

# MEMO

To: Santos Ltd.

From: 

CC: 

Date: 17 June 2022

Re: Tanumbirini 2H/3H Flowback Wastewater - Risk Assessment, EP-161, McArthur Basin

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## Introduction

Santos Ltd. (“Santos”) is conducting an exploration and appraisal program within Exploration Permit (EP)161, which is located in the Beetaloo Sub-basin of the broader McArthur Basin. The McArthur Basin is located southeast of Katherine, Northern Territory (NT), and covers approximately 180,000 square kilometres. Santos has undertaken exploration activities in EP161 since 2013, including drilling of two exploration wells and monitoring bores.

Santos prepared an Environment Management Plan (EMP) for the McArthur Basin Hydraulic Fracturing Program EP-161 (Santos, 2021). The EMP proposed Hydraulic Fracture Stimulation (HFS) be conducted at the Tanumbirini well site (“Site”) and Inacumba well site. As part of the EMP, a chemical risk assessment was completed for the flowback/produced water after hydraulic fracturing. This risk assessment evaluated the chemistry of the hydraulic fracturing fluid systems, estimated the probable concentration of these chemicals in flowback and completed a quantitative evaluation of potential risks. Based on the assessment completed for hydraulic fracturing fluid chemicals, it was determined that the only potentially complete exposure pathway (considering the program of works and associated management controls) was to avian receptors that may come in contact with flowback fluids contained in open-top tanks. The quantitative risk assessment evaluated the potential risks to avian receptors and determined that there would be no unacceptable risks to avian receptors from direct contact and ingestion of wastewater.

Pursuant to the approval conditions of the EMP (Department of Environment, Parks and Water Security [DEPWS], 2021), sampling and analysis of flowback water is required to be routinely conducted. Condition 7 of the EMP approval requires risks associated with flowback water from the hydraulic fracturing phase to be assessed.

The operational philosophy and management controls discussed in the EMP were effectively implemented at the Site. Therefore, the conceptual exposure model (CEM) for potential exposures to chemicals in flowback water remained unchanged from the EMP, with potential exposures limited to avian receptors. Consistent with the CEM, an avian risk assessment of flowback/produced water from the Tanumbirini 1 well was performed in March 2020 (EHS Support, 2020a). The March 2020 avian risk assessment concluded that there were no unacceptable risks to this receptor group from the Tanumbirini 1 flowback/produced water.





Subsequent to the avian risk assessment, the NT Government asked Santos to assess the potential ecological risks from a hypothetical release of liquids to soil within the containment area. An assessment of the potential release of liquids to soil within the containment area was performed for the flowback risk assessment (EHS Support, 2020b). In the terrestrial risk assessment, a hypothetical maximum release scenario was evaluated and concluded that no chemicals detected in the flowback/produced water at their maximum concentration would result in soil levels above screening criteria protective of terrestrial receptors. It should be noted that there are operational controls outlined in the Spill Management Plan (SMP) that was included as an appendix to the EMP to minimise, assess and manage risks from potential spills of flowback wastewater at the Site.

Drilling for Tanumbirini 2H commenced on the Site in May 2021 and was followed by drilling for well Tanumbirini 3H. Subsequent to drilling, the wells were hydraulically fractured in 2021. This memo uses risk assessment methodologies documented in the EMP and the risk assessments submitted by Santos to address EMP approval Condition 7. This risk assessment also satisfies requirements 2(a) and 2(b) of Regulation 37A of the Petroleum (Environment) Regulations 2016 (Northern Territory Government, 2021). The requirements of Regulation 37A include:

- 1) An interest holder in relation to an activity that includes hydraulic fracturing must give the Minister a report about flowback fluid within 6 months of the flowback occurring
- 2) The report must contain the following information:
  - a. the identity of any chemical or naturally occurring radioactive material (NORM) found in the flowback fluid;
  - b. the concentration of any chemical or NORM found in the flowback fluid;
  - c. details regarding how any chemical or NORM has been or will be managed;
  - d. details regarding how any chemical or NORM has been or will be transported;
  - e. details regarding how any chemical or NORM has been or will be treated;
  - f. details regarding any action proposed to be taken to prevent any chemical or NORM spill;
  - g. details of the emergency contingency plan included in the environment management plan to which the activity relates;
  - h. the requirements in relation to the management of any chemical or NORM of the prescribed chemical legislation

Detail regarding how any chemical or NORM will be managed, transported or treated (requirements 2(c) through 2(e) of Regulation 37A) is provided in Sections 3.3, 7.5 and Appendix G (Wastewater Management Plan) (Santos, 2021). Requirements 2(f) through 2(g) of Regulation 37A are addressed in Section 7.6, Appendix H (SMP) and Appendix K (Drilling and Completions Emergency and Well Control Response Plan) of the EMP (Santos, 2021). Management of chemicals or NORM, requirement 2[h] of Regulation 37A, is addressed in 3.3 of the EMP.

The following sections discuss the data used in the risk assessment and presents the avian and terrestrial soil risk assessments.

## Data Used in the Risk Assessment

Flowback water from the Tanumbirini 2H and Tanumbirini 3H wells is conveyed along the flowlines to the bunded area and managed and comingled in four storage tanks. Flowback samples for Tanumbirini 2H and Tanumbirini 3H were collected weekly directly from flowlines from the well to the storage tanks from 1 January 2022 to 4 May 2022. Six samples were collected from the concept



tanks from 2 February 2022 through 17 May 2022. **Attachment A** presents the analytical data from the weekly sampling and storage tanks.

Based on the CEM, the point of exposure for receptors is flowback water stored in an open-top tank. Additionally, the terrestrial assessment evaluates releases of flowback water from these tanks. As the flowback water is managed through multiple tanks, the six samples collected from the flowback water tanks will be used in this risk assessment.

## Avian Risk Assessment

This avian risk assessment is focused on potential exposure of avian receptors to chemicals detected above screening criteria in flowback water samples collected from the storage tanks. Laboratory analyses of these wastewater samples for inorganic, organic and radionuclide analytes have been completed pursuant to the monitoring wastewater chemistry analytes specified in Section C.8 of the Code of Practice: Onshore Petroleum Activities in the Northern Territory (Northern Territory Government, 2019).

Consistent with the March 2020 avian risk assessment (EHS Support, 2020a), this avian risk assessment conducted on the flowback/produced water samples included the following two steps:

1. Screening Assessment – Identify chemicals of low ecological concern that do not require additional evaluation in the risk assessment process based on a comparison to the Australian and New Zealand Guidelines (ANZG) for Fresh & Marine Water Quality (ANZG, 2018) trigger values or, absent such values, alternative screening criteria as noted in **Attachment B**.
2. Quantitative Risk Evaluation – Identify chemicals that are a concern for avian receptors, and therefore require an additional evaluation to characterise the potential risks. The potential exposure was assessed using a quantitative evaluation of the potentially complete avian exposure pathway and the screening assessment.

As noted above, the Quantitative Risk Evaluation methods used below are identical to those used for the hydraulic fracturing risk assessment and flowback/produced water risk assessment conducted prior to approval and undertaking of the activities at the Tanumbirini 2H and Tanumbirini 3H wells Site (EHS Support, 2019 and 2020a).

## Screening Assessment

The screening assessment consisted of a focused evaluation of the potential risks to avian receptors if exposed to chemicals detected in flowback/produced water samples (**Attachment B**). The objective of the screening assessment was to identify chemicals of low concern to avian receptors that do not require additional evaluation in the risk assessment process.

The screening assessment used freshwater trigger values (ANZG, 2018) which are deemed to be protective of aquatic species such as fish, invertebrates and algae assuming chronic, continual and prolonged contact with surface water at a 95 percent protection level. In instances where no trigger values were available, alternative screening criteria were employed and are noted as such in **Attachment B**. Inherently this approach is considered highly conservative given the following:



- In toxicological testing, aquatic species are more sensitive than terrestrial species to chemicals due to their emersion within the fluid, additional modes of action (for example, impacts on gill function) and the potential for secondary stressors to impact health.
- Even if exposed, avian receptors will have limited periods of duration in contact with the fluids. Roosting, breeding and continuous access will not occur on the water body; therefore, contact will be episodic in nature and possibly only involve ingestion during dry periods.

Chemicals detected in the flowback/produced water samples with concentrations exceeding the conservatively adopted water quality criteria were carried through the quantitative risk evaluation.

The detected chemicals analysed in the wastewater samples that had concentrations exceeding the conservatively adopted water quality criteria and that may pose a potential risk to avian receptors include:

- Boron
- Zinc
- Aluminium
- Chromium
- Copper
- Nickel
- Uranium
- Ammonia
- Total Nitrogen, as N
- Total Phosphorus as P
- >C10 - C16 Fraction minus Naphthalene (F2)
- >C16 - C34 Fraction (F3)
- Gross alpha
- Gross beta

It should be noted that the gross alpha and gross beta screening criteria are only generic screening values and, consistent with the Australian Drinking Water Guidelines (National Health and Medical Research Council [NHMRC], National Resource Management Ministerial Council [NRMMC], 2011, and as updated), triggers a more detailed assessment. As outlined in the detailed assessment framework, an order-of-magnitude higher radiological exposure is acceptable as the natural background is higher than the screening level and thresholds for active intervention have been established at corresponding doses 10 to 50 times higher than the corresponding screening value. Thus, gross alpha and gross beta detected at levels of 0.76 becquerels per litre (Bq/L) and 0.73 Bq/L, respectively, require no further evaluation.

**Attachment B** presents the results of the screening level assessment.

### Quantitative Risk Assessment

Potential exposure of avian receptors to the chemicals of concern in the flowback/produced water samples was quantitatively assessed for representative avian species that were previously evaluated in the chemical risk assessments (EHS Support, 2019 and 2020a). The potential avian exposure pathway was assessed based on the potential ingestion of flowback/produced water by avian receptors using standard methods and in accordance with the methodologies used in the previous avian risk assessments.

Potential dietary intake of water containing these chemicals was compared to toxicity reference values (TRVs) developed specifically for avian wildlife. Exposure assumptions for the dietary intake and TRV development were designed to be conservative to reduce uncertainty in the quantitative risk estimates. The potential risks were estimated using a chemical-specific hazard quotient (HQ). A hazard index (HI) is the sum of the HQs on an avian species-specific basis. A potential HI threshold level of less than 1 indicates there are no unacceptable exposures to the avian species.



**Table 1** summarises the results of the quantitative risk evaluation and includes a short-term (21-day) and long-term (1-year) scenario of fluid exposure that aligns with the current approach of off-site transportation and management of fluids and a possible future scenario with possible longer-term storage on-site. The HIs for all the assessed avian species were orders of magnitude less than the threshold HI of 1 for the 21-day scenario exposure scenarios and did not exceed the HI target of 1 under the longer-term on-site storage scenario. Therefore, there were no unacceptable exposures to the avian species from potential ingestion of chemicals in flowback/produced water.

**Table 1 Hazard indices for target avian species exposed to wastewater**

Avian Species	Hazard Index for 21 days of Storage	Hazard Index for 1 year of Storage
Crested Pigeon	2.6E-02	4.5E-01
Willie Wagtail	3.1E-02	5.4E-01
Peaceful Dove	2.9E-03	5.0E-01
Cattle Egret	2.5E-03	4.3E-01
Brown Honeyeater	3.3E-02	5.7E-01

**Attachment C** presents the detailed calculations and outcomes of the quantitative risk evaluation for the target avian species in **Table 1**.

### Avian Risk Assessment Conclusions

This avian risk assessment was conducted consistent with the results of the previous risk assessments conducted prior to the approval of the activities at the Tanumbirini 2H and Tanumbirini 3H wells Site (EHS Support, 2019 and 2020a). The screening assessment and quantitative risk assessment concluded there is no unacceptable risk to avian receptors from flowback from these wells stored at the Site in open-top tanks.

### Terrestrial Soil Risk Assessment

This terrestrial soil risk assessment was conducted assuming chemicals detected in flowback water samples would ultimately be incorporated into soils within the bund that could pose an exposure risk to terrestrial receptors. Consistent with the 2020 Terrestrial Soil Exposure Risk Assessment (EHS Support, 2020b), to assess a potential release of liquids to soil within the containment area, concentrations of chemicals in soil that would result from a release of flowback/produced water to soil within the bunded area were calculated. These concentrations were compared, where possible, to ecological soil screening criteria.

### Calculation of Chemical Concentrations in Soil

The Tanumbirini 1 terrestrial risk assessment evaluated the potential for a release of flowback from the tank to the bunded area soils (EHS Support, 2020b). The vertical depth of associated infiltration from this hypothetical release was estimated as 1 metre (m) based on modelling (EHS Support, 2019). Using this information, the area of the compound and the depth of infiltration of the volume of affected soil were calculated at 20,000 cubic metres (m<sup>3</sup>). Maximum and median concentrations of detected chemicals in flowback/produced water from the sampled flowback/produced water



samples were used to determine their respective maximum and median concentrations in soils ( $C_{\text{soil}}$ ) according to Equation 1 below.

$$C_{\text{soil}} = C_{\text{wat}} \times V_{\text{tank}} / M_{\text{soil}} / D_{\text{soil}} \quad \text{Eq. 1}$$

Where:

- $C_{\text{wat}}$  = maximum detected concentration of chemical in wastewater from four wells
- $V_{\text{tank}}$  = volume of the largest enclosed storage tank in the event of a complete release (litres [L])
- $M_{\text{soil}}$  = mass of soil ( $2 \times 10^4 \text{ m}^3$ )
- $D_{\text{soil}}$  = bulk density of soil (1,350 kilograms per cubic metre [ $\text{kg}/\text{m}^3$ ])

The volume of water in the tank, which is the maximum storage volume for one of the tanks within the bunded area on the Site is approximately 7 megalitres (ML;  $7 \times 10^6 \text{ L}$ ). Including 0.3 m freeboard, the maximum storage in covered tanks is reduced to approximately 6.48 ML. For uncovered tanks containing flowback, freeboard is increased to 1.5 m, and tank volumes are further reduced to 4.22 ML. Measured total flowback volumes stored within individual tanks range from a maximum of 1.52 ML to 3.23 ML. Conservatively, a maximum volume of 6.48 ML was used in the calculation of soil concentrations.

