0.001	<0.001	0.02
Discharge point - s3	EB1100279	Discharge Point (MP1)	05/01/2011	0.09	0.002	<0.0001	<0.001	0.002	0.12	<0.001	<0.001	0.008	1.33	<0.001	<0.001	<0.01
Isaac 1 - qc1	EB1100279	Up Stream (MP3) QC	05/01/2011	6.87	0.002	<0.0001	0.01	0.007	8.51	0.004	0.01	0.012	0.08	<0.001	<0.001	0.02
Isaac 2 - qc2	EB1100279	Downstream (MP2)QC	05/01/2011	6.36	0.001	<0.0001	0.009	0.007	7.91	0.004	0.01	0.011	0.06	<0.001	<0.001	0.02
Discharge point - s3	EB1100279	Discharge Point (MP1) QC	05/01/2011	0.09	0.002	<0.0001	<0.001	0.002	0.13	<0.001	<0.001	0.008	1.39	<0.001	<0.001	<0.01
S1	EB1100506	Up Stream (MP3)	06/01/2011	6.37	<0.001	<0.0001	0.009	0.007	7.99	0.004	0.009	0.01	<0.05	<0.001	<0.001	0.02
S2	EB1100506	Downstream (MP2)	06/01/2011	6.16	<0.001	<0.0001	0.008	0.006	7.36	0.004	0.008	0.01	<0.05	<0.001	<0.001	0.02
S3	EB1100506	Discharge Point (MP1)	06/01/2011	0.11	<0.001	<0.0001	0.001	0.002	0.13	<0.001	0.001	<0.005	1.09	<0.001	<0.001	<0.01
QC1	EB1100506	Up Stream (MP3) QC	06/01/2011	6.33	<0.001	<0.0001	0.009	0.007	7.81	0.004	0.009	0.01	0.06	<0.001	<0.001	0.02
QC2	EB1100506	Downstream (MP2)QC	06/01/2011	5.68	<0.001	<0.0001	0.008	0.006	6.7	0.004	0.008	0.009	<0.05	<0.001	<0.001	0.02
QC3	EB1100506	Discharge Point (MP1) QC	06/01/2011	0.12	<0.001	<0.0001	0.001	0.002	0.15	<0.001	0.001	<0.005	1.03	<0.001	<0.001	<0.01
QC4			06/01/2011													
S1	EB1100507	Up Stream (MP3)	07/01/2011	10.6	0.002	<0.0001	0.015	0.01	13.7	0.006	0.015	0.021	0.07	<0.001	<0.001	0.03
S2	EB1100507	Downstream (MP2)	07/01/2011	9.11	0.002	<0.0001	0.013	0.009	11.6	0.005	0.012	0.016	0.06	<0.001	<0.001	0.02
S3	EB1100507	Discharge Point (MP1)	07/01/2011	0.14	<0.001	<0.0001	0.001	0.003	0.28	<0.001	0.003	0.005	1.04	<0.001	<0.001	<0.01
QC1	EB1100507	Up Stream (MP3) QC	07/01/2011	12.1	0.002	<0.0001	0.017	0.011	15.9	0.006	0.016	0.019	0.09	<0.001	<0.001	0.03
QC2	EB1100507	Downstream (MP2)QC	07/01/2011	9.39	0.002	<0.0001	0.012	0.009	12	0.005	0.013	0.016	0.07	<0.001	<0.001	0.02
QC3	EB1100507	Discharge Point (MP1) QC	07/01/2011	0.18	<0.001	<0.0001	0.002	0.003	0.3	<0.001	0.003	0.016	1.03	<0.001	<0.001	<0.01
QC4			07/01/2011													
S1	EM1101133	Up Stream (MP3)	31/01/2011	21.1	<0.010	0.002	<0.05	0.021	29.4	0.046	<0.0001	0.844	0.043	0.07	0.014	0.047
S2	EM1101133	Downstream (MP2)	31/01/2011	21.2	<0.010	0.001	<0.05	0.019	28.8	0.047	<0.0001	0.81	0.045	0.07	0.014	0.041
S3	EM1101133	Discharge Point (MP1)	31/01/2011	0.55	<0.010	0.002	1.01	<0.001	0.62	0.003	<0.0001	0.028	<0.005	0.02	<0.001	0.001
QC1	EM1101133	Up Stream (MP3) QC	31/01/2011	17.4	<0.010	0.001	<0.05	0.017	23.4	0.036	<0.0001	0.724	0.034	0.06	0.011	0.035
QC2	EM1101133	Downstream (MP2)QC	31/01/2011	22	<0.010	0.002	<0.05	0.02	28.3	0.046	<0.0001	0.822	0.046	0.07	0.014	0.044
QC3	EM1101133	Discharge Point (MP1) QC	31/01/2011	0.44	<0.010	0.002	0.96	<0.001	0.56	0.002	<0.0001	0.025	<0.005	0.02	<0.001	<0.001
QC4			31/01/2011													
S1 ISAC 2	EM1101101	Up Stream (MP3)	01/02/2011	13	<0.010	0.002	<0.05	0.009	17.8	0.025	<0.0001	0.433	0.022	0.05	0.008	0.021
S2 ISAC 1	EM1101101	Downstream (MP2)	01/02/2011	17	<0.010	0.002	0.05	0.014	23.8	0.032	<0.0001	0.583	0.035	0.05	0.012	0.031
S3 DISCHARGE	EM1101101	Discharge Point (MP1)	01/02/2011	0.04	<0.010	0.002	1.4	<0.001	0.08	0.001	<0.0001	0.005	0.011	0.01	<0.001	<0.001
QC1 ISAC 2	EM1101101	Up Stream (MP3) QC	01/02/2011	11.7	<0.010	0.002	0.05	0.009	14.4	0.021	<0.0001	0.422	0.018	0.04	0.008	0.019
QC2 ISAC 1	EM1101101	Downstream (MP2)QC	01/02/2011	17.4	<0.010	0.002	0.06	0.013	22.8	0.032	<0.0001	0.567	0.034	0.05	0.011	0.029

ALS			Analyte	Aluminium	Arsenic	Cadmium	Chromium	Copper	Iron	Lead	Nickel	Zinc	Boron	Silver	Uranium	Vanadium
ALS Sample ID	**Lab ID**	**Monitoring Point**	**Units**	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
			Date Sampled/LOR	0.01	0.01-0.001	0.005 - 0.0001	0.01-0.001	0.01-0.001	0.05	0.01-0.001	0.01-0.001	0.01-0.005	0.1-0.05	0.001	0.001	0.01
Draft TEP Trigger Investigation Level				**0.055**	**0.013**	**0.0002**	**0.001**	**0.002**	**0.3**	**0.01**	**0.011**	**0.008**	**0.37**	**0.001**	**0.001**	**0.01**
QC3 DISCHARGE	EM1101101	Discharge Point (MP1) QC	01/02/2011	0.04	<0.010	0.002	1.53	<0.001	0.07	<0.001	<0.0001	0.004	0.009	0.01	<0.001	<0.001
QC4 TRIP			01/02/2011													
S1	EM1101103	Up Stream (MP3)	02/02/2011	11.9	<0.010	0.002	0.07	0.008	15.6	0.02	0.0002	0.341	0.022	0.04	0.007	0.018
S2	EM1101103	Downstream (MP2)	02/02/2011	10.3	<0.010	0.001	0.05	0.006	13.4	0.017	<0.0001	0.295	0.017	0.04	0.006	0.015
QC1	EM1101103	Up Stream (MP3) QC	02/02/2011	12.9	<0.010	0.002	0.06	0.007	16.4	0.02	<0.0001	0.321	0.02	0.04	0.007	0.018
QC2	EM1101103	Downstream (MP2)QC	02/02/2011	11	<0.010	0.002	0.06	0.006	14	0.016	<0.0001	0.264	0.016	0.04	0.006	0.015
QC4			02/02/2011													
ISAC 2 S1	EM1101104	Up Stream (MP3)	03/02/2011	12.1	0.002	<0.0001	0.02	0.007	15.4	0.3	0.007	0.002	0.06	<0.001	0.04	0.019
ISAC 1 S1	EM1101104	Downstream (MP2)	03/02/2011	12.8	0.002	<0.0001	0.021	0.008	16.7	0.357	0.007	0.001	0.06	<0.001	0.04	0.024
ISAC 2 QC1	EM1101104	Up Stream (MP3) QC	03/02/2011	12.5	0.002	<0.0001	0.02	0.007	16.2	0.322	0.007	0.001	0.06	<0.001	0.04	0.021
ISAC 1 QC1	EM1101104	Downstream (MP2)QC	03/02/2011	13.6	0.002	<0.0001	0.022	0.008	17.6	0.366	0.008	0.001	0.06	<0.001	0.04	0.026
TRIP QC4			03/02/2011													
Upstream MP3 - S10	EB1102552	Upstream MP3 - S1	09/02/2011	6.49	0.001	<0.0001	0.008	0.007	7.93	0.004	0.009	0.022	<0.05	<0.001	<0.001	0.02
Downstream - MP2 - S2	EB1102552	Downstream - MP2 - S2	09/02/2011	5.94	0.001	<0.0001	0.008	0.007	7.32	0.004	0.009	0.027	<0.05	<0.001	<0.001	0.02
QC2	EB1102552	QC2	09/02/2011	5.69	<0.001	<0.0001	0.007	0.007	6.69	0.004	0.009	0.022	<0.05	<0.001	<0.001	0.01
QC3	EB1102552	QC3	09/02/2011													
Upstream MP3 - S1	EB1102554	Up Stream (MP3)	10/02/2011	4.9	<0.001	<0.0001	0.006	0.006	5.65	0.004	0.008	0.018	<0.05	<0.001	<0.001	0.01
Downstream - MP2 - S2	EB1102554	Downstream (MP2)	10/02/2011	5.99	<0.001	<0.0001	0.007	0.007	7.23	0.004	0.009	0.017	<0.05	<0.001	<0.001	0.02
QC2	EB1102554	Downstream (MP2)QC	10/02/2011	6.82	<0.001	<0.0001	0.008	0.008	8.5	0.004	0.01	0.073	<0.05	<0.001	<0.001	0.02
QC3	EB1102554		10/02/2011													
March 2011 Discharge																
REG	EB105951	Upstream MP3 - S1	25/03/2011	17.9	0.001	<0.0001	0.029	0.036	18.9	0.016	0.054	0.066	0.08	<0.001	0.001	0.06
REG	EB105951	Downstream - MP2 - S2	25/03/2011	3.44	0.001	<0.0001	0.004	0.018	2.86	0.011	0.028	0.025	0.1	<0.001	0.001	0.04
REG	EB105951	Discharge - MP1 - S3	25/03/2011	<0.01	<0.001	0.0002	<0.001	0.003	<0.05	<0.001	0.003	<0.005	1.28	<0.001	<0.001	<0.01
REG	EB105951	Upstream QC1	25/03/2011	<0.01	<0.001	0.0002	0.001	0.003	<0.05	<0.001	0.004	0.007	1.25	<0.001	<0.001	<0.01
REG	EB105951	Downstream QC2	25/03/2011	9.74	0.002	0.0002	0.017	0.025	10.8	0.012	0.046	0.042	0.1	<0.001	0.001	0.05
REG	EB105951	Discharge QC3	25/03/2011	21	0.002	0.0001	0.039	0.036	24.2	0.017	0.069	0.068	0.07	<0.001	0.002	0.07
REG	EB105951	Trip QC4	25/03/2011													
REG	EB105951	Rinsate QC5	25/03/2011													
Upstream MP3-S1	EB1105942	Upstream MP3-S1	26/03/2011	17.5	0.001	<0.0001	0.023	0.015	16.2	0.007	0.027	0.033	0.06	<0.001	<0.001	0.03
Downstrream-MP2-S2	EB1105942	Downstrream-MP2-S2	26/03/2011	16.7	0.001	<0.0001	0.025	0.016	18.7	0.007	0.029	0.034	0.1	<0.001	<0.001	0.03
Discharge-MP1-S3	EB1105942	Discharge-MP1-S3	26/03/2011	0.03	<0.001	0.0004	0.001	0.005	0.11	<0.001	0.006	0.007	1.22	<0.001	<0.001	<0.01

ALS			Analyte	Aluminium	Arsenic	Cadmium	Chromium	Copper	Iron	Lead	Nickel	Zinc	Boron	Silver	Uranium	Vanadium
ALS Sample ID	**Lab ID**	**Monitoring Point**	**Units**	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
			Date Sampled/LOR	0.01	0.01-0.001	0.005 - 0.0001	0.01-0.001	0.01-0.001	0.05	0.01-0.001	0.01-0.001	0.01-0.005	0.1-0.05	0.001	0.001	0.01
Draft TEP Trigger Investigation Level				**0.055**	**0.013**	**0.0002**	**0.001**	**0.002**	**0.3**	**0.01**	**0.011**	**0.008**	**0.37**	**0.001**	**0.001**	**0.01**
Upstream QC1	EB1105942	Upstream QC1	26/03/2011	19	0.002	<0.0001	0.025	0.016	18.6	0.007	0.03	0.04	0.08	<0.001	<0.001	0.03
Downstream QC2	EB1105942	Downstream QC2	26/03/2011	17.6	0.002	<0.0001	0.026	0.016	19.1	0.008	0.029	0.034	0.09	<0.001	<0.001	0.03
Discharge QC3	EB1105942	Discharge QC3	26/03/2011	0.04	0.001	0.0002	<0.001	0.004	0.08	<0.001	0.003	0.01	1.27	<0.001	<0.001	<0.01
TRip QC4	EB1105942	Trip QC4	26/03/2011													
Rinsate QC5	EB1105942	Rinsate QC5	26/03/2011													
March 2011 Discharge Dam Monitoring																
Pond 1	EB1105946	P1-S1	26/03/2011	0.06	0.003	<0.0001	<0.001	0.002	0.09	<0.001	<0.001	<0.005	1.14	<0.001	0.001	<0.01
Pond 2 (Discharge)	EB1105946	P2-S2	26/03/2011	0.24	0.003	<0.0001	0.001	0.004	0.32	<0.001	0.002	<0.005	0.86	<0.001	<0.001	<0.01
Pond 5	EB1105946	P5-S5	26/03/2011	0.02	0.002	0.0002	<0.001	0.002	0.05	<0.001	0.003	<0.005	1.16	<0.001	<0.001	<0.01
Pond 10	EB1105946	P10-S10	26/03/2011	0.03	0.002	<0.0001	<0.001	0.002	<0.05	<0.001	<0.001	<0.005	1.19	<0.001	<0.001	<0.01
Pond 1 Duplicate	EB1105946	P1-QC1	26/03/2011	0.07	0.003	<0.0001	0.001	0.002	0.12	<0.001	<0.001	<0.005	1.15	<0.001	0.001	<0.01
Pond 2 Duplicate	EB1105946	P2-QC2	26/03/2011	0.27	0.003	<0.0001	0.001	0.003	0.34	<0.001	0.002	<0.005	0.9	<0.001	<0.001	<0.01
Pond 5 Duplicate	EB1105946	P5-QC5	26/03/2011	0.02	0.002	0.0001	<0.001	0.002	<0.05	<0.001	0.002	0.045	1.2	<0.001	<0.001	<0.01
Pond 10 Duplicate	EB1105946	P10-QC10	26/03/2011	0.01	0.002	<0.0001	<0.001	0.002	<0.05	<0.001	<0.001	<0.005	1.2	<0.001	<0.001	<0.01
Trip Blank	EB1105946	Trip QC4	26/03/2011													
Rinsate Sample	EB1105946	Rinsate QC5	26/03/2011													
March 2011 Discharge																
Upstream MP3-S1	EB1105944	Upstream MP3-S1	27/03/2011	15	0.002	<0.0001	0.02	0.019	17.3	0.008	0.03	0.041	0.08	<0.001	<0.001	0.03
Downstream-MP2-S2	EB1105944	Downstream-MP2-S2	27/03/2011	10.4	0.002	<0.0001	0.019	0.017	15.4	0.007	0.027	0.035	0.07	<0.001	<0.001	0.03
Upstream QC1	EB1105944	Upstream QC1	27/03/2011	10.3	0.002	<0.0001	0.018	0.017	15.1	0.007	0.027	0.033	0.07	<0.001	<0.001	0.03
Downstream QC2	EB1105944	Downstream QC2	27/03/2011	10.3	0.002	<0.0001	0.019	0.017	16.1	0.007	0.027	0.035	0.07	<0.001	<0.001	0.03
Trip QC4	EB1105944		27/03/2011													
Rinsate QC5	EB1105944		27/03/2011													
Upstream MP3 - S1	EB1105983	Upstream MP3 - S1	28/03/2011	5.43	<0.001	<0.0001	0.007	0.007	6.77	0.004	0.009	0.015	0.06	<0.001	<0.001	0.02
Downstream - MP2 - S2	EB1105983	Downstream - MP2 - S2	28/03/2011	5.45	<0.001	<0.0001	0.007	0.007	6.76	0.004	0.009	0.016	0.06	<0.001	<0.001	0.02
Upstream QC1	EB1105983	Upstream QC1	28/03/2011													
Downstream QC2	EB1105983	Downstream QC2	28/03/2011													
Trip QC4	EB1105983		28/03/2011													
Rinsate QC5	EB1105983		28/03/2011													
Upstream MP3- S1	EB1106761	Upstream MP3- S1	05/04/2011	11	0.002	<0.0001	0.014	0.011	13.1	0.006	0.015	0.027	0.05	<0.001	<0.001	0.03

ALS			Analyte	Aluminium	Arsenic	Cadmium	Chromium	Copper	Iron	Lead	Nickel	Zinc	Boron	Silver	Uranium	Vanadium
ALS Sample ID	Lab ID	Monitoring Point	Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
			Date Sampled/LOR	0.01	0.01-0.001	0.005 - 0.0001	0.01-0.001	0.01-0.001	0.05	0.01-0.001	0.01-0.001	0.01-0.005	0.1-0.05	0.001	0.001	0.01
Draft TEP Trigger Investigation Level				**0.055**	**0.013**	**0.0002**	**0.001**	**0.002**	**0.3**	**0.01**	**0.011**	**0.008**	**0.37**	**0.001**	**0.001**	**0.01**
Downstream MP2 - S2	EB1106761	Downstream MP2 - S2	05/04/2011	6.07	0.001	<0.0001	0.007	0.008	7.02	0.004	0.008	0.017	0.11	<0.001	<0.001	0.02
Discharge MP1 - S3	EB1106761	Discharge MP1 - S3	05/04/2011	<0.01	0.002	0.0003	<0.001	0.003	<0.05	<0.001	0.003	0.006	1.24	<0.001	<0.001	<0.01
Upstream QC1	EB1106761	Upstream QC1	05/04/2011	9.25	0.001	<0.0001	0.011	0.01	10.7	0.005	0.012	0.022	0.06	<0.001	<0.001	0.02
Downstream QC2	EB1106761	Downstream QC2	05/04/2011	8.48	0.001	<0.0001	0.01	0.009	10.3	0.005	0.012	0.02	0.11	<0.001	<0.001	0.02
Discharge QC3	EB1106761	Discharge QC3	05/04/2011	<0.01	0.002	0.0003	0.001	0.003	<0.05	<0.001	0.004	<0.005	1.22	<0.001	<0.001	<0.01
Trip QC4	EB1106761	Trip QC4	05/04/2011													
Upstream MP3 - S1	EB1106763	Upstream MP3 - S1	06/04/2011	8.78	0.001	<0.0001	0.01	0.009	9.76	0.005	0.01	0.019	0.06	<0.001	<0.001	0.02
Downstream MP2- S2	EB1106763	Downstream MP2- S2	06/04/2011	7.85	0.002	<0.0001	0.009	0.009	9.01	0.005	0.01	0.018	0.05	<0.001	<0.001	0.02
Upstream QC1	EB1106763	Upstream QC1	06/04/2011	7.59	0.002	<0.0001	0.008	0.008	9.18	0.005	0.01	0.016	0.06	<0.001	<0.001	0.02
Downstream QC2	EB1106763	Downstream QC2	06/04/2011	7.03	0.002	0.0001	0.007	0.008	7.83	0.005	0.009	0.014	0.05	<0.001	<0.001	0.02
Trip QC4	EB1106763	Trip QC4	06/04/2011													
Rinsate QC5	EB1106763	Rinsate QC5	06/04/2011													
Upstream MP3 - S1	EB1106850	Upstream MP3 - S1	07/04/2011	6.44	0.001	<0.0001	0.008	0.009	7.21	0.004	0.008	0.016	<0.05	<0.001	<0.001	0.02
Downstream - MP2 - S2	EB1106850	Downstream - MP2 - S2	07/04/2011	7.02	0.001	<0.0001	0.008	0.008	8.04	0.005	0.009	0.012	<0.05	<0.001	<0.001	0.02
Upstream QC1	EB1106850	Upstream QC1	07/04/2011	9.54	0.002	<0.0001	0.012	0.011	12.6	0.006	0.013	0.021	<0.05	<0.001	<0.001	0.02
Downstream QC2	EB1106850	Downstream QC2	07/04/2011	7.82	0.001	<0.0001	0.009	0.012	9.39	0.005	0.01	0.015	<0.05	<0.001	<0.001	0.02
Trip QC4	EB1106850	Trip QC4	07/04/2011													
Rinsate QC5	EB1106850	Rinsate QC5	07/04/2011													

ALS			Analyte	C6 - C9 Fraction	C10 - C14 Fraction	C15 - C28 Fraction	C29 - C36 Fraction	C10 - C36 Fraction (sum)	Benzene	Toluene	Ethylbenzene	meta- & para-Xylene	ortho-Xylene
ALS Sample ID	Lab ID	Monitoring Point	Units	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
			Date Sampled/LOR	20	50	100	50	50	1	2	2	2	2
Draft TEP Trigger Investigation Level				**20**	**100**			**100**	**1**	**800**	**300**	**20**	
DISCHARGE POINT		Discharge Point (MP1)	21/12/2010	<20	-	-	-	-	<1	<2	<2	<2	<2
ISAAC 1		Up Stream (MP3)	21/12/2010	<20	-	-	-	-	<1	<2	<2	<2	<2
ISAAC 2		Downstream (MP2)	21/12/2010	<20	-	-	-	-	<1	<2	<2	<2	<2
DISCHARGE POINT			21/12/2010	-	-	-	-	-	-	-	-	-	-
ISAAC 1			21/12/2010	-	-	-	-	-	-	-	-	-	-
ISSAC 2		Downstream (MP2) QC	21/12/2010	<20	-	-	-	-	<1	<2	<2	<2	<2
DISCHARGE POINT		Discharge Point (MP1)	23/12/2010	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
Downstream		Downstream (MP2)	23/12/2010	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
ISAAC 2		Downstream (MP2) QC	23/12/2010	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
ISAAC 1-S1	EB1100019	Up Stream (MP3)	24/12/2010	<20	<50	<100	<50	60	<1	<2	<2	<2	<2
ISAAC 1-QC1	EB1100019	Up Stream (MP3) QC	24/12/2010	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
ISAAC 2- S2	EB1100019	Downstream (MP2)	24/12/2010	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
ISAAC 2- QC2	EB1100019	Downstream (MP2) QC	24/12/2010	<20	<50	<100	50	<50	<1	<2	<2	<2	<2
DISCHARGE-S3	EB1100019	Discharge Point (MP1)	24/12/2010	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
DISCHARGE-QC3	EB1100019	Discharge Point (MP1) QC	24/12/2010	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
QC 5	EB1100019		24/12/2010	20	-	-	-	-	<1	<2	<2	<2	<2
S5	EB1100019		25/12/2010	<20	-	-	-	-	<1	<2	<2	<2	<2
ISAAC 1-S1	EB1100019	Up Stream (MP3)	24/12/2010	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
ISAAC 1-QC1	EB1100019	Up Stream (MP3) QC	24/12/2010	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
ISAAC 2- S2	EB1100019	Downstream (MP2)	24/12/2010	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
ISAAC 2- QC2	EB1100019	Downstream (MP2) QC	24/12/2010	<20	<50	<100	50	50	<1	<2	<2	<2	<2
DISCHARGE-S3	EB1100019	Discharge Point (MP1)	24/12/2010	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
DISCHARGE-QC3	EB1100019	Discharge Point (MP1) QC	24/12/2010	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
ISAAC 1-S1	EB1100019	Up Stream (MP3)	25/12/2010	<20	<50	<100	60	60	<1	<2	<2	<2	<2
ISAAC 1-QC1	EB1100019	Up Stream (MP3) QC	25/12/2010	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
ISAAC 2- S2	EB1100019	Downstream (MP2)	25/12/2010	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
ISAAC 2- QC2	EB1100019	Downstream (MP2) QC	25/12/2010	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
DISCHARGE-S3	EB1100019	Discharge Point (MP1)	25/12/2010	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
DISCHARGE-QC3	EB1100019	Discharge Point (MP1) QC	25/12/2010	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
ISAAC 1-S1	EB1100019	Up Stream (MP3)	27/12/2010	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
ISAAC 1-QC1	EB1100019	Up Stream (MP3) QC	27/12/2010	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
ISAAC 2- S2	EB1100019	Downstream (MP2)	27/12/2010	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
ISAAC 2- QC2	EB1100019	Downstream (MP2) QC	27/12/2010	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
DISCHARGE-S3	EB1100019	Discharge Point (MP1)	27/12/2010	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
DISCHARGE-QC3	EB1100019	Discharge Point (MP1) QC	27/12/2010	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
TRIP-S5			29/12/2010	30					<1	<2	<2	<2	<2
S5			25/12/2010	<20					<1	<2	<2	<2	<2
QC 5			24/12/2010	20					<1	<2	<2	<2	<2

ALS			Analyte	C6 - C9 Fraction	C10 - C14 Fraction	C15 - C28 Fraction	C29 - C36 Fraction	C10 - C36 Fraction (sum)	Benzene	Toluene	Ethylbenzene	meta- & para-Xylene	ortho-Xylene
ALS Sample ID	**Lab ID**	**Monitoring Point**	**Units**	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
			Date Sampled/LOR	20	50	100	50	50	1	2	2	2	2
Draft TEP Trigger Investigation Level				**20**	**100**			**100**	**1**	**800**	**300**	**20**	
QC 5			25/12/2010	20					<1	<2	<2	<2	<2
ISAAC1-S1	ES1100200	Up Stream (MP3)	29/12/2010	<20	<50	<100	<50	<50	<1	<5	<2	<2	<2
ISAAC1-QC1	ES1100200	Up Stream (MP3)QC	29/12/2010	<20	<50	<100	<50	<50	<1	<5	<2	<2	<2
ISAAC2-S2	ES1100200	Downstream (MP2)	29/12/2010	<20	<50	<100	<50	<50	<1	<5	<2	<2	<2
ISAAC2-QC2	ES1100200	Downstream (MP2) QC	29/12/2010	<20	<50	<100	<50	<50	<1	<5	<2	<2	<2
DISCHARGE-S3	ES1100200	Discharge Point (MP1)	29/12/2010	<20	<50	<100	<50	<50	<1	<5	<2	<2	<2
DISCHARGE-QC3	ES1100200	Discharge Point (MP1) QC	29/12/2010	<20	<50	<100	<50	<50	<1	<5	<2	<2	<2
TRIP-QC5			29/12/2010						<1	<5	<2	<2	<2
TRIP-S5			29/12/2010						<1	<2	<2	<2	<2
DISCHARGE POINT	ES1100200	Discharge Point (MP1)	31/12/2010	<20	<50	<100	<50	<50	<1	<5	<2	<2	<2
ISAAC 1	ES1100200	Up Stream (MP3)	31/12/2010	<20	<50	<100	<50	<50	<1	<5	<2	<2	<2
ISAAC 2	ES1100200		31/12/2010	<20	<50	<100	<50	<50	<1	<5	<2	<2	<2
TRIP 1 2	ES1100200		31/12/2010						<1	<5	<2	<2	<2
Issac 1 - s1	EB1100132	Up Stream (MP3)	02/01/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
Issac 2 - s2	EB1100132	Downstream (MP2)	02/01/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
Discharge point - s3	EB1100132	Discharge Point (MP1)	02/01/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
Issac 1 - qc1	EB1100132	Up Stream (MP3) QC	02/01/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
Issac 2 - qc2	EB1100132	Downstream (MP2)QC	02/01/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
Discharge point = qc3	EB1100132	Discharge Point (MP1) QC	02/01/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
Trip - QC5			02/01/2011	40	-	-	-	-	<1	<2	<2	<2	<2
Issac 1 - s1	EB1100130	Up Stream (MP3)	03/01/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
Issac 2 - s2	EB1100130	Downstream (MP2)	03/01/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
Discharge point - s3	EB1100130	Discharge Point (MP1)	03/01/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
Issac 1 - qc1	EB1100130	Up Stream (MP3) QC	03/01/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
Issac 2 - qc2	EB1100130	Downstream (MP2)QC	03/01/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
Discharge point - qc3	EB1100130	Discharge Point (MP1) QC	03/01/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
Trip - QC5			03/01/2011	<20					<1	<2	<2	<2	<2
Isaac 1 - s1	EB1100282	Up Stream (MP3)	04/01/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
Isaac 2 - s2	EB1100282	Downstream (MP2)	04/01/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
Discharge point - s3	EB1100282	Discharge Point (MP1)	04/01/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
Isaac 1 - qc1	EB1100282	Up Stream (MP3) QC	04/01/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
Isaac 2 - qc2	EB1100282	Downstream (MP2)QC	04/01/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
Discharge point - s3	EB1100282	Discharge Point (MP1) QC	04/01/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
Trip - s5			04/01/2011	<20					<1	<2	<2	<2	<2
Isaac 1 - s1	EB1100279	Up Stream (MP3)	05/01/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
Isaac 2 - s2	EB1100279	Downstream (MP2)	05/01/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
Discharge point - s3	EB1100279	Discharge Point (MP1)	05/01/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
Isaac 1 - qc1	EB1100279	Up Stream (MP3) QC	05/01/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
Isaac 2 - qc2	EB1100279	Downstream (MP2)QC	05/01/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2

ALS			Analyte	C6 - C9 Fraction	C10 - C14 Fraction	C15 - C28 Fraction	C29 - C36 Fraction	C10 - C36 Fraction (sum)	Benzene	Toluene	Ethylbenzene	meta- & para-Xylene	ortho-Xylene
ALS Sample ID	Lab ID	Monitoring Point	Units	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
			Date Sampled/LOR	20	50	100	50	50	1	2	2	2	2
Draft TEP Trigger Investigation Level				**20**	**100**			**100**	**1**	**800**	**300**	**20**	
Discharge point - s3	EB1100279	Discharge Point (MP1) QC	05/01/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
S1	EB1100506	Up Stream (MP3)	06/01/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
S2	EB1100506	Downstream (MP2)	06/01/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
S3	EB1100506	Discharge Point (MP1)	06/01/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
QC1	EB1100506	Up Stream (MP3) QC	06/01/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
QC2	EB1100506	Downstream (MP2)QC	06/01/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
QC3	EB1100506	Discharge Point (MP1) QC	06/01/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
QC4			06/01/2011	20					<1	<2	<2	<2	<2
S1	EB1100507	Up Stream (MP3)	07/01/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
S2	EB1100507	Downstream (MP2)	07/01/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
S3	EB1100507	Discharge Point (MP1)	07/01/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
QC1	EB1100507	Up Stream (MP3) QC	07/01/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
QC2	EB1100507	Downstream (MP2)QC	07/01/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
QC3	EB1100507	Discharge Point (MP1) QC	07/01/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
QC4			07/01/2011	<20					<1	<2	<2	<2	<2
S1	EM1101133	Up Stream (MP3)	31/01/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
S2	EM1101133	Downstream (MP2)	31/01/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
S3	EM1101133	Discharge Point (MP1)	31/01/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
QC1	EM1101133	Up Stream (MP3) QC	31/01/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
QC2	EM1101133	Downstream (MP2)QC	31/01/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
QC3	EM1101133	Discharge Point (MP1) QC	31/01/2011	<20	<50	130	80	210	<1	<2	<2	<2	<2
QC4			31/01/2011	<20					<1	<2	<2	<2	<2
S1 ISAC 2	EM1101101	Up Stream (MP3)	01/02/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
S2 ISAC 1	EM1101101	Downstream (MP2)	01/02/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
S3 DISCHARGE	EM1101101	Discharge Point (MP1)	01/02/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
QC1 ISAC 2	EM1101101	Up Stream (MP3) QC	01/02/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
QC2 ISAC 1	EM1101101	Downstream (MP2)QC	01/02/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
QC3 DISCHARGE	EM1101101	Discharge Point (MP1) QC	01/02/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
QC4 TRIP			01/02/2011	<20					<1	<2	<2	<2	<2
S1	EM1101103	Up Stream (MP3)	02/02/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
S2	EM1101103	Downstream (MP2)	02/02/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
QC1	EM1101103	Up Stream (MP3) QC	02/02/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
QC2	EM1101103	Downstream (MP2)QC	02/02/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
QC4			02/02/2011	<20					<1	<2	<2	<2	<2
ISAC 2 S1	EM1101104	Up Stream (MP3)	03/02/2011	<20	<50	140	100	240	<1	<2	<2	<2	<2
ISAC 1 S1	EM1101104	Downstream (MP2)	03/02/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
ISAC 2 QC1	EM1101104	Up Stream (MP3) QC	03/02/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
ISAC 1 QC1	EM1101104	Downstream (MP2)QC	03/02/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
TRIP QC4			03/02/2011	<20					<1	<2	<2	<2	<2