### Screening Assessment

Chemical calculated maximum and median soil concentrations are presented in **(Attachment D)**. These concentrations reflect a range of chemical concentrations potentially expected in the 1-m stratum of soil adjacent to the enclosed storage tanks as a result of a release from a tank. Ecological soil screening levels defined by National Environment Protection (Assessment of Site Contamination) Measure (ASC NEPM) were used to determine a ratio of the calculated concentration in soil to screening criteria. In certain instances, where NEPM values were not available, other data available from the European Union, the United States Environmental Protection Agency, or background threshold values for the McArthur Basin surficial soils were used as the screening level.

To determine whether the maximum or median soil concentrations exceeded the screening level, a ratio of the soil concentration to the screening levels was calculated. If the ratio exceeded 1, the estimated concentration for the chemical exceeded the screening level.

No ratios exceeded 1; therefore, the calculated soil concentrations for both the maximum and median flowback concentrations did not exceed the screening levels. Given that the predicted soil concentration was based on a potential maximum tank volume (including freeboard of 0.3 m) it is unlikely that a potential release to soils within the bunded area of stored flowback water would result in an unacceptable level of ecological risks.

### Conclusions and Recommendations

Pursuant to Condition 7 of the EMP approval (DEWPS, 2021), a risk assessment of flowback water from the hydraulic fracturing phase of Tanumbirini 2H and Tanumbirini 3H was conducted. This assessment included determination of potential risk to avian receptors exposed to flowback from wells Tanumbirini 2H and Tanumbirini 3H. Additionally, an assessment was conducted of a potential release of flowback water to soils within the bunded area. As noted above, the risk evaluation methods used are consistent with those used for the hydraulic fracturing fluid risk assessment



conducted prior to approval of the activities at the Tanumbirini well Site and the previous avian risk assessment and terrestrial assessment conducted for flowback from Tanumbirini 1 (EHS Support, 2019, 2020a, 2020b).

Consistent with the results of the previous avian risk assessments (EHS Support, 2019 and 2020a), this risk assessment conducted for the avian receptors potentially exposed to flowback/produced water concluded there is no unacceptable risk to these receptors potentially exposed to chemicals in the Tanumbirini 2H and 3H flowback water samples. Therefore, with respect to avian use of flowback water from wells Tanumbirini 2H and Tanumbirini 3H and the approved Site activities and associated management controls, no further action is recommended.

Likewise, a screening assessment was performed to determine the potential risk to terrestrial receptors exposed to soils affected by Tanumbirini 2H and Tanumbirini 3H flowback water based on a hypothetical release scenario. The assessment consisted of a screening level evaluation to determine if a further quantitative risk assessment would be required to assess the potential risk to terrestrial receptors. This screening level risk assessment concluded that no chemicals detected in the flowback water at their maximum or median concentrations, under a hypothetical maximum release scenario, would result in soil levels above screening criteria protective of terrestrial receptors. Therefore, with the approved Site activities and associated management controls (e.g., maintenance of measures outlined in the SMP), no further action is recommended.

These findings are consistent with the chemical risk assessment that was developed and submitted with the EMP (EHS Support, 2019) and the subsequent risk assessments conducted for flowback water from the Tanumbirini 1 well (EHS Support, 2020a and 2020b), which also concluded that there were no unacceptable risks to avian or terrestrial receptors. This risk assessment satisfies Condition 7 of the EMP approval (DEPWS, 2021) and requirements 2(a) and 2(b) of Regulation 37A of the Petroleum (Environment) Regulations 2016 (Northern Territory Government, 2021). As noted previously, requirements 2(c) through 2(h) of Regulation 37A are addressed in the EMP.

## References

ANZG. 2018. Australian and New Zealand Guidelines for Fresh & Marine Water Quality. Available online at: <https://www.waterquality.gov.au/anz-guidelines/guideline-values/default>

DEPWS. 2021. Approval notice and statement of reason. 10 June.

EHS Support. 2019. Beetaloo McArthur Basin Hydraulic Fracturing Fluid System - Chemical Risk Assessment. 03 July.

EHS Support. 2020a. Memorandum RE: Tanumbirini Flowback Wastewater - Avian Risk Assessment, EP-161, McArthur Basin.

EHS Support. 2020b. Memorandum RE: Tanumbirini Wastewater - Terrestrial Soil Exposure Risk Assessment, EP-161, McArthur Basin.



NHMRC, NRMCC. 2011. Australian Drinking Water Guidelines Paper 6 National Water Quality Management Strategy. National Health and Medical Research Council, National Resource Management Ministerial Council, Commonwealth of Australia, Canberra. Updated January 2022. Available: <https://www.nhmrc.gov.au/about-us/publications/australian-drinking-water-guidelines>

Northern Territory Government. 2019. Code of Practice: Onshore Petroleum Activities in the Northern Territory. 31 May.

Northern Territory Government. 2021. Petroleum (Environment) Regulations 2016. 1 January 2021.

Santos. 2021. Environment Management Plan: McArthur Basin Hydraulic Fracturing Program. NT Exploration Permit (EP) 161. May.





## Attachment A Tanumbirini Wells 2H and 3H Analytical Data

**Attachment A-1**  
**Tanumbirini Wells 2H and 3H Weekly Samples**  
**Tanumbirini 2H/3H Flowback Wastewater - Risk Assessment, EP-161, McArthur Basin**  
**Katherine, Northern Territory**  
**Santos Ltd.**

METHOD	PARAMETER-CHEMICAL	FRACTION	LOR	UNIT	FACILITY	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN		
					SAMPLE_DATE	1/1/2022	1/4/2022	1/11/2022	1/19/2022	1/26/2022	2/2/2022	2/11/2022	2/15/2022	2/22/2022	3/7/2022	3/9/2022	3/17/2022
					LOCATION	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	
					DESCRIPTION	TANUMBIRINI 2 FLOWBACK	TANUMBIRINI 2 FLOWBACK	TANUMBIRINI 2 FLOWBACK	TANUMBIRINI 2 FLOWBACK	TANUMBIRINI 2 FLOWBACK	TANUMBIRINI 2 FLOWBACK	TANUMBIRINI 2 FLOWBACK	TANUMBIRINI 2 FLOWBACK	TANUMBIRINI 2 FLOWBACK	TANUMBIRINI 2 FLOWBACK	TANUMBIRINI 2 FLOWBACK	
					WORK ORDER	EB2200426	EB2200425	EB2200626	EB2201600	EB2202044	EB2203092	EB2204027	EB2204324	EB2205345	EB2206798	EB2206798	EB2207570
					SAMPLE TYPE	N	N	N	N	N	N	N	N	N	N	N	N
					RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT
APHA 3125 B	Boron	D	100	µg/L	23500	22400			19900			16800	21300		20100		
APHA 3125 B	Boron	D	1000	µg/L									20100				
APHA 3125 B	Boron	D	10000	µg/L													16500
APHA 3125 B	Boron	D	5	µg/L				18400									
APHA 3125 B	Boron	D	500	µg/L													13700
APHA 3125 B	Boron	T	105	µg/L	24000	23700			20000			18700	20400	20400	19400	20900	16600
APHA 3125 B	Boron	T	210	µg/L								23800					
APHA 3125 B	Boron	T	5	µg/L				24400		10200							
APHA 3125 B	Selenium	D	0.5	µg/L				1.3									
APHA 3125 B	Selenium	D	10	µg/L									< 10				
APHA 3125 B	Selenium	D	100	µg/L													< 100
APHA 3125 B	Selenium	D	2	µg/L	5	5			12		9	8		7			
APHA 3125 B	Selenium	D	5	µg/L													12
APHA 3125 B	Selenium	T	0.2	µg/L						0.5							
APHA 3125 B	Selenium	T	0.5	µg/L			< 0.5										
APHA 3125 B	Selenium	T	2	µg/L	7	6			21		15	9	< 2	9	13	19	< 2
APHA 3125 B	Zinc	D	2	µg/L				14									
APHA 3125 B	Zinc	D	25	µg/L													< 25
APHA 3125 B	Zinc	D	5	µg/L	< 5	< 5			35		16	7		8			
APHA 3125 B	Zinc	D	50	µg/L									< 50				
APHA 3125 B	Zinc	D	500	µg/L													< 500
APHA 3125 B	Zinc	T	1	µg/L						603							
APHA 3125 B	Zinc	T	10	µg/L								20					
APHA 3125 B	Zinc	T	5	µg/L	36	57	42	821			41		22	34	54	25	27
APHA_1030F	Ionic Balance	N	0.01	%	0.65	0.59	4.69	4.71	9.96		1.2	3.48	4.74	2.23	0.38	0.23	5.1
APHA_1030F	Total Anions	N	0.01	meq/L	249	253	265	275	355	301	280	277	280	218	237	205	
APHA_1030F	Total Cations	N	0.01	meq/L	252	256	291	302	290	294	300	305	293	219	238	185	
APHA_2320_B	Bicarbonate Alkalinity as CaCO3	N	1	mg/L	748	708	606	487	465	485	458	449	370	219	203	158	
APHA_2320_B	Carbonate Alkalinity as CaCO3	N	1	mg/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
APHA_2320_B	Hydroxide Alkalinity as CaCO3	N	1	mg/L	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
APHA_2320_B	Total Alkalinity as CaCO3	N	1	mg/L	748	708	606	487	465	485	458	449	370	219	203	158	
APHA_2510_B	Electrical Conductivity @ 25°C	N	1	µS/cm	24100	25800	28000	26200	23200	27500	28700	27700	27900	22300	23500	24200	
APHA_2540_C	Total Dissolved Solids @180°C	T	10	mg/L	15200	16700	18900	20600	18500	18700	19000	18300	16700	13300	14900	12900	
APHA_2540_D	Suspended Solids	N	5	mg/L	441	76	206	144	181	98	68	76	126	199	317	352	
APHA_3112_CV_FIMS	Mercury	D	0.0001	mg/L	< 0.0001	< 0.0001	< 0.0001		< 0.0001	< 0.0001	< 0.0001		< 0.0001	< 0.0001	< 0.0001		
APHA_3112_CV_FIMS	Mercury	D	0.0005	mg/L													
APHA_3112_CV_FIMS	Mercury	D	0.005	mg/L				< 0.0050				< 0.0050					< 0.0050
APHA_3112_CV_FIMS	Mercury	T	0.0001	mg/L	< 0.0001	< 0.0001		0.0002	< 0.0001		0.0005				0.0018	0.0016	0.0011
APHA_3112_CV_FIMS	Mercury	T	0.0005	mg/L			< 0.0005					0.0009		0.0014			
APHA_3112_CV_FIMS	Mercury	T	0.001	mg/L													
APHA_3112_CV_FIMS	Mercury	T	0.005	mg/L									< 0.0050				
APHA_3112_CV_FIMS	Mercury	T	0.010	mg/L													
APHA_3120	Calcium	D	1	mg/L	166	158	210	225	221	307	273	186	266	169	188		
APHA_3120	Calcium	D	5	mg/L													99
APHA_3120	Magnesium	D	1	mg/L	77	80	98	106	102	103	100	104	94	51	56		
APHA_3120	Magnesium	D	5	mg/L													44
APHA_3120	Potassium	D	1	mg/L	49	50	138	126	102	93	80	47	81	55	57		
APHA_3120	Potassium	D	5	mg/L													50
APHA_3120	Sodium	D	1	mg/L	5430	5520	6180	6420	6170	6150	6350	6570	6210	4720	5120		
APHA_3120	Sodium	D	5	mg/L													4030
APHA_4110	Bromide	N	1.00	mg/L							172				117	130	99.2
APHA_4110	Bromide	N	2.00	mg/L	119	125	139	139	135	142		144	126				
APHA_4500_Cl	Chloride	N	1	mg/L	8290	8460				10300	9570		9660				7140
APHA_4500_Cl	Chloride	N	10	mg/L										7540	8230		

**Attachment A-1**  
**Tanumbirini Wells 2H and 3H Weekly Samples**  
**Tanumbirini 2H/3H Flowback Wastewater - Risk Assessment, EP-161, McArthur Basin**  
**Katherine, Northern Territory**  
**Santos Ltd.**