ALS			Analyte	C6 - C9 Fraction	C10 - C14 Fraction	C15 - C28 Fraction	C29 - C36 Fraction	C10 - C36 Fraction (sum)	Benzene	Toluene	Ethylbenzene	meta- & para-Xylene	ortho-Xylene
ALS Sample ID	**Lab ID**	**Monitoring Point**	**Units**	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
			Date Sampled/LOR	20	50	100	50	50	1	2	2	2	2
Draft TEP Trigger Investigation Level				**20**	**100**			**100**	**1**	**800**	**300**	**20**	
Upstream MP3 - S10	EB1102552	Upstream MP3 - S1	09/02/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
Downstream - MP2 - S2	EB1102552	Downstream - MP2 - S2	09/02/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
QC2	EB1102552	QC2	09/02/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
QC3	EB1102552	QC3	09/02/2011	<20					<1	<2	<2	<2	<2
Upstream MP3 - S1	EB1102554	Up Stream (MP3)	10/02/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
Downstream - MP2 - S2	EB1102554	Downstream (MP2)	10/02/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
QC2	EB1102554	Downstream (MP2)QC	10/02/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
QC3	EB1102554		10/02/2011	<20					<1	<2	<2	<2	<2
March 2011 Discharge													
REG	EB105951	Upstream MP3 - S1	25/03/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
REG	EB105951	Downstream - MP2 - S2	25/03/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
REG	EB105951	Discharge - MP1 - S3	25/03/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
REG	EB105951	Upstream QC1	25/03/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
REG	EB105951	Downstream QC2	25/03/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
REG	EB105951	Discharge QC3	25/03/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
REG	EB105951	Trip QC4	25/03/2011			<20			<1	<2	<2	<2	<2
REG	EB105951	Rinsate QC5	25/03/2011			<20			<1	<2	<2	<2	<2
Upstream MP3-S1	EB1105942	Upstream MP3-S1	26/03/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
Downstrream-MP2-S2	EB1105942	Downstrream-MP2-S2	26/03/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
Discharge-MP1-S3	EB1105942	Discharge-MP1-S3	26/03/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
Upstream QC1	EB1105942	Upstream QC1	26/03/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
Downstream QC2	EB1105942	Downstream QC2	26/03/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
Discharge QC3	EB1105942	Discharge QC3	26/03/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
TRip QC4	EB1105942	Trip QC4	26/03/2011	<20					<1	<2	<2	<2	<2
Rinsate QC5	EB1105942	Rinsate QC5	26/03/2011	<20					<1	<2	<2	<2	<2
March 2011 Discharge Dam Monitoring													
Pond 1	EB1105946	P1-S1	26/03/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
Pond 2 (Discharge)	EB1105946	P2-S2	26/03/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
Pond 5	EB1105946	P5-S5	26/03/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
Pond 10	EB1105946	P10-S10	26/03/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
Pond 1 Duplicate	EB1105946	P1-QC1	26/03/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
Pond 2 Duplicate	EB1105946	P2-QC2	26/03/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
Pond 5 Duplicate	EB1105946	P5-QC5	26/03/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2

ALS			Analyte	C6 - C9 Fraction	C10 - C14 Fraction	C15 - C28 Fraction	C29 - C36 Fraction	C10 - C36 Fraction (sum)	Benzene	Toluene	Ethylbenzene	meta- & para-Xylene	ortho-Xylene
ALS Sample ID	**Lab ID**	**Monitoring Point**	**Units**	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
			Date Sampled/LOR	20	50	100	50	50	1	2	2	2	2
Draft TEP Trigger Investigation Level				**20**	**100**			**100**	**1**	**800**	**300**	**20**	
Pond 10 Duplicate	EB1105946	P10-QC10	26/03/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
Trip Blank	EB1105946	Trip QC4	26/03/2011	<20					<1	<2	<2	<2	<2
Rinsate Sample	EB1105946	Rinsate QC5	26/03/2011	<20					<1	<2	<2	<2	<2
March 2011 Discharge													
Upstream MP3-S1	EB1105944	Upstream MP3-S1	27/03/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
Downstream-MP2-S2	EB1105944	Downstream-MP2-S2	27/03/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
Upstream QC1	EB1105944	Upstream QC1	27/03/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
Downstream QC2	EB1105944	Downstream QC2	27/03/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
Trip QC4	EB1105944		27/03/2011	<20					<1	<2	<2	<2	<2
Rinsate QC5	EB1105944		27/03/2011	<20					<1	<2	<2	<2	<2
Upstream MP3 - S1	EB1105983	Upstream MP3 - S1	28/03/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
Downstream - MP2 - S2	EB1105983	Downstream - MP2 - S2	28/03/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
Upstream QC1	EB1105983	Upstream QC1	28/03/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
Downstream QC2	EB1105983	Downstream QC2	28/03/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
Trip QC4	EB1105983		28/03/2011	<20					<1	<2	<2	<2	<2
Rinsate QC5	EB1105983		28/03/2011	<20					<1	<2	<2	<2	<2
Upstream MP3- S1	EB1106761	Upstream MP3- S1	05/04/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
Downstream MP2 - S2	EB1106761	Downstream MP2 - S2	05/04/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
Discharge MP1 - S3	EB1106761	Discharge MP1 - S3	05/04/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
Upstream QC1	EB1106761	Upstream QC1	05/04/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
Downstream QC2	EB1106761	Downstream QC2	05/04/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
Discharge QC3	EB1106761	Discharge QC3	05/04/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
Trip QC4	EB1106761	Trip QC4	05/04/2011	<20					<1	<2	<2	<2	<2
Upstream MP3 - S1	EB1106763	Upstream MP3 - S1	06/04/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
Downstream MP2- S2	EB1106763	Downstream MP2- S2	06/04/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
Upstream QC1	EB1106763	Upstream QC1	06/04/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
Downstream QC2	EB1106763	Downstream QC2	06/04/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
Trip QC4	EB1106763	Trip QC4	06/04/2011	<20					<1	<2	<2	<2	<2
Rinsate QC5	EB1106763	Rinsate QC5	06/04/2011	<20					<1	<2	<2	<2	<2
Upstream MP3 - S1	EB1106850	Upstream MP3 - S1	07/04/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
Downstream - MP2 - S2	EB1106850	Downstream - MP2 - S2	07/04/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
Upstream QC1	EB1106850	Upstream QC1	07/04/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
Downstream QC2	EB1106850	Downstream QC2	07/04/2011	<20	<50	<100	<50	<50	<1	<2	<2	<2	<2
Trip QC4	EB1106850	Trip QC4	07/04/2011	<20					<1	<2	<2	<2	<2
Rinsate QC5	EB1106850	Rinsate QC5	07/04/2011	<20					<1	<2	<2	<2	<2

ALS			Analyte	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Benzo(a)pyrene	Indeno(1.2.3.cd)pyrene	Dibenz(a.h)anthracene	Benzo(g.h.i)perylene
ALS Sample ID	Lab ID	Monitoring Point	Units	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
			Date Sampled/LOR	1	1	1	1	1	1	1	1	1	1	1	1	0.5	1	1	1
Draft TEP Trigger Investigation Level																			
DISCHARGE POINT		Discharge Point (MP1)	21/12/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ISAAC 1		Up Stream (MP3)	21/12/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ISAAC 2		Downstream (MP2)	21/12/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DISCHARGE POINT			21/12/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ISAAC 1			21/12/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ISSAC 2		Downstream (MP2) QC	21/12/2010																
DISCHARGE POINT		Discharge Point (MP1)	23/12/2010	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
Downstream		Downstream (MP2)	23/12/2010	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
ISAAC 2		Downstream (MP2) QC	23/12/2010	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
ISAAC 1-S1	EB1100019	Up Stream (MP3)	24/12/2010	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
ISAAC 1-QC1	EB1100019	Up Stream (MP3) QC	24/12/2010	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
ISAAC 2- S2	EB1100019	Downstream (MP2)	24/12/2010	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
ISAAC 2- QC2	EB1100019	Downstream (MP2) QC	24/12/2010	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
DISCHARGE-S3	EB1100019	Discharge Point (MP1)	24/12/2010	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
DISCHARGE-QC3	EB1100019	Discharge Point (MP1) QC	24/12/2010	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
QC 5	EB1100019		24/12/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S5	EB1100019		25/12/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ISAAC 1-S1	EB1100019	Up Stream (MP3)	24/12/2010	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
ISAAC 1-QC1	EB1100019	Up Stream (MP3) QC	24/12/2010	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
ISAAC 2- S2	EB1100019	Downstream (MP2)	24/12/2010	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
ISAAC 2- QC2	EB1100019	Downstream (MP2) QC	24/12/2010	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
DISCHARGE-S3	EB1100019	Discharge Point (MP1)	24/12/2010	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
DISCHARGE-QC3	EB1100019	Discharge Point (MP1) QC	24/12/2010	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
ISAAC 1-S1	EB1100019	Up Stream (MP3)	25/12/2010	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
ISAAC 1-QC1	EB1100019	Up Stream (MP3) QC	25/12/2010	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
ISAAC 2- S2	EB1100019	Downstream (MP2)	25/12/2010	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
ISAAC 2- QC2	EB1100019	Downstream (MP2) QC	25/12/2010	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
DISCHARGE-S3	EB1100019	Discharge Point (MP1)	25/12/2010	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
DISCHARGE-QC3	EB1100019	Discharge Point (MP1) QC	25/12/2010	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
ISAAC 1-S1	EB1100019	Up Stream (MP3)	27/12/2010	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.9	<1.0	<1.0	<1.0
ISAAC 1-QC1	EB1100019	Up Stream (MP3) QC	27/12/2010	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
ISAAC 2- S2	EB1100019	Downstream (MP2)	27/12/2010	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
ISAAC 2- QC2	EB1100019	Downstream (MP2) QC	27/12/2010	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
DISCHARGE-S3	EB1100019	Discharge Point (MP1)	27/12/2010	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
DISCHARGE-QC3	EB1100019	Discharge Point (MP1) QC	27/12/2010	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
TRIP-S5			29/12/2010																
S5			25/12/2010																
QC 5			24/12/2010																
QC 5			25/12/2010																
ISAAC1-S1	ES1100200	Up Stream (MP3)	29/12/2010	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
ISAAC1-QC1	ES1100200	Up Stream (MP3)QC	29/12/2010	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
ISAAC2-S2	ES1100200	Downstream (MP2)	29/12/2010	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
ISAAC2-QC2	ES1100200	Downstream (MP2) QC	29/12/2010	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
DISCHARGE-S3	ES1100200	Discharge Point (MP1)	29/12/2010	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
DISCHARGE-QC3	ES1100200	Discharge Point (MP1) QC	29/12/2010	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
TRIP-QC5			29/12/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

ALS			Analyte	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Benzo(a)pyrene	Indeno(1.2.3.cd)pyrene	Dibenz(a.h)anthracene	Benzo(g.h.i)perylene
ALS Sample ID	Lab ID	Monitoring Point	Units	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
			Date Sampled/LOR	1	1	1	1	1	1	1	1	1	1	1	1	0.5	1	1	1
Draft TEP Trigger Investigation Level																			
TRIP-S5			29/12/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DISCHARGE POINT	ES1100200	Discharge Point (MP1)	31/12/2010	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
ISAAC 1	ES1100200	Up Stream (MP3)	31/12/2010	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
ISAAC 2	ES1100200		31/12/2010	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
TRIP 1 2	ES1100200		31/12/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Issac 1 - s1	EB1100132	Up Stream (MP3)	02/01/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
Issac 2 - s2	EB1100132	Downstream (MP2)	02/01/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
Discharge point - s3	EB1100132	Discharge Point (MP1)	02/01/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
Issac 1 - qc1	EB1100132	Up Stream (MP3) QC	02/01/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
Issac 2 - qc2	EB1100132	Downstream (MP2)QC	02/01/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
Discharge point = qc3	EB1100132	Discharge Point (MP1) QC	02/01/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
Trip - QC5			02/01/2011	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Issac 1 - s1	EB1100130	Up Stream (MP3)	03/01/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
Issac 2 - s2	EB1100130	Downstream (MP2)	03/01/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
Discharge point - s3	EB1100130	Discharge Point (MP1)	03/01/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
Issac 1 - qc1	EB1100130	Up Stream (MP3) QC	03/01/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
Issac 2 - qc2	EB1100130	Downstream (MP2)QC	03/01/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
Discharge point - qc3	EB1100130	Discharge Point (MP1) QC	03/01/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
Trip - QC5			03/01/2011																
Isaac 1 - s1	EB1100282	Up Stream (MP3)	04/01/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
Isaac 2 - s2	EB1100282	Downstream (MP2)	04/01/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
Discharge point - s3	EB1100282	Discharge Point (MP1)	04/01/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
Isaac 1 - qc1	EB1100282	Up Stream (MP3) QC	04/01/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
Isaac 2 - qc2	EB1100282	Downstream (MP2)QC	04/01/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
Discharge point - s3	EB1100282	Discharge Point (MP1) QC	04/01/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
Trip - s5			04/01/2011																
Isaac 1 - s1	EB1100279	Up Stream (MP3)	05/01/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
Isaac 2 - s2	EB1100279	Downstream (MP2)	05/01/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
Discharge point - s3	EB1100279	Discharge Point (MP1)	05/01/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
Isaac 1 - qc1	EB1100279	Up Stream (MP3) QC	05/01/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
Isaac 2 - qc2	EB1100279	Downstream (MP2)QC	05/01/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
Discharge point - s3	EB1100279	Discharge Point (MP1) QC	05/01/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
S1	EB1100506	Up Stream (MP3)	06/01/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
S2	EB1100506	Downstream (MP2)	06/01/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
S3	EB1100506	Discharge Point (MP1)	06/01/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
QC1	EB1100506	Up Stream (MP3) QC	06/01/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
QC2	EB1100506	Downstream (MP2)QC	06/01/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
QC3	EB1100506	Discharge Point (MP1) QC	06/01/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
QC4			06/01/2011																
S1	EB1100507	Up Stream (MP3)	07/01/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
S2	EB1100507	Downstream (MP2)	07/01/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
S3	EB1100507	Discharge Point (MP1)	07/01/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
QC1	EB1100507	Up Stream (MP3) QC	07/01/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
QC2	EB1100507	Downstream (MP2)QC	07/01/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
QC3	EB1100507	Discharge Point (MP1) QC	07/01/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
QC4			07/01/2011																
S1	EM1101133	Up Stream (MP3)	31/01/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0

ALS			Analyte	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Benzo(a)pyrene	Indeno(1.2.3.cd)pyrene	Dibenz(a.h)anthracene	Benzo(g.h.i)perylene
ALS Sample ID	Lab ID	Monitoring Point	Units	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
			Date Sampled/LOR	1	1	1	1	1	1	1	1	1	1	1	1	0.5	1	1	1
Draft TEP Trigger Investigation Level																			
S2	EM1101133	Downstream (MP2)	31/01/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
S3	EM1101133	Discharge Point (MP1)	31/01/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
QC1	EM1101133	Up Stream (MP3) QC	31/01/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
QC2	EM1101133	Downstream (MP2)QC	31/01/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
QC3	EM1101133	Discharge Point (MP1) QC	31/01/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
QC4			31/01/2011																
S1 ISAC 2	EM1101101	Up Stream (MP3)	01/02/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
S2 ISAC 1	EM1101101	Downstream (MP2)	01/02/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
S3 DISCHARGE	EM1101101	Discharge Point (MP1)	01/02/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
QC1 ISAC 2	EM1101101	Up Stream (MP3) QC	01/02/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
QC2 ISAC 1	EM1101101	Downstream (MP2)QC	01/02/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
QC3 DISCHARGE	EM1101101	Discharge Point (MP1) QC	01/02/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
QC4 TRIP			01/02/2011																
S1	EM1101103	Up Stream (MP3)	02/02/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
S2	EM1101103	Downstream (MP2)	02/02/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
QC1	EM1101103	Up Stream (MP3) QC	02/02/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
QC2	EM1101103	Downstream (MP2)QC	02/02/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
QC4			02/02/2011																
ISAC 2 S1	EM1101104	Up Stream (MP3)	03/02/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
ISAC 1 S1	EM1101104	Downstream (MP2)	03/02/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
ISAC 2 QC1	EM1101104	Up Stream (MP3) QC	03/02/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
ISAC 1 QC1	EM1101104	Downstream (MP2)QC	03/02/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
TRIP QC4			03/02/2011																
Upstream MP3 - S10	EB1102552	Upstream MP3 - S1	09/02/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
Downstream - MP2 - S2	EB1102552	Downstream - MP2 - S2	09/02/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
QC2	EB1102552	QC2	09/02/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
QC3	EB1102552	QC3	09/02/2011																
Upstream MP3 - S1	EB1102554	Up Stream (MP3)	10/02/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
Downstream - MP2 - S2	EB1102554	Downstream (MP2)	10/02/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
QC2	EB1102554	Downstream (MP2)QC	10/02/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
QC3	EB1102554		10/02/2011																
March 2011 Discharge																			
REG	EB105951	Upstream MP3 - S1	25/03/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
REG	EB105951	Downstream - MP2 - S2	25/03/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
REG	EB105951	Discharge - MP1 - S3	25/03/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
REG	EB105951	Upstream QC1	25/03/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
REG	EB105951	Downstream QC2	25/03/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
REG	EB105951	Discharge QC3	25/03/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
REG	EB105951	Trip QC4	25/03/2011																
REG	EB105951	Rinsate QC5	25/03/2011																
Upstream MP3-S1	EB1105942	Upstream MP3-S1	26/03/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
Downstrream-MP2-S2	EB1105942	Downstrream-MP2-S2	26/03/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
Discharge-MP1-S3	EB1105942	Discharge-MP1-S3	26/03/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
Upstream QC1	EB1105942	Upstream QC1	26/03/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0

ALS			Analyte	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Benzo(a)pyrene	Indeno(1.2.3.cd)pyrene	Dibenz(a.h)anthracene	Benzo(g.h.i)perylene
ALS Sample ID	Lab ID	Monitoring Point	Units	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
			Date Sampled/LOR	1	1	1	1	1	1	1	1	1	1	1	1	0.5	1	1	1
Draft TEP Trigger Investigation Level																			
Downstream QC2	EB1105942	Downstream QC2	26/03/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
Discharge QC3	EB1105942	Discharge QC3	26/03/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
TRip QC4	EB1105942	Trip QC4	26/03/2011																
Rinsate QC5	EB1105942	Rinsate QC5	26/03/2011																
March 2011 Discharge Dam Monitoring																			
Pond 1	EB1105946	P1-S1	26/03/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
Pond 2 (Discharge)	EB1105946	P2-S2	26/03/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
Pond 5	EB1105946	P5-S5	26/03/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
Pond 10	EB1105946	P10-S10	26/03/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
Pond 1 Duplicate	EB1105946	P1-QC1	26/03/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
Pond 2 Duplicate	EB1105946	P2-QC2	26/03/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
Pond 5 Duplicate	EB1105946	P5-QC5	26/03/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
Pond 10 Duplicate	EB1105946	P10-QC10	26/03/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
Trip Blank	EB1105946	Trip QC4	26/03/2011																
Rinsate Sample	EB1105946	Rinsate QC5	26/03/2011																
March 2011 Discharge																			
Upstream MP3-S1	EB1105944	Upstream MP3-S1	27/03/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
Downstream-MP2-S2	EB1105944	Downstream-MP2-S2	27/03/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
Upstream QC1	EB1105944	Upstream QC1	27/03/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
Downstream QC2	EB1105944	Downstream QC2	27/03/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
Trip QC4	EB1105944		27/03/2011																
Rinsate QC5	EB1105944		27/03/2011																
Upstream MP3 - S1	EB1105983	Upstream MP3 - S1	28/03/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
Downstream - MP2 - S2	EB1105983	Downstream - MP2 - S2	28/03/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
Upstream QC1	EB1105983	Upstream QC1	28/03/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
Downstream QC2	EB1105983	Downstream QC2	28/03/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
Trip QC4	EB1105983		28/03/2011																
Rinsate QC5	EB1105983		28/03/2011																
Upstream MP3- S1	EB1106761	Upstream MP3- S1	05/04/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
Downstream MP2 - S2	EB1106761	Downstream MP2 - S2	05/04/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
Discharge MP1 - S3	EB1106761	Discharge MP1 - S3	05/04/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
Upstream QC1	EB1106761	Upstream QC1	05/04/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
Downstream QC2	EB1106761	Downstream QC2	05/04/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
Discharge QC3	EB1106761	Discharge QC3	05/04/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
Trip QC4	EB1106761	Trip QC4	05/04/2011																
Upstream MP3 - S1	EB1106763	Upstream MP3 - S1	06/04/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
Downstream MP2- S2	EB1106763	Downstream MP2- S2	06/04/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
Upstream QC1	EB1106763	Upstream QC1	06/04/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
Downstream QC2	EB1106763	Downstream QC2	06/04/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
Trip QC4	EB1106763	Trip QC4	06/04/2011																
Rinsate QC5	EB1106763	Rinsate QC5	06/04/2011																
Upstream MP3 - S1	EB1106850	Upstream MP3 - S1	07/04/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0

ALS			Analyte	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Benzo(a)pyrene	Indeno(1.2.3.cd)pyrene	Dibenz(a.h)anthracene	Benzo(g.h.i)perylene
ALS Sample ID	**Lab ID**	**Monitoring Point**	**Units**	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
			Date Sampled/LOR	1	1	1	1	1	1	1	1	1	1	1	1	0.5	1	1	1
Draft TEP Trigger Investigation Level																			
Downstream - MP2 - S2	EB1106850	Downstream - MP2 - S2	07/04/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
Upstream QC1	EB1106850	Upstream QC1	07/04/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
Downstream QC2	EB1106850	Downstream QC2	07/04/2011	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0
Trip QC4	EB1106850	Trip QC4	07/04/2011																
Rinsate QC5	EB1106850	Rinsate QC5	07/04/2011																

ALS			Analyte		pH Value	Electrical Conductivity @ 25°C	Turbidity	Hydroxide Alkalinity as CaCO3	Carbonate Alkalinity as CaCO3	Bicarbonate Alkalinity as CaCO3	Total Alkalinity as CaCO3	Sulfate as SO4 2-	Chloride	Calcium	Magnesium	Sodium	Potassium	Fluoride	Volatile Acids as Acetic Acid	Nitrite as N	Nitrate as N	Nitrite + Nitrate as N	Reactive Phosphorus as P	Ammonia as N
ALS Sample ID	**Lab ID**	**Monitoring Point**	**Units**		pH Unit	µS/cm	NTU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
			Date Sampled/LOR		0.00	0	0.0	1	1	1	1	1	1	1	1	1	1	0.1	5	0.01	0.01	0.01	0.01	0.01
Draft TEP Trigger Investigation Level																		**2**			**1.1**			**0.9**
DISCHARGE POINT		Discharge Point (MP1)	21/12/2010	-	-	-	-	-	-	-	-	8	53	10	5	45	4	-	14	<0.01	0.08	0.06	-	-
ISAAC 1		Up Stream (MP3)	21/12/2010	-	-	-	-	-	-	-	-	8	47	8	5	27	4	-	10	<0.01	0.06	0.06	-	-
ISAAC 2		Downstream (MP2)	21/12/2010	-	-	-	-	-	-	-	-	8	21	8	4	23	3	-	7	<0.01	0.06	0.06	-	-
DISCHARGE POINT			21/12/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ISAAC 1			21/12/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ISSAC 2		Downstream (MP2) QC	21/12/2010	-	-	-	-	-	-	-	-	11	38	10	5	35	3	-	10	<0.01	0.09	0.09	-	-
DISCHARGE POINT		Discharge Point (MP1)	23/12/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Downstream		Downstream (MP2)	23/12/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ISAAC 2		Downstream (MP2) QC	23/12/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ISAAC 1-S1	EB1100019	Up Stream (MP3)	24/12/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ISAAC 1-QC1	EB1100019	Up Stream (MP3) QC	24/12/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ISAAC 2- S2	EB1100019	Downstream (MP2)	24/12/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ISAAC 2- QC2	EB1100019	Downstream (MP2) QC	24/12/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DISCHARGE-S3	EB1100019	Discharge Point (MP1)	24/12/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DISCHARGE-QC3	EB1100019	Discharge Point (MP1) QC	24/12/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
QC 5	EB1100019		24/12/2010	-	-	-	-	-	-	-	-							-					-	-
S5	EB1100019		25/12/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ISAAC 1-S1	EB1100019	Up Stream (MP3)	24/12/2010																					
ISAAC 1-QC1	EB1100019	Up Stream (MP3) QC	24/12/2010																					
ISAAC 2- S2	EB1100019	Downstream (MP2)	24/12/2010																					
ISAAC 2- QC2	EB1100019	Downstream (MP2) QC	24/12/2010																					
DISCHARGE-S3	EB1100019	Discharge Point (MP1)	24/12/2010																					
DISCHARGE-QC3	EB1100019	Discharge Point (MP1) QC	24/12/2010																					
ISAAC 1-S1	EB1100019	Up Stream (MP3)	25/12/2010																					
ISAAC 1-QC1	EB1100019	Up Stream (MP3) QC	25/12/2010																					
ISAAC 2- S2	EB1100019	Downstream (MP2)	25/12/2010																					
ISAAC 2- QC2	EB1100019	Downstream (MP2) QC	25/12/2010																					
DISCHARGE-S3	EB1100019	Discharge Point (MP1)	25/12/2010																					
DISCHARGE-QC3	EB1100019	Discharge Point (MP1) QC	25/12/2010																					
ISAAC 1-S1	EB1100019	Up Stream (MP3)	27/12/2010																					
ISAAC 1-QC1	EB1100019	Up Stream (MP3) QC	27/12/2010																					
ISAAC 2- S2	EB1100019	Downstream (MP2)	27/12/2010																					
ISAAC 2- QC2	EB1100019	Downstream (MP2) QC	27/12/2010																					
DISCHARGE-S3	EB1100019	Discharge Point (MP1)	27/12/2010																					
DISCHARGE-QC3	EB1100019	Discharge Point (MP1) QC	27/12/2010																					
TRIP-S5			29/12/2010																					
S5			25/12/2010																					
QC 5			24/12/2010																					
QC 5			25/12/2010																					

ALS			Analyte		pH Value	Electrical Conductivity @ 25°C	Turbidity	Hydroxide Alkalinity as CaCO3	Carbonate Alkalinity as CaCO3	Bicarbonate Alkalinity as CaCO3	Total Alkalinity as CaCO3	Sulfate as SO4 2-	Chloride	Calcium	Magnesium	Sodium	Potassium	Fluoride	Volatile Acids as Acetic Acid	Nitrite as N	Nitrate as N	Nitrite + Nitrate as N	Reactive Phosphorus as P	Ammonia as N
ALS Sample ID	**Lab ID**	**Monitoring Point**	**Units**		pH Unit	µS/cm	NTU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
			Date Sampled/LOR		0.00	0	0.0	1	1	1	1	1	1	1	1	1	1	0.1	5	0.01	0.01	0.01	0.01	0.01
Draft TEP Trigger Investigation Level																		**2**			**1.1**			**0.9**
ISAAC1-S1	ES1100200	Up Stream (MP3)	29/12/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ISAAC1-QC1	ES1100200	Up Stream (MP3)QC	29/12/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ISAAC2-S2	ES1100200	Downstream (MP2)	29/12/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ISAAC2-QC2	ES1100200	Downstream (MP2) QC	29/12/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DISCHARGE-S3	ES1100200	Discharge Point (MP1)	29/12/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DISCHARGE-QC3	ES1100200	Discharge Point (MP1) QC	29/12/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TRIP-QC5			29/12/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TRIP-S5			29/12/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DISCHARGE POINT	ES1100200	Discharge Point (MP1)	31/12/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ISAAC 1	ES1100200	Up Stream (MP3)	31/12/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ISAAC 2	ES1100200		31/12/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TRIP 1 2	ES1100200		31/12/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Issac 1 - s1	EB1100132	Up Stream (MP3)	02/01/2011		8.63	735	438	<1	11	92	102	15	158	11	6	128	4	IS		IS	IS	IS	IS	<0.01
Issac 2 - s2	EB1100132	Downstream (MP2)	02/01/2011		8.06	345	422	<1	<1	69	69	16	51	11	6	44	4	IS		IS	IS	IS	IS	0.08
Discharge point - s3	EB1100132	Discharge Point (MP1)	02/01/2011		9.25	11200	3.3	<1	342	754	1100	<10	3460	8	20	2470	11	IS		IS	IS	IS	IS	0.12
Issac 1 - qc1	EB1100132	Up Stream (MP3) QC	02/01/2011		8.69	744	417	<1	12	88	101	17	164	11	6	126	4	IS		IS	IS	IS	IS	<0.01
Issac 2 - qc2	EB1100132	Downstream (MP2)QC	02/01/2011		8.12	345	484	<1	<1	67	67	18	53	12	6	43	4	IS		IS	IS	IS	IS	<0.01
Discharge point = qc3	EB1100132	Discharge Point (MP1) QC	02/01/2011		9.26	11200	3.9	<1	346	753	1100	<10	3460	7	19	2510	12	IS		IS	IS	IS	IS	0.14
Trip - QC5			02/01/2011	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Issac 1 - s1	EB1100130	Up Stream (MP3)	03/01/2011		7.89	370	1890	<1	<1	53	53	9	74	6	3	57	4	0.1		0.03	0.06	0.1	<0.01	<0.01
Issac 2 - s2	EB1100130	Downstream (MP2)	03/01/2011		7.5	185	920	<1	<1	43	43	9	30	5	3	31	4	<0.1		0.04	0.06	0.09	<0.01	<0.01
Discharge point - s3	EB1100130	Discharge Point (MP1)	03/01/2011		9.23	10700	4	<1	293	666	960	<1	3320	7	16	2620	9	1.8		<0.01	0.03	0.03	0.03	0.09
Issac 1 - qc1	EB1100130	Up Stream (MP3) QC	03/01/2011		8.38	368	1190	<1	2	54	56	9	80	6	3	68	4	0.1		0.03	0.08	0.12	<0.01	<0.01
Issac 2 - qc2	EB1100130	Downstream (MP2)QC	03/01/2011		7.65	1850	940	<1	<1	46	46	9	30	5	3	20	4	<0.1		0.03	0.06	0.08	<0.01	<0.01
Discharge point - qc3	EB1100130	Discharge Point (MP1) QC	03/01/2011		9.23	10700	3.6	<1	292	670	963	<1	3330	9	19	2500	10	1.9		<0.01	<0.01	<0.01	0.02	0.06
Trip - QC5			03/01/2011		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Isaac 1 - s1	EB1100282	Up Stream (MP3)	04/01/2011		7.6	370	400	<1	<1	51	51	20	60	11	6	51	4	0.1		<0.01	0.14	0.14	0.02	0.01
Isaac 2 - s2	EB1100282	Downstream (MP2)	04/01/2011		7.66	332	400	<1	<1	63	63	19	51	10	6	47	4	0.1		<0.01	0.15	0.15	<0.01	0.02
Discharge point - s3	EB1100282	Discharge Point (MP1)	04/01/2011		9.2	11100	5.8	<1	331	578	909	5	3690	13	27	2420	15	1.6		<0.01	<0.01	<0.01	0.03	0.22
Isaac 1 - qc1	EB1100282	Up Stream (MP3) QC	04/01/2011		8.14	367	390	<1	<1	60	60	20	61	10	6	51	4	0.1		<0.01	0.14	0.14	<0.01	0.02
Isaac 2 - qc2	EB1100282	Downstream (MP2)QC	04/01/2011		7.7	336	450	<1	<1	50	50	18	50	10	6	46	4	0.1		<0.01	0.15	0.15	<0.01	0.02
Discharge point - s3	EB1100282	Discharge Point (MP1) QC	04/01/2011		9.2	11100	6.1	<1	329	585	914	5	3690	13	26	2380	15	1.6		<0.01	<0.01	<0.01	0.02	0.22
Trip - s5			04/01/2011		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Isaac 1 - s1	EB1100279	Up Stream (MP3)	05/01/2011		8.14	387	280	<1	<1	59	59	16	68	10	7	50	4	0.1		<0.01	0.05	0.05	0.01	0.02
Isaac 2 - s2	EB1100279	Downstream (MP2)	05/01/2011		7.33	341	280	<1	<1	68	68	15	52	11	6	46	4	0.2		<0.01	0.05	0.05	<0.01	0.04
Discharge point - s3	EB1100279	Discharge Point (MP1)	05/01/2011		9.25	11000	11	<1	331	567	898	5	3650	14	27	2520	15	1.6		<0.01	<0.01	<0.01	0.03	0.06
Isaac 1 - qc1	EB1100279	Up Stream (MP3) QC	05/01/2011		8.27	391	260	<1	<1	70	70	14	70	11	6	55	4	0.1		<0.01	0.05	0.05	<0.01	0.02
Isaac 2 - qc2	EB1100279	Downstream (MP2)QC	05/01/2011		7.9	352	280	<1	<1	58	58	17	50	10	6	41	4	0.1		<0.01	0.05	0.05	0.01	0.02
Discharge point - s3	EB1100279	Discharge Point (MP1) QC	05/01/2011		9.25	11000	11	<1	331	558	889	5	3630	12	26	2600	13	1.6		<0.01	<0.01	<0.01	0.02	0.09
S1	EB1100506	Up Stream (MP3)	06/01/2011		7.97	215	270	<1	<1	60	60	4	19	10	6	20	4	0.1		<0.01	0.01	0.01	<0.01	0.01

ALS			Analyte		pH Value	Electrical Conductivity @ 25°C	Turbidity	Hydroxide Alkalinity as CaCO3	Carbonate Alkalinity as CaCO3	Bicarbonate Alkalinity as CaCO3	Total Alkalinity as CaCO3	Sulfate as SO4 2-	Chloride	Calcium	Magnesium	Sodium	Potassium	Fluoride	Volatile Acids as Acetic Acid	Nitrite as N	Nitrate as N	Nitrite + Nitrate as N	Reactive Phosphorus as P	Ammonia as N
ALS Sample ID	Lab ID	Monitoring Point	Units		pH Unit	µS/cm	NTU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
			Date Sampled/LOR		0.00	0	0.0	1	1	1	1	1	1	1	1	1	1	0.1	5	0.01	0.01	0.01	0.01	0.01
Draft TEP Trigger Investigation Level																		**2**			**1.1**			**0.9**
S2	EB1100506	Downstream (MP2)	06/01/2011		7.89	211	250	<1	<1	65	65	4	24	12	6	21	4	0.1		<0.01	0.01	0.01	<0.01	0.02
S3	EB1100506	Discharge Point (MP1)	06/01/2011		9.07	9190	10	<1	121	313	434	1	2780	19	27	1930	11	1.5		<0.01	<0.01	<0.01	0.04	0.06
QC1	EB1100506	Up Stream (MP3) QC	06/01/2011		7.92	218	320	<1	<1	61	61	4	19	11	6	20	4	0.1		<0.01	0.01	0.01	<0.01	0.02
QC2	EB1100506	Downstream (MP2)QC	06/01/2011		7.82	211	260	<1	<1	57	57	4	19	11	6	19	4	0.1		<0.01	0.01	0.01	<0.01	0.02
QC3	EB1100506	Discharge Point (MP1) QC	06/01/2011		9.16	9250	4.8	<1	178	248	426	2	2940	19	27	1940	11	1.4		<0.01	<0.01	<0.01	0.04	0.06
QC4			06/01/2011																					
S1	EB1100507	Up Stream (MP3)	07/01/2011		8.16	207	330	<1	<1	58	58	3	17	11	6	18	4	0.1		<0.01	0.03	0.03	0.02	0.02
S2	EB1100507	Downstream (MP2)	07/01/2011		7.95	206	280	<1	<1	56	56	3	17	11	6	17	4	<0.1		<0.01	0.03	0.03	0.02	0.01
S3	EB1100507	Discharge Point (MP1)	07/01/2011		9.16	9550	7.8	<1	178	258	434	2	2890	19	27	1950	11	1.4		<0.01	<0.01	<0.01	0.04	0.1
QC1	EB1100507	Up Stream (MP3) QC	07/01/2011		8.19	210	370	<1	<1	61	61	3	18	11	6	18	4	0.1		<0.01	0.03	0.03	0.02	0.02
QC2	EB1100507	Downstream (MP2)QC	07/01/2011		7.95	206	340	<1	<1	57	57	3	17	11	6	17	4	<0.1		<0.01	0.03	0.03	0.01	0.04
QC3	EB1100507	Discharge Point (MP1) QC	07/01/2011		9.17	9560	13	<1	171	261	432	2	2960	19	27	1970	11	1.4		<0.01	<0.01	<0.01	0.04	0.07
QC4			07/01/2011																					
S1	EM1101133	Up Stream (MP3)	31/01/2011		7.9	220	1550	<1	<1	62	62	51	32	7	4	28	4	<0.1		<0.01	0.1	0.1	0.02	<0.01
S2	EM1101133	Downstream (MP2)	31/01/2011		7.82	210	1380	<1	<1	60	60	50	35	7	4	27	4	<0.1		<0.01	0.09	0.09	0.02	<0.01
S3	EM1101133	Discharge Point (MP1)	31/01/2011		9.32	9370	20	<1	282	202	484	3	2930	13	24	2270	12	1.9		<0.01	0.07	0.07	0.04	0.18
QC1	EM1101133	Up Stream (MP3) QC	31/01/2011		8.05	200	1080	<1	<1	60	60	48	29	8	4	30	4	<0.1		<0.01	0.08	0.08	0.02	<0.01
QC2	EM1101133	Downstream (MP2)QC	31/01/2011		7.89	215	1690	<1	<1	60	60	48	33	8	4	32	4	<0.1		<0.01	0.09	0.09	0.02	<0.01
QC3	EM1101133	Discharge Point (MP1) QC	31/01/2011		9.33	9410	16.4	<1	287	190	477	1	3010	12	24	2100	13	1.9		<0.01	<0.01	<0.01	0.04	0.17
QC4			31/01/2011																					
S1 ISAC 2	EM1101101	Up Stream (MP3)	01/02/2011		7.99	260	890	<1	<1	60	60	57	40	10	5	49	4	<0.1		<0.01	0.09	0.09	0.02	<0.01
S2 ISAC 1	EM1101101	Downstream (MP2)	01/02/2011		7.98	440	810	<1	<1	70	70	43	91	11	6	79	5	0.1		<0.01	0.09	0.09	0.02	<0.01
S3 DISCHARGE	EM1101101	Discharge Point (MP1)	01/02/2011		9.41	11800	3.4	<1	524	480	1000	<1	3960	2	20	3150	16	2.4		<0.01	<0.01	<0.01	0.04	0.13
QC1 ISAC 2	EM1101101	Up Stream (MP3) QC	01/02/2011		8.1	250	830	<1	<1	61	61	46	40	10	5	50	5	<0.1		<0.01	0.09	0.09	0.02	<0.01
QC2 ISAC 1	EM1101101	Downstream (MP2)QC	01/02/2011		8.06	400	790	<1	<1	75	75	46	88	10	5	79	5	0.1		<0.01	0.09	0.09	0.02	<0.01
QC3 DISCHARGE	EM1101101	Discharge Point (MP1) QC	01/02/2011		9.41	11700	3.6	<1	524	461	985	<1	4640	2	20	3610	19	2.4		<0.01	<0.01	<0.01	0.04	0.13
QC4 TRIP			01/02/2011																					
S1	EM1101103	Up Stream (MP3)	02/02/2011		8.19	470	550	<1	<1	72	72	66	87	9	6	57	3	<0.1		0.03	0.11	0.14	<0.01	<0.01
S2	EM1101103	Downstream (MP2)	02/02/2011		8.04	480	540	<1	<1	73	73	68	104	9	6	73	3	0.1		0.02	0.12	0.14	<0.01	<0.01
QC1	EM1101103	Up Stream (MP3) QC	02/02/2011		7.98	440	550	<1	<1	70	70	64	90	8	5	62	3	<0.1		0.02	0.13	0.15	<0.01	<0.01
QC2	EM1101103	Downstream (MP2)QC	02/02/2011		7.99	455	580	<1	<1	71	71	66	93	8	5	68	3	<0.1		0.02	0.16	0.18	<0.01	<0.01
QC4			02/02/2011																					
ISAC 2 S1	EM1101104	Up Stream (MP3)	03/02/2011		7.68	456	630	<1	<1	69	69	66	24	8	6	63	3	<0.1		0.02	0.22	0.23	<0.01	<0.01
ISAC 1 S1	EM1101104	Downstream (MP2)	03/02/2011		7.68	456	620	<1	<1	68	68	60	45	10	6	67	3	<0.1		0.03	0.2	0.24	<0.01	0.02
ISAC 2 QC1	EM1101104	Up Stream (MP3) QC	03/02/2011		7.67	456	860	<1	<1	69	69	67	29	9	6	64	4	<0.1		0.02	0.23	0.25	<0.01	0.03
ISAC 1 QC1	EM1101104	Downstream (MP2)QC	03/02/2011		7.67	455	770	<1	<1	68	68	63	46	11	7	68	4	<0.1		0.02	0.23	0.25	<0.01	0.05
TRIP QC4			03/02/2011																					
Upstream MP3 - S10	EB1102552	Upstream MP3 - S1	09/02/2011		7.82	197	300	<1	<1	53	53	4	25	12	6	21	3	0.1		<0.01	0.05	0.05	0.01	<0.01
Downstream - MP2 - S2	EB1102552	Downstream - MP2 - S2	09/02/2011		7.86	201	240	<1	<1	56	56	4	26	11	5	20	3	0.1		<0.01	0.04	0.04	<0.01	<0.01
QC2	EB1102552	QC2	09/02/2011																					

ALS			Analyte		pH Value	Electrical Conductivity @ 25°C	Turbidity	Hydroxide Alkalinity as CaCO3	Carbonate Alkalinity as CaCO3	Bicarbonate Alkalinity as CaCO3	Total Alkalinity as CaCO3	Sulfate as SO4 2-	Chloride	Calcium	Magnesium	Sodium	Potassium	Fluoride	Volatile Acids as Acetic Acid	Nitrite as N	Nitrate as N	Nitrite + Nitrate as N	Reactive Phosphorus as P	Ammonia as N
ALS Sample ID	Lab ID	Monitoring Point	Units		pH Unit	µS/cm	NTU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
			Date Sampled/LOR		0.00	0	0.0	1	1	1	1	1	1	1	1	1	1	0.1	5	0.01	0.01	0.01	0.01	0.01
Draft TEP Trigger Investigation Level																		2			1.1			0.9
QC3	EB1102552	QC3	09/02/2011																					
Upstream MP3 - S1	EB1102554	Up Stream (MP3)	10/02/2011		7.91	212	290	<1	<1	57	57	4	28	13	6	22	3	0.1		<0.01	0.03	0.03	<0.01	<0.01
Downstream - MP2 - S2	EB1102554	Downstream (MP2)	10/02/2011		7.92	216	290	<1	<1	59	59	5	28	13	6	24	3	0.1		<0.01	0.04	0.04	<0.01	0.01
QC2	EB1102554	Downstream (MP2)QC	10/02/2011																					
QC3	EB1102554		10/02/2011																					
March 2011 Discharge																								
REG	EB105951	Upstream MP3 - S1	25/03/2011		7.9	324	3300	<1	<1	70	70	16	45	10	6	48	3	0.1		<0.01	0.12	0.12	<0.01	<0.01
REG	EB105951	Downstream - MP2 - S2	25/03/2011		8.07	663	3000	<1	<1	84	84	16	149	10	6	116	3	0.2		<0.01	0.11	0.11	<0.01	<0.01
REG	EB105951	Discharge - MP1 - S3	25/03/2011		9.37	11500	17	<1	468	403	871	2	3810	9	27	2560	16	2.3		<0.01	<0.01	<0.01	0.05	<0.01
REG	EB105951	Upstream QC1	25/03/2011																					
REG	EB105951	Downstream QC2	25/03/2011																					
REG	EB105951	Discharge QC3	25/03/2011																					
REG	EB105951	Trip QC4	25/03/2011																					
REG	EB105951	Rinsate QC5	25/03/2011																					
Upstream MP3-S1	EB1105942	Upstream MP3-S1	26/03/2011		7.72	324	500	<1	<1	74	74	14	42	12	7	37	4	0.1		<0.01	0.12	0.12	0.01	0.02
Downstrream-MP2-S2	EB1105942	Downstrream-MP2-S2	26/03/2011		8.14	666	500	<1	<1	92	92	13	145	13	7	114	4	0.2		<0.01	0.12	0.12	<0.01	0.05
Discharge-MP1-S3	EB1105942	Discharge-MP1-S3	26/03/2011																					
Upstream QC1	EB1105942	Upstream QC1	26/03/2011																					
Downstream QC2	EB1105942	Downstream QC2	26/03/2011																					
Discharge QC3	EB1105942	Discharge QC3	26/03/2011																					
TRip QC4	EB1105942	Trip QC4	26/03/2011																					
Rinsate QC5	EB1105942	Rinsate QC5	26/03/2011																					
March 2011 Discharge Dam Monitoring																								
Pond 1	EB1105946	P1-S1	26/03/2011		9.18	11400	21	<1	445	725	1170	9	3590	12	28	2670	17	2.1		<0.01	0.01	0.01	0.03	0.03
Pond 2 (Discharge)	EB1105946	P2-S2	26/03/2011		9.2	9570	37	<1	240	240	480	2	3270	18	27	2070	13	1.8		<0.01	0.02	0.02	0.02	0.08
Pond 5	EB1105946	P5-S5	26/03/2011		9.36	12500	13	<1	515	567	1080	2	3700	9	28	2600	20	2.3		<0.01	0.02	0.02	0.05	0.02
Pond 10	EB1105946	P10-S10	26/03/2011		9.38	12800	13	<1	551	571	1120	2	3980	9	29	2780	22	2.4		<0.01	0.02	0.02	0.05	0.03
Pond 1 Duplicate	EB1105946	P1-QC1	26/03/2011																					
Pond 2 Duplicate	EB1105946	P2-QC2	26/03/2011																					
Pond 5 Duplicate	EB1105946	P5-QC5	26/03/2011																					
Pond 10 Duplicate	EB1105946	P10-QC10	26/03/2011																					
Trip Blank	EB1105946	Trip QC4	26/03/2011																					
Rinsate Sample	EB1105946	Rinsate QC5	26/03/2011																					

ALS			Analyte		pH Value	Electrical Conductivity @ 25°C	Turbidity	Hydroxide Alkalinity as CaCO3	Carbonate Alkalinity as CaCO3	Bicarbonate Alkalinity as CaCO3	Total Alkalinity as CaCO3	Sulfate as SO4 2-	Chloride	Calcium	Magnesium	Sodium	Potassium	Fluoride	Volatile Acids as Acetic Acid	Nitrite as N	Nitrate as N	Nitrite + Nitrate as N	Reactive Phosphorus as P	Ammonia as N
ALS Sample ID	**Lab ID**	**Monitoring Point**	**Units**		pH Unit	µS/cm	NTU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
			Date Sampled/LOR		0.00	0	0.0	1	1	1	1	1	1	1	1	1	1	0.1	5	0.01	0.01	0.01	0.01	0.01
Draft TEP Trigger Investigation Level																		**2**			**1.1**			**0.9**
March 2011 Discharge																								
Upstream MP3-S1	EB1105944	Upstream MP3-S1	27/03/2011		7.5	552	600	<1	<1	82	82	25	99	16	9	79	4	0.5		<0.01	0.24	0.24	<0.01	0.05
Downstream-MP2-S2	EB1105944	Downstream-MP2-S2	27/03/2011		7.5	553	600	<1	<1	82	82	27	104	16	9	83	4	0.5		<0.01	0.21	0.21	<0.01	0.08
Upstream QC1	EB1105944	Upstream QC1	27/03/2011																					
Downstream QC2	EB1105944	Downstream QC2	27/03/2011																					
Trip QC4	EB1105944		27/03/2011																					
Rinsate QC5	EB1105944		27/03/2011																					
Upstream MP3 - S1	EB1105983	Upstream MP3 - S1	28/03/2011		7.56	326	200	<1	<1	81	81	10	40	13	8	39	4	0.2		<0.01	0.12	0.12	<0.01	0.14
Downstream - MP2 - S2	EB1105983	Downstream - MP2 - S2	28/03/2011		7.67	333	220	<1	<1	82	82	11	43	13	8	40	4	0.2		<0.01	0.14	0.14	0.02	<0.01
Upstream QC1	EB1105983	Upstream QC1	28/03/2011																					
Downstream QC2	EB1105983	Downstream QC2	28/03/2011																					
Trip QC4	EB1105983		28/03/2011																					
Rinsate QC5	EB1105983		28/03/2011																					
Upstream MP3- S1	EB1106761	Upstream MP3- S1	05/04/2011		7.97	408	290	<1	<1	71	71	20	63	13	7	53	4	0.1		<0.01	0.19	0.19	0.02	0.01
Downstream MP2 - S2	EB1106761	Downstream MP2 - S2	05/04/2011		8.53	1050	270	<1	11	107	118	19	242	13	8	183	5	0.3		<0.01	0.2	0.2	<0.01	0.03
Discharge MP1 - S3	EB1106761	Discharge MP1 - S3	05/04/2011		9.3	11800	16	<1	476	625	1100	4	3290	10	28	2530	18	2.4		<0.01	<0.01	<0.01	0.04	0.02
Upstream QC1	EB1106761	Upstream QC1	05/04/2011																					
Downstream QC2	EB1106761	Downstream QC2	05/04/2011																					
Discharge QC3	EB1106761	Discharge QC3	05/04/2011																					
Trip QC4	EB1106761	Trip QC4	05/04/2011																					
Upstream MP3 - S1	EB1106763	Upstream MP3 - S1	06/04/2011		8.03	290	260	<1	<1	70	70	7	35	12	6	34	4	0.1		<0.01	0.09	0.09	<0.01	0.01
Downstream MP2- S2	EB1106763	Downstream MP2- S2	06/04/2011		7.96	288	240	<1	<1	69	69	7	36	12	6	32	7	0.1		<0.01	0.08	0.08	<0.01	0.01
Upstream QC1	EB1106763	Upstream QC1	06/04/2011																					
Downstream QC2	EB1106763	Downstream QC2	06/04/2011																					
Trip QC4	EB1106763	Trip QC4	06/04/2011																					
Rinsate QC5	EB1106763	Rinsate QC5	06/04/2011																					
Upstream MP3 - S1	EB1106850	Upstream MP3 - S1	07/04/2011		7.61	268	250	<1	<1	67	67	6	31	12	6	29	4	0.1		<0.01	0.08	0.08	<0.01	0.03
Downstream - MP2 - S2	EB1106850	Downstream - MP2 - S2	07/04/2011		7.78	268	240	<1	<1	68	68	6	31	12	6	29	4	0.1		<0.01	0.07	0.07	<0.01	0.02
Upstream QC1	EB1106850	Upstream QC1	07/04/2011																					
Downstream QC2	EB1106850	Downstream QC2	07/04/2011																					
Trip QC4	EB1106850	Trip QC4	07/04/2011																					
Rinsate QC5	EB1106850	Rinsate QC5	07/04/2011																					

INCIDENT ALERT INSTRUCTIONS (delete this information box before emailing)

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Method for alerting A/DG of incidents:

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- potential or actual harm to reputation of, or confidence in, DERM/Government (ie. breach of public expectations)
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- potential or actual material or serious environmental harm or natural resource degradation

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- email and/or phone - within 2 hours (if a moderate level incident), or 1 hour (if a major or catastrophic level incident) (NB: further guidance on incident levels and escalation timelines will be provided)
- email 'Incident Alert' form – same day as becoming aware of incident, or if after hours, next business day

Instructions for filling out 'Incident Alert' form:

Where choices are provided, delete all those that do not apply.

If the Alert is an update (eg. providing progress with investigations or requesting approval to take enforcement action) - superfluous text should be stuck out, and new text should be in blue.

Approved alerts should be emailed as a minimum to relevant SMT member and through to A/DG (with CC to A/DG Principal Advisor). Email heading is to read "Incident Alert – *incident name – version*" and a brief description is to be provided in body of email.

Alerts should not place incident responses on hold, including communication with operational contacts in other government departments, and carrying out of site inspections.

Alert responsibilities of SMT members:

All information is to be reviewed by A/DG before briefing further. If approved, A/DG to email incident alerts to:

- Associate-Director General OER
- Director General
- Minister's advisors - [redacted] (Min Jones) and/or [redacted] (Min Robertson)
- Media (Media@derm.qld.gov.au)
- and if relevant: CSG Communications (Sam Kumm), ADG RSD, and/or DDG WCS

If A/DG unavailable, A/DG Principal Advisor to obtain alternate SMT member approval to brief Associate-Director General OER.

Choice: LITIGATION ALERT OR INCIDENT ALERT
ENRR DIVISION

TYPE OF ALERT:	P&G/CSG Incident
INCIDENT NAME:	Arrow Moranbah Discharge
ALERT DATE:	15 December 2010
ALERT VERSION:	Initial
ECOTRACK & FILE REF:	
RESPONSIBLE MINISTER:	Kate Jones MP, Minister for Climate Change and Sustainability Stephen Robertson MP, Minister for Natural Resources, Mines and Energy and Minister for Trade

CONTACT OFFICER: [redacted]

NAME OF ALLEGED SOURCE:
- Arrow Energy

DATE AND TIME OF INCIDENT:
- Monday 13 December 2010

INCIDENT NOTIFIED BY: *(entity and person)*
- Arrow – Ben McMahon Team Leader Compliance

DATE, TIME, METHOD OF NOTIFICATION:
- Monday 13 December 2010, 3.30pm phone call.
- Written advice received via email at 3.48pm

LOCATION OF INCIDENT:
- Arrow Energy Moranbah gas fields, located approximately 5km to the North of Moranbah on the banks of the Isaacs River.
- The Isaacs River is part of the greater Fitzroy Catchment.

SUMMARY OF INCIDENT AS NOTIFIED:

<u>Background to discharge</u>

- Arrow Energy advised the Department through a program notice on 3 December of concerns with water management at their Moranbah operation on the banks of the Isaacs River, adjacent to Moranbah. This notification did not contain any concerns about the integrity any specific dam, but advised that a TEP would be submitted to deal with forecast water management issues at the site over the remainder of the wet season.
- Up until September 2010 Arrow had approval under a previous EA to discharge untreated CSG well water (EC max of 2500 microsiemens) during high flow events.
- The EA was amended in September 2010, to only allow release of **RO treated CSG water after** they had obtained approval from the Office of the Water Supply Regulator prior to any discharge.
- A meeting was scheduled with Arrow for 14 December to discuss the proposed TEP, however on Monday 13 December Arrow contacted DERM to advise that a discharge had commenced from a dam into the Isaacs River.
- <u>NOTE – Discharge ceased 14 December at 5.42pm with 2.6ML being discharged.</u>

<u>Notification information</u>
- 125mm of rain had fallen at the site from 10 December to 12 December 2010.
- Several dams at the site were approaching their Mandatory Reporting Level (MRL).
- Arrow formed a view on Monday 13 December that Pond 2 was in danger of suffering structural integrity issues and that water needed to be removed from it to reduce this risk.

- Arrow decided to release water from Pond 2 to an existing release point into the Isaacs River.
- The untreated CSG water was being discharged at 15L per second.
- No laboratory analysis of water quality information was available.
- Probe measurements showed the discharge had an electrical conductivity of 9450 microsiemens.
- The Isaacs River was in flood. DERM records show the Isaacs River was flowing at 2500ML per day on 13 December.

POTENTIAL IMPACTS:

- Without current water quality information it is not possible to advise definitively on likelihood of environmental harm nor on potential risk to public health.
- However based on likely water quality and the level of dilution that would have been achieved (approx 960 part river flow to 1 part discharge) it is unlikely that environmental harm would have been caused.
- Given the dilution rate and that the discharge was untreated CSG water, not concentrated brine, it is also unlikely that the discharge posed a risk to public health. However, this will need to be determined by Qld Health once water quality information is available
- Likelihood of potential risk to public health
- What is the population affected

RELEVANCE TO NEIGHBOURING LANDHOLDERS:

- Adjacent landholders have not been notified at this time.
- Refer to potential impacts above.

ACTIONS TAKEN BY COMPANY OR SOURCE OF THE INCIDENT:

- Arrow ceased the discharge on 14 December at 5.42pm and commenced pumping the untreated water from Pond 2 to another dam not subject to any structural integrity concerns.
- Arrow has agreed to provide water samples to QLD Health for priority analysis.
- Arrow has stated they will submit a Transitional Environmental Program (TEP) detailing proposals for water management at the site.

DERM's ASSESSMENT AND PLANNED ACTIONS:

- DERM (including QLD Health) met with Arrow on 14 December 2010 and discussed the discharge and the Arrows plans to manage water at the site.
- DERM advised Arrow that the discharge of untreated CSG water of an unknown quality was an inappropriate breach of their EA.
- DERM requested Arrow consider ceasing this discharge and manage the water by other means (pumping water to other dams).
- DERM also advised Arrow that a Direction to cease the discharge may be issued. As Arrow voluntarily ceased the discharge at this time no Direction or other enforcement tools have been issued to Arrow.
- DERM will now compile a Possible Compliance Action Report outlining the relevant issues in regards to this unauthorised release of water.
- DERM will contact Arrow week ending 17 December to further discuss Arrows plans in regards to managing water at the site.
- Arrow is required to submit a TEP, given their submission of a Program Notice.

- DERM will assess any submitted TEP, however based on Arrows verbal advice that water could be stored in dams at the site on 14 December and Arrows actions to date, it is highly likely DERM will not be able to approve a TEP requesting a release of untreated CSG water to the Isaacs River.

NEXT UPDATE EXPECTED / FINAL RECOMMENDATIONS:

- Monday 20 December 2010.

COMMUNICATION:

- Internal – P&G immediately advised RSD that Arrow were discharging on 13 December. RSD attended meeting on 14 December via teleconference.
- On 15 December DERM P&G contacted the Mayor for Isaac Regional Council and Rockhampton Regional Council and advised them that a discharge had occurred for a 24 hour period, that the water quality was unknown, that the discharge had ceased after DERM met with Arrow, and that the discharge would have been highly diluted due to the flood in the Isaacs River and the small volume discharged.
- Both Mayors stated they appreciated the information and requested they be kept informed of the situation, should any further discharges occur or be likely to occur.
- QLD Health was advised of the discharge and attended the meeting with Arrow on 14 December. QLD Health is aware the discharge has ceased.
- No downstream users have been advised.
- No public notifications have been made.

MAP OR PLAN OF SITE:

Pond2_Map3.pdf (5 MB)

- See attached map.

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- Associate-Director General OER
- Director General
- Minister's advisors - [redacted] (Min Jones) and/or [redacted] (Min Robertson)
- Media (Media@derm.qld.gov.au)
- and if relevant: CSG Communications [redacted] ADG RSD, and/or DDG WCS

If A/DG unavailable, A/DG Principal Advisor to obtain alternate SMT member approval to brief Associate-Director General OER.

INCIDENT ALERT
ENRR DIVISION

TYPE OF ALERT:	P&G/CSG Incident
INCIDENT NAME:	Arrow Moranbah Discharge
ALERT DATE:	15 December 2010
ALERT VERSION:	Update
ECOTRACK & FILE REF:	
RESPONSIBLE MINISTER:	Kate Jones MP, Minister for Climate Change and Sustainability Stephen Robertson MP, Minister for Natural Resources, Mines and Energy and Minister for Trade

Deleted: Initial

CONTACT OFFICER: [redacted]

NAME OF ALLEGED SOURCE:
- Arrow Energy

DATE AND TIME OF INCIDENT:
- Monday 13 December 2010
- Monday 20 December 2010

Formatted: Bullets and Numbering

INCIDENT NOTIFIED BY: *(entity and person)*
- Arrow – Ben McMahon Team Leader Compliance 13 December 2010
- Arrow – Carolyn Collins Environment Manager 20 December 2010

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DATE, TIME, METHOD OF NOTIFICATION:
- Monday 13 December 2010, 3.30pm phone call.
- Written advice received via email at 3.48pm
- Monday 20 December 2010, 8pm phone call
- Written advice received via email at 7.56pm 20 December 2010

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LOCATION OF INCIDENT:
- Arrow Energy Moranbah gas fields, located approximately 5km to the North of Moranbah on the banks of the Isaacs River.
- The Isaacs River is part of the greater Fitzroy Catchment.

SUMMARY OF INCIDENT AS NOTIFIED:

20 December 2010 release - Discharge commenced at 8pm 20 December. Max discharge rate approx 5ML per day and would cease once Isaac River drops to 2000ML day flow.

Monday 20 December 2010 Arrow contacted DERM and requested a meeting as a discharge was imminent.

DERM/Q Health met with Arrow 3pm 20 December. Key points in regards to the current discharge are -

- 80mm of rain fell over the 18 to 19 December.
- The Isaacs River is running at around 4875ML per day at 9am 21 December 2010. All flows are based on DERM gauging station data from Goonyella.
- When discharge commenced at 8pm 20 December the Isaac River was flowing at 11 000ML per day.
- Arrow believes a further 80mm of rain at the site could lead to a need to discharge untreated csg water.
- Any discharge is unapproved by DERM, no TEP is in place or being assessed.
- Arrow advised any discharge would be a maximum of 5ML per day, with a maximum release of 60ML in total needed in their view to reach safe levels in dams. DERM has not sighted any engineering advice.
- Arrow commenced discharging 8pm 20 December due to concerns about a dam overtopping and spilling untreated CSG water into a wetland.

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- Arrow stated they believed a controlled discharge to the Isaacs River was preferable to the dam overtopping its spill way and untreated CSG water flowing overland through a wetland.
- The release would cease when river flows dropped below the 2000ML per day needed to achieve a 400 to 1 dilution.
- The flow rate would be taken from the Goonyella gauging station approximately 30km upstream of the site.
- Daily sampling would be conducted upstream, downstream, end of pipe and of the source water during any discharge.
- Samples would be sent to QLD Health lab for analysis.
- DERM (1300 pollution number, Rod and Anita (OWSR)) and Health (Paul Florian in Rockhampton) was notified when the release commenced.
- Arrow intends to submit a TEP for assessment either Tuesday or Wednesday this week.
- Arrow intends to advise landholders their tenure is on, but no other partys.
- DERM advised the Mayors for it would notify Isaacs and Rockhampton Regional Council Mayors and would also speak with landholders with Arrow dams on their property.
- Arrow provided ALS water sample results showing BTEX as a no detect. Metal results not yet done. Verbally advised EC should be 8000 to 10 000 microsiemens.

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Background to 13 December 2010 discharge

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- Arrow Energy advised the Department through a program notice on 3 December of concerns with water management at their Moranbah operation on the banks of the Isaacs River, adjacent to Moranbah. This notification did not contain any concerns about the integrity any specific dam, but advised that a TEP would be submitted to deal with forecast water management issues at the site over the remainder of the wet season.
- Up until September 2010 Arrow had approval under a previous EA to discharge untreated CSG well water (EC max of 2500 microsiemens) during high flow events.
- The EA was amended in September 2010, to only allow release of **RO treated CSG water after** they had obtained approval from the Office of the Water Supply Regulator prior to any discharge.
- A meeting was scheduled with Arrow for 14 December to discuss the proposed TEP, however on Monday 13 December Arrow contacted DERM to advise that a discharge had commenced from a dam into the Isaacs River.
- NOTE – Discharge ceased 14 December at 5.42pm with 2.6ML being discharged.

Notification information

- 125mm of rain had fallen at the site from 10 December to 12 December 2010.
- Several dams at the site were approaching their Mandatory Reporting Level (MRL).
- Arrow formed a view on Monday 13 December that Pond 2 was in danger of suffering structural integrity issues and that water needed to be removed from it to reduce this risk.
- Arrow decided to release water from Pond 2 to an existing release point into the Isaacs River.

- The untreated CSG water was being discharged at 15L per second.
- No laboratory analysis of water quality information was available.
- Probe measurements showed the discharge had an electrical conductivity of 9450 microsiemens.
- The Isaacs River was in flood. DERM records show the Isaacs River was flowing at 2500ML per day on 13 December.

POTENTIAL IMPACTS:

- Water samples received 21 December (non certified) are relevant to the discharges on 13 December and 20 December .
- The results provided by Arrow show BTEX as a no detect and levels of metals within the 95th percentile for ecosystem protection.
- Q Health have verbally advised that water samples they have received have so far shown no detectable levels of BTEX.
- Based on these results it is highly likely when considering the levels of dilution being achieved currently that no environmental harm would result.
- Given the dilution rate and that the discharge was untreated CSG water, not concentrated brine, it is also unlikely that the discharge posed a risk to public health. However, this will need to be determined by Qld Health once water quality information is available
- HOW FAR DOWNSTREAM IS ROCKY WATER OFFTAKE???Likelihood of potential risk to public health
- What is the population affected

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Deleted: Without current water quality information it is not possible to advise definitively on likelihood of environmental harm nor on potential risk to public health.¶
However based on likely water quality and the

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Comment [k1]: Heather/Anita ?? Any comments given results??

Comment [k2]: Heather ??

RELEVANCE TO NEIGHBOURING LANDHOLDERS:

- Adjacent landholders have not been notified at this time.
- Refer to potential impacts above.

ACTIONS TAKEN BY COMPANY OR SOURCE OF THE INCIDENT:

- Arrow ceased the discharge on 14 December at 5.42pm and commenced pumping the untreated water from Pond 2 to another dam not subject to any structural integrity concerns.
- Arrow provided water samples to QLD Health for priority analysis on Friday 17 December.
- Arrow has stated they will submit a Transitional Environmental Program (TEP) detailing proposals for water management at the site.
- In regards to the ongoing 20 December discharge, Arrow have advised this discharge was unavoidable due to water levels on site and engineering conerns about pond 2.
- Arrow have stated an engineer was on site 20 December to advise on concerns about structural stability for pond 2.

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DERM's ASSESSMENT AND PLANNED ACTIONS:

13 December discharge

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- DERM (including QLD Health) met with Arrow on 14 December 2010 and discussed the discharge and the Arrows plans to manage water at the site.
- DERM advised Arrow that the discharge of untreated CSG water of an unknown quality was an inappropriate breach of their EA.

- DERM requested Arrow consider ceasing this discharge and manage the water by other means (pumping water to other dams).
- DERM also advised Arrow that a Direction to cease the discharge may be issued. As Arrow voluntarily ceased the discharge at this time no Direction or other enforcement tools have been issued to Arrow.
- DERM will now compile a Possible Compliance Action Report outlining the relevant issues in regards to this unauthorised release of water.
- DERM will contact Arrow week ending 17 December to further discuss Arrows plans in regards to managing water at the site.
- Arrow is required to submit a TEP, given their submission of a Program Notice.

20 December discharge

- DERM (including QLD Health) met with Arrow on 20 December 2010 and discussed the likely discharge and the Arrows plans to manage water at the site.
- Arrow was advised any discharge was unauthorised as it was not under an approved TEP.
- Arrow stated discharge would likely become unavoidable given water levels and rain events.
- Arrow has advised a TEP will be submitted for assessment on 22 December 2010. DERM has provided specific advice to Arrow, in line with advice provided to coal mines, who have received approved TEP's allowing discharge.

Deleted: <#>DERM will assess any submitted TEP, however based on Arrows verbal advice that water could be stored in dams at the site on 14 December and Arrows actions to date, it is highly likely DERM will not be able to approve a TEP requesting a release of untreated CSG water to the Isaacs River.¶

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NEXT UPDATE EXPECTED / FINAL RECOMMENDATIONS:

- Friday 24 December 2010.

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COMMUNICATION:

- Internal – P&G immediately advised RSD that Arrow were discharging on 13 December. RSD attended meeting on 14 December via teleconference.
- On 15 December DERM P&G contacted the Mayor for Isaac Regional Council and Rockhampton Regional Council and advised them that a discharge had occurred for a 24 hour period, that the water quality was unknown, that the discharge had ceased after DERM met with Arrow, and that the discharge would have been highly diluted due to the flood in the Isaacs River and the small volume discharged.
- Both Mayors stated they appreciated the information and requested they be kept informed of the situation, should any further discharges occur or be likely to occur.
- QLD Health was advised of the discharge and attended the meeting with Arrow on 14 December. QLD Health is aware the discharge has ceased.
- No downstream users have been advised.
- No public notifications have been made.

Communication in regards to 20 December discharge.

- 20 December DERM advised of impending discharge to Cedric Marshall (Mayor for Isaacs Regional council) and left a message for Brad Carter (Mayor for Rockhampton Regional Council).
- 21 December DERM contacted both Mayors successfully and advised an unauthorised discharging was occurring. Both Mayors were advised given high dilution it was unlikely any impacts would occur, however DERM did not have a complete set of water quality. Both were advised BTEX was not detected.

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- DERM contacted a landholders with Arrow Dams on their property [redacted] today.

MAP OR PLAN OF SITE:

Pond2_Map3.pdf (5 MB)

- See attached map.

CTS No. 00754/11

Advisor .... OK
Dated / /
Approved Not Approved Noted
Further information required
[redacted]
Minister..................................
Dated / 12 / 1 /

Department of Environment and Resource Management
MINISTERIAL BRIEFING NOTE

TO: **Minister for Climate Change and Sustainability**

SUBJECT: **Mine water management issues**

REQUESTED BY

- Minister's Office requested this brief by 21 January 2011

RECOMMENDATION

It is recommended that the Minister **note** the assistance that has been provided to mines in relation to their water management issues and the correspondence that has occurred with the Queensland Resources Council.