METHOD	PARAMETER-CHEMICAL	FRACTION	LOR	UNIT	FACILITY	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN		
					SAMPLE_DATE	1/1/2022	1/4/2022	1/11/2022	1/19/2022	1/26/2022	2/2/2022	2/11/2022	2/15/2022	2/22/2022	3/7/2022	3/9/2022	3/17/2022
					LOCATION	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	
					DESCRIPTION	TANUMBIRINI 2 FLOWBACK	TANUMBIRINI 2 FLOWBACK	TANUMBIRINI 2 FLOWBACK	TANUMBIRINI 2 FLOWBACK	TANUMBIRINI 2 FLOWBACK	TANUMBIRINI 2 FLOWBACK	TANUMBIRINI 2 FLOWBACK	TANUMBIRINI 2 FLOWBACK	TANUMBIRINI 2 FLOWBACK	TANUMBIRINI 2 FLOWBACK	TANUMBIRINI 2 FLOWBACK	
					WORK ORDER	EB2200426	EB2200425	EB2200626	EB2201600	EB2202044	EB2203092	EB2204027	EB2204324	EB2205345	EB2206798	EB2206798	EB2207570
					SAMPLE TYPE	N	N	N	N	N	N	N	N	N	N	N	N
APHA_4500_Cl	Chloride	N	5	mg/L				8910	9370				9510				
APHA_4500_Cl	Chloride	N	50	mg/L						12200							
APHA_4500_Cl_G	Free Chlorine	N	0.02	mg/L				< 0.02	< 0.02			< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
APHA_4500_Cl_G	Total Residual Chlorine	N	0.02	mg/L				< 0.02	< 0.02			< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
APHA_4500_CN_O	Total Cyanide	T	0.004	mg/L	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
APHA_4500_F_C	Fluoride	N	0.1	mg/L	1.5	1.5	1.4	1.3	1.1	1	0.9	0.8	0.7	< 0.1	< 0.1	< 0.1	< 0.1
APHA_4500_H_B	pH - Lab	N	0.01	pH Unit	7.09	7.07	7.2	7.06	7.67	6.77	7.07	7.54	7.25	7.02	6.8	6.54	6.54
APHA_4500_NH3_G	Ammonia as N	N	0.01	mg/L	16	15.5											0.77
APHA_4500_NH3_G	Ammonia as N	N	0.05	mg/L			17.1										
APHA_4500_NH3_G	Ammonia as N	N	0.10	mg/L				19.1									
APHA_4500_NH3_G	Ammonia as N	N	0.50	mg/L					31.1	17.4				22.4	19.2		
APHA_4500_NH3_G	Ammonia as N	N	1.00	mg/L							19.1	21	21.3				
APHA_4500_NO2_B	Nitrite as N	N	0.01	mg/L						0.03	< 0.01		< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
APHA_4500_NO2_B	Nitrite as N	N	0.05	mg/L	< 0.05		< 0.05	< 0.05				< 0.05					
APHA_4500_NO2_B	Nitrite as N	N	0.10	mg/L		< 0.10											
APHA_4500_NO2_B	Nitrite as N	N	0.50	mg/L					< 0.50								
APHA_4500_NO3_F	Nitrate as N	N	0.01	mg/L						< 0.01	< 0.01			0.04	0.04	< 0.01	
APHA_4500_NO3_F	Nitrate as N	N	0.05	mg/L	< 0.05		< 0.05	< 0.05				< 0.05					
APHA_4500_NO3_F	Nitrate as N	N	0.1	mg/L		0.31							< 0.1				
APHA_4500_NO3_F	Nitrate as N	N	0.5	mg/L					< 0.5								
APHA_4500_NORG_D	Total Kjeldahl Nitrogen as N	N	0.1	mg/L													
APHA_4500_NORG_D	Total Kjeldahl Nitrogen as N	N	0.5	mg/L	42.8			63		59.4	51.4	54	51.8	43.3	44.2	40.9	40.9
APHA_4500_NORG_D	Total Kjeldahl Nitrogen as N	N	1.0	mg/L			56.7		61.4								
APHA_4500_NORG_D	Total Kjeldahl Nitrogen as N	N	10.0	mg/L		51.5											
APHA_4500_NORG+NO3	Total Nitrogen as N	N	0.1	mg/L													
APHA_4500_NORG+NO3	Total Nitrogen as N	N	0.5	mg/L	42.8			63		59.4	51.4	54	51.8	43.3	44.2	40.9	40.9
APHA_4500_NORG+NO3	Total Nitrogen as N	N	1	mg/L			56.7		61.4								
APHA_4500_NORG+NO3	Total Nitrogen as N	N	10	mg/L		51.6											
APHA_4500_P_E	Reactive Phosphorus as P	T	0.01	mg/L	< 0.01					0.02	0.06		0.06	< 0.01	0.02		
APHA_4500_P_E	Reactive Phosphorus as P	T	0.02	mg/L		< 0.02		0.04				< 0.02					
APHA_4500_P_E	Reactive Phosphorus as P	T	0.05	mg/L		< 0.05										< 0.05	
APHA_4500_P_E	Reactive Phosphorus as P	T	0.25	mg/L				< 0.25									
APHA_4500_P_H	Total Phosphorus as P	T	0.01	mg/L													
APHA_4500_P_H	Total Phosphorus as P	T	0.05	mg/L	< 0.05			1.13		0.59	0.52	0.51	0.33	0.1	0.16	0.07	0.07
APHA_4500_P_H	Total Phosphorus as P	T	0.10	mg/L			1.31		0.77								
APHA_4500_P_H	Total Phosphorus as P	T	0.20	mg/L		1.42											
APHA_4500_P_H	Total Phosphorus as P	T	1.00	mg/L													
APHA_4500_SIO2	Reactive Silica	N	0.05	mg/L	119	114		142	127		61.6		41.1	11.9	7.49	9.16	9.16
APHA_4500_SIO2	Reactive Silica	N	0.25	mg/L			117					75.7					
APHA_4500_SIO2	Reactive Silica	N	1.00	mg/L					81.9								
APHA_4500_SO4_E	Sulfate as SO4 2-	D	1	mg/L	< 1	3				29	38		25				22
APHA_4500_SO4_E	Sulfate as SO4 2-	D	10	mg/L										30	40		
APHA_4500_SO4_E	Sulfate as SO4 2-	D	5	mg/L			66	56				< 5					
APHA_4500_SO4_E	Sulfate as SO4 2-	D	50	mg/L					60								
APHA_5310_B_DOC	Dissolved Organic Carbon	N	10	mg/L				342									
APHA_5310_B_DOC	Dissolved Organic Carbon	N	100	mg/L			390										
APHA_5310_B_DOC	Dissolved Organic Carbon	N	20	mg/L													
APHA_5310_B_DOC	Dissolved Organic Carbon	N	5	mg/L	314	425			300	261	245	233	216	167	178	132	132
APHA_5310_B_DOC	Dissolved Organic Carbon	N	1	mg/L			426										
APHA_5310_B_DOC	Dissolved Organic Carbon	N	10	mg/L				497									
APHA_5310_B_DOC	Dissolved Organic Carbon	N	20	mg/L													
APHA_5310_B_DOC	Dissolved Organic Carbon	N	5	mg/L	327	426			458	383	352	272	262	171	194	159	159
ASTM_D_6303-98	Formaldehyde	N	0.1	mg/L				7.6	5.4					2		4.9	4.9
ASTM_D_6303-98	Formaldehyde	N	0.2	mg/L									4				

**Attachment A-1**  
**Tanumbirini Wells 2H and 3H Weekly Samples**  
**Tanumbirini 2H/3H Flowback Wastewater - Risk Assessment, EP-161, McArthur Basin**  
**Katherine, Northern Territory**  
**Santos Ltd.**

METHOD	PARAMETER-CHEMICAL	FRACTION	LOR	UNIT	FACILITY	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN		
					SAMPLE_DATE	1/1/2022	1/4/2022	1/11/2022	1/19/2022	1/26/2022	2/2/2022	2/11/2022	2/15/2022	2/22/2022	3/7/2022	3/9/2022	3/17/2022
					LOCATION	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	
					DESCRIPTION	TANUMBIRINI 2	TANUMBIRINI 2	TANUMBIRINI 2	TANUMBIRINI 2	TANUMBIRINI 2	TANUMBIRINI 2	TANUMBIRINI 2	TANUMBIRINI 2	TANUMBIRINI 2	TANUMBIRINI 2	TANUMBIRINI 2	
					WORK ORDER	EB2200426	EB2200425	EB2200626	EB2201600	EB2202044	EB2203092	EB2204027	EB2204324	EB2205345	EB2206798	EB2206798	EB2207570
					SAMPLE TYPE	N	N	N	N	N	N	N	N	N	N	N	N
					RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT
ASTM_D_6303-98	Formaldehyde	N	0.4	mg/L								7.4	7.4				9.5
ASTM_D_6303-98	Formaldehyde	N	2.0	mg/L							15.8						
ASTM_D_6303-98	Formaldehyde	N	4.0	mg/L	15.6		15.2	9.2									
CSN_75_7611_75_7612	Gross alpha	N	0.05	Bq/L			0.79										
CSN_75_7611_75_7612	Gross alpha	N	0.30	Bq/L													
CSN_75_7611_75_7612	Gross alpha	N	0.32	Bq/L											0.77		
CSN_75_7611_75_7612	Gross alpha	N	0.37	Bq/L													
CSN_75_7611_75_7612	Gross alpha	N	0.38	Bq/L													< 0.38
CSN_75_7611_75_7612	Gross alpha	N	0.39	Bq/L													
CSN_75_7611_75_7612	Gross alpha	N	0.40	Bq/L	0.75												0.98
CSN_75_7611_75_7612	Gross alpha	N	0.42	Bq/L										1.47			
CSN_75_7611_75_7612	Gross alpha	N	0.44	Bq/L													
CSN_75_7611_75_7612	Gross alpha	N	0.45	Bq/L													
CSN_75_7611_75_7612	Gross alpha	N	0.46	Bq/L								1.87	1.48				
CSN_75_7611_75_7612	Gross alpha	N	0.47	Bq/L													
CSN_75_7611_75_7612	Gross alpha	N	0.48	Bq/L				1.32	2.29	1.28							
CSN_75_7611_75_7612	Gross alpha	N	2.60	Bq/L			< 2.60										
CSN_75_7611_75_7612	Gross beta activity - 40K	N	0.10	Bq/L			0.38										
CSN_75_7611_75_7612	Gross beta activity - 40K	N	0.60	Bq/L													
CSN_75_7611_75_7612	Gross beta activity - 40K	N	0.65	Bq/L											< 0.65		
CSN_75_7611_75_7612	Gross beta activity - 40K	N	0.74	Bq/L													
CSN_75_7611_75_7612	Gross beta activity - 40K	N	0.76	Bq/L													
CSN_75_7611_75_7612	Gross beta activity - 40K	N	0.77	Bq/L													< 0.77
CSN_75_7611_75_7612	Gross beta activity - 40K	N	0.78	Bq/L													
CSN_75_7611_75_7612	Gross beta activity - 40K	N	0.80	Bq/L	< 0.80												1.24
CSN_75_7611_75_7612	Gross beta activity - 40K	N	0.83	Bq/L													
CSN_75_7611_75_7612	Gross beta activity - 40K	N	0.85	Bq/L										0.91			
CSN_75_7611_75_7612	Gross beta activity - 40K	N	0.89	Bq/L													
CSN_75_7611_75_7612	Gross beta activity - 40K	N	0.90	Bq/L													
CSN_75_7611_75_7612	Gross beta activity - 40K	N	0.93	Bq/L							< 0.93	< 0.93					
CSN_75_7611_75_7612	Gross beta activity - 40K	N	0.94	Bq/L													
CSN_75_7611_75_7612	Gross beta activity - 40K	N	0.95	Bq/L				< 0.95	< 0.95								
CSN_75_7611_75_7612	Gross beta activity - 40K	N	0.96	Bq/L													
CSN_75_7611_75_7612	Gross beta activity - 40K	N	0.97	Bq/L				< 0.97									
CSN_75_7611_75_7612	Gross beta activity - 40K	N	5.19	Bq/L			< 5.19										
FIELD MEASURE	Dissolved Oxygen - Field	N		mg/L	0	0	3.3		0	0	0	0	0	0	0	0	0
FIELD MEASURE	Electrical Conductivity - Field	N		µS/cm	27330	28630	30510	31490	28920	29450	27800	28460	27080	20380	20380	20380	20660
FIELD MEASURE	Field Ambient Temperature	N		°C	30.28	34.97	25.87	27.07	25.43	27.71	23.75	28.12	29.36	28.17	20.86	28.34	
FIELD MEASURE	pH - Field	N		pH Unit	6.45	7.5	7.22	7.16	6.78	6.83	6.59	6.77	6.73	6.64	7.03	6.41	
IN_HOUSE_LC-MSMS_EDC	2,4-Dinitrophenol	N	0.01	µg/L	< 0.01		< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	
IN_HOUSE_LC-MSMS_EDC	2-Methyl-4,6-dinitrophenol	N	0.05	µg/L			< 0.05	< 0.05									
IN_HOUSE_LC-MSMS_EDC	2-Methyl-4,6-dinitrophenol	N	0.10	µg/L	< 0.10		< 0.10										
IN_HOUSE_LC-MSMS_EDC	4-Chloro-3-Methylphenol	N	0.10	µg/L	0.3		0.21	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	
IN_HOUSE_LC-MSMS_EDC	4-Nitrophenol	N	0.10	µg/L	< 0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	
IN_HOUSE_LC-MSMS_EDC	Dinoseb	N	0.10	µg/L	< 0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	
IN_HOUSE_LC-MSMS_EDC	Hexachlorophene	N	0.10	µg/L			< 0.10	< 0.10									
IN_HOUSE_LC-MSMS_EDC	Hexachlorophene	N	0.50	µg/L	< 0.50		< 0.50		< 0.50	< 0.50		< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	
USEPA_6020	Aluminium	D	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	
USEPA_6020	Aluminium	D	0.50	mg/L													< 0.50
USEPA_6020	Aluminium	T	0.01	mg/L													0.09
USEPA_6020	Aluminium	T	0.05	mg/L	< 0.05	< 0.05	< 0.05	0.37	< 0.05	< 0.05	0.08	0.1	0.11	0.1	0.08		
USEPA_6020	Antimony	D	0.001	mg/L													
USEPA_6020	Antimony	D	0.005	mg/L	0.009	0.007	0.011	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	
USEPA_6020	Antimony	D	0.050	mg/L													< 0.050

**Attachment A-1**  
**Tanumbirini Wells 2H and 3H Weekly Samples**  
**Tanumbirini 2H/3H Flowback Wastewater - Risk Assessment, EP-161, McArthur Basin**  
**Katherine, Northern Territory**  
**Santos Ltd.**