BACKGROUND

- In October 2010, the department contacted all major mining companies to discuss their water management plans given the likelihood of a substantial wet season in northern Queensland.
- Since this date, and as a result of recent rainfall and flooding events, several coal mines have been inundated or are experiencing issues with on-site water management.
- Since 1 December 2010, many mines have been applying for Transitional Environmental Programs (TEPs) that involve the discharge of mine affected water to nearby watercourses.
- Given the widespread nature of the rainfall events and the understanding that the discharge of mine affected water is critical to some mines' operations, staff of the department have been assessing all TEP applications in as timely and efficient manner as possible, well under the statutory timeframes.
- The Queensland Resources Council (QRC) has been in consistent contact with the department over this period and, until recently, had been supportive of the department's performance in assessing and approving TEP applications in very compressed timeframes.
- In order to assist mining companies in submitting TEP applications, a simplified application form was provided to all companies prior to 20 December 2010.
- As flows have been decreasing in major watercourses and significantly reducing or ceasing in ephemeral streams and tributaries, several companies have applied for amendments to approved TEPs or have been applying for new TEPs that allow discharge of mine affected water in situations of reduced or zero flow in receiving watercourses.
- In considering these applications, the department requires a more rigorous technical assessment in order to ensure that the risks of unacceptable environmental harm are minimised and adequately addressed by the applicants. Not withstanding this requirement, applications have still been dealt with by the department in a very timely manner and continue to be well within statutory timeframes
- The QRC has become increasingly critical of the need to conduct a detailed technical assessment for TEP applications involving discharge of mine affected water and on 6 January proposed that the department issue "an open invitation which invites all companies to discharge as much water as possible within a short a period of time as possible".
- The department advised QRC that it was not supportive of this concept as the risks to the environment, downstream water users and some drinking water supplies was unacceptable

Author	Cleared by	Recommended:
Name: Andrew Brier Position: Director LNG Enforcement Unit Tel No: [redacted] Date:21 January 2011	Name: Michael Birchley Position: ~~A/ADG OER~~ RSD [redacted] Tel No: [redacted] Date: 21 January 2011	Name: John Bradley ~~Director-General, DERM~~ Tel No: [redacted] Date: 21/1/11

and would continue to assess each application on its merits in as short a timeframe as possible.

CURRENT ISSUES

- By 1pm on 21 January, 25 TEP applications or amendments relating to the discharge of mine affected water had been approved by the department.
- A further 15 applications are currently undergoing assessment. Based on information provided by the applicants, the applications are considered to fall into the following broad categories:
  - 1 application that is critical to mine operations and appears to pose a low to medium risk to the environment
  - 2 applications that are critical to mine operations and appear to pose a medium to high risk to the environment
  - 7 applications that do not appear critical to mine operations and appear to pose a low to medium risk to the environment, and
  - 5 applications that do not appear critical to mine operations and appear to pose a medium to high risk to the environment.
- Critical to mine operations is roughly defined as a situation where production cannot commence or continue unless the water is removed. A higher risk to the environment generally relates to either higher salinity water or lower receiving flows in watercourses.
- In recent meetings with the QRC on 10, 18 and 20 January, the department confirmed that it would assess all applications on their individual merits and that if it could be demonstrated that the risks to the environment could be adequately managed, then it was likely that an application for a TEP would be approved.
- It has also been made clear to the QRC that if the department determined the risks to the environment were too great or could not be adequately managed, then approval to discharge mine affected water under a TEP would not be granted. Similarly, it has been explained that most TEPs that have been granted require mines to cease discharging once certain flow or water quality triggers in receiving waters are reached and it was unlikely that all mines would be able to fully discharge the mine affected water they may have on site.
- The QRC appears to be maintaining the stance that mines should be allowed to discharge all mine affected water, regardless of environmental harm, in order to recommence production as soon as possible and assist in the economic recovery of Queensland. The focus of QRC's argument now appears to be moving towards the need for political intervention to achieve this outcome, rather than DERM approving all TEP applications.
- The attached letter from the Director-General to Michael Roche of the QRC provides further information in regard to the latest correspondence that has occurred.

RESOURCE/IMPLEMENTATION IMPLICATIONS

- An additional 15 staff have been assigned to the assessment of TEPs in order to provide as high a level of service as possible while still maintaining the level of assessment required to ensure risks to the environment are adequately addressed.
- Interstate assistance is being sought in order to enable further additional resources to be assigned to the assessment of applications

PROPOSED ACTION

- The department will continue to process TEP applications as quickly as possible and assess each application on its merits.
- Applications will be declined or refused where it is determined that the risks to the environment from the proposal are too great and cannot be adequately managed without unacceptable environmental harm occurring.

Author Name: Andrew Brier Position: Director LNG Enforcement Unit Tel No: [redacted] Date:21 January 2011	Cleared by Name: Michael Birchley Position: A/ADG OER RSD Tel No: [redacted] Date: 21 January 2011	Recommended: Name: John Bradley Director-General, DERM Tel No: [redacted] Date:

- The department will maintain ongoing communications with each mine and will assist in identifying further information requirements or details that the company may be able to supply to assist their application to discharge under a TEP.
- If the department becomes aware of emergent situations where environmental harm is likely to occur, other regulatory tools such as emergency directions or environmental protection orders will be considered.
- Companies are being reminded of their general environmental duty and their obligation to take all reasonable and practicable measures to prevent or minimise environmental harm.

MINISTER'S COMMENTS

ATTACHMENTS

- Letter from Director General to Michael Roche of QRC – 21 January 2011

Author Name: Andrew Brier Position: Director LNG Enforcement Unit Tel No: [redacted] Date:21 January 2011	Cleared by Name: Michael Birchley Position: A/ADG OER RSD Tel No: [redacted] Date: 21 January 2011	Recommended: Name: John Bradley Director-General, DERM Tel No: [redacted] Date:

File Ref:

Queensland Government

Department of
Environment and Resource
Management

Ref CTS [CTS No.]

21 JAN 2011

Mr Michael Roche
Chief Executive
Queensland Resources Council
Level 13, 133 Mary Street
Brisbane, Queensland 4000, Australia

Dear ~~Mr~~ Michael Roche

I wish to provide you with an update on my Department's progress in processing applications for Transitional Environmental Programs (TEP's) and to address some of the concerns you have raised in recent email correspondence.

As at 1pm on the 21st January, my department had approved 25 TEP applications or amendments to existing approvals since the 1st December 2010. A further 15 applications or amendment requests have been received and are currently undergoing assessment. Several of the outstanding applications are awaiting more detailed information from the applicants before they can be properly assessed.

1. Issues raised in Recent Discussions

As per my commitment to you in our meeting on the 18th January 2011, I have attached some general guidelines relating to TEP applications involving discharge of mine affected water to waterways. These guidelines are not intended to be definitive or exhaustive and are intended to provide a basic level of guidance to some of the risks and issues that are necessary to consider in a TEP application of this nature.

As has been discussed on several occasions, applications will be considered on a case by case basis to ensure they achieve the best result for the applicant while still ensuring the safety and well being of the environment and downstream water users. As such, applications that do not fall within the broad guidelines provided may still be acceptable in certain situations. Similarly, if an application appears to meet the requirements of the attached document, this does not mean it will be automatically approved as there may be other mitigating circumstances.

My department has recently approved a TEP application that involved the discharge of mine affected waters to an ephemeral stream under low or no flow conditions. In this instance, the environmental values of the ephemeral stream and the quality of the discharge water were such that the application could be approved. Conditions have been placed on the TEP which require a minimum flow in the major watercourse which receives the discharge from the ephemeral stream and minimum water quality triggers for this major watercourse have also been specified. Decisions such as this demonstrate the flexibility and innovation in DERM's approach, while maintaining the rigour of the environmental assessment and

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defensible outcomes. I note that several other applications which propose similar receiving flows are under consideration and will be assessed on a case by case basis.

2. Issues Raised in QRC Correspondence

In reference to your email correspondence of 20 January, I would like address a number of issues.

- As you noted, a TEP application for the **Millenium mine** was submitted two weeks ago on January 7 2011. In discussions with the applicant, departmental staff were informed that the mines operation was not currently impacted by the water on site, although there was the potential for this situation to change in the future as coal in other mining areas needed to be accessed. This advice was confirmed in further communication with the mine on the 20th January. My department has considered this advice when prioritising its review of TEPs while meeting statutory timeframes in all cases. This has permitted the assessment of applications for TEPs from mines where the discharge of water <u>*was*</u> essential in restoring mine operations to be expedited. Nevertheless, comments on the application were provided back to the mine on the 20th January and it is likely that a TEP will be issued in the near future.

- With regards to the **Lake Vermont** mine, a TEP application was received by my department on the 14th January, six days prior to your email correspondence. The application relates to the discharge of mine affected water into a watercourse with a low receiving flow. There has been ongoing discussion between staff of my department and the mine since the application was submitted. Given the lack of a receiving flow, the application proposes the release of better quality water in order to provide a flow in the watercourse to allow the discharge of the mine affected water. As previously discussed, proposals to discharge into watercourses without a reasonable receiving flow require a higher degree of technical assessment and there has been ongoing contact and communication with the applicant in this regard as further information to support the application was required. It is anticipated that a decision on this application will be finalised shortly.

- You indicated you had received feedback that my department has been conservative in the conditions applying to the approval of some TEP applications received prior to Christmas. As you are aware, these applications were assessed and approved in exceptionally short timeframes in order to allow approved discharges to commence as soon as possible. In order to achieve this timeframe, the flow conditions in the TEP would necessarily be higher to permit earlier and larger discharges and to ensure the cumulative impacts could be managed. Such approvals cannot reasonably be compared to the assessments now being conducted on applications to discharge to significantly smaller receiving flows. Several of the companies which received TEPs have since applied for amendments allowing them to discharge at reduced receiving flows and these amended applications in turn require a more rigorous technical assessment prior to making a decision.

3. Importance of Proactive Action by Companies

My Department is highly conscious of the extraordinary recent rainfall events and their impact on the resources sector. We are committed to remaining responsive, flexible and appropriately resourced to assist proponents as they meet their obligations in relation to environmental compliance.

Equally, it will be important for applicants, particularly those seeking to discharge in low flow environments, to be proactive in managing the information and other resources which will improve the prospects of a TEP application being approved. Staff of my department have been dedicated in assessing applications for TEP's in a timely and efficient manner over the last few weeks. In many instances, the level of information and detail supplied by the

applicants has been insufficient for a decision to be made. In these cases, staff of the department have been as helpful as possible in identifying these deficiencies and requesting further information as appropriate.
I would like to reiterate two important considerations discussed in our recent meetings, which have assisted companies in successfully receiving TEP approvals.

- Companies which have received approval of TEPs have been able to clearly address the identification and management of mine-affected water environmental risks.

- Some companies have been active in maintaining or gathering fundamental information requirements for TEP application (as identified to the QRC last year) relating to proposed discharge water quality, blending options, environmental values and receiving water flows, etc.

- Many companies have undertaken careful onsite water management, implemented infrastructure solutions or procured additional pumping capacity so as to be able to take advantage of flows opportunistically. I am informed that several mines have not made the most of the opportunity that has been available to them to date. Some mines have been authorised under TEPs to discharge significantly more affected water than has actually been disposed of in the last few weeks. It would appear that equipment constraints or other operational factors have limited some mines' ability to discharge affected water and they have therefore not taken full advantage of the high flows that were apparent in receiving waters while they were available.

As acknowledged in our recent discussion, for some companies the granting of a TEP will be delayed at least partly by their environmental assessment capacity and the available information they have maintained. Equally, it should be noted that some applications have been of very good quality and several mines should be commended on their demonstrated ability to manage water on their sites through this difficult time.

Should you have any further enquiries, please do not hesitate to contact Mr Mike Birchley, Assistant Director General - Regional Service Delivery of the department on telephone 07 [redacted]

Yours sincerely

[redacted]

John Bradley
Director-General

General and Non-Binding Guidance on Coal Mine TEPs and Managing Salinity

1. For releases associated with stream flow

Generally, the discharge waters can be considered in three categories:

- Lower Risk - EC <1500uS/cm
- Medium Risk – EC between 1500uS/cm and 4000uS/cm
- Higher Risk – EC > 4000uS/cm

Obviously these are broad generalisations and only relate to EC values whereas there must be consideration of other analytes in determining the risk of the discharge waters to the environment. An indication of what is generally expected for each category in relation to discharge to receiving waters is as follows:

- **Lower risk water – EC<1500uS/cm**
  - Generally 1:1 or 1:2 dilution with receiving waters may be permitted for good quality water depending on the receiving waters quality and the location of the mine. Upper catchment mine will be given more allowance
  - Flow triggers for local gauging stations can typically be reduced.
  - Guaging station locations reasonably flexible. For example, downstream gauging stations on major waterway may be used in some cases.

- Medium risk water – 1500uS/cm < EC < 4000uS/cm
  - Immediately downstream of the discharge point must achieve less than 750 to 1000uS/cm with better results further downstream. Downstream trigger for ceasing discharge are typically around 500uS/cm to manage potential cumulative impacts
  - Less flexibility is available in relation discharge, dilution and sampling
  - If the discharge is into ephemeral streams or tributaries that feed into a major watercourse, lower dilution rates (and hence higher combined EC values) may be possible in the tributary providing there are no key environmental values in the tributary that may be affected

- Higher risk water – EC>4000uS/cm
  - Generally more applicable to those mine located adjacent to major waterways.
  - Obviously the higher the EC then the lower the discharge rate and the higher the dilution that must be achieved immediately downstream of the discharge point
  - Immediately downstream of the discharge point typically required to achieve less than 750 to 1000uS/cm. Downstream trigger for ceasing discharge are typically around 500uS/cm or better to manage potential cumulative impacts
  - Conditions relating to discharge rate, dilutions and sampling locations will remain and may be more detailed/onerous. Typically higher stream flow triggers for release may be required.

- The same considerations relating to ephemeral streams or tributaries apply as per the medium risk water but obviously dilution rates will generally need to be considerably higher

2. For releases not associated with stream flow (or minimal flow)

Generally these releases will need to meet ambient reference water quality at the discharge point and in the receiving environment. This option would normally only be suitable where there are no other alternatives and a "good" water quality can be achieved end-of-pipe (most likely 100 to 750uS/cm depending on the location). Historical DERM water quality data can be used to derive the release limits and the downstream trigger values. The numbers typically used would be between taken from between 50th and 90th percentile of the historical DERM data depending on the situation.

General Comments

The above indications are not absolute and each application/case will be assessed on its merits based on the information available. Indeed, consideration and approval has been given for applications that do not adhere to the generalisations presented above but these applications obviously require a certain level of detail in order to ensure that the potential for environmental harm is appropriately managed and minimised.

Similarly, some applications that do meet the above generalisations may not be approved due to other considerations and contributing factors. Some of these considerations include:

- Drinking water supplies that might be affected by discharges requiring consultation with the Office of the Water Supply Regulator and Queensland Health
- Target water quality parameters for major watercourses
- Cumulative impacts of multiple discharges
- The turbulence of the receiving waters and whether layers of differing water quality are likely to eventuate
- Sensitive key environmental assets
- Downstream land and water use
- The flow rate of receiving waters – low and no flows can pose significantly higher risk
- The availability of a suitable watercourse – ie is the discharge to overland flow
- Background water quality
- Duration of discharge
- Prioritising discharges based on safety, key infrastructure and operational ability in times of low river flow
- Proximity to other discharges

As such, each application must be assessed on a case by case basis in order to consider all contributing factors. That being said, the information in this sheet may be considered by applicants in preparing a TEP requiring the discharge of mine affected water.

10/2

CTS No. 01030/11

[redacted]

Department of Environment and Resource Management
JOINT MINISTERIAL BRIEFING NOTE

TO: **Minister for Environment and Resource Management**

SUBJECT: Regulatory options for approving and managing mine discharges

REQUESTED BY

- The Director-General of the Department of Environment and Resource Management requested this brief by 25 January 2011.

RECOMMENDATION

It is recommended that the Ministers:

- **note** the regulatory options available to the Department of Environment and Resource Management (DERM) and the Department of Employment, Economic Development and Innovation (DEEDI) in relation to approving and managing the release of mine affected water.
- **note** that DERM will be unable to approve the discharge or release of mine affected water where there is an unacceptable risk to the environment or downstream land and water users.

BACKGROUND

- Following the recent flooding across Queensland, a number of mines are in the position of having to release large volumes of potentially contaminated water from storage facilities prior to being able to resume coal production.
- Mine operators in these circumstances often approach DERM to authorise a release that would otherwise breach either the conditions of their environmental authority or the *Environmental Protection Act 1994* (the EP Act) or both. These discharges are usually requested due to the need to remove mine affected water in order to re-commence coal production but there is the potential for a discharge to be requested due to safety concerns at the mine site.
- A number of regulatory tools are available to authorise discharges in a variety of circumstances.

CURRENT ISSUES

ENVIRONMENTAL PROTECTION ACT (DERM)

- The EP Act provides for a number of regulatory tools relevant to managing mine water discharges.
- ***Transitional environmental programs (TEPs)***
  - TEPs are often used to manage mine water discharges. They are a program submitted to DERM for assessment/approval that authorise a breach or breaches of the EP Act while the applicant takes steps to return to compliance with the Act.
  - TEPs are an appropriate tool where the mine operator has performed an act or omission that breaches the EP Act (including breaching its environmental authority), and it requires a period of months or years to carry out works to rectify that breach and return to compliance with the EP Act.
  - This tool is the primary method used by DERM for authorising discharges of mine affected water where the risk of unacceptable environmental harm can be managed through release rates, monitoring and dilution by floodwaters or river flows. Similarly, the potential impact on downstream water and land uses must also be considered in assessing a TEP application.
  - As at 1pm on the 25 January, DERM had approved 26 discharge related TEP's or amendments to existing TEP's for coal mining operations. There were an additional 15 applications under assessment at this point.

Rec'd - ODG
27 JAN 2011

Author Name: Andrew Brier Position: Director LNG Enforcement Unit Tel No[redacted] Date:24 January 2011	**Cleared by** Name: Michael Birchley Position: A/ADG OER RSD Tel No:[redacted] *Received: 25/01/2011* [redacted]	**Cleared by** Name: Position: Tel No:
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File Ref:

- A TEP will not be approved where it is considered the risk of unacceptable environmental harm is too great and cannot be adequately managed or mitigated.

- ***Emergency release of contaminants***
  - An authorised person may give a written direction to a person (an 'emergency direction') to release contaminants into the environment if the authorised person is satisfied that it is necessary and reasonable to do so because of an emergency and that there is no other practicable alternative to the release. The authorised person may impose reasonable conditions on the direction.
  - In order to give an emergency direction, the authorised person must be satisfied that an 'emergency' exists. The emergency need not be limited to an emergency that threatens the environment (for example, a situation that threatened human safety could qualify as an emergency). The department must, however, be satisfied that there is no other practicable alternative than for the mine operator to release the contaminant.
  - Where the criteria described above are met, the department may use an emergency direction to authorise (and put conditions on) an otherwise unlawful release of contaminants by a mine operator.
  - The assessment of whether a situation poses a health or safety risk at a mine would be made by an appointed inspector of coal mines in the Mines Inspectorate, Safety and Health, DEEDI
  - Consideration would need to be given as to whether it was appropriate for DERM to issue an emergency direction to discharge for reasons other than a benefit to the environment. Generally, the emergency provisions would only be used in a way which supports the object of the EP Act. The object of the EP Act is to protect Queensland's environment while allowing for development that improves the total quality of life, both now and the future, in a way that maintains the ecological processes on which life depends (ecologically sustainable development).

- ***Environmental protection orders (EPOs)***
  - EPOs may be issued by DERM, to secure compliance with the general environmental duty imposed by the EP Act or with a condition of an environmental authority.
  - EPOs are intended to be used where a person has breached the EP Act and must be ordered to take steps to prevent or minimise environmental harm. They are used for actions that will be completed within a short period of time (days to two or three months).
  - Because EPOs are used once a breach of the EP Act has occurred, they are not appropriate for authorising a breach of the Act (such as a release of contaminants or discharge of mine affected water) that has not yet occurred.

- ***Environmental evaluations (EEs)***
  - EEs may be issued by the department to a person to require them to conduct an investigation into the cause of, and possible solutions to, and environmental problem. Because they are concerned with requiring a person to carry out an investigation, they are not appropriate for authorising a discharge of contaminants by mine operators.

- ***General Environmental Duty (GED)***
  - While the general environmental duty is not a regulatory tool, mines that make the decision to discharge and the discharge results in environmental harm may use the GED as a defence.
  - Section 319 of the EP Act states, "A person must not carry out any activity that causes, or is likely to cause, environmental harm unless the person takes all reasonable and practicable measures to prevent or minimise the harm (the general environmental duty)"
  - If a mine operator is required to discharge mine affected water in order to ensure the safety or health of mine personnel then if the discharge is conducted and managed in accordance with the GED it could be considered that the mine operator had met their environmental duty in this regard.

COAL MINE SAFETY AND HEALTH ACT (DEEDI)

- ***Directive to Reduce Risk s 166 Coal Mining Safety and Health Act 1999***

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- If an inspector believes a risk from coal mining operations may reach an unacceptable level, a directive may be given to take corrective or preventative action to prevent the risk reaching an unacceptable level
- This tool may be suitable for use in situations where a TEP cannot be issued due to the risk of unacceptable environmental harm but a discharge of mine affected water is required to ensure the safety or health of personnel at the mine site. This is considered a more suitable regulatory tool in these situations than an emergency release of contaminants under the EP Act as the driver for the release is safety concerns rather than a desire to minimise environmental harm.
- Similarly to DERM needing to consult with DEEDI on safety issues in regards to an emergency release of contaminants, discussions with DERM would occur regarding environmental considerations relevant to the direction.

RESOURCE/IMPLEMENTATION IMPLICATIONS

- An additional 15 resources within DERM have been re-assigned to the assessment of TEP applications.
- DERM will continue to afford the assessment of TEP applications for flood or rain affected mines a high priority.
- Not all requests or submissions from mines relating to the need to discharge mine affected water will be able to be approved or authorised using the regulatory tools outlined in this brief. It is highly probable that a number of mines will remain affected by inundation and be unable to discharge the mine affected water without breaching the conditions of their environmental authority or the requirements of the EP Act.

PROPOSED ACTION

- Where the risks to the environment and downstream users can be appropriately managed DERM will continue to manage, authorise or approve releases of contaminants from mine sites using the most appropriate regulatory tools available in the EP Act
- Should a discharge be required due to safety concerns and that discharge would not able to be authorised under the EP Act due to unacceptable environmental risk, DERM will consult with DEEDI regarding issuing a directive to reduce risk in accordance with the Coal Mine Safety and Health Act.

OTHER INFORMATION

- Compliance and Investigations Unit, Environment and Natural Resource Regulation have been consulted over the use of regulatory tools under the EP Act.
- Queensland Mines and Energy within DEEDI have been consulted over the use of regulatory tools in the Coal Mine Safety and Health Act

[redacted]. 2 / 2 / 11 **Director-General**

Approved ✓ **Comments:**	Not approved / /	Noted [redacted]...................... 25 / 2 / 11 **Principal Advisor**
Minister for Environment and Resource Management		

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CTS No. 03704/10

Advisor .... OK	
Dated / /	
Approved Not Approved Noted	
Further information required	
Minister..................................	
Dated / /	

Department of Environment and Resource Management
MINISTERIAL DEPUTATION BRIEFING NOTE
8 March 2011 – 2pm Room A35
Hon Andrew Fraser MP, Treasurer and Minister for State Development and Trade and
Hon Stirling Hinchliffe MP, Minister for Employment, Skills and Mining

TO: **Minister for Environment and Resource Management**

SUBJECT: **Update on mine recovery relating to water discharges and transitional environmental programs (TEPs)**

DEP REP: Andrew Brier, General Manager Coal and CSG Operations

BACKGROUND

- The Treasurer has requested this meeting as a result of concerns raised by Japanese steel companies during his visit to Tokyo last week.
- As a result of recent flooding and rainfall, a large number of coal mines have been inundated or are experiencing issues with on-site water management.
- Of the 57 coal mines in Queensland, it is estimated that approximately 70% are currently experiencing impacts on their production due to water management issues on site.
- The Department of Environment and Resource Management is responsible for the conditioning of Environmental Authorities and assessment of applications for transitional environmental programs (TEPs).
- As a result of the Hart review in 2009, a set of model water conditions for mines in the Fitzroy Basin were developed and mines were invited to apply for amendments to their environmental authorities incorporating these new conditions. These conditions specified the circumstances under which mines could discharge affected water to the environment.
- In October 2010, the department contacted all major mining companies to discuss their water management plans given the likelihood of a substantial wet season in northern Queensland.
- As a result of the significant rainfall and flooding that occurred since 1 December 2010, many mines have been applying for TEPs that involve the discharge of mine affected water to nearby watercourses in order to clear the water from mining pits.
- TEPs have been used to authorise the discharge of mine affected water to watercourses in situations where the risks to the environment and downstream users can be adequately managed but the discharge would not otherwise be compliant with the mines environmental authority.
- Given the widespread nature of the rainfall events and the understanding that the discharge of mine affected water is critical to some mines' operations, staff of the department have been assessing all TEP applications in as timely and efficient manner as possible, well under the statutory timeframes.
- The Queensland Resources Council (QRC) has become increasingly critical of the need to conduct a detailed assessment of TEP applications and on 6 January proposed that the department issue "an open invitation which invites all companies to discharge as much water as possible within as short a period of time as possible".
- The department advised QRC that it was not supportive of this concept as the risks to the environment, downstream water users and some drinking water supplies were unacceptable.

Author	**Cleared by**	**Cleared by**	**Recommended:**
Name: Andrew Brier Position: GM Coal & CSG Operations Tel N[redacted] Date:7 March 2011	Name: Mike Birchley Position: A/ADG RSD Tel No: [redacted] Rec'd: 07/03/2011	Name: Terry Wall Position: ADG OER Tel No: [redacted]	Name: John Bradley Director-General, DERM Tel No: [redacted] Date:
	Name: Position: Tel No:	Name: Position: Tel No:	

File Ref:

- The department continues to assess TEP applications on a case by case basis. TEPs will only be approved if it can be adequately demonstrated that the discharge can be managed to avoid unacceptable risks to the environment or downstream water users.

CURRENT ISSUES

- Since 1 December 2010 and as at 1pm on Friday 4 March, the department has approved 58 TEPs or amendments to existing TEPs across 37 mine sites in Queensland. There are currently eight further applications under consideration
- Most approved TEPs allow mines to discharge mine affected water in various quantities as long as the receiving watercourse is flowing at a minimum rate and certain water quality thresholds are not exceeded.
- As flows in major watercourses have diminished, mines have been applying for TEPs that involve a significantly higher degree of environmental risk due to the desire to discharge mine affected water into low or zero flow in receiving watercourses.
- The department has approved several of these applications where the risks can be adequately managed. These approvals generally apply only to releases during the wet season and are not ongoing.
- It is highly unlikely that the approved TEPs will enable all mines to discharge the amount of water required to allow the mines to achieve full production. Several mines have significant volumes of water stored in mining pits that would take several months of pumping to remove. Some mines are also located on ephemeral streams and tributaries and there is unlikely to be sufficient flow in these tributaries to enable the ongoing discharge of saline water in a manner which ensures the protection of the environment and downstream water users.
- Mines in these circumstances will most likely need to investigate other methods of water disposal including (but not limited to) increased water storage on site, reverse osmosis treatment plants and pipelines to enable the movement of mine affected water.
- The department will continue to actively work with affected mines in order to ensure that any alternative water management proposals can be progressed in as timely a manner as possible.
- In order to address longer term issues surrounding mine water management, the department is intending to complete several key projects and reviews in 2011:
  - A review of the model water conditions for mines in the Fitzroy Basin. This review will be completed by August 2011.
  - The development of water quality guidelines for rivers in the Fitzroy Basin. This process is likely to be completed by mid 2011.
  - A review of mine water management plans to ensure they are adequate given the learnings from the recent wet season.
  - Mines are being encouraged to apply for amendments to their environmental authorities where they believe they can vary the conditions relating to the discharge mine affected water in a manner that is safe and sustainable for the environment.
- DEEDI has prepared a brief for the meeting and provided an advance copy to the Treasurer (refer Attachment 1).

MINISTER'S COMMENTS

Attachments:
Attachment 1 - Copy of DEEDI brief

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Mine	Tonnage Currently Being Produced	Current Rate of Production cf Normal Output (%) as at 21.2.11	Summary Comments
Fully Operating			
Central Qld			
Carborough Downs incl Broadlea (closed - C&M)		100	**7 Jan:** Mining coal. **19 Jan:** The mine has been able to continue operating apart from 4 days repairing box-cut erosion. The mine is fully operational at 100% capacity. Coal transported by train to DBCT. (contacted [redacted], Mine Manager, Carborough Downs ph [redacted]
Cook		100	**8 Feb:** Has been at full production for ~3 weeks; main impact had been access to site for staff and equipment movement; as an u/g mine, limited affect from rainfall, limited runoff into site dams and has been able to be discharged; had been affected by Blackwater rail system closure but OK since it became operational again
Eaglefield		80-100	**30 Dec:** force majeure declared. **4 Jan:** Mine is currently running at half capacity, looking to start extra capacitiy the evening of 4 January. All water from the main pit has been pumped out into a sump currently holding roughly 300 megalitres of water. The water isn't currently impacting production, but may in the near future. There are staffing issues with some staff stuck around the Rockhampton area, however the mine is receiving freight and fuel through to the mine after being cut off last week. **10 Jan:** currently producing coal; most of water out of pit; reduced workforce due to Rockhampton situation. **19 Jan:** Mine operating as normal **11 Feb:** Mine has recovered from all of the rain events and is now operating at budgeted production rate.
Ensham		80-100	**14 Jan:** mining operation spared inundation, due to site's new levees, built to withstand a one in 1000-year flood **18 Jan:** production resumed between 10 & 13 Jan after more than two week's interruption due to heavy rain, but output can't yet be shipped from the mine. Production equipment intact, so could be restarted once the rain stopped. Finalising the dewatering, mining in all mining areas, pit not inundated from river, levees held. Closure of Blackwater rail prevents transporting coal to ports. **31 Jan:** Back to reasonable normality re production; northern (Yongala) pit still has water in it. **7 Mar:** Water in pits in nthn & sthn sections still constraining coal prod'n; but are producing from other pits; TEP in place; rain on weekend and flow in river but background ec is above TEP limit at monitoring point.
Kestrel		80-100	**13 Jan:** Company had reported on 6 Jan that work had started on bringing Kestrel underground coking and thermal coal mine back into production. **14 Jan:** Rail services would be available progressively to mines located on the (northern) Gregory branch from the weekend (22/23 January?) **19 Jan:** all Rio mines operational but constrained; Rio had restarted mining at the Kestrel underground mine about a week ago and was focusing on rebuilding inventories **31 Jan:** Operating under a TEP at present; no significant issues at present; trains to Gladstone running OK **7 Feb:** have had to maintain pumping without major water ingress; production losses mainly because workers affected by Emerald flooding and clean up and access issues; producing coal again how; had been railing through Mackay to Dal Bay till end Jan but now back on Blackwater system to G'stone.
Lake Vermont		80-90	**19 Jan:** Mine not inundated by floodwaters but pit accumulated water from rain which affected mining operations. Water in the pit has prevented mining the lower seams and mining is currently restricted to the upper seams. The mine is partially operating at 30% to 40% capacity. Expect to get back to full capacity in 2 to 4 weeks. Able to rail coal north to DBCT along the Goonyella line in the last couple of weeks. Two crucial issues to get back to 100% capacity - reconstruction of rail capacity to get coal to a port; and obtaining approvals from DERM to discharge water from the pits in a timely manner to take advantage of the dilution factor in flooding rivers. **9 Feb:** Had been closed for about 2 months; a couple of train loads to Dalrymple Bay over past month. Started railing regularly again on 2 Feb - to Gladstone; expect to be back up to 70% production soon and at that level for next couple of months. **7 Mar:** Still water in pits being pumped to surface storages and will use on site; production up to 80-90%.
Middlemount		80-100	**22 Dec:** Delays to rail spur construction schedule; flood erosion of haul road crossing of Roper Creek between pit and CHPP; containment of impacted water an issue and would like ability to discharge some; have been road hauling 50,000 t of product coal per month to rail loader at Carborough Downs but this is likely to be affected. **19 Jan:** Levee protected pit, mining is being carried out, some production transported by road to Coppabella. New rail loop contruction has been affected. Overall production not overly affected as they weren't producing much. **31 Jan:** A bit of water in pit; production OK but mine still scaling up; construction activities eg rail spur and road haul of equipment has been hampered **8 Feb:** Minimal impact from Yasi; in production but limited to 55,000 t per month by road haulage limits; have ability to produce more and keen to seek approval for expanded road haulage until rail spur is operational (expected late Oct 11)

Mine	Tonnage Currently Being Produced	Current Rate of Production cf Normal Output (%) as at 21.2.11	Summary Comments
Millenium		80-100	**30 Dec:** force majeure declared. **4 Jan:** ACE [redacted] back in full production. Had rain impact, no water impact. Staffing down by 10 on 2 crews. All areas, including washplant in full production. **10 Jan:** about a week's water in bottom of pit; should be able to start coal production mid-Jan; have mined coal stocks to supply shipping to mid/end Feb; reduced workforce due to Rockhampton situation. **19 Jan:** Mine operating as normal **11 Feb:** Mine has recovered from all of the rain events and is now operating at budgeted production rate.
Minerva		>80	**18 Jan:** Rail spur damaged by floods; running out of room on stockpile, so work will have to halt until the track has been rebuilt **19 Jan:** Repairs to the track west of Burngrove are expected to be completed by 25 Jan. **24 Jan:** Expect to resume coal exports from Gladstone port either tomorrow or Wednesday **25 Jan:** Coal can once again be transported from mine, where stockpiles have almost reached capacity **8 Feb:** Producing coal from higher seams but water in pit covering lower seams that are needed for blending into product with right specs for sale. Are railing some coal as well as stockpiling on site; water in pit impeding access to coal and waste dumping; need to remove 500ML of water with e/c of 1500. **7 Mar:** Going OK at >80% production; further 130mm rain over weekend put some water back in pit and caused some movement problems; about a week's more pumping to be done; remainder of water will be used on site; railings going well.
North Goonyella		80-100	**30 Dec:** force majeure declared. **11 Feb:** Mine has recoverd from all of the rain events and is now operating at budgeted produtcion rate.
Sonoma		80-100	**19 Jan:** Mine in full production since New Year; record output in Dec although lost 5 days in late Dec through rain; no problems with infrastructure; TEP granted for water discharge; would like to be able to produce more to take advantage of spot market but limited by plant capacity. **3 Feb:** While the mine was shut down before the cyclone, less rain was received than expected. As impact was less than expected, mine is restarting operations and working to get its staff back in again. **8 Feb:** Mine currently operating at 50% production due to reduced staff numbers; a number of employees are unable to report to work because of impacts of Cyclone Yasi to properties etc. **14 Feb:** Rainfall over past couple of months has impacted on mine scheduling, particularly overburden removal; so still not producing or railing normal tonnages. **7 Mar:** back to full production; stopped pumping water; railing OK; mine plan/schedule changed by delays to overburden removal and coal extraction from higher seams when pit had water in it.
Yarrabee		100	**4 Jan:** Not as badly affected as some other mines. Limited diesel being conserved for pumps, generators and road haulage - no diesel supplies coming due to roads cut off. Had hired-in four pumps before floods. Many staff on leave with only essential staff being flown in by chopper - also using chopper for monitoring. Pumps are dewatering in compliance with EA conditions. Access to half of mine cut off by floodwater. Have some coal stockpiled ready to rail but QR cannot supply trains due to flood and wash-outs. Haul roads impacted by on-going rain. [redacted] **21 Feb:** Had closed for 3 wks Xmas-New Year; back in production 18 Jan and at full production now; still pumping water under TEP; need to get equipment to site continuing to be an issue. [redacted]
Southern Region			
Meandu - south west of Nanango		100	**7 Jan:** Delivery risk is being managed by maintaining access to coal from the upper benches of the pits. This strategy means the mine is able to deliver coal after a few hours of a rain event ceasing and mine roads drying out. There is no inundation risk from nearby water courses as the mine is in an elevated position on a ridge. **19 Jan:** Disruption during rain events with a requirement to stand down operations to protect mine infrastructure e.g. roads, equipment etc. Some water in pits has resulted in adjustment to production schedules and longer term coal availability issues. Diversion of resources to coal production to overburden movement to ensure deliveries of coal. Operating at full capacity in the short term and developing strategies for longer term recovery. Current operations involve extensive dewatering of pits. Currently at full production however recent rain events have required major mine planning and scheduling efforts and will ultimately impact on future production costs.
Commodore Mine - Millmerran		100	**4 Jan:** all 6 pits (3 of which have coal exposed) have been inundated with water from local run-off since 27 Dec. They have pumped out one of the coal pits and are now producing from that and are able to produce sufficient coal to keep the power plant going in the short term. Longer term (+2 weeks) their ability to supply the power station depends of being able to pump out the water and access the coal in the larger pit. **19 Jan:** Mine has advised it will be another 3 weeks. The mine has 3 operational pits and they are being dewatered under a TEP. There have been a few days when mining was not possible. The mine is currently partially operational at about 70% but is still able to keep up with power station demands and able to slowly replenish the stockpiles. They obtained approval last Sunday from DERM to carry out a blast (on a Sunday). [redacted] is the contract miner. Most of the mine workers are local and there were no major problems getting workers to the mine. **21 Feb:** back to normal production but not fully back to mine plan yet

Mine	Tonnage Currently Being Produced	Current Rate of Production cf Normal Output (%) as at 21.2.11	Summary Comments
Kogan Creek Mine		100	**4 Jan:** Have started to produce coal. Road access to Chinchilla cut (anticipate should be open 6/1 or 7/1). Water covering coal in the centre of the pit but have access to coal at the eastern end. Have 70-80000 tonnes of coal stockpiled between the mine and the power station (burns at rate of approx. 6000tpd).. **7 Jan:** Road access still cut. It is predicted water released from Leslie Dam at Warwick into the Condamine River may cause some issues as it reaches the area. **18 Jan:** There is water in the pit but they are mining the higher coal seams to add to the ROM stockpile. The mine is ramping up to full production and is currently partially operational and operating at about 85% capacity. When road access is available expect to be able to go to full production. Currently flying in workers by helicopter. The roads are expected to reopen from 20 January. Limited fuel supply at mine. **18 Feb:** Road access is OK now. No water left in pit - capping in one corner progressing. Water levels on site now back to same level as June 2010 **21 Feb:** Back in full production
Partially Operating			
Central Qld			
Blackwater		50-80	**30 Dec:** force majeure declared. **17 Jan:** Blackwater mine remained affected by the closure of the Blackwater rail line. **19 Jan:** Blackwater rail has now opened. **21 Jan:** Currently all mines have been significantly impacted due to water in pits limiting access to mine coal. A longer term issue is the fact that current stripping is also hampered which will slow down coal uncovery for the coming months. Coal production of the operations will be running at approximately 20 – 50% of capacity in at least the short term. Transport restrictions are currently hampering our ability to transport equipment, fuel and explosives to site which further delays recovery times. Returning operations to full capacity will take 6 – 18 months; depending on further rain, storage capacity and the ability to release water from site. **31 Jan:** No significant change **7 Mar:** productiion at 50-80%
Blair Athol		50	**29 Dec:** Rio Tinto Coal declared force majeure. **4 Jan::** Mining operations have restarted on an intermittent basis at less than full capacity **19 Jan:** All RIO mines operational but constrained; The Blair Athol mine was running, but at below full capacity. **31 Jan:** Mine gearing back to full production; no major issues at present **7 Feb:** Water still in pits covering coal; operating at approx 50% of normal capacity at present; expect production for 2010/11 to be down 1.0 - 1.5 mt.
Broadmeadow		50-80	**30 Dec:** force majeure declared. **4 Jan:** Manager advised that the weather has resulted in a fall on the long wall face. They are currently cleaning up but are unsure as to time frames due to being short manned as many staff are cut off due to the flooding. There is currently a lot of water in the pit and they are only operating at about 75% due the staffing issues. **20 Jan:** Currently all mines have been significantly impacted due to water in pits limiting access to mine coal. A longer term issue is the fact that current stripping is also hampered which will slow down coal uncovery for the coming months. Coal production of the operations will be running at approximately 20 – 50% of capacity in at least the short term. Transport restrictions are currently hampering our ability to transport equipment, fuel and explosives to site which further delays recovery times. Returning operations to full capacity will take 6 – 18 months; depending on further rain, storage capacity and the ability to release water from site. **31 Jan:** No significant change **7 Mar:** productiion at 50-80%
Burton		??	**10 Jan:** Haul road between CHPP and TLO should be open by weekend; coal stocks predicted to last approx 2 weeks; significant water in operating pits; could take 2-3 months to dewater; evaluating mining options to see what can be mined before water is fully pumped out. **19 Jan:** Thiess (mining contractor) advises that mine is partially operational; still pumping from one pit. **20 Jan:** Thiess says it has been able to extract coal from the Burton mine near Moranbah despite recent flooding **11 Feb:** Production severely constrained because of water in pits and flooding impeding access to some pits and to rail loadout facility **7 Mar:** Rain on weekend has cut haul road again; still constrained by water in pits

Mine	Tonnage Currently Being Produced	Current Rate of Production cf Normal Output (%) as at 21.2.11	Summary Comments
Callide - Boundary Hill		60	**30 Dec:** force majeure declared. **6 Jan:** Coal being railed to Gladstone Power Station (and QAL?) **19 Jan:** Callide and Boundary Hill mines affected by rain; dewatering nearly complete and production about to restart; Moura line now open and can begin shipments soon. **31 Jan:** Anglo Coal mines operating at about 60% capacity overall; expect to be close to 100% production by end of Q1 if no more heavy rain.
Clermont		50	**29 Dec:** Rio Tinto Coal declared force majeure. **4 Jan:** Mining operations have restarted on an intermittent basis at less than full capacity. **19 Jan:** all RIO mines operational but constrained; UBS analyst [redacted] said he understood the Clermont mine was affected by the flood, with no update on a restart **31 Jan:** Mine gearing back to full production; no major issues at present **7 Feb:** additional recent rain; still have water in pit covering coal; have been able to pump some to Blair Athol; operating at approx 50%
Collinsville		<50	**31 Jan:** Some production but at less than optimal level **8 Feb:** producing and railing coal **17 Feb:** Still problems with water; can't discharge because of low pH; pumping to an old pit so can get coal out. Not a lot of production so far in 2011.
Coppabella		>50	**30 Dec:** force majeure declared **11 Jan:** A return to normal production may take at least a month, provided there's no "further big rain". **15 Jan:** increased focus on water management since 2008 has paid off: **27 Jan:** Still dewatering but started "coaling" again today; processing some ROM coal but not best quality; will probably have to do more dewatering before can return to full production; want TEP to discharge water under low flow conditions **31 Jan:** Rain overnight had stopped operation again but could be back in a week if no more rain **4 Feb:** Macarthur Coal said its Coppabella and Moorvale mines were resuming normal operations **14 Feb:** Mine back in production but not yet at full capacity **22 Feb:** Still impacted by water; mining restarted in one pit (<50% production); will be pumping others till mid-March; normal operations in April
Crinum		50-80	**17 Jan:** At this time there was no mining at BMA's Norwich Park, Poitrel and Gregory mines **21 Jan:** Currently all mines have been significantly impacted due to water in pits limiting access to mine coal. A longer term issue is the fact that current stripping is also hampered which will slow down coal uncovery for the coming months. Coal production of the operations will be running at approximately 20 – 50% of capacity in at least the short term. Transport restrictions are currently hampering our ability to transport equipment, fuel and explosives to site which further delays recovery times. Returning operations to full capacity will take 6 – 18 months; depending on further rain, storage capacity and the ability to release water from site. **31 Jan:** No significant change **7 Mar:** productiion at 50-80%
Curragh		60-70	**11 Jan:** The flooding continued to significantly impact met coal production at Curragh mine and rail operations are unlikely to resume before mid-Jan at the earliest. **12 Jan:** Curragh's met coal sales forecast to be 5.8 mt - 6.2 mt for current financial year, down from pre-flood forecast of 6 - 6.5 mt. **8 Feb:** Are mining, washing and railing coal but still hampered by a lot of water on site; one dragline parked for a couple of weeks; have a 4 month pumping program to dewater mine. **18 Feb:** Mine in intermittent production but still affected by water in some pits covering coal; overburden stripping going well; about to lodge TEP appln. **7 Mar:** Still affected by water in pits; TEP appln to be lodged 11 Mar; production pinch-point expected in a month if no ability to discharge
Dawson		60	**21 Jan:** Coal production is slowly resuming at the Anglo American owned Dawson Mine, near Moura, with the first load of coal sent by rail late in the second week of January. **22 Jan:** Working since rain event to restore operations; should be shipping out more than 7 mt of coal a year. The rain filled dams on the site, flooded some key infrastructure such as conveyor belts and stranded fly-in, fly-out staff across the country. Have mobilised 16 pumps from various locations to get the mine up and going again and have been busy procuring about 60km of pipeline. Although mine operations were back to about 60 per cent of capacity by mid-week, coal shipments are still well down as equipment is resited. Normally rail about 20 to 25 trains a week but have only railed 10 this week; now probably out of coal, so there'll probably be a gap of a day or two. **31 Jan:** Anglo Coal mines operating at about 60% capacity overall; expect to be close to 100% production by end of Q1 if no more heavy rain.
Foxleigh		60	**30 Dec:** force majuere declared. **4 Jan:** message left for either Mine Manager or SSE to ring back. Left voice message on mobile as well. **6 Jan:** assessing impacts; pumping out open cuts; issues with rail access **19 Jan:** Still dewatering. **31 Jan:** Anglo Coal mines operating at about 60% capacity overall; expect to be close to 100% production by end of Q1 if no more heavy rain.

Mine	Tonnage Currently Being Produced	Current Rate of Production cf Normal Output (%) as at 21.2.11	Summary Comments
Goonyella-Riverside		50-80	**4 Jan:** [redacted] Acting SSE - not hauling out of any pits due to water. Expect to be mining 2 pits 10/01/11 and expect to be okay to run for 3 weeks. Currently pumping out of ramps 25 and 14. Expect full production in approx 6 weeks. Impacts/impediments - running out of water storage. Goonyella Riverside is operational, with limited pre-strip. December coal production was well down. **21 Jan:** Currently all mines have been significantly impacted due to water in pits limiting access to mine coal. A longer term issue is the fact that current stripping is also hampered which will slow down coal uncovery for the coming months. Coal production of the operations will be running at approximately 20 – 50% of capacity in at least the short term. Transport restrictions are currently hampering our ability to transport equipment, fuel and explosives to site which further delays recovery times. Returning operations to full capacity will take 6 – 18 months; depending on further rain, storage capacity and the ability to release water from site. **31 Jan:** No substantial change **7 Mar:** productiion at 50-80%
German Creek - Bundoora Pit		60	**30 Dec:** force majeure declared. **4 Jan:** No Comment from company **6 Jan:** Bundoora Pit - assessing situation; about to restart operations **19 Jan:** Underground is mining but not in full production. Movement of equipment into mine is restricted by Dysart road partially closed. **31 Jan:** Anglo Coal mines operating at about 60% capacity overall; expect to be close to 100% production by end of Q1 if no more heavy rain.
Grasstree		<50	**30 Dec:** force majeure declared. **4 Jan:** message left for SSE to contact RD CQ. **6 Jan:** operational at reduced output but rail access issues **22 Jan:** Serious water ingress into underground workings. Understand that Anglo Coal had reported that no one was injured when the tunnel flooded about 7pm Thursday. Initial reports suggested the water might have been from a nearby surface pit; now believed to have been from groundwater. Timeframe for tunnel to be reopened unknown at this stage but could be lengthy. **31 Jan:** Situation stabilised
Gregory		50-80	**14 Jan:** Rail services would be available progressively to mines located on the (northern) Gregory branch from the weekend (22/23 January?) **17 Jan:** At this time there is no mining at BMA's Norwich Park, Poitrel and Gregory mines **21 Jan:** Currently all mines have been significantly impacted due to water in pits limiting access to mine coal. A longer term issue is the fact that current stripping is also hampered which will slow down coal uncovery for the coming months. Coal production of the operations will be running at approximately 20 – 50% of capacity in at least the short term. Transport restrictions are currently hampering our ability to transport equipment, fuel and explosives to site which further delays recovery times. Returning operations to full capacity will take 6 – 18 months; depending on further rain, storage capacity and the ability to release water from site. **31 Jan:** No substantial change **7 Mar:** productiion at 50-80%
Hail Creek		30-50	**29 Dec:** Rio Tinto Coal declared force majeure. **19 Jan:** All Rio mines operational but constrained; Hail Creek producing at around capacity **31 Jan:** Impacted significantly by rain events, including weekend just passed; discharging under TEP at present; currently pits are closed; no rail or port problems; coal production and overburden removal are behind sheduled rates **1 Feb:** Mine shut down this morning, as the impact of Cyclone Yasi may be felt over a large area. **4 Feb:** Rio Tinto expects to reopen its Hail Creek coa lmine this morning **7 Feb:** had another 200 mm rain from Yasi; water in pits and all surface storages are full; have TEP in place but a lot of water to remove and timing of approval inopportune; road access to mine cut several times recently; now operating at 30-50%; production for 2010/11 expected to be down 1 mt.
Jellinbah East		75-80	**4 Jan:** Expressed disappointment of failure of all infrastructure, e.g. rail, roads etc. Operating at reduced capacity of 40% and is pumping water. **19 Jan:** The mine has not been inundated by floodwaters but the pit has accumulated water from rain which has affected mining operations. Currently, the mine is partially operating at a capacity of about 80% to 90%. They expect to be back in full production in the next couple of weeks. The Blackwater line is not operating and they are currently stockpiling coal. The company is expecting to deliver coal to RG Tanna in a light rail configuration tomorrow. The company has revised forecasted coal production from 4.6Mtpa to 4.0Mtpa for FY 2010-2011. **21 Jan:** Company assisting in obtaining food & stores for local commumity in Bluff. **14 Feb:** Production returning to near normal (75-80%); still pumping water out of pits and will take at least a month to dewater northern pit.
Lake Lindsay		60	**4 Jan:** SSE & Mine Manager trapped in Biloela. A/Mine Manager Matt MILLS - Major issue is manning - have made arrangements to fly staff in. Major damage to roads, but they are in the process of fixing same and water ingress. Are pumping, but within regulations. Are back in production, but at 60% and if fine weather for 1 week expect to be 100% full production then. **31 Jan:** Anglo Coal mines operating at about 60% capacity overall; expect to be close to 100% production by end of Q1 if no more heavy rain.
Moranbah North		60	**30 Dec:** force majeure declared. **4 Jan:** email sent to verify identity of enquirer (RD CQ). **6 Jan:** assessing impacts **19 Jan:** Underground is operating; still at least a week before full production. **31 Jan:** Anglo Coal mines operating at about 60% capacity overall; expect to be close to 100% production by end of Q1 if no more heavy rain.

Mine	Tonnage Currently Being Produced	Current Rate of Production cf Normal Output (%) as at 21.2.11	Summary Comments
Moorvale		50-80	**3 Dec:** force majeure declared. **4 Jan:** Currently operating 4 out of 4 excavators to move overburden. Coal mining significantly impeded by water. Doing their best to pump all the water out and their dams have been discharged in line with the Environmental Requirements. There are issues with safe access for people to and from site. They are currently continually monitoring conditions to ensure staff safety e.g - weather forecasts, river bottlenecks, road closures. Roads are causing significant problems for staff getting in and out of the mine site. **27 Jan:** Still dewatering; water in bottom of pit but accessing coal higher up; railing coal but not at full production; want TEP to discharge water under low flow conditions **31 Jan:** no substantial change **4 Feb:** Macarthur Coal said its Coppabella and Moorvale mines were resuming normal operations **14 Feb:** Mine back in production but not yet at full capacity **22 Feb:** Normal ops in one pit; others in a week or two; full production by mid-March
Newlands		70-80	**4 Jan:** [redacted]dvises no significant impacts, at full production, putting in additional pumps to cope with water, some staff unable to get to/from site. **11 Jan:** underground Oaky Creek operations and Newlands are continuing to produce coal and deliver it to port in most instances. **24 Jan:** risk of water ingress to underground workings caused closure of mine; open cuts also impacted by recent havy rain **31 Jan:** situation stabilised and coal again being produced from underground **3 Feb:** Newlands open cut and underground mine was shut down just for night shift. **4 Feb:** Xstrata said it had resumed operations at its Newlands coal mine; producing and railing coal. **17 Feb:** Pumping and discharging water under TEP; coal production at lower than scheduled levels (70-80% for whole of Newlands group of mines)
Norwich Park		50-80	**4 Jan:** Norwich Park is operational, with 3 of 6 draglines operating, limited pre-strip, coal production to commence in 36 hours. **17 Jan:** At this time there is no mining at BMA's Norwich Park, Poitrel and Gregory mines **21 Jan:** Currently all mines have been significantly impacted due to water in pits limiting access to mine coal. A longer term issue is the fact that current stripping is also hampered which will slow down coal uncovery for the coming months. Coal production of the operations will be running at approximately 20 – 50% of capacity in at least the short term. Transport restrictions are currently hampering our ability to transport equipment, fuel and explosives to site which further delays recovery times. Returning operations to full capacity will take 6 – 18 months; depending on further rain, storage capacity and the ability to release water from site. **7 Mar:** productiion at 50-80%
Oak Park		60	As for German Creek **31 Jan:** Anglo Coal mines operating at about 60% capacity overall; expect to be close to 100% production by end of Q1 if no more heavy rain.
Oaky Creek		??	**4 Jan:** email sent as requested. **10 Jan:** Shipments from Oaky Creek are delayed because of the rail line, but the majority of customers are getting coal and the mine is still producing coal. **11 Jan:** underground Oaky Creek operations are continuing to produce coal and deliver it to port in most instances. **31 Jan:** Mine is OK; had a lot of water in u/g that had to be removed; some ground stability issues resolved; producing coal again **8 Feb:** Producing and railing coal
Peak Downs		50-80	**17 Jan:** UBS noted that production had returned to BMA's Goonyella Riverside, Peak Downs and Saraji open cut mines, according to a BMA notice sent to two north Asian customers on 7 Jan. **20 Jan:** Currently all mines have been significantly impacted due to water in pits limiting access to mine coal. A longer term issue is the fact that current stripping is also hampered which will slow down coal uncovery for the coming months. Coal production of the operations will be running at approximately 20 – 50% of capacity in at least the short term. Transport restrictions are currently hampering our ability to transport equipment, fuel and explosives to site which further delays recovery times. Returning operations to full capacity will take 6 – 18 months; depending on further rain, storage capacity and the ability to release water from site. **31 Jan:** no substantial change **7 Mar:** productiion at 50-80%
Poitrel		50-80	**30 Dec:** force majeure declared. **4 Jan:** Poitrel and South Walker Creek Mines are operational and focusing on recovery efforts. Wet site conditions are impacting mining and recovery efforts. **17 Jan:** At this time there was no mining at BMA's Norwich Park, Poitrel and Gregory mines At this time there was no mining at BMA's Norwich Park, Poitrel and Gregory mines **21 Jan:** Currently all mines have been significantly impacted due to water in pits limiting access to mine coal. A longer term issue is the fact that current stripping is also hampered which will slow down coal uncovery for the coming months. Coal production of the operations will be running at approximately 20 – 50% of capacity in at least the short term. Transport restrictions are currently hampering our ability to transport equipment, fuel and explosives to site which further delays recovery times. Returning operations to full capacity will take 6 – 18 months; depending on further rain, storage capacity and the ability to release water from site. **31 Jan:** No substantial change **7 Mar:** productiion at 50-80%

Mine	Tonnage Currently Being Produced	Current Rate of Production cf Normal Output (%) as at 21.2.11	Summary Comments
Saraji		50-80	**30 Dec:** force majeure declared. **4 Jan:** [redacted] to coordinate a whole of BMA/BHP response. Saraji is almost entirely operational. **17 Jan:** UBS noted that production had returned to BMA's Goonyella Riverside, Peak Downs and Saraji open cut mines, according to a BMA notice sent to two north Asian customers on 7 Jan **21 Jan:** Currently all mines have been significantly impacted due to water in pits limiting access to mine coal. A longer term issue is the fact that current stripping is also hampered which will slow down coal uncovery for the coming months. Coal production of the operations will be running at approximately 20 – 50% of capacity in at least the short term. Transport restrictions are currently hampering our ability to transport equipment, fuel and explosives to site which further delays recovery times. Returning operations to full capacity will take 6 – 18 months; depending on further rain, storage capacity and the ability to release water from site. **31 Jan:** no significant change **7 Mar:** productiion at 50-80%
South Walker Creek		50-80	**30 Dec:** force majeure declared. **4 Jan:** [redacted] to coordinate a whole of BMA/BHP response. South Walker Creek Mine is operational and focusing on recovery efforts. Wet site conditions are impacting mining and recovery efforts **21 Jan:** Currently all mines have been significantly impacted due to water in pits limiting access to mine coal. A longer term issue is the fact that current stripping is also hampered which will slow down coal uncovery for the coming months. Coal production of the operations will be running at approximately 20 – 50% of capacity in at least the short term. Transport restrictions are currently hampering ability to transport equipment, fuel and explosives to site which further delays recovery times. Returning operations to full capacity will take 6 – 18 months; depending on further rain, storage capacity and the ability to release water from site. **31 Jan:** no significant change **7 Mar:** productiion at 50-80%
Suttor Creek (part of Newlands group)		50	Part of Newlands group of mine workings **17 Feb:** Dragline working; producing some coal but below scheduled rate
Wollombi (part of Newlands group)		<50	Part of Newlands group of mine workings **31 Jan:** Wollombi pit closed; a lot of water in pit **17 Feb:** Still pumping water out of pit but are producing some coal; several 100,000 t of coking coal still under water in pit
Southern Region			
Jeebropilly - West of Ipswich		50-80	**6 Jan:** reduced production, but no flood damage. **24 Jan:** producing coal and railing to Port
New Oakleigh - Rosewood		50-80	**6 Jan:** reduced production, but no flood damage. **24 Jan:** producing coal and railing to Port
New Hope - New Acland		50-80	**6 Jan:** No major problems however site does have some water impacts at one end of a pit which is being pumped. There has been limited loss to production and outlook is positive. **7 Jan:** occasional localised flood may temporarily cut access to site. However no other production issues at this stage. **24 Jan:** Water in parts of workings still being pumped out but coal is being produced; waiting on QR advice on state of rail track (Toowoomba Range) and timeline for repairs. QR has declared force majeure re company's contracts. Company looking at other transport options incl road haul to Jeebropilly for rail loading; if transport not possible will continue to produce coal and stockpile but will eventually run out of stockpile room. **14 Feb:** New Hope has received approval to transport coal by road to their Jeebropilly rail loading facility west of Ipswich while the Jondaryan to Toowoomba section of the rail line is repaired.
Producing Coal but No Transport			
Central Qld			

Mine	Tonnage Currently Being Produced	Current Rate of Production cf Normal Output (%) as at 21.2.11	Summary Comments
Rolleston		20-50	**10 Jan:** Rolleston mine flooded; force majeure declared; **14 Jan:** Rolleston spur line extensively damaged. **18 Jan:** Spur lines from the Rolleston and Minerva mines damaged by floods **19 Jan:** 110km spur to Xstrata's Rolleston mine is being assessed in detail following the receding of floodwaters. The re-opening date is yet to be confirmed. QR National has established a project team with Xstrata to manage this recovery work. **20 Jan:** The costs to repair the Rolleston branch line are still being assessed. Mine might not start deliveries until late February **31 Jan:** Levees protected mine from inundation but some water to be removed; recovery going well but will be a while before coal can be railed **8 Feb:** Producing coal but no rail access **7 Mar:** producing & stockpiling coal at ~75% of normal rate; expecting first train in pm of 8 Mar; will be railing at contracted rate; still water on site; TEP in place; rain again on weekend; a lot of mud & silt in pits will need extra handling and slow mining
Southern Qld			
Peabody - Wilkie Creek		<50	**17 Jan:** Site access is still a problem and currently using helicopter to access site to man pumps. Limited fuel supplies on site. May gain vehicle access Tuesday or Wednesday. Of main concern is that it could take 3 months to get the rail up and running. **19 Jan:** Wilkie Creek continues to recede and is no longer inundating pits; access via road has been restored; Western Downs Regional Council notified DERM that a flyover identified a possible unauthorised discharge and that ABC filmed the site for a news story on Coal Mines. DERM is arranging a site inspection for tomorrow morning. **20 Jan:** Company advises that access to site re-established today. Dozer and grader work will be necessary over the next day or so to get excavators back in action. Main access to train loadout still inaccessible. Pumping continues. **11 Feb:** Production at the mine is still severely impacted by restricted access to the mine for people and supplies and closure of the rail link to Port of Brisbane (Toowoomba Range). Preliminary meeting with DTMR re options for road haul of coal but no formal application for approval.
Not Operating			
Southern Qld			
Syntech - Cameby Downs		0	**19 Jan:** Most of water now out of pit; minesite in reasonable shape. Mining restarted. 40,000 t of product coal at mine that could be moved but rail line to Port of Brisbane closed. Timing of rail repairs critical; will seek approvals to haul on road to rail loader. Road options being considered Ipswich line (eg Swanbank) or to Moura (perhaps use Baralaba load-out) depends on overall costs and approvals to haul on roads; spare capacity on Moura rail and at Gladstone port. **8 Feb:** No agreement from other coal companies for access to coal loaders at Moura. Inability to road haul down T'ba Range and no access to loader near Ipswich. Have been mining coal and stockpiling for a couple of weeks. Most likely that will have to go onto C&M until rail link to Port of Bne reopens. **7 Mar:** No success in alternate road/rail transport link; so mine has gone onto care & maint until line to Bne reopens (early April); have stockpiled about 100,000t of coal in preparation; no site issues (water etc)
Central Qld			
Baralaba		0	**19 Jan:** Mine flooded; most infrastructure is OK (some coal crushing gear affected); had raw coal stockpiled at mine; DTMR has been helpful with permits for carriage of gear on flood affected roads but access in and out is still issue. 0% production at present. Could be producing coal in up to 3 months but full production likely 4-6 months. Access to bring in required equipment is the biggest issue. **21 Jan:** A 1:1000 year flood levee will also be built, commencing from February. Dewatering of pit underway under EA conditions. Mining possible from late February. **31 Jan:** Still pumping water; return to production 7-8 weeks if no more rain; road access for haulage of some stockpiled coal to Moura may be open is a couple of days; need heavy haulage approval to get equipment to site to construct 1:1000 year bunds **25 Feb:** still pumping but close to TEP limits and likely to have to reduce puming rate to comply; aim to produce some coal from new shallow pit in April but full return willl be 2 to 4 months yet.

Mine	Tonnage Currently Being Produced	Current Rate of Production cf Normal Output (%) as at 21.2.11	Summary Comments
Isaac Plains		<20	**21 Jan:** Coal washing and train loading had resumed at the Isaac Plains mine. While all equipment is in working order, resumption of full production rates will take some time while dewatering of the site is completed. Still be some time before the mine is back to full production **21 Feb:** Has been only intermittent production (5 days in 3 months); no production at present; another 4 days prod'n coming up then will close again; intermittent prod'n till mid March; full prod'n not expected till mid May. **25 Feb:** As above; still pumping water but getting close to EC and stream flow limits under current TEP; likely to need further TEP amendment to remove water from all pits to achieve reasonable level of continuous production

Rail			
Goonyella Line			**18 Jan:** currently working at around 70 percent capacity due to reduced coal availability.
Moura Line			**19 Jan:** Moura rail line open and the Dawson, Callide and Boundary Hill mines railing coal the port of Gladstone can now start ramping up our export capacity. "Based on supply chain delivery we would expect to be able to load around 2 million tonne of coal this month with the port reaching full capacity by the end of March.
Blackwater Line			**19 Jan:** first loaded coal trains will begin heading to the port of Gladstone soon after 6pm Wednesday. The Blackwater track is now available for mines from Burngrove (near Blackwater) east to Gladstone port. From Monday 24 January, the track is scheduled to be available to mines on the (northern) Gregory branch.
Blackwater Line -Gregory line			**24 Jan:** From today the track is scheduled to be available to mines on the (northern) Gregory branch **25 Jan:** As of yesterday, the track was also made available to mines on the northern Gregory branch
Blackwater Line - Rolleston line			**22 Jan:** almost all of QR National's network was built to withstand a once-in-100-year flood, the Rolleston line was built merely to stand up to a once-in-20-year event. "We're investigating all the possibilities you'd imagine, to see whether coal can be trucked to other places served by rail," [redacted] said. **24 Jan:** is being assessed in detail following the receding of floodwaters **25 Jan:** QR National has established a project team with Xstrata to manage the recovery work.
Newlands line			**18 Jan:** continues to operate
North Coast Line			**19 Jan:** locations beyond Gladstone to Cairns are on track to re-commence later today (Jan 19) following the repair of track damaged by floodwaters at Rockhampton
Emerald to Longreach			**19 Jan:** there are still many areas of Qld that are not operating - west of Emerald has been hit badly **21 Jan:** the line from Longreach to Rockhampton may be open by the end of February.
West of Emerlad			**19 Jan:** there are still many areas of Qld that are not operating - west of Emerald has been hit badly
Ports			
Gladstone			**19 Jan:** Based on supply chain delivery we would expect to be able to load around 2 million tonne of coal this month **20 Jan:** There are 10 vessels at anchor while another six are due to arrive at the port next week **21 Jan:** the first train load of coal will be loaded onto a ship today, with 12 trains expected to be unloaded at the port in the next 24 hours. **25 Jan:** Based on supply chain delivery we would expect to be able to load around two million tonnes of coal this month.
Port Alma			**19 Jan:** "Port Alma will remain closed to commercial shipping until we can assess the impact of the floods. "Survey work is intended to be undertaken between the 20th and 24th of this month," [redacted] said
Abbott Point CT			**19 Jan:** Newlands line to Abbot Point Coal terminal continues to operate
Hay Point CT			**19 Jan:** 18 moored off Hay Point **22 Jan:** dropped 22 percent in December **25 Jan:** shipments from Hay Point in Queensland dropping 22% as stockpiles become exhausted in the wake of the flood disaster.
Dalrymple Bay Coal Terminal			**19 Jan:** receiving between 17 and 20 trains a day, with 22 on Monday and 10 on Sunday; 38 ships in the queue off DBCT yesterday; terminal is 100 per cent operational; DBCT is also receiving some trains from the Blackwater system too

(NB: Maximum length is to be two pages)

TBN

To: Andrew Fraser Treasurer Copy: ADG – DEEDI Mines and Energy

From: **Name**
Title

7 March 2011

Flood Recovery of Coal Mines

Summary and/or Recommendation

Note

Timing

Include urgency, when to implement, and / or details of any critical timelines to be met

Background

The Treasurer has requested this meeting as a result of concerns raised by Japanese steel companies during his visit to Tokyo last week.

Many coal mines in Queensland suffered significant disruption as a result of heavy rain and flooding during late 2010 and early 2011.

Whilst only a small number of mines were inundated by flooding from adjacent streams, almost all were impacted by incident rainfall and site run-off, with open pits collecting large volumes.

Almost continual heavy falls of rain both before and after the flooding events severely impacted mine planning; overburden removal and production scheduling.

The flooding disrupted the coal transport system, cut off access to mines for workers, directly impacted some workers resident in Emerald and Theodore and caused supply chain difficulties for fuel, explosives, etc.

Because of the above impacts on production and transport of coal, many mine owners declared *force majeure* in respect of supply contract obligations.

While exports for December 2010 were around 15% down on those for December 2009, the January 2011 export tonnage (9.17 Mt) was 45% lower than the same month in 2010. In February 2011 the tonnage exported was 8.12 Mt, 33% lower than the tonnage for February 2010 (12.138 Mt).

Whilst much of the transport system is back in normal operation, except for the Rolleston spur line and the Western line that services the Surat Basin mines, February exports have been significantly affected by lack of coal availability from mines, particularly in the Newlands and Goonyella rail systems. Ongoing difficulties being experienced by some mines in removing water from workings to allow a return to full production are the key cause.