METHOD	PARAMETER-CHEMICAL	FRACTION	LOR	UNIT	FACILITY	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	
					SAMPLE_DATE	1/1/2022	1/4/2022	1/11/2022	1/19/2022	1/26/2022	2/2/2022	2/11/2022	2/15/2022	2/22/2022	3/7/2022	3/9/2022
					LOCATION	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	
					DESCRIPTION	TANUMBIRINI 2	TANUMBIRINI 2	TANUMBIRINI 2	TANUMBIRINI 2	TANUMBIRINI 2	TANUMBIRINI 2	TANUMBIRINI 2	TANUMBIRINI 2	TANUMBIRINI 2	TANUMBIRINI 2	
					WORK ORDER	EB2200426	EB2200425	EB2200626	EB2201600	EB2202044	EB2203092	EB2204027	EB2204324	EB2205345	EB2206798	
					SAMPLE TYPE	N	N	N	N	N	N	N	N	N	N	
					RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	
USEPA_6020	Antimony	T	0.001	mg/L												0.001
USEPA_6020	Antimony	T	0.005	mg/L	0.01	0.018	0.015	0.009	< 0.005	< 0.005	< 0.005	< 0.005	0.006	< 0.005	< 0.005	
USEPA_6020	Arsenic	D	0.005	mg/L	0.009	< 0.005	< 0.005	0.006	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	
USEPA_6020	Arsenic	D	0.050	mg/L												< 0.050
USEPA_6020	Arsenic	T	0.001	mg/L												0.005
USEPA_6020	Arsenic	T	0.005	mg/L	0.008	0.014	0.02	0.025	0.014	0.013	0.036	0.009	0.005	0.016	0.016	
USEPA_6020	Barium	D	0.001	mg/L												
USEPA_6020	Barium	D	0.005	mg/L	5.9	6.09	8.78		12.5	13.1	13.7	2.99	13	5.46	4.65	
USEPA_6020	Barium	D	0.010	mg/L				10.8								
USEPA_6020	Barium	D	0.050	mg/L												1.5
USEPA_6020	Barium	T	0.001	mg/L												2.3
USEPA_6020	Barium	T	0.005	mg/L	8.42	10.5	6.71	11.8	11	17.5	14.7	16.2	16.3	7.96	7.31	
USEPA_6020	Beryllium	D	0.005	mg/L	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	
USEPA_6020	Beryllium	D	0.050	mg/L												< 0.050
USEPA_6020	Beryllium	T	0.001	mg/L												< 0.001
USEPA_6020	Beryllium	T	0.005	mg/L	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	
USEPA_6020	Cadmium	D	0.0005	mg/L	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	
USEPA_6020	Cadmium	D	0.005	mg/L												< 0.0050
USEPA_6020	Cadmium	T	0.0001	mg/L												< 0.0001
USEPA_6020	Cadmium	T	0.0005	mg/L	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	
USEPA_6020	Chromium	D	0.005	mg/L	0.146	0.097	0.164	0.245	0.176	0.173	0.115	0.024	0.1	0.012	0.01	
USEPA_6020	Chromium	D	0.050	mg/L												< 0.050
USEPA_6020	Chromium	T	0.001	mg/L												0.442
USEPA_6020	Chromium	T	0.005	mg/L	0.191	0.292	0.265	0.36	0.307	0.332	0.337	0.354	0.361	0.721	0.564	
USEPA_6020	Cobalt	D	0.005	mg/L	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	
USEPA_6020	Cobalt	D	0.050	mg/L												< 0.050
USEPA_6020	Cobalt	T	0.001	mg/L												0.001
USEPA_6020	Cobalt	T	0.005	mg/L	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	
USEPA_6020	Copper	D	0.005	mg/L	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	
USEPA_6020	Copper	D	0.050	mg/L												< 0.050
USEPA_6020	Copper	T	0.001	mg/L												0.01
USEPA_6020	Copper	T	0.005	mg/L	0.017	< 0.005	0.011	0.011	0.009	0.006	< 0.005	0.007	0.014	0.023	0.018	
USEPA_6020	Iron	D	0.05	mg/L	0.33	1.13	3.66	44.5	6.56	32.9	24.9	< 0.05	1.93	0.15	7.22	
USEPA_6020	Iron	D	0.50	mg/L												< 0.50
USEPA_6020	Iron	T	0.05	mg/L	37.1	76.7	85.3	84.5	79.2	94.4	97.4	100	107	139	152	147
USEPA_6020	Lead	D	0.005	mg/L	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	
USEPA_6020	Lead	D	0.050	mg/L												< 0.050
USEPA_6020	Lead	T	0.001	mg/L												< 0.001
USEPA_6020	Lead	T	0.005	mg/L	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	
USEPA_6020	Manganese	D	0.005	mg/L	1.2	1.44	1.26	1.34	1.3	1.38	1.22	1.1	1.19	0.932	1.11	
USEPA_6020	Manganese	D	0.050	mg/L												0.757
USEPA_6020	Manganese	T	0.001	mg/L												1
USEPA_6020	Manganese	T	0.005	mg/L	1.79	1.42	1.48	1.31	1.32	1.52	1.5	1.47	1.4	1.08	1.22	
USEPA_6020	Molybdenum	D	0.005	mg/L	0.056	0.035	0.037	0.035	0.031	0.019	0.009	0.04	0.014	0.046	0.042	
USEPA_6020	Molybdenum	D	0.050	mg/L												< 0.050
USEPA_6020	Molybdenum	T	0.001	mg/L												0.077
USEPA_6020	Molybdenum	T	0.005	mg/L	0.054	0.067	0.05	0.086	0.068	0.043	0.037	0.037	0.035	0.228	0.181	
USEPA_6020	Nickel	D	0.005	mg/L	0.019	0.01	0.006	< 0.005	0.006	< 0.005	< 0.005	0.022	< 0.005	0.006	0.018	
USEPA_6020	Nickel	D	0.050	mg/L												< 0.050
USEPA_6020	Nickel	T	0.001	mg/L												0.009
USEPA_6020	Nickel	T	0.005	mg/L	0.007	0.006	< 0.005	0.018	0.009	< 0.005	< 0.005	< 0.005	0.012	0.028	0.036	
USEPA_6020	Silver	D	0.005	mg/L	< 0.005	< 0.005	0.006	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	
USEPA_6020	Silver	D	0.050	mg/L												< 0.050
USEPA_6020	Silver	T	0.001	mg/L												< 0.001

**Attachment A-1**  
**Tanumbirini Wells 2H and 3H Weekly Samples**  
**Tanumbirini 2H/3H Flowback Wastewater - Risk Assessment, EP-161, McArthur Basin**  
**Katherine, Northern Territory**  
**Santos Ltd.**

METHOD	PARAMETER-CHEMICAL	FRACTION	LOR	UNIT	FACILITY	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	
					SAMPLE_DATE	1/1/2022	1/4/2022	1/11/2022	1/19/2022	1/26/2022	2/2/2022	2/11/2022	2/15/2022	2/22/2022	3/7/2022	3/9/2022
					LOCATION	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	
					DESCRIPTION	TANUMBIRINI 2	TANUMBIRINI 2	TANUMBIRINI 2	TANUMBIRINI 2	TANUMBIRINI 2	TANUMBIRINI 2	TANUMBIRINI 2	TANUMBIRINI 2	TANUMBIRINI 2	TANUMBIRINI 2	
					WORK ORDER	EB2200426	EB2200425	EB2200626	EB2201600	EB2202044	EB2203092	EB2204027	EB2204324	EB2205345	EB2206798	
					SAMPLE TYPE	N	N	N	N	N	N	N	N	N	N	
					RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	
USEPA_6020	Silver	T	0.005	mg/L	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	
USEPA_6020	Strontium	D	0.005	mg/L	18.5	18.8	24.4	30	31.1	31.3	34.7	35.5	34.2	25.9	28.1	
USEPA_6020	Strontium	D	0.050	mg/L											20.3	
USEPA_6020	Strontium	T	0.001	mg/L											23	
USEPA_6020	Strontium	T	0.005	mg/L	24.1	24.6	27	30.7	31.6	36.5	34.9	36.6	38.3	28.4	32.1	
USEPA_6020	Thorium	D	0.005	mg/L	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	
USEPA_6020	Thorium	D	0.050	mg/L											< 0.050	
USEPA_6020	Thorium	T	0.001	mg/L											< 0.001	
USEPA_6020	Thorium	T	0.005	mg/L	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	
USEPA_6020	Tin	D	0.005	mg/L	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	
USEPA_6020	Tin	D	0.050	mg/L											< 0.050	
USEPA_6020	Tin	T	0.001	mg/L											< 0.001	
USEPA_6020	Tin	T	0.005	mg/L	< 0.005	< 0.005	< 0.005	0.01	< 0.005	< 0.005	0.01	< 0.005	< 0.005	< 0.005	< 0.005	
USEPA_6020	Uranium	D	0.005	mg/L	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	
USEPA_6020	Uranium	D	0.050	mg/L											< 0.050	
USEPA_6020	Uranium	T	0.001	mg/L											< 0.001	
USEPA_6020	Uranium	T	0.005	mg/L	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	
USEPA_6020	Vanadium	D	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	
USEPA_6020	Vanadium	D	0.50	mg/L											< 0.50	
USEPA_6020	Vanadium	T	0.01	mg/L											< 0.01	
USEPA_6020	Vanadium	T	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	
USEPA_8015	>C10 - C16 Fraction	N	100	µg/L									7720	4210	9500	2860
USEPA_8015	>C10 - C16 Fraction	N	140	µg/L					114000			6620				
USEPA_8015	>C10 - C16 Fraction	N	1400	µg/L			282000									
USEPA_8015	>C10 - C16 Fraction	N	1420	µg/L		72100										
USEPA_8015	>C10 - C16 Fraction	N	1440	µg/L												
USEPA_8015	>C10 - C16 Fraction	N	1500	µg/L												
USEPA_8015	>C10 - C16 Fraction	N	1830	µg/L												
USEPA_8015	>C10 - C16 Fraction	N	280	µg/L				57800		47400	20200					
USEPA_8015	>C10 - C16 Fraction	N	3950	µg/L			254000									
USEPA_8015	>C10 - C16 Fraction	N	300	µg/L												
USEPA_8015	>C10 - C16 Fraction minus Naphthalene (F2)	N	100	µg/L								7720	4210	9500	2860	
USEPA_8015	>C10 - C16 Fraction minus Naphthalene (F2)	N	140	µg/L					114000			6620				
USEPA_8015	>C10 - C16 Fraction minus Naphthalene (F2)	N	1400	µg/L			282000									
USEPA_8015	>C10 - C16 Fraction minus Naphthalene (F2)	N	1420	µg/L		72100										
USEPA_8015	>C10 - C16 Fraction minus Naphthalene (F2)	N	1440	µg/L												
USEPA_8015	>C10 - C16 Fraction minus Naphthalene (F2)	N	1500	µg/L												
USEPA_8015	>C10 - C16 Fraction minus Naphthalene (F2)	N	1830	µg/L												
USEPA_8015	>C10 - C16 Fraction minus Naphthalene (F2)	N	280	µg/L				57800		47400	20200					
USEPA_8015	>C10 - C16 Fraction minus Naphthalene (F2)	N	3950	µg/L			254000									
USEPA_8015	>C10 - C16 Fraction minus Naphthalene (F2)	N	300	µg/L												
USEPA_8015	>C10 - C40 Fraction (sum)	N	100	µg/L								10900	6130	12300	4760	
USEPA_8015	>C10 - C40 Fraction (sum)	N	140	µg/L					117000			9310				
USEPA_8015	>C10 - C40 Fraction (sum)	N	1400	µg/L			290000									
USEPA_8015	>C10 - C40 Fraction (sum)	N	1420	µg/L		75000										
USEPA_8015	>C10 - C40 Fraction (sum)	N	1440	µg/L												
USEPA_8015	>C10 - C40 Fraction (sum)	N	1500	µg/L												
USEPA_8015	>C10 - C40 Fraction (sum)	N	1830	µg/L												
USEPA_8015	>C10 - C40 Fraction (sum)	N	280	µg/L				59600		52000	22600					
USEPA_8015	>C10 - C40 Fraction (sum)	N	3950	µg/L			263000									
USEPA_8015	>C10 - C40 Fraction (sum)	N	300	µg/L												
USEPA_8015	>C10 - C40 Fraction (sum)	N	100	µg/L								3220	1920	2790	1900	
USEPA_8015	>C16 - C34 Fraction	N	140	µg/L					2910			2580				
USEPA_8015	>C16 - C34 Fraction	N	1400	µg/L			7540									

**Attachment A-1**  
**Tanumbirini Wells 2H and 3H Weekly Samples**  
**Tanumbirini 2H/3H Flowback Wastewater - Risk Assessment, EP-161, McArthur Basin**  
**Katherine, Northern Territory**  
**Santos Ltd.**

METHOD	PARAMETER-CHEMICAL	FRACTION	LOR	UNIT	FACILITY	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN		
					SAMPLE_DATE	1/1/2022	1/4/2022	1/11/2022	1/19/2022	1/26/2022	2/2/2022	2/11/2022	2/15/2022	2/22/2022	3/7/2022	3/9/2022	3/17/2022
					LOCATION	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	
					DESCRIPTION	TANUMBIRINI 2	TANUMBIRINI 2	TANUMBIRINI 2	TANUMBIRINI 2	TANUMBIRINI 2	TANUMBIRINI 2	TANUMBIRINI 2	TANUMBIRINI 2	TANUMBIRINI 2	TANUMBIRINI 2	TANUMBIRINI 2	
					WORK ORDER	EB2200426	EB2200425	EB2200626	EB2201600	EB2202044	EB2203092	EB2204027	EB2204324	EB2205345	EB2206798	EB2206798	EB2207570
					SAMPLE TYPE	N	N	N	N	N	N	N	N	N	N	N	N
					RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT
USEPA_8015	>C16 - C34 Fraction	N	1420	µg/L	2890												
USEPA_8015	>C16 - C34 Fraction	N	1440	µg/L													
USEPA_8015	>C16 - C34 Fraction	N	1500	µg/L													
USEPA_8015	>C16 - C34 Fraction	N	1830	µg/L													
USEPA_8015	>C16 - C34 Fraction	N	280	µg/L				1820		4460	2440						
USEPA_8015	>C16 - C34 Fraction	N	3950	µg/L		8950											
USEPA_8015	>C16 - C34 Fraction	N	300	µg/L													
USEPA_8015	>C34 - C40 Fraction	N	100	µg/L				< 100				110	< 100	< 100	< 100	< 100	< 100
USEPA_8015	>C34 - C40 Fraction	N	110	µg/L					140	< 110							
USEPA_8015	>C34 - C40 Fraction	N	140	µg/L													
USEPA_8015	>C34 - C40 Fraction	N	1420	µg/L	< 1420												
USEPA_8015	>C34 - C40 Fraction	N	1440	µg/L													
USEPA_8015	>C34 - C40 Fraction	N	1500	µg/L													
USEPA_8015	>C34 - C40 Fraction	N	1830	µg/L													
USEPA_8015	>C34 - C40 Fraction	N	280	µg/L				< 280									
USEPA_8015	>C34 - C40 Fraction	N	300	µg/L													
USEPA_8015	>C34 - C40 Fraction	N	3950	µg/L		< 3950											
USEPA_8015	>C34 - C40 Fraction	N	560	µg/L			< 560										
USEPA_8015	>C34 - C40 Fraction	N	570	µg/L													
USEPA_8015	C6 - C36 Fraction (Sum)	N	110	µg/L				59700		51800	22700						
USEPA_8015	C6 - C36 Fraction (Sum)	N	120	µg/L													
USEPA_8015	C6 - C36 Fraction (Sum)	N	1580	µg/L		264000											
USEPA_8015	C6 - C36 Fraction (Sum)	N	20	µg/L								11000	6220	12400	4850		
USEPA_8015	C6 - C36 Fraction (Sum)	N	560	µg/L			290000										
USEPA_8015	C6 - C36 Fraction (Sum)	N	570	µg/L	75600												
USEPA_8015	C6 - C36 Fraction (Sum)	N	580	µg/L													
USEPA_8015	C6 - C36 Fraction (Sum)	N	60	µg/L				117000			9300						
USEPA_8015	C6 - C36 Fraction (Sum)	N	600	µg/L													
USEPA_8015	C6 - C36 Fraction (Sum)	N	730	µg/L													
USEPA_8260	Benzene	N	1	µg/L	< 1		< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
USEPA_8260	Benzene	N	2	µg/L		< 2											
USEPA_8260	Benzene	N	25	µg/L													
USEPA_8260	C6 - C10 Fraction	N	100	µg/L		< 100					< 100						
USEPA_8260	C6 - C10 Fraction	N	1000	µg/L													
USEPA_8260	C6 - C10 Fraction	N	20	µg/L	< 20		< 20	20	< 20	30		< 20	< 20	< 20	< 20	< 20	< 20
USEPA_8260	C6 - C10 Fraction	N	40	µg/L													
USEPA_8260	C6 - C10 Fraction minus BTEX (F1)	N	100	µg/L		< 100					< 100						
USEPA_8260	C6 - C10 Fraction minus BTEX (F1)	N	1000	µg/L													
USEPA_8260	C6 - C10 Fraction minus BTEX (F1)	N	20	µg/L	< 20		< 20	20	< 20	30		< 20	< 20	< 20	< 20	< 20	< 20
USEPA_8260	C6 - C10 Fraction minus BTEX (F1)	N	40	µg/L													
USEPA_8260	Ethylbenzene	N	2	µg/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
USEPA_8260	Ethylbenzene	N	25	µg/L													
USEPA_8260	meta- & para-Xylene	N	2	µg/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
USEPA_8260	meta- & para-Xylene	N	5	µg/L		< 5											
USEPA_8260	meta- & para-Xylene	N	50	µg/L													
USEPA_8260	ortho-Xylene	N	2	µg/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
USEPA_8260	ortho-Xylene	N	25	µg/L													
USEPA_8260	Toluene	N	2	µg/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
USEPA_8260	Toluene	N	25	µg/L													
USEPA_8260	Total Xylenes	N	2	µg/L	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
USEPA_8260	Total Xylenes	N	25	µg/L													
USEPA_8270_UT	2-Nitrophenol	N	0.1	µg/L								< 0.1					
USEPA_8270_UT	2-Nitrophenol	N	0.2	µg/L							< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
USEPA_8270_UT	2-Nitrophenol	N	1.9	µg/L	< 1.9		< 1.9			< 1.9							