The Department of Environment and Resource Management (DERM) is responsible for the conditioning of Environmental Authorities (EA) and assessment of applications for transitional environmental programs (TEPs).

As a result of the Hart review in 2009, a set of model water conditions for mines in the Fitzroy Basin were developed and mines were invited to apply for amendments to their environmental authorities incorporating these new conditions. These conditions specified the circumstances under which mines could discharge affected water to the environment.

In October 2010, DERM contacted all major mining companies to discuss their water management plans given the likelihood of a substantial wet season in northern Queensland.

As a result of the significant rainfall and flooding that occurred since 1 December 2010, many mines have been applying for TEPs that involve the discharge of mine affected water to nearby watercourses in order to clear the water from mining pits.

TEPs have been used to authorise the discharge of mine affected water to watercourses in situations where the risks to the environment and downstream users can be adequately managed but the discharge would not otherwise be compliant with the mines EA.

Since 1 December 2010 and as at 1pm on Friday 4 March, the department has approved 58 TEPs or amendments to existing TEPs across 37 mine sites in Queensland. There are currently 8 further applications under consideration.

DERM continues to assess TEP applications on a case by case basis. TEPs will only be approved if it can be adequately demonstrated that the discharge can be managed to avoid unacceptable risks to the environment or downstream water users.

Many of the mines have been unable or disinclined to supply detailed information on the impacts to their operations and to their production level as a result of the rain and flooding events. Therefore, key data required to fully understand the industry's position is subject to uncertainty.

However, information gathered by DEEDI indicates that the following mines are still constrained operationally by the presence of water in workings, notwithstanding that many have approved TEPs in place:

(NB: Maximum length is to be two pages)

TBN

Many of the BMA (BHP Billiton Mitsubishi Alliance) and BMC (BHP Mitsui Coal) mines, some of the Anglo Coal mines (especially Dawson North), Baralaba, Burton, Isaac Plains, Curragh, Lake Vermont, Moorvale, Coppabella

Currently DEEDI understands that 15 mines are operating at or close to full production (80-100% of normal output); 34 mines are in partial production (20-80% of normal output); two mines are producing coal but are unable to transport it because of rail closures; two mines are not operational or are producing only small intermittent tonnages (0-20% of normal output) and one mine has gone into care and maintenance until the Western Line is reopened.

Attachments

Attachment 1: Running Sheet of mine by mine status.

Next steps

As flows in major watercourses have diminished, mines have been applying for TEPs that involve a significantly higher degree of environmental risk due to the desire to discharge mine affected water into low or zero flow in receiving watercourses.

DERM has approved several of these applications where the risks can be adequately managed. These approvals generally apply only to releases during the wet season and are not ongoing.

It is highly unlikely that the approved TEPs will enable all mines to discharge the amount of water required to allow the mines to achieve full production. Several mines have significant volumes of water stored in mining pits that would take several months of pumping to remove. Some mines are also located on ephemeral streams and tributaries and there is unlikely to be sufficient flow in these tributaries to enable the ongoing discharge of saline water in a manner which ensures the protection of the environment and downstream water users.

Mines in these circumstances will most likely need to investigate other methods of water disposal including (but not limited to) increased water storage on site, reverse osmosis treatment plants and pipelines to enable the movement of mine affected water.

Name

Enquiries: [redacted]
Telephone:
Mobile:

CTS No. 04185/11

Advisor .... OK	
Dated / /	
Approved Not Approved Noted Further information required	
Minister..................................	
Dated / /	

Rec'd - OER 15 MAR 2011

Department of Environment and Resource Management
MINISTERIAL DEPUTATION BRIEFING NOTE
17 March 2011 @ 11:20am
Mr Michael Roche, Chief Executive Officer,
Qld Resources Council

TO: **Minister for Environment and Resource Management**

SUBJECT: Update on mine water issues

DEP REP: Andrew Brier, General Manager Coal and CSG Operations

BACKGROUND

- Mr Michael Roche has requested this meeting following the appointment of Minister Jones to the Environment and Resource Management portfolio.
- As a result of recent flooding and rainfall, a large number of coal mines have been inundated or are experiencing issues with on-site water management.
- Of the 57 coal mines in Queensland, it is estimated that approximately 70 percent are currently experiencing impacts on their production due to water management issues on site.
- The Department of Environment and Resource Management is responsible for the conditioning of Environmental Authorities and assessment of applications for transitional environmental programs (TEPs).
- As a result of the Hart review in 2009, a set of model water conditions for mines in the Fitzroy Basin were developed and mines were invited to apply for amendments to their environmental authorities incorporating these new conditions. These conditions specified the circumstances under which mines could discharge affected water to the environment.
- In October 2010 the department contacted all major mining companies to discuss their water management plans given the likelihood of a substantial wet season in northern Queensland.
- As a result of the significant rainfall and flooding that occurred since 1 December 2010, many mines have been applying for TEPs that involve the discharge of mine affected water to nearby watercourses in order to clear the water from mining pits.
- TEPs have been used to authorise the discharge of mine affected water to watercourses in situations where the risks to the environment and downstream users can be adequately managed but the discharge would not otherwise be compliant with the mines environmental authority.
- Given the widespread nature of the rainfall events and the understanding that the discharge of mine affected water is critical to some mines' operations, staff of the department have been assessing all TEP applications in as timely and efficient manner as possible, well under the statutory timeframes.
- The Queensland Resources Council (QRC) has become increasingly critical of the need to conduct a detailed assessment of TEP applications and on 6 January proposed that the department issue "an open invitation which invites all companies to discharge as much water as possible within as short a period of time as possible".
- The department advised QRC that it was not supportive of this concept as the risks to the environment, downstream water users and some drinking water supplies were unacceptable.
- The department continues to assess TEP applications on a case by case basis. TEPs will only be approved if it can be adequately demonstrated that the discharge can be managed to avoid unacceptable risks to the environment or downstream water users.

Author Name: Andrew Brier Position: GM Coal & CSG Operations Tel No: [redacted] Date:15 March 2011	Cleared by Name: Mike Birchley Position: A/ADG RSD Tel No: [redacted] *Rec'd: 15/03/2011*	Cleared by Name: Terry Wall [redacted] Position: ADG OER Tel No: [redacted]	Recommended: Name: John Bradley Director-General, DERM Tel No: [redacted] Date:
	Name: Position: Tel No:	Name: Position: Tel No:	

File Ref:

CURRENT ISSUES

- Since 1 December 2010 and as at 1pm on Friday 1 March, the department has approved 59 TEPs or amendments to existing TEPs across 37 mine sites in Queensland. There are currently eight further applications under consideration.
- Most approved TEPs allow mines to discharge mine affected water in various quantities as long as the receiving watercourse is flowing at a minimum rate and certain water quality thresholds are not exceeded.
- As flows in major watercourses have diminished, mines have been applying for TEPs that involve a significantly higher degree of environmental risk due to the desire to discharge mine affected water into low or zero flow in receiving watercourses.
- The department has approved several of these applications where the risks can be adequately managed. These approvals generally apply only to releases during the wet season and are not ongoing.
- It is highly unlikely that the approved TEPs will enable all mines to discharge the amount of water required to allow the mines to achieve full production. Several mines have significant volumes of water stored in mining pits that would take several months of pumping to remove. Some mines are also located on ephemeral streams and tributaries and there is unlikely to be sufficient flow in these tributaries to enable the ongoing discharge of saline water in a manner which ensures the protection of the environment and downstream water users.
- Mines in these circumstances will most likely need to investigate other methods of water disposal including (but not limited to) increased water storage on site, reverse osmosis treatment plants and pipelines to enable the movement of mine affected water.
- The department will continue to actively work with affected mines in order to ensure that any alternative water management proposals can be progressed in as timely a manner as possible.
- In order to address longer term issues surrounding mine water management, the department is intending to complete several key projects and reviews in 2011:
  - A review of the model water conditions for mines in the Fitzroy Basin. This review will be completed by the end of July 2011.
  - The development of environmental water quality guidelines for rivers in the Fitzroy Basin. This process is likely to be completed by mid 2011.
  - A review of mine water management plans to ensure they are adequate given the learnings from the recent wet season.
  - Mines are being encouraged to apply for amendments to their environmental authorities where they believe they can vary the conditions relating to the discharge mine affected water in a manner that is safe and sustainable for the environment.
- In meetings between the department and QRC, it has been explained that the expectations relating to the review of the Fitzroy model conditions need to be managed. As these are model conditions applying to all mines they must therefore be applicable to all situations and this means they are generally conservative. It has been explained that the department is able to be considerably more flexible if mines negotiate EA amendments with the department based on their individual circumstances.
- The QRC is also proposing a partnership between the QRC and the department in sponsoring a feasibility study relating to the Hunter Valley Salinity Trading Scheme and its likely applicability to the Fitzroy Basin in Queensland. The study has been proposed by the Centre for Water in the Minerals Industry (Sustainable Minerals Institute, The University of Queensland) as the result of a request by the QRC and the proposal is attached to this brief (Attachment 1).
- The proposed study involves a total investment of $126,110 which the QRC proposes be split between the QRC and DERM. The department has provided feedback on the proposal

Author	Cleared by	Cleared by	Recommended:
Name: Andrew Brier Position: GM Coal & CSG Operations Tel No [redacted] Date:15 March 2011	Name: Mike Birchley Position: A/ADG RSD Tel No: [redacted] *Rec'd: 15/03/2011*	Name: Terry Wall Position: ADG OER Tel No: [redacted]	Name: John Bradley Director-General, DERM Tel No: [redacted] Date:
	Name: Position: Tel No:	Name: Position: Tel No:	

File Ref:

requesting further information surrounding the proposed governance arrangements, stakeholder consultation and project milestones. It was indicated to the QRC that the proposal seems to have some merit and would be considered further once the additional information has been supplied.

MINISTER'S COMMENTS

Attachments:
Attachment 1 – Salinity trading feasibility study

Author	Cleared by	Cleared by	Recommended:
Name: Andrew Brier Position: GM Coal & CSG Operations Tel No: [redacted] Date: 15 March 2011	Name: Mike Birchley Position: A/ADG RSD Tel No: [redacted] *Rec'd: 15/03/2011*	Name: Terry Wall Position: ADG OER Tel No: [redacted]	Name: John Bradley Director-General, DERM Tel No: [redacted] Date:
	Name: Position: Tel No:	Name: Position: Tel No:	

File Ref:

Assessing the feasibility of salinity trading for mine discharge regulation in the Fitzroy Catchment.

Prepared for: Frances Hayter

Director, Environment and Social Policy

Queensland Resources Council

Prepared by: [redacted]

Centre for Water in the Minerals Industry

Sustainable Minerals Institute

The University of Queensland

26 September 2011

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Background

Since 2008 Bowen Basin coal mines have experienced consecutive wet seasons with higher than average rainfall. Excessive rainfall and tighter regulation of mine discharge in the basin has resulted in the accumulation of large volumes of water on most mine sites. It is estimated that most of this water has salinity approximately 6000 µS/cm, around 4 times higher than the end of pipe discharge criteria set in the Fitzroy Model Conditions. To assist in alleviating concerns with storages reaching their capacity and the compromise to coal production, the Department of Environment and Resource Management (DERM) has been granting TEP's to enable discharge of excess mine water. While the conditions for release set in the TEP's is reducing the volume of water currently held on sites, there remain significant questions regarding how best to regulate and manage mine water discharge in the basin on an ongoing basis.

The combined challenges of managing mine water quantity and quality and regulating discharge is particularly acute in situations such as the Bowen Basin where highly variable climatic conditions exist. Rainfall is strongly governed by the El Nino/La Nina cycles that recur with varying intensity on a decadal or shorter timescale. Highly variable seasonal rainfall results in ephemeral and intermittent stream flow which restricts opportunities for mine discharge to occur when there has been enough rainfall to require it. High evaporation is a major factor governing ongoing concentration of salts in water stored on mine sites. In addition, highly variable and often intense rainfall results in rapid accumulation of large volumes of water across the mines. Finally, spatial variability in catchment landuse, soil types and other factors is reflected in spatial and temporal variations in stream salinity. These challenges are compounded by the need to manage the cumulative impacts of multiple discharges from multiple mines across the catchment.

Current discharge licence conditions are specified in the Fitzroy Model Conditions. These relatively conservative conditions were based on the best available data and designed to minimise impacts of mine discharge by ensuring that only water with a relatively low conductivity was discharged into streams with sufficient flow for dilution to achieve background stream salinities. These conditions have been relaxed in response to the need to reduce excess water accumulating on the sites. TEP's granted to individual mines are allowing water with higher salinity (up to 6,500 µS/cm) to be released with less dilution from upstream flow but maintaining relatively low salinities in the higher order tributaries. While the granting of the TEP's is providing relief for the current situation, limited periods of stream flow continues to restrict the volume of water able to be discharged. In addition there has been a considerable impost on the regulator considering TEP applications and anxiety on the part of the mines in terms of lost production and increasingly hazardous conditions of storages. Perhaps more importantly the current regulatory system is not addressing the fundamental question of best practice management of the cumulative impacts of discharge in ephemeral river systems.

An alternative model for regulating mine discharge has been implemented in the Hunter Valley, NSW. The Hunter Valley Salinity Trading Scheme (HVSTS) uses market mechanisms to regulate saline discharge to the river system from mines and electricity generators to ensure salinity in the river is maintained at levels suitable for use by irrigators and protective of aquatic ecosystem health. Using salt load based criteria coupled with a trading scheme has allowed better regulation of cumulative impacts of discharge in the Hunter Valley. This is evident by an overall decrease in salinity in the river. Significant differences between the Hunter Valley and Fitzroy catchments, including catchment size and stream flow dynamics, however may preclude findings from the Hunter Valley being directly translated to other catchments.

Queensland Resource Council (QRC) has been engaged in an ongoing dialog with the Department of Environment and Resource Management about regulation of mine discharge in the Bowen Basin. The need for a scoping study to assess the feasibility of an alternative model for mine discharge regulation has been acknowledged. This proposal was developed through discussions with Frances Hayter, Director, Environment and Social Policy, Queensland Resources Council. Collaboration with DERM would be an essential element in the success of the project. Of particular importance is the DERM expertise associated with development of a cumulative impact model of mine discharge for the Fitzroy catchment. The nature and extent of this collaboration will be defined through further discussion between QRC, DERM and CWiMI.

The timing of this project is such that it will be informed by other research being conducted in the catchment. Of particular note is the work being conducted by DERM in developing its Cumulative Impacts Model for the Fitzroy and the data collected for the development of the draft Water Quality Objectives, the development of a regional monitoring program by the FBA partnership for River Health; and data and findings from research projects supported by the QRC Coal Minesite Rehabilitation Trust Fund postgraduate scholarship and ACARP. The QRC is supporting a PhD project titled: Quantifying the impact of saline mine water discharge on aquatic ecosystems in the Bowen Basin (Beyer, SMI).The ACARP projects are titled: Governance Strategies to Manage and Monitor Cumulative Impacts at the Regional Scale (Brereton, SMI) and Guidelines for ecologically sustainable discharge criteria in seasonally flowing streams (Vink, SMI). This proposed project scope has been designed to complement and extend and utilise the findings of these projects.

Scope

The work will be conducted in three phases.

Phase 1: Review of existing HVSTS, Fitzroy catchment data and information and development of preliminary scheme design for the Fitzroy should it be considered viable;

Phase 2: Development of trial catchment/sites and testing;

Phase 3: Refinement of design and rollout. The continuation and development of each phase will be dependent on outcomes of preceding phases.

This proposal outlines the scope, budget and workflow for the first phase of the project. The decision to proceed with Phases 2 and 3 will be dependent on the findings of Phase 1.

2.1. Objectives

The primary objectives of the first phase work are:

- Undertake an analysis of existing data and information required to develop a preliminary scheme design for the Fitzroy; and
- Evaluate the strengths and weaknesses of implementing a scheme salinity trading type of scheme in the Fitzroy.

2.2. Tasks

The above objectives will be met by completing the following tasks.

Task 1 – Review Hunter Valley Salinity Trading Scheme

This task will review the attributes of the HVSTS including design and operations, environmental objectives, discharge limits, market components and mine site water quality attributes and volumes.

Output – Review paper of the HVSTS

Task 2 – Workshop to inform review of Fitzroy catchment characteristics

The workshop would involve, at a minimum, representatives from QRC, DERM regulatory and aquatic sciences sections, Fitzroy Basin Association – Partnership for River Health, Mining Company representatives and CWiMI. The purpose of the workshop would be to provide an overview of the HVSTS, and identify scope and critical comparisons to be undertaken during Task 3: Review of Fitzroy Catchment Characteristics. During the workshop an overview of existing mine, stream flow and water quality modelling capability, mine site and DERM monitoring in the catchment will also be discussed.

Output –Agreed scope, data availability and modelling capability for review of Fitzroy Catchment characteristics.

Task 3 – Review of Fitzroy catchment characteristics and modelling

This task will require up to date stream flow and water quality data from mine site monitoring, the Partnership for River Health (FBA) and the DERM database. In addition, time series data on mine sites water storage and quality will be required.

The analysis will be partially informed by the workshop but will include the following components.

- Spatial variation in stream flow and water quality (concentration and load).
- Temporal variation in stream flow and water quality dynamics (concentration and load).
- Mine site water stocks/stores and water quality variability.
- Computation of the salt load of the system, variability and controlling factors.
- Identification of "control points" in the catchment for regulation and monitoring of salt loads.
- Integration of mine site water and salt modelling with DERM cumulative impacts catchment models to run scenarios of mine discharge under variable stream flow conditions.

Output – A report detailing comparative stream flow and water quality characteristics for the Hunter valley and Fitzroy catchments; analysis of stream flow and water quality on a sub-catchment basis; mine site water volume and quality characterisation; cumulative discharge scenario(s) model output and a summary of data, model and knowledge gaps.

Task 4 – Conceptual design of a salinity trading scheme for the Fitzroy

Based on the outcomes of Task 1 to 3, if considered feasible, we will develop a conceptual design for a salinity trading scheme in the Fitzroy. Preliminary scenarios of changes to water quality of streams receiving discharge from multiple mines under a range of stream flow conditions driven by climate variability will be presented. An analysis of the strengths and weakness of the scheme would be conducted. This analysis would include consideration of administrative and implementation barriers.

Output – Report detailing the conceptual scheme design, model scenarios and strength and weakness analysis.

Outcomes and Benefits

- Basis for evaluating the potential for, and effectiveness of, a salinity trading scheme in the Fitzroy River catchment to improve water quality in rivers and streams.
- Information that supports an effective regulatory framework for mine site water discharge in ephemeral streams.
- Information that supports a regulatory framework for ephemeral streams
- Greater transparency of discharge and river conditions to all stakeholders.
- Improved understanding of catchment water quality dynamics and values by mine sites.
- Improved understanding of the scope and scale of mine site water management by the regulator

While this work may conclude that a salinity trading scheme for regulating discharge may not be feasible in the Bowen Basin, the fundamental understanding of catchment salt dynamics and influence of inputs from mines and other users (including coal seam gas producers, power stations and agriculture) gained through this project can be used to inform revision of the current Fitzroy Model Conditions and/or the development of an alternative model for discharge regulation.

Work Plan and Budget

The budget is summarised in Table 1 exclusive of GST. The budget breakdown by task is given in Table 2. The project will be directed by Dr Sue Vink. Most of the work will be undertaken by a Postdoctoral Research Fellow, supervised by Vink, with support from a research assistant. The Postdoctoral Research Fellow will work 70% on the project with 50% of the salary costs to be provided by CWiMI. The budget was prepared using estimated time required for the project. Only costs for staff time to organise, participate and report on the workshop have been included. Additional expenses for running the workshop have not been included in this budget as the number of participants and location are to be determined through discussion with stakeholders. We also included the cost for contract administration covering the commercial agent for CWiMI, JKTech P/L, who will deal with contract negotiation and execution.

The tasks will be delivered over a 12 month period from April 2011 to March 2012 with the distribution of effort as indicated in Table 3.

Table 1 –Budget Summary

Personnel	Time Allocation (%)	Total Salary ($)	CWiMI Cash Input	Cost to QRC
Sue Vink	10	$ 32,865		$ 32,865
Postdoctoral Fellow	70	$ 97,416	$ 48,708	$ 48,708
Research Assistant	30	$ 33,073		$ 33,073
Contract Administration		$ 11,464		$ 11,464
Total (ex. GST)		$ 174,818		$126,110

Table 2 - Budget Summary - Task

Tasks	TOTAL
1. Review HRSTS	$17,811
2. Workshop	$9,563
3. Fitzroy Characterisation, Modelling	$100,376
4. Conceptual design	$17,797
5. Reporting	$17,807
Contract Administration	$11,464
TOTAL	$174, 818

Table 3 – Task Timeline

Tasks	Apr - Jun	Jul - Sept	Oct - Dec	Jan - Mar
1. Review HRSTS				
2. Workshop				
3. Fitzroy Catchment Characterisation				
4. Conceptual Design				
5. Reporting		R1	R2	R3

R1 – Task 1: review of HVSTS

R2 – Task 3: Review of Fitzroy catchment stream flow and water quality characteristics

R3 – Task 4: Conceptual design of salinity trading in the Fitzroy catchment

Statewide Mine Activities: Flood-related Issues

Update #53 as at 1pm 28 July 2011

Contact: Andrew Brier, General Manager, Coal and CSG Operations
Ph: [redacted]

Known flood and wet season related incidents relating to mines

Site	Company	Nature of Breach	Date of Breach	Compliance/Investigation Activity
Condamine Catchment				
1. Commodore Coal Mine	Millmerran Power Partners	Total suspended solids. To Back Creek.	26/12/10 - 14/1/11	DERM provided comments on the draft TEP for release of water to Back Ck above suspended solids limit and to improve water management on site. Final draft TEP was approved on 5 May 2011. Site currently in compliance with TEP conditions.
2. Peabody Wilkie Creek	Peabody Pty Ltd	Inundation of non-active mining pits, voluntary releasing to Wilkie Creek. Mine affected water actively released to Wilkie Creek above TSS limits.	28/12/11 - 19/1/11 19/1/11 - 31/1/11 16/5/11	Draft TEP has been submitted for approval for release to adjacent farm dams and to Wilkie Creek above release limits. Notice requiring additional info has been sent. Response to information request was received on 11 April. This has been reviewed and TEP approved on 29 April. Warning notice issued 3/6/11 for non-compliance with reporting requirements of TEP. Site now in compliance with TEP conditions. Releases to Wilkie Creek in June resulted in exceedance of suspended solids EA limit (background + 10%) and failed to comply with daily monitoring requirements during the release. DERM is investigating the non-compliances with a view to issuing a PIN.
3. Cameby Downs	Syntech Resources	Overtopping of dirty water dams (1 & 2), Breach of sedimentation dam.	26/12/10 - 14/1/11	Warning Notice sent by DERM on 20 April regarding releases to waters above TDS limit during and after flood events in early 2011.
4. Kogan Creek	Aberdare Collieries Pty Ltd	Water storage facilities at capacity and impacting on supply to power station. Ash dam (IADA) is above MRL and unauthorised discharge is imminent.	31/12/10 - 4/1/11	Release was avoided and well below MRL.
5. New Acland	New Acland Coal Pty Ltd	Recent monitoring indicates release occurred above EA limits	Between 26/12/10 - 4/1/11 - continuing within EA conditions	Warning letter be sent by DERM regarding releases to waters above TDS limit on 18/5/11.
Border Rivers Catchment				
6. Texas Silver	Alcyone Resources	Release in breach of EA conditions but releasing under TEP has ceased.	13/1/11- 2/2/11	
Fitzroy Catchment				

7. Blackwater	BMA Coal	1. Released water for three hours with a higher electrical conductivity than the limit set in its EA; 2. Released water for a short period when the flow in the receiving water had receded below the authorised limit. 3. Released water with higher electrical conductivity than the limit set in its EA.	30 Nov 10 19 Dec 10 19 Jan 11	Compliance and Investigation Unit has provided preliminary recommendations to Central West Region (CWR) for its approval. . Warning Letter sent 30 June 2011 in accordance with the Compliance & Investigation Unit's recommendations.
8. German Creek	Anglo Coal	Discharged from an unauthorised discharge point Four discharges with elevated electrical conductivity from an unauthorised discharge point. Discharge ceased 16/2/11, notification received 17/2/11.	1 Dec 10 2 Dec 10 16 Jan 11 22 Jan 11 11 Feb 11	CWR issued a warning letter on 15 December 2010 for the unauthorised release of water to German Creek on 1 – 2 December 2010. CWR issued a Warning Notice on 19 January 2011 for the unauthorised release of mine affected water from Grasstree Dam on 16 January 2011. CWR is investigating and considering issuing a PIN for the unauthorised releases of mine affected water from Grasstree Dam on 11 February 2011. CWR is in process of issuing a PIN for this unauthorised release. PIN is being issued for this release, documents have been reviewed waiting for final approvals. PIN issued 4 July 2011 – PIN Number – Q200000040003013. Final reports were received on 18 July (were due on 27 May 2011). Currently being assessed.
9. Oaky Creek	Xstrata	Discharged from an unauthorised discharge point	20 Nov 10 - 22 Nov 10 3 Dec 10 - 7 Dec 10 20 Dec 10 26 Dec 10 - 31 Dec 10 6 Jan 11 6 Mar 11 - 8 Mar 11 20 Mar 11 - 25 Mar 11 3 Apr 11	A warning letter was sent on 3 Dec 10 regarding earlier breaches. No action has been taken by the region for Dec 10 - Apr 11 breaches. A draft TEP was approved on 11 Apr 11 to allow releases from the eight locations not authorised under current EA. There have been no non-compliant releases under TEP.
10. Ensham	Ensham Resources	Released water with a higher electrical conductivity than the limit set in its EA	11 Dec 10	Warning letter issued on 4 July 2011.
11. Moorvale	Macarthur Coal	Released water with a higher pH levels than the limit set in its EA; and Released water with a higher electrical conductivity than the limit set in its EA	12 Dec 10 1 Jan 11 1 Apr 2011	Warning notice issued on 5 July 2011 for 12 December 2010 and 1 January 2011 and 1 April 2011 non-compliances. Compliance and Investigation Unit has provided preliminary recommendations to CWR for its approval of 1 April non-compliance.
12. Coppabella	Macarthur Coal	Released water for a short period when the flow in the receiving water had receded below the authorised limit	3 Dec 10	Warning notice issued on 5 July 2011.
13. Callide	Anglo Coal	Released water with a higher electrical conductivity than the limit set in its EA; and Released water when the flow in the receiving water	19 Dec 10 4 Jan 11	A DERM brief has been prepared. Penalty infringement notices and warning letters have been prepared for Dunn Creek Dam TEP, Lake

		had receded below the authorised limit. Release of mine affected waters from Lake Gasteen exceeded Callide's discharge limits during no flow conditions with EC levels ranging from 956 – 1085 uS/cm. DERM requested cessation of discharge on 05/04/11. Callide advised that pumping ceased but natural inflow and water backup prevented immediate cessation. Release of mine affected waters from Lake Gasteen exceeded Callide's discharge limits under TEP amendment (approved 25/03/11) during no flow conditions with EC level ranging from 1114 - 1264uS/cm. Release of mine affected waters from Oaky Creek exceeded Callide's discharge limits during no flow conditions with EC levels ranging from 1010 – 1064 uS/cm. Release of mine affected waters from Dunn Creek exceeded its dilution limits. As a result of rise in water level in Callide Dam, the receiving waters of Dunn Creek Dam are now part of ponded area of Callide Dam. As a result, dilution of Dunn Creek Dam discharge is prevented prior to entering the Callide Dam. DERM requested cessation of discharge on 05/04/11. Callide advised that pumping ceased but natural inflow and water backup prevented immediate cessation.	11/02/11 - 21/02/11 24/02/11 - 28/02/11 03/03/11 24/03/11 27/03/11 - 30/03/11 2/04/11 – 09/04/11 24/04/11 25/02/11 – 03/03/11 05/03/11 30/03/11, 18/04/11 28/02/11 – 11/04/11, 19/04/11 – 23/04/11	Gasteen Dam TEP, Oaky Creek Diversion Dam TEP and will be issued on 15 July 2011.
14. Cook	Cook Resource Mining	Released water with a higher electrical conductivity than the limit set in its EA	4 Dec 10 12 Dec 10	Compliance and Investigation Unit has provided preliminary recommendations to CWR for its approval. Enforcement recommendation from C&I to forward warning letter to mine. Letter was signed 27 June 2011 and will be sent 28 June 2011. Ecotrack to be updated once letter is sent.
15. Yarrabee	Yancoal	Released water outside of authority. The release was to land and not to a watercourse, and water quality was within approved parameters.	20 Dec 10	Project Manager has been in contact with the client regarding actions taken to remedy the non compliance. No further action likely to be taken by the department.
16. Moranbah North	Anglo	Released water for a short period when the flow in the receiving water had receded below the authorised limit.	1 Dec 10 23 Dec 10	CWR issued a warning notice on 28 January 2011 for failing to comply with the requirements of an emergency direction.
17. Dawson	Anglo	Released water with a higher electrical conductivity than the limit set in its EA. Discharged from an unauthorised discharge point	29 Dec 10 23 Jan 11	Compliance and Investigation Unit has referred this matter back to CWR without a recommendation as there was insufficient information provided to the Compliance and Investigation Unit to finalise a recommendation. A warning letter has been prepared and sent to the client on 4 July 2011.

18. Rolleston	Xstrata	Released water from a non-authorised discharge point.	30 Dec 10	No further action is likely to be taken by the department
19. South Walker Ck	BHP Mitsui	Released water when the flow in the receiving water had receded below the authorised limit	19 Jan 11	No compliance action proposed by ES-Mining considering nature of the release (high rainfall event, release over dam spillway, limited quantity of water released, water quality within EA limits for duration of the release) and actions of the EA holder (attempts to prevent and control the release, TEP submitted 10/1/11 requesting releases to Sandy Creek under low-flow events which was still being considered by the department when the non-compliant release occurred).
20. Kestral	Rio Tinto Coal	Released water outside of authority. The release was to land and not to a watercourse, and water quality was within approved parameters.	19 Jan 11	Compliance and Investigation Unit has provided preliminary recommendations to CWR for its approval. Warning letter to be sent by the project manager.
21. Baralaba	Cockatoo Coal	Released water with a lower pH than the limit set in its EA	23 Jan 11	Compliance and Investigation Unit has referred this matter back to CWR without a recommendation as there was insufficient information provided to the Compliance and Investigation Unit to finalise a recommendation. A warning letter has been prepared and sent to the client on 4 July 2011.
22. Poitrel	BHP Mitsui	Released water with a higher electrical conductivity than the limit set in its TEP	23 Jan 11	No compliance action proposed by ES Mining given downstream limits for EC were not triggered and Poitrel's cessation of the release upon realisation that EC limits were being breached and corrective actions taken to ensure compliance of all future releases.
23. Lake Vermont Coal	Bowen Basin Coal Pty Ltd	Released water with high EC from RP3 for 2 hrs. Notification received 17/2/11	16 Feb 11	Warning letter issued on 21 March 2011
24. Carborough Downs	Vale Australia	Potential breach of EA conditions for 18 hours with discharge of water slightly above EA condition of 1500 EC. The last sample taken the day before discharge ceased was 1505 EC.	22 Dec 10	Warning letter issued on 4 July 2011.
25. German Creek	Anglo Coal (German Creek) Pty Ltd	Released water for two days exceeding the end of pipe release limits contained within the Oak Park TEP. (MAN11523).	2 March - 3 March 2011	CWR is investigating and considering issuing a PIN for exceeding the authorised release limit of mine affected water. In process of completing investigation reports and issuing PIN. German Creek is also a month behind in providing a final assessment to the administering authority (was due 27 May). Final reports to be provided by 11 July 2011. PIN issued on 4 July 2011. Final reports were received on 18 July (were due on 27 May 2011). Currently being assessed. Further information was requested for this final report.