**Attachment A-1**  
**Tanumbirini Wells 2H and 3H Weekly Samples**  
**Tanumbirini 2H/3H Flowback Wastewater - Risk Assessment, EP-161, McArthur Basin**  
**Katherine, Northern Territory**  
**Santos Ltd.**

METHOD	PARAMETER-CHEMICAL	FRACTION	LOR	UNIT	FACILITY	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	
					SAMPLE_DATE	1/1/2022	1/4/2022	1/11/2022	1/19/2022	1/26/2022	2/2/2022	2/11/2022	2/15/2022	2/22/2022	3/7/2022	3/9/2022
					LOCATION	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	
					DESCRIPTION	TANUMBIRINI 2	TANUMBIRINI 2	TANUMBIRINI 2	TANUMBIRINI 2	TANUMBIRINI 2	TANUMBIRINI 2	TANUMBIRINI 2	TANUMBIRINI 2	TANUMBIRINI 2	TANUMBIRINI 2	
					WORK ORDER	EB2200426	EB2200425	EB2200626	EB2201600	EB2202044	EB2203092	EB2204027	EB2204324	EB2205345	EB2206798	
					SAMPLE TYPE	N	N	N	N	N	N	N	N	N	N	
					RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	
USEPA_8270_UT	2-Nitrophenol	N	2.0	µg/L					< 2.0	< 2.0						
USEPA_8270_UT	3-Methylcholanthrene	N	0.1	µg/L								< 0.1				
USEPA_8270_UT	3-Methylcholanthrene	N	0.2	µg/L								< 0.2		< 0.2	< 0.2	< 0.2
USEPA_8270_UT	3-Methylcholanthrene	N	1.9	µg/L	< 1.9		< 1.9			< 1.9						
USEPA_8270_UT	3-Methylcholanthrene	N	2.0	µg/L				< 2.0	< 2.0							
USEPA_8270_UT	7.12-Dimethylbenz(a)anthracene	N	0.1	µg/L								< 0.1				
USEPA_8270_UT	7.12-Dimethylbenz(a)anthracene	N	0.2	µg/L								< 0.2		< 0.2	< 0.2	< 0.2
USEPA_8270_UT	7.12-Dimethylbenz(a)anthracene	N	1.9	µg/L	< 1.9		< 1.9			< 1.9						
USEPA_8270_UT	7.12-Dimethylbenz(a)anthracene	N	2.0	µg/L				< 2.0	< 2.0							
USEPA_8270_UT	Acenaphthene	N	0.1	µg/L								< 0.1				
USEPA_8270_UT	Acenaphthene	N	0.2	µg/L								< 0.2		< 0.2	< 0.2	< 0.2
USEPA_8270_UT	Acenaphthene	N	1.9	µg/L	< 1.9		< 1.9			< 1.9						
USEPA_8270_UT	Acenaphthene	N	2.0	µg/L				< 2.0	< 2.0							
USEPA_8270_UT	Acenaphthylene	N	0.1	µg/L								< 0.1				
USEPA_8270_UT	Acenaphthylene	N	0.2	µg/L								< 0.2		< 0.2	< 0.2	< 0.2
USEPA_8270_UT	Acenaphthylene	N	1.9	µg/L	< 1.9		< 1.9			< 1.9						
USEPA_8270_UT	Acenaphthylene	N	2.0	µg/L				< 2.0	< 2.0							
USEPA_8270_UT	Anthracene	N	0.1	µg/L								< 0.1				
USEPA_8270_UT	Anthracene	N	0.2	µg/L								< 0.2		< 0.2	< 0.2	< 0.2
USEPA_8270_UT	Anthracene	N	1.9	µg/L	< 1.9		< 1.9			< 1.9						
USEPA_8270_UT	Anthracene	N	2.0	µg/L				< 2.0	< 2.0							
USEPA_8270_UT	Benzo(a)anthracene	N	0.1	µg/L								< 0.1				
USEPA_8270_UT	Benzo(a)anthracene	N	0.2	µg/L								< 0.2		< 0.2	< 0.2	< 0.2
USEPA_8270_UT	Benzo(a)anthracene	N	1.9	µg/L	< 1.9		< 1.9			< 1.9						
USEPA_8270_UT	Benzo(a)anthracene	N	2.0	µg/L				< 2.0	< 2.0							
USEPA_8270_UT	Benzo(a)pyrene	N	0.05	µg/L								< 0.05				
USEPA_8270_UT	Benzo(a)pyrene	N	0.19	µg/L								< 0.19		< 0.19		< 0.19
USEPA_8270_UT	Benzo(a)pyrene	N	0.20	µg/L									< 0.20	< 0.20		
USEPA_8270_UT	Benzo(a)pyrene	N	0.22	µg/L												
USEPA_8270_UT	Benzo(a)pyrene	N	1.89	µg/L	< 1.89		< 1.89			< 1.89						
USEPA_8270_UT	Benzo(a)pyrene	N	2.00	µg/L				< 2.00	< 2.00							
USEPA_8270_UT	Benzo(a)pyrene TEQ (zero)	N	0.1	µg/L								< 0.1				
USEPA_8270_UT	Benzo(a)pyrene TEQ (zero)	N	0.2	µg/L								< 0.2		< 0.2	< 0.2	< 0.2
USEPA_8270_UT	Benzo(a)pyrene TEQ (zero)	N	1.9	µg/L	< 1.9		< 1.9			< 1.9						
USEPA_8270_UT	Benzo(a)pyrene TEQ (zero)	N	2.0	µg/L				< 2.0	< 2.0							
USEPA_8270_UT	Benzo(b+j)fluoranthene	N	0.1	µg/L								< 0.1				
USEPA_8270_UT	Benzo(b+j)fluoranthene	N	0.2	µg/L								< 0.2		< 0.2	< 0.2	< 0.2
USEPA_8270_UT	Benzo(b+j)fluoranthene	N	1.9	µg/L	< 1.9		< 1.9			< 1.9						
USEPA_8270_UT	Benzo(b+j)fluoranthene	N	2.0	µg/L				< 2.0	< 2.0							
USEPA_8270_UT	Benzo(g,h,i)perylene	N	0.1	µg/L								< 0.1				
USEPA_8270_UT	Benzo(g,h,i)perylene	N	0.2	µg/L								< 0.2		< 0.2	< 0.2	< 0.2
USEPA_8270_UT	Benzo(g,h,i)perylene	N	1.9	µg/L	< 1.9		< 1.9			< 1.9						
USEPA_8270_UT	Benzo(g,h,i)perylene	N	2.0	µg/L				< 2.0	< 2.0							
USEPA_8270_UT	Benzo(k)fluoranthene	N	0.1	µg/L								< 0.1				
USEPA_8270_UT	Benzo(k)fluoranthene	N	0.2	µg/L								< 0.2		< 0.2	< 0.2	< 0.2
USEPA_8270_UT	Benzo(k)fluoranthene	N	1.9	µg/L	< 1.9		< 1.9			< 1.9						
USEPA_8270_UT	Benzo(k)fluoranthene	N	2.0	µg/L				< 2.0	< 2.0							
USEPA_8270_UT	Chrysene	N	0.1	µg/L								< 0.1				
USEPA_8270_UT	Chrysene	N	0.2	µg/L								< 0.2		< 0.2	< 0.2	< 0.2
USEPA_8270_UT	Chrysene	N	1.9	µg/L	< 1.9		< 1.9			< 1.9						
USEPA_8270_UT	Chrysene	N	2.0	µg/L				< 2.0	< 2.0							
USEPA_8270_UT	Dibenz(a,h)anthracene	N	0.1	µg/L								< 0.1				
USEPA_8270_UT	Dibenz(a,h)anthracene	N	0.2	µg/L								< 0.2		< 0.2	< 0.2	< 0.2
USEPA_8270_UT	Dibenz(a,h)anthracene	N	1.9	µg/L	< 1.9		< 1.9			< 1.9						



**Attachment A-1**  
**Tanumbirini Wells 2H and 3H Weekly Samples**  
**Tanumbirini 2H/3H Flowback Wastewater - Risk Assessment, EP-161, McArthur Basin**  
**Katherine, Northern Territory**  
**Santos Ltd.**

METHOD	PARAMETER-CHEMICAL	FRACTION	LOR	UNIT	FACILITY	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	
					SAMPLE_DATE	1/1/2022	1/4/2022	1/11/2022	1/19/2022	1/26/2022	2/2/2022	2/11/2022	2/15/2022	2/22/2022	3/7/2022	3/9/2022
					LOCATION	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	
					DESCRIPTION	TANUMBIRINI 2	TANUMBIRINI 2	TANUMBIRINI 2	TANUMBIRINI 2	TANUMBIRINI 2	TANUMBIRINI 2	TANUMBIRINI 2	TANUMBIRINI 2	TANUMBIRINI 2	TANUMBIRINI 2	TANUMBIRINI 2
					WORK ORDER	EB2200426	EB2200425	EB2200626	EB2201600	EB2202044	EB2203092	EB2204027	EB2204324	EB2205345	EB2206798	EB2206798
					SAMPLE TYPE	N	N	N	N	N	N	N	N	N	N	N
					RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT
USEPA_8270_UT	Dibenz(a,h)anthracene	N	2.0	µg/L					< 2.0	< 2.0						
USEPA_8270_UT	Fluoranthene	N	0.1	µg/L								< 0.1				
USEPA_8270_UT	Fluoranthene	N	0.2	µg/L								< 0.2		< 0.2	< 0.2	< 0.2
USEPA_8270_UT	Fluoranthene	N	1.9	µg/L	< 1.9		< 1.9			< 1.9						
USEPA_8270_UT	Fluoranthene	N	2.0	µg/L					< 2.0	< 2.0						
USEPA_8270_UT	Fluorene	N	0.1	µg/L								< 0.1				
USEPA_8270_UT	Fluorene	N	0.2	µg/L								< 0.2		< 0.2	< 0.2	< 0.2
USEPA_8270_UT	Fluorene	N	1.9	µg/L	< 1.9		< 1.9			< 1.9						
USEPA_8270_UT	Fluorene	N	2.0	µg/L					< 2.0	< 2.0						
USEPA_8270_UT	Indeno(1.2.3.cd)pyrene	N	0.1	µg/L								< 0.1				
USEPA_8270_UT	Indeno(1.2.3.cd)pyrene	N	0.2	µg/L								< 0.2		< 0.2	< 0.2	< 0.2
USEPA_8270_UT	Indeno(1.2.3.cd)pyrene	N	1.9	µg/L	< 1.9		< 1.9			< 1.9						
USEPA_8270_UT	Indeno(1.2.3.cd)pyrene	N	2.0	µg/L					< 2.0	< 2.0						
USEPA_8270_UT	m & p-Cresol	N	0.2	µg/L										3.4	5.4	0.3
USEPA_8270_UT	m-Cresol	N	0.1	µg/L								< 0.1				
USEPA_8270_UT	m-Cresol	N	0.2	µg/L								< 0.2		< 0.2	0.3	0.4
USEPA_8270_UT	m-Cresol	N	1.9	µg/L	< 1.9		< 1.9			< 1.9						
USEPA_8270_UT	m-Cresol	N	2.0	µg/L					< 2.0	< 2.0						
USEPA_8270_UT	Naphthalene	N	0.1	µg/L								< 0.1				
USEPA_8270_UT	Naphthalene	N	0.2	µg/L								< 0.2		< 0.2	< 0.2	< 0.2
USEPA_8270_UT	Naphthalene	N	1.9	µg/L	< 1.9		< 1.9			< 1.9						
USEPA_8270_UT	Naphthalene	N	2.0	µg/L					< 2.0	< 2.0						
USEPA_8270_UT	p-Cresol	N	0.1	µg/L								< 0.1				
USEPA_8270_UT	p-Cresol	N	0.2	µg/L								< 0.2		< 0.2	3.1	5
USEPA_8270_UT	p-Cresol	N	1.9	µg/L	< 1.9		< 1.9			< 1.9						
USEPA_8270_UT	p-Cresol	N	2.0	µg/L					< 2.0	< 2.0						
USEPA_8270_UT	Phenanthrene	N	0.1	µg/L								< 0.1				
USEPA_8270_UT	Phenanthrene	N	0.2	µg/L								< 0.2		< 0.2	< 0.2	< 0.2
USEPA_8270_UT	Phenanthrene	N	1.9	µg/L	< 1.9		< 1.9			< 1.9						
USEPA_8270_UT	Phenanthrene	N	2.0	µg/L					< 2.0	< 2.0						
USEPA_8270_UT	Pyrene	N	0.1	µg/L								< 0.1				
USEPA_8270_UT	Pyrene	N	0.2	µg/L								< 0.2		< 0.2	< 0.2	< 0.2
USEPA_8270_UT	Pyrene	N	1.9	µg/L	< 1.9		< 1.9			< 1.9						
USEPA_8270_UT	Pyrene	N	2.0	µg/L					< 2.0	< 2.0						
USEPA_8270_UT	Sum of polycyclic aromatic hydrocarbons (PAHs)	N	0.1	µg/L								< 0.1				
USEPA_8270_UT	Sum of polycyclic aromatic hydrocarbons (PAHs)	N	0.2	µg/L								< 0.2		< 0.2	< 0.2	< 0.2
USEPA_8270_UT	Sum of polycyclic aromatic hydrocarbons (PAHs)	N	1.9	µg/L	< 1.9		< 1.9			< 1.9						
USEPA_8270_UT	Sum of polycyclic aromatic hydrocarbons (PAHs)	N	2.0	µg/L					< 2.0	< 2.0						
USEPA_8270B_PAH	2,3,4,6-Tetrachlorophenol	N	1.0	µg/L												
USEPA_8270B_PAH	2,3,4,6-Tetrachlorophenol	N	10.0	µg/L												
USEPA_8270B_PAH	2,3,4,6-Tetrachlorophenol	N	12.2	µg/L												
USEPA_8270B_PAH	2,3,4,6-Tetrachlorophenol	N	20.0	µg/L												
USEPA_8270B_PAH	2,3,4,6-Tetrachlorophenol	N	2.3	µg/L										< 2.3	< 2.3	< 2.3
USEPA_8270B_PAH	2,3,4,6-Tetrachlorophenol	N	2.4	µg/L								< 2.4				
USEPA_8270B_PAH	2,3,4,6-Tetrachlorophenol	N	26.3	µg/L			< 26.3									
USEPA_8270B_PAH	2,3,4,6-Tetrachlorophenol	N	4.7	µg/L					< 4.7							
USEPA_8270B_PAH	2,3,4,6-Tetrachlorophenol	N	9.2	µg/L						< 9.2						
USEPA_8270B_PAH	2,3,4,6-Tetrachlorophenol	N	9.3	µg/L			< 9.3			< 9.3						
USEPA_8270B_PAH	2,3,4,6-Tetrachlorophenol	N	9.4	µg/L	< 9.4											< 9.4
USEPA_8270B_PAH	2,3,4,6-Tetrachlorophenol	N	9.5	µg/L								< 9.5				
USEPA_8270B_PAH	2,3,4,6-Tetrachlorophenol	N	9.6	µg/L												
USEPA_8270B_PAH	2,4,5-Trichlorophenol	N	10.0	µg/L												
USEPA_8270B_PAH	2,4,5-Trichlorophenol	N	12.2	µg/L												
USEPA_8270B_PAH	2,4,5-Trichlorophenol	N	20.0	µg/L												