26. German Creek	Anglo Coal (German Creek) Pty Ltd	Released water exceeding the end of pipe release limits contained within the German Creek TEP (MAN11619).	18 March - 5 April 2011 7 April 2011	CWR is investigating and considering issuing a PIN for exceeding the authorised release limit of mine affected water. In process of completing investigation reports and issuing PIN. German Creek is also a month behind in providing a final assessment to the administering authority (was due 27 May). Final reports to be provided by 11 July 2011. PIN issued on 4 July 2011. Final reports were received on 18 July (were due on 27 May 2011). Currently being assessed.
27. Hail Creek Mine	Rio Tinto	Release of water exceeding the end of pipe limits for turbidity contained in the Hail Creek TEP (MAN11801)	17 May 2011	Warning notice issued on 5 July 2011.
28. Isaac Plains Coal Mine	Vale Australia (IP) P/L	Release of water not in compliance with TEP (MAN12479) water quality limits. EC was slightly above limits nominated for available flow rates in receiving water on two occasions.	10 April 2011 11 April 2011	Warning letter issued on 4 July 2011
Burdekin Catchment				
29. Newlands	Xstrata	Released water with a higher electrical conductivity than the limit set in its EA. Volume of water released exceeded the daily limit in the TEP	3 Dec 10 20 Jan 11	Compliance and Investigation Unit has provided partial recommendations to CWR for its approval. A warning letter has been prepared and sent to the client on 4 July 2011.
30. Sonoma	QCoal	Released water with a higher electrical conductivity than the limit set in its EA Released water with a higher electrical conductivity than the limit set in its EA. pH and EC levels exceeded TEP conditions at downstream location in Pelican Creek.	30 Nov 10 10 Jan 11 20 Jan 11	Warning notice issued for 30 November 2010, 10 January 2011 and 20 January 2011
31. Balcooma Mine (Mt Garnet)	Kagara Pty Ltd	Release of contaminated stormwater containing low pH and elevated levels of electrical conductivity	Intermittently over 2010/2011 wet season.	EPO issued 28 March 2011. Works required by the EPO have been undertaken. Reports on the works required by the EPO have been lodged by the client and are currently under review by the department.
32. Thalanga Copper Mine	Kagara Copper Pty Ltd	Exceedence water quality - elevated levels of pH, EC, sulphate, copper, cadmium and zinc.	Intermittently over 2010/2011 wet season.	TEP issued 18 February 2011 To date the client has met all TEP milestones.
33. Surveyor Mine (Mt Garnet)	Kargara Pty Ltd	Discharge of contaminated waters commenced 2 March. pH outside licence limits, elevated EC levels. Discharge has ceased	02/03/11 – 09/03/11	EPO issued 28 March 2011 Works required by the EPO have been undertaken. Reports on the works required by the EPO have been lodged and are currently under review by the department.
North West Mines				
34. Eloise Copper Mine	FMR Investments Pty Ltd	Release of contaminated stormwater containing elevated levels of sulphate	08/01/11 – 10/01/11	Environmental Evaluation issued 7 June 2011
35. Mt Oxide mine - Abandoned	DEEDI	Landowner has advised of visible blue precipitate re-occurring in a limited area downstream of the abandoned mine. Inspection being conducted today,	28 Jan 11	DEEDI has verbally advised DERM (North Region) that approximately $1-2M will be set aside for remedial works during 2011/12. Officers

		16 March.		from DERM and DEEDI met on 26 July to discuss recommendations on remedial works.
36. Century Mine	MMG Century Limited	Discharges from various sediments dams on site - elevated levels of electrical conductivity and certain metals.	Intermittently over 2010/2011 wet season.	The Compliance and Investigation Unit has commenced the department's formal investigation. Interviews conducted on 18 July. MMG has committed to providing a copy its report on the potential environmental impacts as a result of the discharges. MMG committed to submitting a voluntary TEP by 22 July for construction of a clean water diversion to ensure design storage allowance in the tailings dam can be met by 1 November 2011. This TEP has not been received.
37. Birla Mt Gordon Mine	Aditya Birla Group	Release from unauthorised release points of water with elevated levels of metals and low pH	10 March 2011	1. Breach of Court Order – The Compliance and Investigation Unit has commenced the department's formal investigation. Interviews conducted on 13 July. 2. Advice from Legal Services has been requested regarding the preparation of an Environmental Evaluation.
38. Mount Isa Mines	Xstrata Plc trading as Xstrata Mount Isa Mines Limited	Releases from the Black Star Waste Rock Dump and sediment dam at George Fisher mine. Water Quality unknown, department awaiting results from inspection on 23 March 2011. Discharges have ceased.	George Fisher Mine – 12-13 March 2011; Black Star mine – 15 March 2011	No enforcement action required.
39. Ernest Henry Mine	Ernest Henry Mining Pty Ltd	Releases from the Southern and Northern Sediments ponds have some minor receiving water triggers for EC, Copper and Zinc. Results show full compliance with EA contaminant limits.	Date samples collected on DERM 15 March 2011	No enforcement action required.
40. Kidston Mine	Kidston Gold Mines Ltd	Exceedence water quality - elevated levels of pH, EC, sulphate, copper, cadmium and zinc.	Breach notified on 31/3/02011	An EPO was issued on 24 June 2011. The company will submit a report detailing their proposed program of works to address the requirements of the EPO by 5 August.
Burnett River Catchment				
41. Mount Rawdon Mine	Newcrest Mining Ltd – Mt Rawdon	Dams below the waste rock dump and the tailings dam have been allowed to overflow rather than returning the water into the tailings storage facility (TSF) due to the TSF being above the MRL. This has resulted in stormwater having some metals slightly above EA limits.	Possibly 23 Dec 10: confirmed by samples taken 27 Dec 10 and subsequently.	Client submitted a Voluntary Draft TEP for assessment, which was approved on 18th February 2011. End date is 1st November 2011.
Mitchell River Catchment				
42. Wolfram Camp Mine	Wolfram Camp mining Pty ltd	Discharge from raw water dam. Discharge in excess of environmental authority limits with elevated levels of metals / metalloids and fluoride.	Intermittently over 2010/2011 wet season.	Environmental Evaluation issued on 28 March 2011 The company submitted an Environmental Report on 16 June and a review of the report has identified some areas of concern. The company lodged a voluntary TEP on 4 July to address some of the matters identified in the EE Report. The department is continuing to liaise with the company to address the outstanding

				concerns.
<u>Mary River Catchment</u>				
43. D'Aguilar Gold Mine	D'Aguilar Gold Pty Ltd	Release of water that has been in contact with contaminants. TSF water with low levels of metals.	Apparently after 10 January 2011.	Client submitted a Voluntary Draft TEP for assessment, which was approved on 11th March 2011. End date is 29th April 2011. The client has submitted the final report in relation to the TEP, which will be duly assessed to ensure compliance.

Applications Recently Received

Poitrel (BHP Mitsui) New TEP received 14 June 2011. TEP replaces previously approved TEO (release under the previous TEP ceased on 13 May 2011 and a final report has been submitted) and requests release of mine affected water outside of current environmental authority conditions, specifically electrical conductivity up to 3500 uS/cm to New Chum Creek with no minimum flow requirement but minimum flow of $10m^3$/sec in the Isaac River. BMC resubmitted this TEP to the department on 25 July 2011, including information requested to support a works program.

Wet Season Mine-water Management

TEP Status

SUMMARY

A total of 100 TEPs have been approved or have had amendments approved since 1 December 2010

A further 1 has been received and is currently undergoing assessment

TEP SUMMARY	Central West	South West	South East	North	TOTALS
New TEP Approvals	53	4	3	1	**61**
Approved amendments to existing TEPs	39				**39**
TEPs under assessment	1				**1**
TEPs refused	16	1			**17**
TEPs likely to be received in near future					

Mine	Company	Received Date / PN submitted	Approval action	Expiry Date	Authorisation outside EA Conditions	Comments
Condamine Catchment						
Kogan Creek Power Station	CS Energy	13-Jan-11	TEP **refused** 24-Jan-11 **R-1**		Potential discharge from ash dam to Kogan Creek. IADA is above MRL and just below spillway. Further rainfall will result in an unauthorised release from IADA	CS Energy lodged a TEP application to authorise a release from the IADA but it was refused by DERM. CS Energy held meeting with DERM on 27/1/11 to discuss refusal. CS Energy advised that it wishes to lodge another TEP to authorise release from the IADA. DERM issued letter to CS Energy 1/2/11 stating DERM would be reluctant to approve a short term TEP to authorise a release to allow the IADA to return to DSA
Kogan Creek Mine	CS Energy	06-Jan-11	11-Jan-11 **N-1**	29-Apr-11	Discharge of mine affected water outside TSS release limits. Mine continues to release mine affected water to Kogan Creek in accordance with TEP conditions (TSS up to 1000mg/L).	Approved 11/1/11. Mine operator notified DERM that release of mine affected water ceased on 10/2/11 as in situ monitoring indicated water quality is above release limits for TSS.Discharge has not recommenced. TEP is in force until 29 April. Report on TEP due by 27 May 2011 **Expired**
Peabody Wilkie Creek	Peabody Australia	18-Mar-11	29-Apr-11 **N-2**	31-May-12	1. Transfer water from A Pit and D Pit to adjacent landowners for irrigation. 2. Minimise the potential environmental impact from the discharge of water from A Pit and D Pit into Wilkie Creek, where discharge is necessary outside of current EA limits.	Approved 29 April: TEP authorises discharge to Wilkie Creek with increase of EC limit. Warning notice issued 3/6/11 for non-compliance with reporting requirements of TEP. Company now in compliance with TEP conditions.
Commodore Coal Mine	Millmerran Power Partners	01-May-11	05-May-11 **N-3**	30-Nov-13	Discharge of mine affected water outside TSS limits of EA. TEP is to upgrade current water management infrastructure.	Site discharging under TEP release limits.

Mine	Company	Received Date / PN submitted	Approval action	Expiry Date	Authorisation outside EA Conditions	Comments
Border Rivers Catchment						
Texas Silver	Alcoyne Resources	TEP submitted 17-Jan-11	24-Jan-11 **N-4**	30-Apr-11	Release in breach of EA conditions, which prevents discharge. Mine released mine-affected water to Dry Creek between 24/1/11 and 2/2/11. Release was in accordance with TEP conditions, which authorises release within ANZECC guidelines.	Mine advised on 4/2/11 that release of mine affected water had ceased on 2/2/11. Mine will advise DERM of any further releases. **Expired**

Fitzroy Catchment						
1. Rolleston	Xstrata	30-Sep-10	28-Oct-10 **N-5**		Increased pH and EC. Downstream monitoring at lease boundary	Rolleston submitted a Program Notice on 30 December 2010.
		18-Jan-11	01-Feb-11 (Amendment) **A-1**	29-Aug-11	Extension of TEP until 30/06/11. Reasonable quality discharge water	Amendment to existing TEP
		01-Feb-11	23-Feb-11 **N-6**	29-Aug-11	This TEP approves the discharge of water into Meteor Creek via Sandy Creek using a natural drainage depression used for discharging mine-affected water to Meteor Creek (via Sandy Creek), with contaminant release limits of 1500uS/cm, ph 6.5 – 9.0. The contaminant release limits in TEP are consistent with the current EA MIM800090802 for Rolleston.	
2. Ensham	Ensham Resources	07-Dec-10	10-Dec-10 **N-7**	Superseded	Additional discharge location, Increased EC and reduction of flow in receiving waters (Boggy Creek). Flow trigger on Nogoa River and Downstream monitoring at numerous locations in Nogoa River and Mackenzie River (including Bedford Weir)	
		05-Jan-11	05-Jan-11 (Amendment) **A-2**	Superseded	Amendment to TEP authorised additional increase in EC and release to Nogoa River. Monitoring required.	Amendment to existing TEP Allows for the release of approximately 15,000 megalitres at about 250 megalitres per day to the Nogoa River
		21-Jan-11	11-Feb-11 (Amendment) **A-3**	30-Jun-11	TEP amendment allows an increase EC limits, revised receiving water flow rate, and modified discharge locations. The revised TEP conditions require continued meeting of dilution (50:1) in the receiving water.	Amendment to existing TEP. **Expired**
3. Poitrel	BHP Mitsui	14-Dec-10	15-Dec-10 **N-8**	Superseded	Increased EC (to 1500uS/cm) and reduction of flow in receiving waters (New Chum Creek) Flow Trigger in Isaac River and downstream monitoring in Isaac River	
		10-Jan-11	19-Jan-11 (Amendment) **A-4**	Superseded	TEP approved release during periods of no flow into New Chum ck 4km from Isaacs River. Discharge waters up to 2500uS/cm.	Amendment to existing TEP
		02-Feb-11	11-Feb-11 (Amendment) **A-5**	30-Jun-11	TEP proposes to increase release limit for EC to 3500 uS/cm (up from currently allowed 2500 uS/cm).	Amendment to existing TEP **Expired**

		14-Jun-11	TBA **Ass-1**		TEP requests release of mine affected water outside of current environmental authority conditions, specifically electrical conductivity up to 3500 uS/cm to New Chum Creek with no minimum flow requirement but minimum flow of $10m^3$/sec in the Isaac River.	Amendment to existing TEP TEP is not considered critical to operations but has been submitted in response to predictions of a wetter than usual July/August. BMC resubmitted this TEP to the department on 25 July 2011, including information requested to support a works program.
4. South Walker	BHP Mitsui	16-Dec-10	18-Dec-10 **N-9**	Superseded	Increased pH and EC. Staged EC increase for set flow dilutions, Downstream Monitoring in Bee Creek	
		02-Jan-11	20-Jan-11 (Amendment) **A-6**	30-Jun-11	Discharge up to 2500uS/cm to Walker ck during low flow	Amendment to existing TEP **Expired**
		06-Jan-11	27-Jan-11 **N-10**	Superseded	Proposed elevation in EC (1000uS/cm) and no flow in Sandy Ck.	
		04-Feb-11	09-Feb-11 (Amendment) **A-7**	Superseded	The amended TEP allows for the release of water with elevated electrical conductivity up to 3500uS/cm to Walker Creek with an amended downstream EC trigger of 1000uS/cm in Bee Creek.	Amendment to existing TEP
		14-Feb-11	15-Feb-11 (Amendment) **A-8**	30-Jun-11	The amended TEP allows the downstream limit for electrical conductivity (EC) in Bee Creek be changed to 1000 uS/cm (up from 500 uS/cm) for releases to Sandy Creek. This is consistent with the amended TEP issued 9 February 2011 for releases to Walker Creek.	Amendment to existing TEP **Expired**
		06-Jun-11	08-Jun-11 (Amendment) **A-9**	31-Jan-12	Seeks to extend the end date the TEP MAN1579 remains in force to 30 December 2011, which is 6 months longer than currently allowed.	Amendment to existing TEP
		06-Jun-11	08-Jun-11 (Amendment) **A-10**	31-Jan-12	Seeks to extend the end date of TEP MAN11720 remains in force till 30 December 2011. TEP's are critical as access to active mining pits is still restricted due to rainfall events experienced over the 2010/2011 wet season.	Amendment to existing TEP
5. Isaac Plains	Vale	16-Dec-10	18-Dec-10 **N-11**	Superseded	Additional discharge location, Reduction of flow in receiving waters (Smokey Creek), flow trigger in Isaac River and Downstream monitoring in Isaac River	
		13-Jan-11	17-Jan-11 (Amendment) **A-11**	Superseded	Additional discharge location and no flow in Smokey Ck, Billies Gully and Isaac River. Downstream monitoring in Isaac River.	Amendment to existing TEP
		03-Mar-11	03-Mar-11 (Amendment) **A-12**	Superseded	Amendment to water quality (electrical conductivity and pH) limits and monitoring locations to facilitate dewatering of pit water as per original TEP. An increase of electrical conductivity release limits from 600EC to 720EC at end of pipe for release events under no-flow conditions in the Isaac River.	Amendment to existing TEP

					An increase of pH release limits from 9.0 to 9.3 at end of pipe for all release occurrences; Downstream (MP6) pH limits remain at 9.0, with the addition of a trigger to notify the administering authority at 8.5pH; Removal of water quality limits at the 'interim' monitoring location (MP4 - Smokey Creek), however monitoring & reporting for requirements for background analysis will still occur	
		17-Mar-11	18-Mar-11 (Amendment) **A-13**	30-Jun-11	TEP approves a staged increase of EC for end of pipe release limits. An increase in downstream EC during lower flow conditions from 500EC to 600EC. No change to downstream EC during higher flow periods. Water quality requirements have not changed for releases under no flow conditions (<0.1m3/sec)	Company has indicated that removal of the remaining 1500ML of water from site is critical to continued operations from main pit. IPCM have advised that the release of mine affected water ceased at all remaining discharge locations on 11 April 2011. Approximately 700ML of flood water remain on-site. Ability to dewater under the TEP ceased on 30 May 2011. TEP remains in-force until 30 June 2011. **Expired**
6. Cook	Cook Resource Mining	14-Dec-10	24-Dec-10 **N-12**	30-Jun-11	Increased EC and Turbidity, Downstream monitoring in Blackwater Creek	Cook has submitted TEP completion report, which is currently being reviewed by the department. **Expired**
		28-Jun-11	TEP **refused** on 26-Jul-11 **R-2**		TEP seeks approval to authorise discharges from Cook Colliery and Leichardt Washery at the end of pipe EC limit of 3500uS/cm with 500 EC at downstream Blackwater Creek.	TEP seeks to authorise release of mine affected water for extended period of time under conditions of previous TEP until planned infrastructure upgrades are completed to ensure compliance with EA. Application was refused on 26 July 2011 due to insufficient information being provided as part of the TEP.
7. Callide	Anglo Coal	17-Dec-10	24-Dec-10 **N-13**	30-Jun-11	TEP authorises discharge from Dunn Creek Dam with Increased EC, increased dilution to achieve downstream water quality, Downstream monitoring at Callide Creek	**Expired**
		1-Feb-11	TEP application withdrawn 4-Feb-11		TEP proposes to revise EC to 2000 during periods of high flow, revise EC to 2000 during periods of moderate flow (more that 20% of receiving flow) but limit discharge to 40ML per day, and revise EC to 950 during periods of no flow in the receiving waters.	
		08-Feb-11	11-Feb-11 **N-14**	Superseded	TEP authorises discharge of mine affected water from Lake Gasteen discharge location into Callide Creek at low or no flow conditions. EC limits vary depending on receiving water flow rates.	The TEP is not considered critical to mining operations.
		18-Feb-11	25-Feb-11 **N-15**	Superseded	The TEP allows Callide to discharge into Oaky Creek from NV8 (authorised discharge location). This TEP increases the EC concentration to 1800 (1400 uS/cm within EA) during discharge with flow in the receiving water and an EC concentration of 950 during discharge with no flow. The TEP will end on 15 June 2011	The TEP is not critical to operations TEP approved and issued to client on 25/02/11.

		08-Mar-11	TEP amendment **refused** on 31-Mar-11 **R-3**		Dunn Creek Dam TEP amendment requests higher EC limits on discharge and reduction of flow in receiving waters to 0 and lower dilution ratios.	Amendment to existing TEP TEP Refused on 31-Mar-2011
		08-Mar-11	25-Mar-11 (Amendment) **A-14**	29-Jul-11	Lake Gasteen TEP amendment requests higher EC limits on discharge during both flow and no flow conditions and lower dilution ratios.	Amendment to existing TEP Approved 25/03/11.
		11-Mar-11	31-Mar-11 (Amendment) **A-15**	29-Jul-11	Oaky Creek Diversion Dam TEP amendment requests higher EC limits on discharge during no flow conditions.	Amendment to existing TEP ERS comments received. Draft conditions for TEP amendment agreed to by Callide Mine on 30/03/11. Approved 31/03/11.
		03-May-11	TEP **refused** on 11-May-11 **R-4**		Dunn Creek Dam TEP amendment requests extension to reporting timeframe due to staffing and contractual constraints.	TEP refused on 11 May 2011
8. Moranbah North	Anglo Coal	20-Dec-10	24-Dec-10 **N-16**	Superseded	TEP Titled: Additional Discharge Location TEP. Additional discharge locations, Increased pH and EC. Flow trigger in Isaac River, staged release of high EC water at higher flows. Downstream monitoring in Isaac River	
		16-Dec-10	24-Dec-10 (Amendment) **A-16**	30-Jun-11	TEP Titled: Worked Water Management TEP Change in monitoring locations and flow requirements from the environmental dam as authorised under existing TEP	Amendment to existing TEP granted in August 2010 **Expired**
		22-Feb-11	22-Mar-11 (Amendment) **A-17**	24-Feb-12	The application was approved to remove the use of water spray misters.	Amendment to existing TEP.
9. Minerva	Yancoal Australia	20-Dec-10	24-Dec-10 **N-17**	Superseded	Increased EC and reduction of flow in receiving waters (Sandhurst Creek) Downstream monitoring, consideration of high background EC for downstream monitoring in Sandhurst Creek	
		17-Jan-11	10-Feb-11 (Amendment) **A-18**	Superseded	TEP authorises the release of water with conductivity of up to 2000uS/cm to Sandhurst Creek. The release requires a passing flow to be present in the receiving waters of the Nogoa River.	Amendment to existing TEP.
		22-Feb-11	23-Feb-11 (Amendment) **A-19**	30-Jun-11	This TEP amendment authorises the change in monitoring point MP3 from the Duck Ponds Station on the Nogoa River to the Comet Weir on the Comet River and to reduce their discharge rate to permit discharges where the flow in the Comet River falls below 5 cumecs but still maintaining a 33:1 dilution factor.	Amendment to existing TEP. **Expired**

10. Kestral	Rio Tinto Coal	23-Dec-10	24-Dec-10 **N-18**	30-Jun-11	Increased EC (to 3500uS/cm) and reduction in receiving water flow rate. Downstream monitoring in Crinum Creek with trigger of 600uS/cm	**Expired**
11. Carborough Downs	Vale Australia	23-Dec-10	24-Dec-10 **N-19**	30-Jun-11	Additional discharge locations and reduction of flow rate in receiving water (Various). Greater dilution of releases and downstream monitoring	**Expired**
12. Peak Downs	BMA	21-Dec-10	13-Jan-11 **N-20**	Superseded	Increased EC and reduction in receiving water flow rate. Downstream monitoring required to achieve 1000uS/cm in stream	
		04-Feb-11	01-Mar-11 (Amendment) **A-20**	30-Jun-11	TEP allows for additional discharge of mine affected water to Ripstone Creek during periods of Low/No flow in Ripstone Creek. Flow trigger of $5m^3/s$ in Isaac River for all no flow releases to Ripstone Creek. EC increased to 6000uS/cm maximum. from 1 release point only. Releases to Harrow, Cherwell and Boomerang creeks remain the same as in the TEP approved 13 Jan 2011.	Amendment to existing TEP. The TEP was re-issued on 1 Mar 2011 in order to fix some administrative and transcribing errors **Expired**
		08-Jun-11	10-Jun-11 (Amendment) **A-21**	30-Aug-11	TEP Allows Peak Downs Mine to continue to discharge mine affected water until 20 June 2011 to take advantage of anticipated high flows. No change to conditions.	Amendment to existing TEP. Due to ongoing issues with excess mine affected water in pits, it is expected that BMA will lodge new TEP applications for its sites to enable discharging to continue until November 2011. Conditions will be negotiated at pre-lodgement meetings prior to the submission of the new applications.
		16-Jun-11	14-Jul-11 **N-21**	30-Jan-12	The TEP application allows the extension of the period of time that mine water can be released providing flow and water quality conditions are met until 30 November 2011. The TEP application includes a works program for planned upgrades of the water management system. The department approved this TEP on 14 July 2011.	BMA has lodge TEP application for 6 sites to enable releases to continue until November 2011 due to ongoing issues with excess mine affected water in pits. DERM will hold discussions with BMA to ensure works are continuing to be undertaken to improve the water management system on each of the BMA sites before the applications are decided. TEP approved 14 July 2011.
13. German Creek	Anglo Coal	21-Dec-10	20-Jan-11 **N-22**	30-Jun-11	Increased EC and reduction in receiving water flow rate to German Ck through multi discharge points. Downstream monitoring required. Referred to as "German Creek" TEP	**Expired** Final report has been received late (18 July 2011 due on 27 May 2011) currently being assessed.
		13-Jan-11	14-Jan-11 **N-23**	30-Jun-11	Increased EC and reduction in receiving water flow rate. Downstream monitoring required. Referred to as "Oak Park" TEP	**Expired** Final report has been received late (18 July 2011 due on 27 May 2011) currently being assessed. Further information has been requested for this TEP final Report.
		01-Feb-11	TEP **refused** on 27-Jul-11 **R-5**		Referred to as "Grasstree" TEP TEP proposes to release water with EC of 14,000uS/cm. This is in case of an overflow situation as per previous unauthorised discharges into German Creek. Anglo also proposing to release water with 2500uS/cm from Pit R into Cattle Creek and then a	TEP is considered critical to mining operations as there is significant accumulation of water/flooding in the underground workings from infiltration of rainfall runoff from Pit R. Currently undergoing technical assessment by ERS. Initial comments indicate that the TEP is high risk and

					500 or upstream background electrical conductivity3 + 10% at the downstream monitoring point at Oaky Creek. TEP also proposes no flow conditions for German Creek and >0.5m^3/s for Cattle Creek. It includes 7 MPs 1 upstream 2 at end of pipe/spillway and 4 at downstream monitoring points.	therefore needs further justification and information provided by the mine. Comments were provided to the mine on 2 Feb 2011, • There is no flow triggers for RP1 (14000uS/cm release) essentially releasing high EC into a no flow situations • -The flow limits for RP2 is located approx. 4.5km downstream from release point. • -Water storages have no current EC measurements • -Pits and Water storages have not been clearly identified • -More explanation on how the 14000uS/cm EC limit is going to be met when the Dam is at 17000uS/cm Further information requested from German Ck on 11/02/2011. The department contacted German Ck seeking its response on 16, 18 and 22 Feb 11. Should a response not be provided by 1 March 2011 the TEP may have to be refused, and Anglo Coal will be required to re-submit a new TEP. Phone call with German Creek on 24/02/11 following up with information request. Client hasn't had a chance to look at the TEP, and will submit the information prior to the due date of 1/03/11. Client resubmitted TEP 28/02/11. Comments received from ERS on 1/032011. TEP currently under assessment by CWR. Discussions were held with on site contact on 10/03/2011 where the department raised concerns with the current TEP and the proposed release. A meeting to be organised with Anglo German Creek. A site visit and meeting to discuss the Grasstree TEP proposal has been organised for 29 March 2011. Site visit of the Grasstree section of the German Creek Coal Mine undertaken on 29/03/11. The department discussed the TEP requirements and will provide the German Creek Coal Mine with further comments following the inspection. Mine was advised that the TEP will not be approved and it will need to resubmit a new document. Application was refused on 27 July 2011 due to assessment timeframe being passed.
14. Goonyella Riverside	BMA	22-Dec-10	19-Jan-11 **N-24**	30-Jun-11	Increased EC and reduction in receiving water flow rate (discharge to Eureka Creek and the Isaac River under low flow conditions). EC to 3000us/cm	TEP submitted and assessed by ERS. Comments provided back to mine on 13 January 2011and further info was provided. Company advised TEP not considered urgent. Currently undergoing technical assessment by ERS.

						Expired
		04-Feb-11	TEP application withdrawn 9-Feb-11		Amendment seeks to increase EC to 3500uS/cm and reduce receiving water flow rate in Isaac River and reduce dilution. Downstream trigger of 1000uS/cm has been proposed in Isaac River.	Amendment to existing TEP
		16-Jun-11	14-Jul-11 **N-25**	30-Jan-12	The TEP application allows the extension of the period of time that mine water can be released providing flow and water quality conditions are met until 30 November 2011. The TEP application includes a works program for planned upgrades of the water management system. The department approved this TEP on 14 July 2011.	BMA has lodged TEP applications for 6 sites to enable releases to continue until 30 November 2011 due to ongoing issues with excess mine affected water in pits. DERM will hold discussions with BMA to ensure works are continuing to be undertaken to improve the water management system on each of the BMA sites before the applications are decided. TEP approved on 14 July 2011.
15. Burton	Peabody Pacific	02-Jan-11 (plumb tree)	13-Jan-11 **N-26**	31-May-11	Increased EC. Downstream monitoring required	**Concluded**
		06-Jan-11(the Void)	08-Feb-11 **N-27**	01-Sep-11	TEP authorises the release of water with electrical conductivity of up to 5500uS/cm from the northern part of the operation (Void) to receiving waters including the Isaac River. Downstream EC trigger to cease release is 500uS/cm	
		08-Feb-11	TEP **refused** on 02-Mar-2011 **R-6**		Burton Mine proposes to release high EC water (5500uS/cm) directly into the Burton Gorge Dam.	The TEP has been considered by ERS which has advised that the proposed TEP is problematic in that it has the potential to change the water chemistry of the Burton Gorge dam to the detriment of ecosystems that have adapted to low EC conditions. Ideal mixing is unlikely to occur. Further urgent discussions are progressing with ERS. DERM has advised Peabody that the TEP requires further scientific analysis and that feedback will be provided by 24/02/2011 at the latest. Peabody was satisfied with this advice. The release of high EC water would cause harm to biota within the raw water supply and may pose significant risk to drinking water supplies. The documents supplied by the mine have been forwarded to Qld Health for further comment due to this being a potable water supply for the mine. In its current form, it is likely this application will be refused. The TEP was refused on grounds of the potential environmental degradation due to the introduction of high EC waters to an enclosed freshwater environment. Refusal notice will be sent to client on 2 March 2011.

		04-May-11	TEP **refused** on 27-Jul-11 **R-7**		Burton Mine proposes to mix mine affected water with clean water and release directly into the Burton Gorge Dam	TEP sent to AQAEH group on 6 May 2011 for advice. Awaiting comments from AQAEH group. Project manager sent email to proponent on 26 May 2011 requesting further information regarding the TEP. A meeting is proposed on 8 June 2011 between the proponent. The project manager and Ian Ramsay from AQAEH to discuss TEP comments. Application refused on 27 July 2011 due to assessment timeframe being passed.
16. Dawson Central/North	Anglo	04-Jan-11	TEP application withdrawn 04-Feb-11			Assessed by ERS and further information was requested on 6/01/2011. Meeting occurred on 1 February with Dawson, where they provided information as requested and negotiations were undertaken in an effort to get a decision. Mine are currently putting together the proposal as discussed for further departmental consideration.
		18-Jan-11	TEP application withdrawn 04-Feb-11		Proposal revised (27/01/11) to discharge an estimated 3,700 ML with an EC limit of 3250 into Kianga Creek at low or no flow for up to 8 months at 250l/s. Considerable distance to Dawson River	Mine advised this TEP is critical to mining operations. Revised proposal was forwarded to ERS for comment on 27 Jan 11. Further feedback provided to company on 31 Jan 11. CWR is assessing the revised proposal. This TEP may be rolled into the one document with the application above, awaiting revised documentation from mine.
		04-Feb-11 Replaces the previously submitted Dawson Central and Dawson North	18-Feb-11 **N-28**	30-Jun-11	TEP proposes discharge of 3,700 ML of 4000 us/cm water in Kianga Creek with no flow for 3.5 months from Dawson North Pit, Discharge from Hillview Dam into Kianga Creek at low or no flow conditions may be required to shandy discharge from Dawson North Pit, Discharge from 14 Dam into Kianga Creek may occur if above average rainfall events occur. In addition to Hillview Dam, bottom dam east and 9-12 dam water with low EC may be used to shandy discharge from Dawson Pit North or flush Kianga Creek during discharge. TEP authorises discharge activities at Dawson Central and North operations. The TEP supports dewatering of the Dawson North Pit through the Dawson North Industrial Dam. The TEP provides for a discharge of up to 75ML/day with elevated EC concentrations in Kianga Creek at low and no flow conditions.	TEP accepted 18 February 2011. The mine is currently assessing site conditions for best implementation of discharge activities. Recent natural elevated EC concentrations in the Dawson River may minimise discharge volume. **Expired**
		19-Apr-11	Amendment to TEP **refused** on 12-May-11 **R-8**		TEP amendment request additional releases through the 2011 dry season due to continuing inflow from groundwater to pits on site.	Amendment to TEPs refused 12 May 2011; proposed amendments did not include sufficient justification and compliance with legislation to approve.
		10-Jun-11	11-Jun-11 **N-29**	08-Aug-11	TEP extension requested due to forecast of rainfall event.	Extension of TEP until 8 August 2011 approved by the department on 11 June 2011
		20-Jun-11	Amendment to TEP **refused** **R-9**	30-Nov-11	TEP amendment proposes to revise discharge parameters and extend discharge until 30 November 2011. Application is being assessed by the department.	Amendment to TEP refused as regional water quality does not support continued discharge activities.
17. Dawson South	Anglo	04-Jan-11	13-Jan-11 **N-30**	30-Jun-11	TEP approves discharge of up to 4500 us/cm water into Dawson River with minimum flow of 10m3/sec	**Expired**

					Downstream monitoring required	
		24-Mar-11	TEP **refused** on 30-Mar-11 **R-10**		TEP amendment proposes to allow discharge of mine affected water with no limit of EC concentrations as long as EC concentrations are less than 10% of the EC concentration at the far downstream monitoring location	TEP refused on 30 March 2011 Until the department has completed an investigation regarding elevated levels of EC in the Dawson River, an accurate assessment of the capacity of the Dawson River to accept further contaminants can not be supported.
		19-Apr-11	Amendment to TEP **refused** on 12-May-11 **R-11**		TEP amendment request additional releases through the 2011 dry season due to continuing inflow from groundwater to pits on site.	Amendment to TEPs refused 12 May 2011; proposed amendments did not include sufficient justification and compliance with legislation to approve.
		10-Jun-11	11-Jun-11 **N-31**	08-Aug-11	TEP extension request due to forecast of rainfall event.	Extension of TEP until 8 August 2011 approved by the department on 11 June 2011.
18. Oaky Creek	Xstrata	05-Jan-11	TEP **refused** on 27-Jan-11 **R-12**		Multiple additional release points into Oaky and Sandy creeks. TEP seeking approval to investigate problems with water management system and improve infrastructure. TEP proposed to remain in effect > 12 months.	TEP refused on 27/01/11 TEP not considered critical to mining operations Proponent to resubmit TEP as two TEPs: 1. to authorise additional release points until May 2011; and 2. to undertake long term works to water management infrastructure and interim water management.
		21-Feb-11	11-Apr-11 **N-32**	01-Apr-13	TEP authorises the discharge mine affected water from eight release points additional to those already approved under EA MIN100924209 for a period of 27 months. TEP also makes a commitment to apply for a second TEP to authorise the construction of infrastructure on site and remove the smaller dams that release water during rainfall events.	
		16-Jun-11	08-Jul-11 (Amendment) **A-22**	01-Apr-13	TEP amendment application seeks to extend the timeline for developing and submitting a second TEP detailing the capital works upgrade until 31 August 2011(originally required to be submitted to DERM by 30 June 2011). No change to conditions has been proposed.	Amendment to existing TEP
19. Millenium	Peabody	07-Jan-11	28-Jan-11 **N-33**	30-Jun-11	Approved elevated EC to low flow in New Chum Creek. Downstream monitoring is required in New Chum Creek and the Isaac River.	**Expired**
20. Lake Lindsay	Anglo Coal	13-Jan-11	14-Jan-11 **N-34**	30-Jun-11	Increased EC and reduction in receiving water flow rate. Downstream monitoring required	**Expired** Final report has been received late (18 July 2011 due on 27 May 2011) currently being assessed.
21. Saraji	BMA	14-Jan-11	27-Jan-11 **N-35**	Superseded	Discharge to Phillips and Hughes Ck's up to 8000 uS/cm. Reduced flow for receiving waters	
		04-Feb-11	18-Feb-11 (Amendment) **A-23**	30-Jun-11	The approved TEP allows for discharge of mine water of up to 8000uS/cm to downstream trigger of 1000uS/cm and 500uS/cm in the Isaac. Flow trigger will be maintained at $0.5m^3/s$	Amendment to existing TEP. **Expired**

		08-Jun-11	10-Jun-11 (Amendment) **A-24**	30-Aug-11	TEP allows Saraji Mine to continue to discharge mine affected water until 30 June 2011 to take advantage of anticipated high flows. No change to conditions.	Amendment to existing TEP. Due to ongoing issues with excess mine affected water in pits, it is expected that BMA will lodge new TEP applications for its sites to enable discharge to continue until November 2011. Conditions will be negotiated at pre-lodgement meetings prior to the submission of the new applications.
		16-Jun-11	14-Jul-11 **N-36**	30-Jan-12	The TEP application allows the extension of the period of time that mine water can be released providing flow and water quality conditions are met until 30 November 2011. The TEP application includes a works program for planned upgrades of the water management system. The department approved this TEP on 14 July 2011.	BMA has lodged TEP applications for 6 sites to enable releases to continue until November 2011 due to ongoing issues with excess mine affected water in pits. DERM will hold discussions with BMA to ensure works are continuing to be undertaken to improve the water management system on each of the BMA sites before the applications are decided. TEP approved on 14 July 2011.
22. Baralaba	Cockatoo Coal	14-Jan-11	08-Feb-11 **N-37**	29-Jul-11	TEP authorises the release of mine affected water to the Dawson River from an inundated mine pit. Water quality is in accordance with Baralaba's Environmental Authority (EA).	TEP is considered critical to mining operations. TEP accepted 8 February 2011. Discharge continues.
		19-Apr-11	12-May-11 (Amendment) **A-25**	30-Sep-11	TEP amendment requests additional releases through the 2011 dry season, also requests different release rate. Amended application approved by the department on 12 May 2011.	Amendment to existing TEP.
		09-Jun-11	10-Jun-11 (Amendment) **A-26**	30-Sep-11	TEP amendment requests revision of receiving water pH concentration due to elevated pH concentration in the upstream environment. Request reviewed by the department and approved 10 June 2011.	Amendment to existing TEP.
		21-Jun-11	09-Jul-11 (Amendment) **A-27**	30-Sep-11	TEP application to decrease discharge volume due to decreased flow in the receiving environment.	Amendment to existing TEP
23. Lake Vermont	Lake Vermont Resources PL	14-Jan-10	29-Jan-11 **N-38**	30-Aug-11	TEP approved release of mine affected water to Carfax Gully with no natural flow.	
24. Hail Creek	Rio Tinto Coal	18-Jan-11	29-Jan-11 **N-39**	30-Jun-11	TEP to authorise release through additional discharge points and low flow in receiving waters. Increase in EC to 2000uS/cm as well as increase in ph, turbidity and sulphate. Discharge under no flow allowed if mine releases clean water to create flow.	**Expired**
		18-Apr-11	TEP **refused** on 20-May-11 **R-13**	20-May-11	TEP to discharge additional volumes of water from release points. Extension of the TEP end date to 30 September 2011 Amending EC release limit to 2400 µs/cm across all release points to account for escalation of upstream salinity.	TEP sent to AQAEH group on 27 April 2011 for advice. AQAEH group provided comments on 10 May 2011 noting that TEP should not be accepted based on potential impact to the receiving marine environment Assessment Manager has not forwarded TEP advice to Hail creek yet due to the department decision regarding order Hail Creek to cease current TEP discharge. DERM notified Rio Tinto on 9 May 2011 that Hail Creek must cease discharges under the current TEP by COB 20 May 2011 due to increases in electrical conductivity

						levels in the downstream Connor River TEP amendment application refused on 20 May 2011 due to current increase in EC in the downstream Connor River.
		02-Jun-11	10-Jun-11 (Amendment) **A-28**	30-Sep-11	Extension of TEP, seeks to authorise the discharge of approximately 4000ML of mine affected water to Bee Creek (Connors River). Proposed discharge at up to 2000uS/cm. End date is 30 Sep 2011	Amendment of existing TEP for extension to discharge until 30 June 2011.
		28-Jun-11	11-Jul-11 (Amendment) **A-29**	30-Sep-11	TEP amendment application authorises increase water to be released and increase the electrical conductivity up to 3000uS/cm to Bee Creek with no minimum flow requirement.	Amendment to existing TEP. TEP approved on 11 July 2011.
25. Jellinbah	Jellinbah Resources PL	20-Jan-11	TEP application withdrawn 04-Feb-11		TEP application to pump mine affected water with elevated EC (~2500 uS/cm) to Blackwater Creek	TEP is considered critical to mining operations. Currently being assessed by CWR and technical assessment by ERS. The main issue is the lack of flow in the waterway and lack of conjoining streams to the Mackenzie River. The discharge would not be suitably diluted by the time it arrives at the river. Is the possibility of environmental harm to Blackwater Creek if the water is released without a small flow in the creek
		04-Feb-11	11-Feb-11 **N-40**	30-Jun-11	TEP authorises release of mine affected water with elevated EC (~2500 uS/cm) to Blackwater Creek	TEP is considered critical to mining operations. **Expired**
		15-Mar-11	05-Apr-11 (Amendment) **A-30**	30-Jun-11	Extension of TEP period from 40 days to 12 months. There is no change to the approved release parameters TEP was revised and requested an additional 20 days pumping rather than the extension to 12 Months.	Amendment to existing TEP. Jellinbah were authorised on 25 March 2011 via email to discharge water in accordance with the resubmitted TEP that provides for a further 20 days of pumping. Conditions remain unchanged from existing TEP Amended TEP was approved on 05 April 2011 to authorise additional 20 days pumping. **Expired**
		13-Apr-11	19-Apr-11 (Amendment) **A-31**	30-Jun-11	TEP was revised and requested an additional 20 days pumping to take advantage of flows.	Amendment to existing TEP **Expired**
		13-May-11	03-Jun-11 **N-41**	31-Oct-11	TEP to release mine affected water to Blackwater and Twelve Mile Creek during no flow event	New TEP. Jellinbah was authorised via telephone and email to release on 30 May 2011 Ceased releasing 8 June due to high EC at Coolmairinga
26. Yarrabee	Yancoal Australia	25-Jan-11	10-Feb-11 **N-42**	30-Jun-11	TEP authorises release into Twelve Mile Ck under no/low flow conditions. Water quality of high conductivity 2000uS/cm and pH of between 6.5 and 9.	TEP is considered critical to mining operations Program Notice was accepted. **Expired**
		14-Apr-11	03-May-11 (Amendment) **A-32**	15-Sep-11	Amendment application authorises change of downstream monitoring point in Mackenzie River and extend the TEP timeframe by 6 weeks. Extended to cease releases by 15 July 2011. Final report is due to DERM by 15 September 2011.	Amendment to existing TEP Ceased releasing 8 June due to high EC at Coolmairinga

27. Coppabella	Macarthur Coal	27-Jan-11	TEP **refused** **R-14**		TEP proposes 3 discharge points to release water (EC limit 3500 PH 6.5 – 9.5 Turbidity – 3000NTU) accumulated in pits and water storages into nearby Thirty Mile Creek and Harrybrandt Creek. The TEP propose to discharge during no flow events.	TEP has been assessed by ERS. Comments have been provided back to mine and mine submitted further information. Coppabella responded to the department's comments and provided an updated TEP on 11 February 2011. The updated TEP is currently being reassessed by the region. Further information was requested from the mine on 17/02/11. Followed up on 21/02/11 and message was left with the mine requesting status of information request. Message left with client on 24/02/2011 regarding the submission of information request. Client advised that information will be submitted 24 February 2011. The department is still waiting on revised draft TEP to be submitted by the client. The client advised on the 24 February 2011, that information will be submitted on 28 February 2011. Client was contacted by phone on 02/03/2011 and indicated that revised TEP was to be submitted and that the expected submission date would be late this week or early next week. Client advised on 4/03/11 that information will be submitted on 7/03/11. The client has indicated that it will likely submit the revised TEP to the department on 11/03/11. Revised TEP submitted to the department on 15/03/11. Sent to ERS for advice on 16/03/11. The client has noted that this TEP will most likely be withdrawn and that the decision is with the CEO of Macarthur. Discussion with client on 13 April 2011 indicates that TEP is still likely to be withdrawn as it will not achieve much. A pre lodgement meeting is likely to occur to discuss options for a longer term TEP that deals with water management issues on site. Amendment Refused
28. Moorvale	Macarthur Coal	27-Jan-11	20-Apr-11 **N-43**	31-Aug-11	TEP authorises release of water up to 2500uS/cm to North Creek under no flow conditions. Flow trigger in Isaac River. Dilution requirement to achieve 600uS/cm downstream in Isaac River.	
		10-Apr-11	20-Apr-11 (Amendment) **A-33**	30-Sep-11	TEP amendment to permit release of water up to 2500uS/cm to North Creek under no flow conditions. Flow trigger in Isaac River of minimum 0.7cumecs. Dilution requirement to achieve no more than 120uS/cm at downstream in Isaac River using 50L/sec	Amendment to existing TEP Amendment to TEP was requested due to the environment dam reaching 124% of storage capacity. Moorvale has built a levee on the top of the dam

					release volume. Max release volume of 120ML. Release of mine water is permitted until 30 June 2011.	embankments over the spillway to prevent uncontrolled releases, however required the release of ~111ML to achieve water level below spillway.
		10-Jun-11	10-Jun-11 (Amendment) **A-34**	30-Sep-11	TEP amendment to amend existing TEP as a result of accumulation of mine affected water in the main environment dam. Moorvale temporarily raised the dam wall over spillway to prevent uncontrolled release, but still had limited capacity to manage excess water effectively on-site under EA conditions. Principal changes proposed were to receiving water flow rate, EC level and release volume.	Amendment to existing TEP
29. Norwich Park	BMA	28-Jan-11	11-Feb-11 **N-44**	30-Jul-11	TEP allows the release of mine affected water with elevated Electrical Conductivity (8000uS/cm).	
		08-Jun-11	10-Jun-11 (Amendment) **A-35**	30-Aug-11	TEP Allows Norwich Park Mine to continue to discharge mine affected water until 30 June to take advantage of anticipated high flows. No change to conditions.	Amendment to existing TEP Due to ongoing issues with excess mine affected water in pits, it is expected that BMA will lodge new TEP applications for their sites to enable discharging to continue until November 2011. Conditions will be negotiated at pre-lodgement meetings prior to the submission of the applications.
		16-Jun-11	14-Jul-11 **N-45**	30-Jan-12	The TEP application allows the extension of the period of time that mine water can be released providing flow and water quality conditions are met until 30 November 2011. The TEP application includes a works program for planned upgrades of the water management system. The department approved this TEP on 14 July 2011.	BMA has lodged TEP applications for 6 sites to enable releases to continue until November 2011 due to ongoing issues with excess mine affected water in pits. DERM will hold discussions with BMA to ensure works are continuing to be undertaken to improve the water management system on each of the BMA sites before the applications are decided. TEP approved on 14 July 2011.
30. Blackwater	BMA Coal	26-Jan-11	18-Feb-11 **N-46**	01-Jul-11	TEP allows the release of mine affected water with elevated electrical conductivity from New Deep creek Dam with no flow in receiving water.	**Expired**
		16-Jun-11	14-Jul-11 **N-47**	30-Jan-12	The TEP application allows the extension of the period of time that mine water can be released providing flow and water quality conditions are met until 30 November 2011. The TEP application includes a works program for planned upgrades of the water management system. The department approved the TEP on 14 July 2011.	BMA has lodged TEP applications for 6 sites to enable releases to continue until November 2011 due to ongoing issues with excess mine affected water in pits. DERM will hold discussions with BMA to ensure works are continuing to be undertaken to improve the water management system on each of the BMA sites before the applications are decided. TEP approved on 14 July 2011.
31. Red Mountain (Infrastructure) Joint Venture (RMIJV)	Millennium Coal Pty Ltd & BHP Mitsui Coal Pty Ltd	03-Feb-11	11-Feb-11 **N-48**	31-Jul-11	TEP authorises increase to limits for EC to 2000 uS/cm (increased from current EA limit of 1400 uS/cm) for releases to New Chum Creek during period of no flow, provided there is adequate flow in the Isaac River. TEP also proposes a maximum release flow rate, based on 1% of flow in the Isaac River at DERM's Goonyella gauging station plus 400 litres per second.	The TEP is not considered critical to operations.

32. Boonal Joint Venture	Jellinbah Resources PL & Yancoal Australia	03-Feb-11	14-Feb-11 **N-49**	30-Jun-11	TEP authorises the release of water from the Boonal loadout facility to Bullock Creek. Electrical Conductivity authorised is 500uS/cm. Water must also go through clarifier to remove suspended solids to an acceptable level.	The TEP is critical to operations as it cannot store any more water on site and the water is surplus. Possible issue with the low pH(4) has been resolved, discharge will be between 6 and 9pH, high aluminium content is to be filtered and removed. Discharge will be low volume, low EC. Has Not released water since obtaining TEP. **Expired**
33. Gregory Crinum	BMA/ BHP Coal Pty Ltd and others	14-Feb-11	28-Feb-11 **N-50**	30-Jun-11	TEP allows for releases of higher EC water during periods of low flow in Crinum Creek.	**Expired**
		08-Jun-11	10-Jun-11 (Amendment) **A-36**	30-Aug-11	TEP allows Gregory Crinum Mine to continue to discharge mine affected water until 30 June 2011 to take advantage of anticipated high flows. No change to conditions.	Amendment to existing TEP Due to ongoing issues with excess mine affected water in pits, it is expected that BMA will lodge new TEP applications for their sites to enable discharging to continue until November 2011. Conditions will be negotiated at pre-lodgement meetings prior to the submission of the new applications.
		16-Jun-11	14-Jul-11 **N-51**	30-Aug-12	The TEP application allows the extension of the period of time that mine water can be released providing flow and water quality conditions are met until 30 November 2011. The TEP application includes a works program for planned upgrades of the water management system. The department approved this TEP on 14 July 2011.	BMA has lodged TEP applications for 6 sites to enable releases to continue until November 2011 due to ongoing issues with excess mine affected water in pits. DERM will hold discussions with BMA to ensure works are continuing to be undertaken to improve the water management system on each of the BMA sites before the applications are decided. TEP approved on 14 July 2011.
34. East End Mine	Cement Australia	18-Feb-11	28-Mar-11 **N-52**	29-Jul-11	East End Mine has requested a TEP to amend the volume and contaminant limits of the current EA The TEP allows discharge for up to 30 ML / day with an EC of 4000 for up to 6 months. Consistent with the EA; the TEP also allows the release water from East End Mine pit to East End Creek to Shulz Lagoon.	East End mine has reported reduced production capacity due to water in the mine pit TEP provides discharge of up to 30 ML/day based on a staged EC concentrations and receiving water flow rates, low and no flow conditions are also included. Discharge under the TEP initiated 30 March 2011.
		18-Apr-11	20-Apr-11 (Amendment) **A-37**	29-Jul-11	Increased EC limit downstream to 2000uS/cm	Amendment to existing TEP
35. Curragh	Wesfarmers Resources Ltd	Draft 18-Feb-11	No action required.		The TEP proposes to release water with EC up to 5000 uS/cm with various dilution ratios.	Early draft of proposed TEP has been forwarded to the department from Stanwell Corporation. CWR met with Curragh on 22/02/11 regarding the TEP application and other matters relating to water management on site. A draft and incomplete version of a TEP was received by the department on 18 February 2011.. Curragh advised this document should not have been sent to DERM and should not be considered by the department. Curragh are considering its otions particualry in the light that a TEP has on their categroy three discount. The

						department may or may not receive a TEP for consideration.
		22-Mar-11	TEP **refused** on 27-07-11 **R-15**		TEP is for longer term water management issues to November 2012 – additional release points, proposed changes to contaminant release limits and receiving water flow conditions	Mining operations continue but have been impeded by water issues. The department provided comments back to the site in relation to the draft TEP on 5 April 2011. The department advised the site that the draft TEP in its current form is not acceptable and changes would need to be made in various aspects of the TEP. Curragh to supply further information on reworked TEP following comments provided by the department. Application refused on 27 July 2011 due to assessment timeframe being passed.
		29-Apr-11	13-May-11 **N-53**	31-Nov-11	Approved on 13 May 2011 based on merits that the proposed TEP period was shortened (up to 31 November 2011); releasing of mining affected water will be locked with the water flow in the receiving rivers (min ratio 1:20); and that the higher EC (>5000 uS/cm) water will be discharged at a release point down stream of the Black Water Creek to avoid further deteriorate the water quality.	On 31 May 2011, a meeting was held with the client who requested to increase pH limit of realising water (up to 9.5). After consultation with a water quality scientist, the request was conditionally approved, which is that occasional or temporal release of high pH water (up to 9.5) is acceptable, but prolonged realise such high pH water should be restrained
36. Calliope Limestone Quarry	Unimin	24-Feb-11	TEP application withdrawn 25-Feb-11		The draft TEP requests a new discharge location along an unnamed drainage channel to Awoonga Dam. Water quality is within EA conditions	TEP is not considered critical to mining operations. Technical assessment of proposed TEP is being undertaken by ERS. Assessment of TEP application and discussion with Unimin identified the discharge could be undertaken under the current EA conditions and the TEP was not required. The TEP application was withdrawn via an email on 25 February 2011.
37. North Goonyella Coal Mine (NGCM)	Peabody	03-Mar-11	15-Mar-11 **N-54**	30-Sep-11	TEP allows the release of mine affected water to Goonyella Creek during no flow events, but dependent on there being flow in the Isaac River. Release limits were revised to max. 2500 uS/cm for electrical conductivity (down from the EA limit of 3000 uS/cm) and pH in the range of 6.0 to 9.2.	
38. Foxleigh	Anglo Coal	24-Mar-11	01-Apr-11 **N-55**	30-Jun-11	TEP allows the release of mine affected water to Roper Creek at a higher EC limit (3500uS/cm)	**Expired** Final report has been received 22 July 2011 due on 27 May 2011. The mine has advised that no activities were undertaken under this TEP.
		07-Apr-11	TEP **refused** **R-16**	30-Jun-11	The amended TEP proposes to increase the EC limit from 3500uS/cm to 6000uS/CM for releases to Roper Creek	Amendment to existing TEP TEP sent to Freshwater and Marine Science on 11 April 2011 for further advice regarding acute toxicity potential. Refused due to timeframe being exceeded.

39. McFarlane	QER	08-Apr-11	TEP application withdrawn 29-Apr-11	TBA	TEP amendment requested change in discharge location and removal of 2 monitoring points. No changes to discharge limits.	TEP application was withdrawn on 29 April 2011

Burdekin Catchment						
Newlands	Xstrata	15-Dec-10	23-Dec-10 **N-56**	30-Jun-11	Increased EC and reduction in receiving water flow rate. Downstream monitoring required.	**Expired**
		11-Jan-01	28-Jan-11 (Amendment) **A-38**	30-Jun-11	TEP authorises the release of mine affected water with elevated EC (up to 5500uS/cm) to Cerito Creek with downstream monitoring in Rosella Creek and the Bowen River.	Amendment to existing TEP Mine advised that this TEP is critical to the Mine's operations **Expired**
		24-May-11	TEP **refused** on 08-Jun-11 **R-17**	30-Jun-11	Amendment application received 24 May 2011 to extend discharge activities. Assessment will be undertaken and decision included in the near future.	Amendment Refused
Sonoma	Qcoal	01-Jan-11	07-Jan-11 **N-57**	01-Jun-11	Increased EC levels and downstream monitoring required.	**Expired**
		22-Feb-11	24-Feb-11 (Amendment) **A-39**	30-Jun-11	TEP titled: Emergency Release of Mine Water This TEP authorises the release of water with EC up to 850uS/cm to Pelican Creek.	Amendment to existing TEP TEP is considered critical to the mine's operation. Approved TEP sent to client on 24 February 2011. **Expired**
Thalanga Copper Mine	Kagara Copper Pty Ltd	08-Feb-11	18-Feb-11 **N-58**	31-Oct-13	TEP authorises releases from east evaporation pond whilst the company undertakes studies and site changes to remove contamination, reduce catchment size and increase storage capacity.	The TEP will bring the site back into compliance with licence release limits and hazardous dam conditions.
Burnett River Catchment						
Mt Rawdon	Newcrest Mining Ltd – Mt Rawdon	Resubmitted following DERM comments on 21-Jan-11	18-Feb-11 **N-59**	30-Nov-11	TEP authorises dams below the waste rock dump and the tailings dam to overflow rather than returning the water into the Tailings Storage Facility due to the TSF being above the MRL. Stormwater leaving the ML had some metals slightly above EA limits but the water overflowing the Perry River weir complies with EA limits.	TEP considered critical to the mine's operation. Water levels in the dams below the tails dam and the waste rock dump are now well below spillway levels and water is again being used for processing.
Bremer River Catchment						
New Oakleigh Coal Mine	New Oakleigh Coal	27-Jan-11	01-Feb-11 **N-60**	11-Feb-11	Water Management: TEP issued after the flood event. TEP authorises discharge of captured flood water from extraction pit at a higher electrical conductivity. (1500 us/cm as opposed to background + 15% of offsite gully) Monitoring required along discharge path and downstream.	**TEP Concluded 25 February 2011** **Expired**
Mary River Catchment						
D'Aguilar Gold Mine	D'Aguilar Gold Pty Ltd	01-Feb-11	11-Mar-11 **N-61**	29-Apr-11	Water Management. TEP requests authorisation to release water that has overflowed the TSF into the Shamrock Pit to be released by pumping. Also deals	End date for TEP was 29 April 2011. The client submitted the final report by the due date, which will now be duly assessed to ensure compliance.

					with measures to increase storage capacity of contaminated water.	**Expired**

LNG/CSG activities: Flood-related Issues

Update 58 as at 28 July 2011

Contact: Andrew Brier, General Manager Coal & CSG Operations
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Known flood and wet season related incidents relating to LNG/CSG Activities

Site	Company	Nature of Breach	Date of Breach	Compliance/Investigation Activity
1. Molopo Energy (near Moura)	Molopo Energy Ltd	Produced water overtopping evaporation pond	7 Dec 10	Molopo energy has submitted a total of 3 reports in relation to soil and water sampling undertaken at the impacted site. Results were forwarded to Water Services on 11 May 2011 and Water Services has provided a response to Petroleum and Gas on 17 May 2011. DERM contacted Molopo on 21 June 2011 in regards to a letter issued to Molopo on 7 June 2011. Molopo advised it had not received the letter and intended to submit requested documents by 5 July 2011.
2. Moranbah	Arrow Energy	Controlled discharge of produced water to prevent pond overtopping	13/14 Dec 10	
			20 Dec 10 to 5 Jan 11. 31 Jan – 4 Feb DERM approved TEP for discharge of CSG water on 4 February 2011.	DERM approved TEP for discharge of CSG water on 4 February 2011. The MGP TEP expired on 31 May 2011. Arrow submitted the final TEP report as per objective 5 of the TEP on 31 May 2011. DERM to finalise its assessment of the final TEP Report by 17 June 2011. DERM has completed its assessment of the Final TEP Report and found that Arrow has complied with the conditions and objectives of the TEP. No further action is required.
3. Peat gas field (near Wandoan)	APLNG(Origin)	Controlled discharge of produced water to prevent pond overtopping Program notice accepted. TEP due to be submitted to department July 2011.	27/28 Dec 10	Environmental Services met with Origin on 07/04/11 to discuss progress of the submission of a draft TEP for the discharge. Origin has verbally agreed to a completion of works date by October 2011, before next wet season. On 15 July 2011, APLNG submitted a draft TEP for comment.
4. Denison Trough gas fields (Westgrove north of Injune) ****NB** This is a conventional gas operation**	APLNG(Origin)	Controlled discharge of produced water to prevent pond overtopping Program notice accepted. TEP due to be submitted to department July 2011.	27/28 Dec 10	Environmental Services met with Origin on 07/04/11 to discuss progress of the submission of a draft TEP for the discharge. Origin has verbally agreed to a completion of works date by October 2011, before next wet season. On 15 July 2011, APLNG submitted a draft TEP for comment.
5. Roma gas field (Coxon Creek)	Santos	Spill of drilling fluid as a result of sump failure	31 Dec 10	DERM conducted a site inspection / investigation with Santos on 07/01/11. Water and Soil samples were collected by DERM and Santos. Upon review of all sample results it was determined that there was no environmental harm to

				adjacent environment. Santos provided correspondence that rehabilitation of the site will be conducted within 3 months after termination of well drilling and completion activities. Inspections will be conducted as part of the annual compliance plan to ensure rehabilitation is undertaken at wells as required. No further action is required. **Concluded**
6. Tipton RO Plant (20-30km SW Dalby)	Arrow Energy	Spill of hydrochloric acid as a result of localised flooding	Between 18 Dec 10 and 5 Jan 11	Environmental Services has investigated. Arrow is to submit formal confirmation that the storage area has been moved from any potential flood area. On 3 May Arrow verbally advised that a formal report will be submitted by the end of the week. A consultant is currently undertaking a flood study which will be used to identify future chemical storage sites. In the interim, chemical storage at the Tipton RO site has been relocated to higher ground at the Daandine ROP plant. On 27/5 DERM reminded Arrow that final report has not been submitted and expectation is that this should be finalised. 6/6 Matter finalised NFA required. **Concluded**
7. Tipton RO Plant (20-30km SW Dalby)	Arrow Energy	Oil water pond inundated by floodwaters leading to a release from the pond. Total volume of pond less than 1ML.	Between 10 Jan and 12 Jan	Environmental Services has investigated. Arrow is to submit a formal plan for reconfiguration of the water supply system on site. On 3 May Arrow verbally advised that a formal report will be submitted by the end of the week. Any changes to the operation of the oil water dam must consider the DXP approval which is currently in a review process by DERM. It is anticipated that a new dam will be constructed and the bunding which trapped water during the January flood period will be removed during construction of the new dam. On 27/5 DERM reminded Arrow that final report has not been submitted and expectation is that this should be finalised. 6/6 - Arrow advised that bund surrounding pond has been broken to prevent future stormwater inundation. .Arrow verbally requested more time to continue their investigation into correction measures for inadequate capacity of oily water pond. 16/6 – DERM requested from Arrow a detailed report on the oily water dam including current capacity, contents composition, management practices (present and future). Report due on 1 August.
8. QGC Kenya frac ponds (20km SW Chinchilla)	QGC	Overtopping of 4 frac ponds from incident rainfall. Report received by DERM 31/1/11.	Probably evening of 10/1/11	Further information was requested and is due 25 March 2011. Information received and no further action required. Letter sent to QGC on 19 April 2011 detailing breach of conditions and NFA. This issue could be removed from report. Matter finalised – NFA. **Concluded**

9. Ramyard (Peat)	Origin (APLNG)	Notification (not a program notice) advising Origin believes there may have been minor flooding of dams at Ramyard (Peat) field. Investigation commenced.	Probably January 2011	Wet weather access has been a continual problem for the area. A site inspection is currently planned for early July. Focus of the inspection is pre-planning of site design for coming wet season.

Wet Season CSG/LNG Water Management

TEP Status

A total of 7 TEPs have been approved or have had amendments approved since 1 December 2010. A further one has been received and is currently undergoing assessment. One TEP has been refused.

CSG Operation	Company	Received Date / PN submitted	Approval date	Expiry Date	Authorisation outside EA Conditions	Comments
Fitzroy Catchment						
Spring Gully	APLNG	21/12/10 and resubmitted on 24/12 and 28/12	Approved 28/12/10	28/01/2011	Discharge of RO brine if MRL reached or an engineering concern identified but only if 1:100 dilution, a base flow in creek equal to minor flood and mixing zone limits achieved.	NO discharges yet required. Existing TEP extended to 25 Feb without change to allow for appropriate assessment/discussion of proposed amendment. The initial TEP has been amended twice (28/01/11, 25/02/11) to extend it until conditions of a new TEP have been agreed. The amended TEP was approved on 04/03/11 for the term to 30/09/11. **Concluded**
		11/1/11 and later version incorporating DERM comments resubmitted 25/2/11	Amendments approved on 28/01/11, 25/02/11 and 04/03/2011	30/09/2011	Amendment focuses on allowing higher EC within mixing zone, due to influence of higher EC background water quality. Amendment approved on 04/03/2011allows commencement of release when:: Eurombah Creek is flowing at 240ML per day or 0.2m of water over the Wybara crossing; and A dilution of at least 1:100 (release water to flow in the creek) is met. The controlled release must cease if: The EC is measured above 1500uS/cm at MP3 or MP4, or 100uS/cm at MP5 or MP6; or The freeboard of the cell from which release is occurring is 0.65m; or Water flow in the creek less than 240ML/day;or A dilution level 1:100 can not be maintained.	The TEP has been reissued with agreed amended conditions. This TEP will expire on 30/9/11. Release of water (including brine) under this TEP occurred on 19 April 2011from 7:15 AM to 5: 10 PM, an estimated 36 ML was released. The flow volume in Eurombah Creek was well above 240 ML/d as required by the TEP. In-situ tests of water quality were in compliance. A summary of monitoring data was submitted by APLNG before 23 May 2011 and assessed by DERM officers who concluded that the information was insufficient and requested a full laboratory report to be provided. Full laboratory report (Certificates of Analysis) was submitted and assessed by DERM officers. Assessment indicates compliance with the water quality limits authorised under the TEP. No further action is required.
Moranbah Gas Project (MGP)	Arrow	23 December 2010 and resubmitted 31 December 2010, 28 January 2011 and 4 February 2011	Approved 04/02/2011	31/03/2011	Discharge of CSG water to Isaac River only if dams 1, 2, 5 or 10 at MGP exceed target fill heights (DSA for dams 1, 5 and 10, but 4m below DSA for dam 2), a dilution of at least 400 parts river flow to 1 part discharge can be maintained at all times and flow in Isaac River is greater than 1090 ML/day.	Discharge to cease on 31 March 2011. Arrow has notified that they have developed a management plan to restore or remove dam 2 from service to satisfy objective 3 of TEP. P&G is following up. DERM has approved an application for amendment to extend the Milestone date for Objective 4 from 31 March to 13 May 2011. The decision to grant the amendment was based on - • No increase in environmental harm is expected as a result of this amendment • All previous conditions and requirements of the approved draft TEP will remain. High concentration of Fluoride (9.0 mg/L) was detected

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						downstream of TEP discharge for the sample taken on 26/03/11 and reported on 6/04/11. Upstream Fluoride was 0.1 mg/L in the River on 26/03/11. Subsequent sampling indicated downstream Fluoride level as 0.2 mg/L. It has since been confirmed by Arrow that the laboratory made an analysing error. Discharge ceased at 7pm on 27 March 2011. Arrow is aware that no more releases are authorised after 13 May 2011, as per objective 4 of the TEP. The TEP expired on 31 May 2011. Arrow submitted the final TEP report as per objective 5 of the TEP on 31 May 2011. DERM has completed its assessment of the Final TEP Report and found that Arrow has complied with the conditions and objectives of the TEP. No further action is required. **Concluded**
Condamine Catchment						
Daandine	Arrow	13/01/2011	Approved 18/01/2011	28/02/2011	Discharge of RO permeate to flood flows – Wilkie Ck	Discharge from RO dam and put more assoc water through RO plant and discharge, rather than let associated water dams overflow. Arrow has formally advised they have ceased all discharge. **Concluded**
		15/02/2011	Draft TEP submitted. Request for further information sent – response due 7 March Additional information was requested by DERM on 28 February. A response was provided on 11 March 2011, with a revised version of the TEP submitted by Arrow at that time. 17 May – Decision date extended at Arrow request to allow time for response from water supply regulator. Revised		To authorise all weather discharge of RO permeate from the permeate dam, to enable reduction in volume of associated water in ponds via the RO plant, to reduce risk of discharge from associated water ponds.	Proposal to discharge RO permeate overland to unnamed tributary of Wilkie Ck. LNG EU met with landholders concerned about the proposed TEP 1/3/11. TEP application seeks to discharge into a tributary of Wilkie Creek, whether or not there is flow in the tributary (or creek). DERM advised Queensland Health of the application. QH requested more information. DERM has sought input from Water Sciences and soil sciences on the TEP. DERM has been clear with Arrow that DERM expects Arrow to contact affected landholders about ongoing flows in the creek (Baker access issues) and Council in relation to how the flows will get across Kumbarilla Lane. Soil salinity testing has been raised as an issue. 17 May - Arrow is considering a proposal to change discharge location to a point which discharges directly to Wilkie Creek, reducing impacts upon the surrounding environment. Changes to the proposed draft TEP will be provided on 27 May 2011. 7 June – meeting with Arrow representatives regarding significant amendments to the TEP including change of discharge point direct to Wilkie creek, propose to discharge

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			due date 16 June 2011. 17 June – Information request to be issued on 29 June – revised due date extended to 18 July 2011.			500ML "modified" (calcium dosed) RO permeate. Its emerging need is that it will not meet DSA requirements by November. DERM's position put clearly is that the correct mechanism is through the BUA currently under negotiation, and through amendments to the EA. Arrow maintains there is insufficient time for them to finalise the BUA or amend EA. Regional office is now taking a stronger line on the use of TEPs to correct poor planning, but will consider any application by Arrow. Region is keen that Arrow does not use the TEP as a mechanism to avoid negotiating on the BUA. 17 June – Draft TEP was received from Arrow for the release of amended RO permeate directly to Wilkie Creek. TEP has been assessed and it has been decided that additional information is required in order to properly asses the application. The information request will be issued on 29 June 2011. A due date and subsequent (new) date of application has been set at 18 July 2011. 18 July – Info request and amended TEP received. Due date for a decision will be 15 August 2011.
Fairview Roma Arcadia	Santos	24/01/2011	**Refused 02/0221/11**		Proposal to discharge from 100 associated water dams into flood flows to maintain storage capacity for future water management	Santos has verbally advised that it will consider internally whether TEP is the appropriate tool to seek remediation of the dams. **Concluded**
Mt Kingsley / Arcadia	Santos	03/02/2011	Approved 22/03/2011	31/12/2011	The TEP requires Santos to undertake an assessment as to the reasons behind overtopping of mud and water dams at three sites in November 2010 in order to develop strategies to prevent recurrence.	Santos has submitted reports in accordance with TEP objectives. DERM sent response letter providing comments on completion of TEP objectives. DERM letter outlines further expectations regarding compliance. Santos is to submit a further report before 30 July 2011.
Scotia	Santos	14/02/2011	Approved 28/04/2011	25/10/2011	Proposal to discharge from site dam to avoid overtopping.	Installation of an RO plant to treat associated water and use of resultant good quality permeate as stock water, dust suppression and discharge to an unnamed creek.
		08/06/2011 (Amendment)	Approved 04/07/2011	19/02/2012	Proposal to discharge from site dam to avoid overtopping.	Santos submitted an amendment to the current TEP as its contractor has not been able to supply an RO Plant within the required timeframe. No significant change to the objectives of the TEP, other than extending the timeframe by 4 months to allow commissioning of the RO plant.