**Attachment A-1**  
**Tanumbirini Wells 2H and 3H Weekly Samples**  
**Tanumbirini 2H/3H Flowback Wastewater - Risk Assessment, EP-161, McArthur Basin**  
**Katherine, Northern Territory**  
**Santos Ltd.**

		FACILITY			MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	
		SAMPLE_DATE	LOCATION		1/1/2022	1/4/2022	1/11/2022	1/19/2022	1/26/2022	2/2/2022	2/11/2022	2/15/2022	2/22/2022	3/7/2022	3/9/2022	
		DESCRIPTION			TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	
		WORK ORDER			EB2200426	EB2200425	EB2200626	EB2201600	EB2202044	EB2203092	EB2204027	EB2204324	EB2205345	EB2206798	EB2206798	EB2207570
		SAMPLE TYPE			N	N	N	N	N	N	N	N	N	N	N	N
METHOD	PARAMETER-CHEMICAL	FRACTION	LOR	UNIT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT
USEPA_8270B_PAH	2.4.5-Trichlorophenol	N	1.0	µg/L												
USEPA_8270B_PAH	2.4.5-Trichlorophenol	N	2.3	µg/L									< 2.3	< 2.3	< 2.3	
USEPA_8270B_PAH	2.4.5-Trichlorophenol	N	2.4	µg/L								< 2.4				
USEPA_8270B_PAH	2.4.5-Trichlorophenol	N	26.3	µg/L		< 26.3										
USEPA_8270B_PAH	2.4.5-Trichlorophenol	N	4.7	µg/L				< 4.7								
USEPA_8270B_PAH	2.4.5-Trichlorophenol	N	9.2	µg/L					< 9.2							
USEPA_8270B_PAH	2.4.5-Trichlorophenol	N	9.3	µg/L			< 9.3			< 9.3						
USEPA_8270B_PAH	2.4.5-Trichlorophenol	N	9.4	µg/L	< 9.4											< 9.4
USEPA_8270B_PAH	2.4.5-Trichlorophenol	N	9.6	µg/L												
USEPA_8270B_PAH	2.4.5-Trichlorophenol	N	9.5	µg/L						< 9.5						
USEPA_8270B_PAH	2.4.6-Trichlorophenol	N	10.0	µg/L												
USEPA_8270B_PAH	2.4.6-Trichlorophenol	N	12.2	µg/L												
USEPA_8270B_PAH	2.4.6-Trichlorophenol	N	20.0	µg/L												
USEPA_8270B_PAH	2.4.6-Trichlorophenol	N	1.0	µg/L												
USEPA_8270B_PAH	2.4.6-Trichlorophenol	N	2.3	µg/L									< 2.3	< 2.3	< 2.3	
USEPA_8270B_PAH	2.4.6-Trichlorophenol	N	2.4	µg/L								< 2.4				
USEPA_8270B_PAH	2.4.6-Trichlorophenol	N	26.3	µg/L		< 26.3										
USEPA_8270B_PAH	2.4.6-Trichlorophenol	N	4.7	µg/L				< 4.7								
USEPA_8270B_PAH	2.4.6-Trichlorophenol	N	9.2	µg/L					< 9.2							
USEPA_8270B_PAH	2.4.6-Trichlorophenol	N	9.3	µg/L			< 9.3			< 9.3						
USEPA_8270B_PAH	2.4.6-Trichlorophenol	N	9.4	µg/L	< 9.4											< 9.4
USEPA_8270B_PAH	2.4.6-Trichlorophenol	N	9.5	µg/L							< 9.5					
USEPA_8270B_PAH	2.4.6-Trichlorophenol	N	9.6	µg/L												
USEPA_8270B_PAH	2.4-Dichlorophenol	N	10.0	µg/L												
USEPA_8270B_PAH	2.4-Dichlorophenol	N	12.2	µg/L												
USEPA_8270B_PAH	2.4-Dichlorophenol	N	20.0	µg/L												
USEPA_8270B_PAH	2.4-Dichlorophenol	N	1.0	µg/L												
USEPA_8270B_PAH	2.4-Dichlorophenol	N	1.2	µg/L									< 1.2			
USEPA_8270B_PAH	2.4-Dichlorophenol	N	2.3	µg/L										< 2.3	< 2.3	
USEPA_8270B_PAH	2.4-Dichlorophenol	N	2.4	µg/L								< 2.4				
USEPA_8270B_PAH	2.4-Dichlorophenol	N	26.3	µg/L		< 26.3										
USEPA_8270B_PAH	2.4-Dichlorophenol	N	4.6	µg/L												
USEPA_8270B_PAH	2.4-Dichlorophenol	N	4.7	µg/L				< 4.7								
USEPA_8270B_PAH	2.4-Dichlorophenol	N	4.8	µg/L							< 4.8					
USEPA_8270B_PAH	2.4-Dichlorophenol	N	9.2	µg/L					< 9.2							
USEPA_8270B_PAH	2.4-Dichlorophenol	N	9.3	µg/L			< 9.3			< 9.3						
USEPA_8270B_PAH	2.4-Dichlorophenol	N	9.4	µg/L	< 9.4											< 9.4
USEPA_8270B_PAH	2.4-Dichlorophenol	N	9.6	µg/L												
USEPA_8270B_PAH	2.4-Dimethylphenol	N	10.0	µg/L												
USEPA_8270B_PAH	2.4-Dimethylphenol	N	12.2	µg/L												
USEPA_8270B_PAH	2.4-Dimethylphenol	N	20.0	µg/L												
USEPA_8270B_PAH	2.4-Dimethylphenol	N	1.0	µg/L												
USEPA_8270B_PAH	2.4-Dimethylphenol	N	2.1	µg/L												
USEPA_8270B_PAH	2.4-Dimethylphenol	N	2.3	µg/L									< 2.3	< 2.3	< 2.3	
USEPA_8270B_PAH	2.4-Dimethylphenol	N	2.4	µg/L								< 2.4				
USEPA_8270B_PAH	2.4-Dimethylphenol	N	26.3	µg/L		< 26.3										
USEPA_8270B_PAH	2.4-Dimethylphenol	N	4.7	µg/L				< 4.7								
USEPA_8270B_PAH	2.4-Dimethylphenol	N	9.2	µg/L					< 9.2							
USEPA_8270B_PAH	2.4-Dimethylphenol	N	9.3	µg/L			< 9.3			< 9.3						
USEPA_8270B_PAH	2.4-Dimethylphenol	N	9.4	µg/L	< 9.4											< 9.4
USEPA_8270B_PAH	2.4-Dimethylphenol	N	9.5	µg/L							< 9.5					
USEPA_8270B_PAH	2.4-Dimethylphenol	N	9.6	µg/L												
USEPA_8270B_PAH	2.6-Dichlorophenol	N	10.0	µg/L												
USEPA_8270B_PAH	2.6-Dichlorophenol	N	12.2	µg/L												

**Attachment A-1**  
**Tanumbirini Wells 2H and 3H Weekly Samples**  
**Tanumbirini 2H/3H Flowback Wastewater - Risk Assessment, EP-161, McArthur Basin**  
**Katherine, Northern Territory**  
**Santos Ltd.**

METHOD	PARAMETER-CHEMICAL	FRACTION	LOR	UNIT	FACILITY	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN		
					SAMPLE_DATE	1/1/2022	1/4/2022	1/11/2022	1/19/2022	1/26/2022	2/2/2022	2/11/2022	2/15/2022	2/22/2022	3/7/2022	3/9/2022	3/17/2022
					LOCATION	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN2FB		
					DESCRIPTION	TANUMBIRINI 2 FLOWBACK	TANUMBIRINI 2 FLOWBACK	TANUMBIRINI 2 FLOWBACK	TANUMBIRINI 2 FLOWBACK	TANUMBIRINI 2 FLOWBACK	TANUMBIRINI 2 FLOWBACK	TANUMBIRINI 2 FLOWBACK	TANUMBIRINI 2 FLOWBACK	TANUMBIRINI 2 FLOWBACK	TANUMBIRINI 2 FLOWBACK		
					WORK ORDER	EB2200426	EB2200425	EB2200626	EB2201600	EB2202044	EB2203092	EB2204027	EB2204324	EB2205345	EB2206798	EB2206798	EB2207570
					SAMPLE TYPE	N	N	N	N	N	N	N	N	N	N	N	
					RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	
USEPA_8270B_PAH	2,6-Dichlorophenol	N	20.0	µg/L													
USEPA_8270B_PAH	2,6-Dichlorophenol	N	1.0	µg/L													
USEPA_8270B_PAH	2,6-Dichlorophenol	N	2.3	µg/L													
USEPA_8270B_PAH	2,6-Dichlorophenol	N	2.4	µg/L									< 2.4	< 2.3	< 2.3	< 2.3	
USEPA_8270B_PAH	2,6-Dichlorophenol	N	26.3	µg/L		< 26.3											
USEPA_8270B_PAH	2,6-Dichlorophenol	N	4.7	µg/L				< 4.7									
USEPA_8270B_PAH	2,6-Dichlorophenol	N	9.2	µg/L					< 9.2								
USEPA_8270B_PAH	2,6-Dichlorophenol	N	9.3	µg/L			< 9.3			< 9.3							
USEPA_8270B_PAH	2,6-Dichlorophenol	N	9.4	µg/L	< 9.4												< 9.4
USEPA_8270B_PAH	2,6-Dichlorophenol	N	9.5	µg/L							< 9.5						
USEPA_8270B_PAH	2,6-Dichlorophenol	N	9.6	µg/L													
USEPA_8270B_PAH	2-Chlorophenol	N	10.0	µg/L													
USEPA_8270B_PAH	2-Chlorophenol	N	12.2	µg/L													
USEPA_8270B_PAH	2-Chlorophenol	N	20.0	µg/L													
USEPA_8270B_PAH	2-Chlorophenol	N	1.0	µg/L													
USEPA_8270B_PAH	2-Chlorophenol	N	2.3	µg/L										< 2.3	< 2.3	< 2.3	
USEPA_8270B_PAH	2-Chlorophenol	N	2.4	µg/L									< 2.4				
USEPA_8270B_PAH	2-Chlorophenol	N	26.3	µg/L		< 26.3											
USEPA_8270B_PAH	2-Chlorophenol	N	4.7	µg/L				< 4.7									
USEPA_8270B_PAH	2-Chlorophenol	N	9.2	µg/L					< 9.2								
USEPA_8270B_PAH	2-Chlorophenol	N	9.3	µg/L			< 9.3			< 9.3							
USEPA_8270B_PAH	2-Chlorophenol	N	9.4	µg/L	< 9.4												< 9.4
USEPA_8270B_PAH	2-Chlorophenol	N	9.5	µg/L							< 9.5						
USEPA_8270B_PAH	2-Chlorophenol	N	9.6	µg/L													
USEPA_8270B_PAH	Pentachlorophenol	N	18.5	µg/L					< 18.5								
USEPA_8270B_PAH	Pentachlorophenol	N	18.7	µg/L			< 18.7			< 18.7							
USEPA_8270B_PAH	Pentachlorophenol	N	18.9	µg/L	< 18.9												
USEPA_8270B_PAH	Pentachlorophenol	N	19.0	µg/L							< 19.0						
USEPA_8270B_PAH	Pentachlorophenol	N	19.2	µg/L													
USEPA_8270B_PAH	Pentachlorophenol	N	2.0	µg/L													
USEPA_8270B_PAH	Pentachlorophenol	N	20.0	µg/L													
USEPA_8270B_PAH	Pentachlorophenol	N	24.4	µg/L													
USEPA_8270B_PAH	Pentachlorophenol	N	40.0	µg/L													
USEPA_8270B_PAH	Pentachlorophenol	N	4.7	µg/L									< 4.7	< 4.7	< 4.7		
USEPA_8270B_PAH	Pentachlorophenol	N	4.8	µg/L									< 4.8				
USEPA_8270B_PAH	Pentachlorophenol	N	52.6	µg/L		< 52.6											
USEPA_8270B_PAH	Pentachlorophenol	N	9.4	µg/L				< 9.4									< 9.4
USEPA_8270B_PAH	Phenol	N	1.0	µg/L													
USEPA_8270B_PAH	Phenol	N	10.0	µg/L													
USEPA_8270B_PAH	Phenol	N	12.2	µg/L													
USEPA_8270B_PAH	Phenol	N	2.3	µg/L										3.7	3.3	4.2	
USEPA_8270B_PAH	Phenol	N	2.4	µg/L								2.9					
USEPA_8270B_PAH	Phenol	N	20.0	µg/L													
USEPA_8270B_PAH	Phenol	N	26.3	µg/L		< 26.3											
USEPA_8270B_PAH	Phenol	N	4.7	µg/L				< 4.7									
USEPA_8270B_PAH	Phenol	N	9.2	µg/L					< 9.2								
USEPA_8270B_PAH	Phenol	N	9.3	µg/L			< 9.3			< 9.3							
USEPA_8270B_PAH	Phenol	N	9.4	µg/L	< 9.4												< 9.4
USEPA_8270B_PAH	Phenol	N	9.5	µg/L							< 9.5						
USEPA_8270B_PAH	Phenol	N	9.6	µg/L													

**Attachment A-1**  
**Tanumbirini Wells 2H and 3H Weekly Samples**  
**Tanumbirini 2H/3H Flowback Wastewater - Risk Assessment, EP-161, McArthur Basin**  
**Katherine, Northern Territory**  
**Santos Ltd.**

METHOD	PARAMETER-CHEMICAL	FRACTION	LOR	UNIT	FACILITY	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN		
					SAMPLE_DATE	3/22/2022	3/29/2022	4/8/2022	5/4/2022	1/1/2022	1/4/2022	1/11/2022	1/19/2022	1/26/2022	2/2/2022	2/11/2022	2/15/2022
					LOCATION	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN3FB	TAN3FB	TAN3FB	TAN3FB	TAN3FB	TAN3FB	TAN3FB	
					DESCRIPTION	TANUMBIRINI 2 FLOWBACK	TANUMBIRINI 2 FLOWBACK	TANUMBIRINI 2 FLOWBACK	TANUMBIRINI 2 FLOWBACK	TANUMBIRINI 3 FLOWBACK	TANUMBIRINI 3 FLOWBACK	TANUMBIRINI 3 FLOWBACK	TANUMBIRINI 3 FLOWBACK	TANUMBIRINI 3 FLOWBACK	TANUMBIRINI 3 FLOWBACK	TANUMBIRINI 3 FLOWBACK	
					WORK ORDER	EB2208281	EB2209123	EB2210202	N	EB2200426	EB2200425	EB2200626	EB2201600	EB2202044	EB2203092	EB2204027	EB2204324
					SAMPLE TYPE	N	N	N	N	N	N	N	N	N	N	N	N
					RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT
APHA 3125 B	Boron	D	100	µg/L	12100	15000	406		24400	23900					19500	23000	20600
APHA 3125 B	Boron	D	1000	µg/L													
APHA 3125 B	Boron	D	10000	µg/L													
APHA 3125 B	Boron	D	5	µg/L								20200					
APHA 3125 B	Boron	D	500	µg/L								24200					
APHA 3125 B	Boron	T	105	µg/L	12300	15500	15200		23600	24000		22200		20400		21400	
APHA 3125 B	Boron	T	210	µg/L											26000		
APHA 3125 B	Boron	T	5	µg/L							23500		11000				
APHA 3125 B	Selenium	D	0.5	µg/L							2.3						
APHA 3125 B	Selenium	D	10	µg/L													
APHA 3125 B	Selenium	D	100	µg/L													
APHA 3125 B	Selenium	D	2	µg/L	6	10	< 2		4	5				9	10	< 2	
APHA 3125 B	Selenium	D	5	µg/L									11				
APHA 3125 B	Selenium	T	0.2	µg/L									1.2				
APHA 3125 B	Selenium	T	0.5	µg/L							2.6						
APHA 3125 B	Selenium	T	2	µg/L	< 2	12	10		8	8		34		22	13	< 2	
APHA 3125 B	Zinc	D	2	µg/L							7						
APHA 3125 B	Zinc	D	25	µg/L								< 25					
APHA 3125 B	Zinc	D	5	µg/L	< 5	7	< 5		< 5	< 5				6	< 5		12
APHA 3125 B	Zinc	D	50	µg/L													
APHA 3125 B	Zinc	D	500	µg/L													
APHA 3125 B	Zinc	T	1	µg/L									328				
APHA 3125 B	Zinc	T	10	µg/L											45		
APHA 3125 B	Zinc	T	5	µg/L	40	13	44		199	20	284	334		167		135	
APHA_1030F	Ionic Balance	N	0.01	%	5.18	4.22			0.78	0.73	2.23	0.54		0.01	3.46	2.45	
APHA_1030F	Total Anions	N	0.01	meq/L	197	244			269	270	256	278	354	298	285	287	
APHA_1030F	Total Cations	N	0.01	meq/L	177	266			273	274	268	280	289	298	306	301	
APHA_2320_B	Bicarbonate Alkalinity as CaCO3	N	1	mg/L	163	94	68		686	699	627	534	430	459	374	335	
APHA_2320_B	Carbonate Alkalinity as CaCO3	N	1	mg/L	< 1	< 1	< 1		< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
APHA_2320_B	Hydroxide Alkalinity as CaCO3	N	1	mg/L	< 1	< 1	< 1		< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
APHA_2320_B	Total Alkalinity as CaCO3	N	1	mg/L	163	94	68		686	699	627	534	430	459	374	335	
APHA_2510_B	Electrical Conductivity @ 25°C	N	1	µS/cm	18800	24100	21800		26000	26000	26800	24400	22200	28600	30000	30600	
APHA_2540_C	Total Dissolved Solids @180°C	T	10	mg/L	12000	15700	13000		17000	16900	17400	17900	18700	18400	19300	18800	
APHA_2540_D	Suspended Solids	N	5	mg/L	282	294	318		50	55	685	533	718	362	222	593	
APHA_3112_CV_FIMS	Mercury	D	0.0001	mg/L		< 0.0001			< 0.0001			< 0.0001					< 0.0001
APHA_3112_CV_FIMS	Mercury	D	0.0005	mg/L	< 0.0005												
APHA_3112_CV_FIMS	Mercury	D	0.005	mg/L					< 0.0050	< 0.0050			< 0.0050	< 0.0050	< 0.0050		
APHA_3112_CV_FIMS	Mercury	T	0.0001	mg/L	0.0016		0.0008		< 0.0001	< 0.0001				< 0.0001			0.0004
APHA_3112_CV_FIMS	Mercury	T	0.0005	mg/L													
APHA_3112_CV_FIMS	Mercury	T	0.001	mg/L		0.0022											
APHA_3112_CV_FIMS	Mercury	T	0.005	mg/L						< 0.0050		< 0.0050		< 0.0050			
APHA_3112_CV_FIMS	Mercury	T	0.010	mg/L							< 0.0100						
APHA_3120	Calcium	D	1	mg/L	107	161			187	158	193	191	209	294	262	199	
APHA_3120	Calcium	D	5	mg/L													
APHA_3120	Magnesium	D	1	mg/L	38	56			89	89	87	94	97	105	100	103	
APHA_3120	Magnesium	D	5	mg/L													
APHA_3120	Potassium	D	1	mg/L	42	65			151	153	51	56	52	52	48	47	
APHA_3120	Potassium	D	5	mg/L													
APHA_3120	Sodium	D	1	mg/L	3860	5790			5810	5850	5750	6020	6200	6280	6510	6480	
APHA_3120	Sodium	D	5	mg/L													
APHA_4110	Bromide	N	1.00	mg/L	70.5	130	128								168		
APHA_4110	Bromide	N	2.00	mg/L					125	115	136	144	146	142		155	
APHA_4500_Cl	Chloride	N	1	mg/L		8580			9030	9040				10200	9820		
APHA_4500_Cl	Chloride	N	10	mg/L	6840		8540										

**Attachment A-1**  
**Tanumbirini Wells 2H and 3H Weekly Samples**  
**Tanumbirini 2H/3H Flowback Wastewater - Risk Assessment, EP-161, McArthur Basin**  
**Katherine, Northern Territory**  
**Santos Ltd.**

FACILITY		MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN
SAMPLE_DATE		3/22/2022	3/29/2022	4/8/2022	5/4/2022	1/1/2022	1/4/2022	1/11/2022	1/19/2022	1/26/2022	2/2/2022	2/11/2022	2/15/2022	
LOCATION		TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN3FB	TAN3FB	TAN3FB	TAN3FB	TAN3FB	TAN3FB	TAN3FB	TAN3FB	
DESCRIPTION		TANUMBIRINI 2 FLOWBACK	TANUMBIRINI 2 FLOWBACK	TANUMBIRINI 2 FLOWBACK	TANUMBIRINI 2 FLOWBACK	TANUMBIRINI 3 FLOWBACK	TANUMBIRINI 3 FLOWBACK	TANUMBIRINI 3 FLOWBACK	TANUMBIRINI 3 FLOWBACK	TANUMBIRINI 3 FLOWBACK	TANUMBIRINI 3 FLOWBACK	TANUMBIRINI 3 FLOWBACK	TANUMBIRINI 3 FLOWBACK	
WORK ORDER		EB2208281	EB2209123	EB2210202		EB2200426	EB2200425	EB2200626	EB2201600	EB2202044	EB2203092	EB2204027	EB2204324	
SAMPLE TYPE		N	N	N	N	N	N	N	N	N	N	N	N	
METHOD	PARAMETER-CHEMICAL	FRACTION	LOR	UNIT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT
APHA_4500_Cl	Chloride	N	5	mg/L					8600	9400				9910
APHA_4500_Cl	Chloride	N	50	mg/L						12200				
APHA_4500_Cl_G	Free Chlorine	N	0.02	mg/L	< 0.02	< 0.02	< 0.02			< 0.02	< 0.02		< 0.02	< 0.02
APHA_4500_Cl_G	Total Residual Chlorine	N	0.02	mg/L	< 0.02	< 0.02	< 0.02			< 0.02	< 0.02		< 0.02	< 0.02
APHA_4500_CN_O	Total Cyanide	T	0.004	mg/L	< 0.004	< 0.004	< 0.004		< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
APHA_4500_F_C	Fluoride	N	0.1	mg/L	< 0.1	< 0.1	< 0.1	1.5	1.5	1.3	1.2	1	0.9	0.8
APHA_4500_H_B	pH - Lab	N	0.01	pH Unit	6.3	6.34	6.26	7.01	7.01	7.14	7.22	7.77	6.67	6.82
APHA_4500_NH3_G	Ammonia as N	N	0.01	mg/L	19	0.52	0.38							
APHA_4500_NH3_G	Ammonia as N	N	0.05	mg/L					16.1					
APHA_4500_NH3_G	Ammonia as N	N	0.10	mg/L										
APHA_4500_NH3_G	Ammonia as N	N	0.50	mg/L				13.4	13.8			31.1	18.6	
APHA_4500_NH3_G	Ammonia as N	N	1.00	mg/L									18.2	21.9
APHA_4500_NO2_B	Nitrite as N	N	0.01	mg/L		< 0.01			< 0.01	< 0.01			< 0.01	< 0.01
APHA_4500_NO2_B	Nitrite as N	N	0.05	mg/L						< 0.05	< 0.05			< 0.05
APHA_4500_NO2_B	Nitrite as N	N	0.10	mg/L	< 0.10									
APHA_4500_NO2_B	Nitrite as N	N	0.50	mg/L								< 0.50		
APHA_4500_NO3_F	Nitrate as N	N	0.01	mg/L		< 0.01			< 0.01	< 0.01			0.53	< 0.01
APHA_4500_NO3_F	Nitrate as N	N	0.05	mg/L						< 0.05	< 0.05			< 0.05
APHA_4500_NO3_F	Nitrate as N	N	0.1	mg/L	< 0.1		< 0.1							
APHA_4500_NO3_F	Nitrate as N	N	0.5	mg/L								< 0.5		
APHA_4500_NORG_D	Total Kjeldahl Nitrogen as N	N	0.1	mg/L	34.1									
APHA_4500_NORG_D	Total Kjeldahl Nitrogen as N	N	0.5	mg/L		39.2	35						44.4	43.1
APHA_4500_NORG_D	Total Kjeldahl Nitrogen as N	N	1.0	mg/L					69.6	51.3	52.4	49.7		
APHA_4500_NORG_D	Total Kjeldahl Nitrogen as N	N	10.0	mg/L				50.8						
APHA_4500_NORG+NO3	Total Nitrogen as N	N	0.1	mg/L	34.1									
APHA_4500_NORG+NO3	Total Nitrogen as N	N	0.5	mg/L		39.2	35						44.5	43.1
APHA_4500_NORG+NO3	Total Nitrogen as N	N	1	mg/L					69.6	51.3	52.4	49.7		
APHA_4500_NORG+NO3	Total Nitrogen as N	N	10	mg/L				50.8						
APHA_4500_P_E	Reactive Phosphorus as P	T	0.01	mg/L		< 0.01			0.08	0.05			< 0.01	< 0.01
APHA_4500_P_E	Reactive Phosphorus as P	T	0.02	mg/L						< 0.02	< 0.02			< 0.02
APHA_4500_P_E	Reactive Phosphorus as P	T	0.05	mg/L	0.05		< 0.05							
APHA_4500_P_E	Reactive Phosphorus as P	T	0.25	mg/L							< 0.25			
APHA_4500_P_H	Total Phosphorus as P	T	0.01	mg/L	0.04									
APHA_4500_P_H	Total Phosphorus as P	T	0.05	mg/L		< 0.05	< 0.05						0.69	0.25
APHA_4500_P_H	Total Phosphorus as P	T	0.10	mg/L					1.72	2.93	1.3	1.36		1.25
APHA_4500_P_H	Total Phosphorus as P	T	0.20	mg/L										
APHA_4500_P_H	Total Phosphorus as P	T	1.00	mg/L				< 1.00						
APHA_4500_SIO2	Reactive Silica	N	0.05	mg/L		5.21	3.49		134	131		89.8	74.4	
APHA_4500_SIO2	Reactive Silica	N	0.25	mg/L						101			33.9	
APHA_4500_SIO2	Reactive Silica	N	1.00	mg/L	7.32							50.9		40.6
APHA_4500_SO4_E	Sulfate as SO4 2-	D	1	mg/L		33		28					40	37
APHA_4500_SO4_E	Sulfate as SO4 2-	D	10	mg/L	30		24							
APHA_4500_SO4_E	Sulfate as SO4 2-	D	5	mg/L					31	66	81			38
APHA_4500_SO4_E	Sulfate as SO4 2-	D	50	mg/L								65		
APHA_5310_B_DOC	Dissolved Organic Carbon	N	10	mg/L							249			
APHA_5310_B_DOC	Dissolved Organic Carbon	N	100	mg/L					331	280				
APHA_5310_B_DOC	Dissolved Organic Carbon	N	20	mg/L	137									
APHA_5310_B_DOC	Dissolved Organic Carbon	N	5	mg/L		162	147		354		233	207	198	193
APHA_5310_B_DOC	Dissolved Organic Carbon	N	1	mg/L						287				
APHA_5310_B_DOC	Dissolved Organic Carbon	N	10	mg/L							274			
APHA_5310_B_DOC	Dissolved Organic Carbon	N	20	mg/L	164									
APHA_5310_B_DOC	Dissolved Organic Carbon	N	5	mg/L		172	162		668	347		237	221	214
APHA_5310_B_DOC	Dissolved Organic Carbon	N	20	mg/L										208
ASTM_D_6303-98	Formaldehyde	N	0.1	mg/L						18	11.8			
ASTM_D_6303-98	Formaldehyde	N	0.2	mg/L	10.3	10.5								

**Attachment A-1**  
**Tanumbirini Wells 2H and 3H Weekly Samples**  
**Tanumbirini 2H/3H Flowback Wastewater - Risk Assessment, EP-161, McArthur Basin**  
**Katherine, Northern Territory**  
**Santos Ltd.**

		FACILITY		MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN		
		SAMPLE_DATE	LOCATION	3/22/2022	3/29/2022	4/8/2022	5/4/2022	1/1/2022	1/4/2022	1/11/2022	1/19/2022	1/26/2022	2/2/2022	2/11/2022	2/15/2022		
		DESCRIPTION		TANUMBIRINI 2	TANUMBIRINI 2	TANUMBIRINI 2	TANUMBIRINI 2	TANUMBIRINI 3	TANUMBIRINI 3	TANUMBIRINI 3	TANUMBIRINI 3	TANUMBIRINI 3	TANUMBIRINI 3	TANUMBIRINI 3	TANUMBIRINI 3		
		WORK ORDER		EB2208281	EB2209123	EB2210202	N	EB2200426	EB2200425	EB2200626	EB2201600	EB2202044	EB2203092	EB2204027	EB2204324		
		SAMPLE TYPE		N	N	N	N	N	N	N	N	N	N	N	N		
METHOD	PARAMETER-CHEMICAL	FRACTION	LOR	UNIT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT		
ASTM_D_6303-98	Formaldehyde	N	0.4	mg/L			24								16.6	18.5	
ASTM_D_6303-98	Formaldehyde	N	2.0	mg/L									17.4				
ASTM_D_6303-98	Formaldehyde	N	4.0	mg/L				11.6	12	17.2							
CSN_75_7611_75_7612	Gross alpha	N	0.05	Bq/L													
CSN_75_7611_75_7612	Gross alpha	N	0.30	Bq/L	0.31												
CSN_75_7611_75_7612	Gross alpha	N	0.32	Bq/L													
CSN_75_7611_75_7612	Gross alpha	N	0.37	Bq/L		0.42											
CSN_75_7611_75_7612	Gross alpha	N	0.38	Bq/L			0.52										
CSN_75_7611_75_7612	Gross alpha	N	0.39	Bq/L				0.43									
CSN_75_7611_75_7612	Gross alpha	N	0.40	Bq/L													
CSN_75_7611_75_7612	Gross alpha	N	0.42	Bq/L					0.83								
CSN_75_7611_75_7612	Gross alpha	N	0.44	Bq/L						1.07							
CSN_75_7611_75_7612	Gross alpha	N	0.45	Bq/L					< 0.45								
CSN_75_7611_75_7612	Gross alpha	N	0.46	Bq/L													
CSN_75_7611_75_7612	Gross alpha	N	0.47	Bq/L								1.47		0.93			
CSN_75_7611_75_7612	Gross alpha	N	0.48	Bq/L									0.68			1.12	
CSN_75_7611_75_7612	Gross alpha	N	2.60	Bq/L													
CSN_75_7611_75_7612	Gross beta activity - 40K	N	0.10	Bq/L													
CSN_75_7611_75_7612	Gross beta activity - 40K	N	0.60	Bq/L	< 0.60												
CSN_75_7611_75_7612	Gross beta activity - 40K	N	0.65	Bq/L													
CSN_75_7611_75_7612	Gross beta activity - 40K	N	0.74	Bq/L		< 0.74											
CSN_75_7611_75_7612	Gross beta activity - 40K	N	0.76	Bq/L			< 0.76										
CSN_75_7611_75_7612	Gross beta activity - 40K	N	0.77	Bq/L													
CSN_75_7611_75_7612	Gross beta activity - 40K	N	0.78	Bq/L				< 0.78									
CSN_75_7611_75_7612	Gross beta activity - 40K	N	0.80	Bq/L													
CSN_75_7611_75_7612	Gross beta activity - 40K	N	0.83	Bq/L					< 0.83								
CSN_75_7611_75_7612	Gross beta activity - 40K	N	0.85	Bq/L													
CSN_75_7611_75_7612	Gross beta activity - 40K	N	0.89	Bq/L							< 0.89						
CSN_75_7611_75_7612	Gross beta activity - 40K	N	0.90	Bq/L					< 0.90								
CSN_75_7611_75_7612	Gross beta activity - 40K	N	0.93	Bq/L													
CSN_75_7611_75_7612	Gross beta activity - 40K	N	0.94	Bq/L								< 0.94		< 0.94			
CSN_75_7611_75_7612	Gross beta activity - 40K	N	0.95	Bq/L									< 0.95				
CSN_75_7611_75_7612	Gross beta activity - 40K	N	0.96	Bq/L											< 0.96		
CSN_75_7611_75_7612	Gross beta activity - 40K	N	0.97	Bq/L													
CSN_75_7611_75_7612	Gross beta activity - 40K	N	5.19	Bq/L													
FIELD MEASURE	Dissolved Oxygen - Field	N		mg/L	0	0	0	0	0	1.28			0	0	0	0	
FIELD MEASURE	Electrical Conductivity - Field	N		µS/cm	11750	23980	22400	1776	25920	26780	28480	31730	28970	28810	27730	29070	
FIELD MEASURE	Field Ambient Temperature	N		°C	26.65	20.98	22.09	28.9	30.8	33.71	26.19	25.5	23.85	22.85	23.75	30.21	
FIELD MEASURE	pH - Field	N		pH Unit	6.42	6.41	6.45	6.62	6.46	7.23	7.23	7.59	6.73	6.48	6.61	6.6	
IN_HOUSE_LC-MSMS_EDC	2,4-Dinitrophenol	N	0.01	µg/L	< 0.01	< 0.01	< 0.01		< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	
IN_HOUSE_LC-MSMS_EDC	2-Methyl-4,6-dinitrophenol	N	0.05	µg/L							< 0.05	< 0.05				< 0.05	
IN_HOUSE_LC-MSMS_EDC	2-Methyl-4,6-dinitrophenol	N	0.10	µg/L	< 0.10	< 0.10	< 0.10		< 0.10	< 0.10	< 0.10		< 0.10	< 0.10	< 0.10	< 0.10	
IN_HOUSE_LC-MSMS_EDC	4-Chloro-3-Methylphenol	N	0.10	µg/L	< 0.10	< 0.10	< 0.10		0.3	< 0.10	0.5	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	
IN_HOUSE_LC-MSMS_EDC	4-Nitrophenol	N	0.10	µg/L	< 0.10	< 0.10	< 0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	
IN_HOUSE_LC-MSMS_EDC	Dinoseb	N	0.10	µg/L	< 0.10	< 0.10	< 0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	
IN_HOUSE_LC-MSMS_EDC	Hexachlorophene	N	0.10	µg/L								< 0.10	< 0.10			< 0.10	
IN_HOUSE_LC-MSMS_EDC	Hexachlorophene	N	0.50	µg/L	< 0.50	< 0.50	< 0.50		< 0.50	< 0.50	< 0.50		< 0.50	< 0.50		< 0.50	
USEPA_6020	Aluminium	D	0.05	mg/L	< 0.05	< 0.05			< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	
USEPA_6020	Aluminium	D	0.50	mg/L													
USEPA_6020	Aluminium	T	0.01	mg/L													
USEPA_6020	Aluminium	T	0.05	mg/L	0.12	0.1	0.06		3.01	< 0.05		3.77	1.44	1.22	2.21	0.44	2.66
USEPA_6020	Antimony	D	0.001	mg/L							0.008						
USEPA_6020	Antimony	D	0.005	mg/L	< 0.005	0.01			< 0.005	< 0.005		0.011	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
USEPA_6020	Antimony	D	0.050	mg/L													



**Attachment A-1**  
**Tanumbirini Wells 2H and 3H Weekly Samples**  
**Tanumbirini 2H/3H Flowback Wastewater - Risk Assessment, EP-161, McArthur Basin**  
**Katherine, Northern Territory**  
**Santos Ltd.**

METHOD	PARAMETER-CHEMICAL	FRACTION	LOR	UNIT	FACILITY	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	
					SAMPLE_DATE	3/22/2022	3/29/2022	4/8/2022	5/4/2022	1/1/2022	1/4/2022	1/11/2022	1/19/2022	1/26/2022	2/2/2022	2/11/2022	2/15/2022
					LOCATION	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN3FB	TAN3FB	TAN3FB	TAN3FB	TAN3FB	TAN3FB	TAN3FB	
					DESCRIPTION	TANUMBIRINI 2 FLOWBACK	TANUMBIRINI 2 FLOWBACK	TANUMBIRINI 2 FLOWBACK	TANUMBIRINI 2 FLOWBACK	TANUMBIRINI 3 FLOWBACK	TANUMBIRINI 3 FLOWBACK	TANUMBIRINI 3 FLOWBACK	TANUMBIRINI 3 FLOWBACK	TANUMBIRINI 3 FLOWBACK	TANUMBIRINI 3 FLOWBACK	TANUMBIRINI 3 FLOWBACK	
					WORK ORDER	EB2208281	EB2209123	EB2210202	N	EB2200426	EB2200425	EB2200626	EB2201600	EB2202044	EB2203092	EB2204027	EB2204324
					SAMPLE TYPE	N	N	N	N	N	N	N	N	N	N	N	N
					RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT
USEPA_6020	Silver	T	0.005	mg/L	< 0.005	< 0.005	< 0.005		< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
USEPA_6020	Strontium	D	0.005	mg/L	18.4	26.5			21.7	20.6	22.4	25.2	28.7	32.1	32.1	35.6	
USEPA_6020	Strontium	D	0.050	mg/L													
USEPA_6020	Strontium	T	0.001	mg/L													
USEPA_6020	Strontium	T	0.005	mg/L	15.6	23.4	18.9		24.3	23.9	25.5	25.8	32.6	40	35.6	40.2	
USEPA_6020	Thorium	D	0.005	mg/L	< 0.005	< 0.005			< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
USEPA_6020	Thorium	D	0.050	mg/L													
USEPA_6020	Thorium	T	0.001	mg/L													
USEPA_6020	Thorium	T	0.005	mg/L	< 0.005	< 0.005	< 0.005		< 0.005	< 0.005	< 0.005	0.006	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
USEPA_6020	Tin	D	0.005	mg/L	< 0.005	0.006			< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
USEPA_6020	Tin	D	0.050	mg/L													
USEPA_6020	Tin	T	0.001	mg/L													
USEPA_6020	Tin	T	0.005	mg/L	< 0.005	< 0.005	< 0.005		< 0.005	< 0.005	< 0.005	0.009	< 0.005	< 0.005	0.009	< 0.005	< 0.005
USEPA_6020	Uranium	D	0.005	mg/L	< 0.005	< 0.005			< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
USEPA_6020	Uranium	D	0.050	mg/L													
USEPA_6020	Uranium	T	0.001	mg/L													
USEPA_6020	Uranium	T	0.005	mg/L	< 0.005	< 0.005	< 0.005		< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
USEPA_6020	Vanadium	D	0.05	mg/L	< 0.05	< 0.05			< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
USEPA_6020	Vanadium	D	0.50	mg/L													
USEPA_6020	Vanadium	T	0.01	mg/L													
USEPA_6020	Vanadium	T	0.05	mg/L	< 0.05	< 0.05	< 0.05		< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
USEPA_8015	>C10 - C16 Fraction	N	100	µg/L	3020	9620	4090										
USEPA_8015	>C10 - C16 Fraction	N	140	µg/L									198000				
USEPA_8015	>C10 - C16 Fraction	N	1400	µg/L													
USEPA_8015	>C10 - C16 Fraction	N	1420	µg/L							459000						
USEPA_8015	>C10 - C16 Fraction	N	1440	µg/L					204000								
USEPA_8015	>C10 - C16 Fraction	N	1500	µg/L						134000							
USEPA_8015	>C10 - C16 Fraction	N	1830	µg/L								558000					
USEPA_8015	>C10 - C16 Fraction	N	280	µg/L									61300	26300			
USEPA_8015	>C10 - C16 Fraction	N	3950	µg/L													
USEPA_8015	>C10 - C16 Fraction	N	300	µg/L													318000
USEPA_8015	>C10 - C16 Fraction minus Naphthalene (F2)	N	100	µg/L	3020	9620	4090							198000			
USEPA_8015	>C10 - C16 Fraction minus Naphthalene (F2)	N	140	µg/L													
USEPA_8015	>C10 - C16 Fraction minus Naphthalene (F2)	N	1400	µg/L													
USEPA_8015	>C10 - C16 Fraction minus Naphthalene (F2)	N	1420	µg/L							459000						
USEPA_8015	>C10 - C16 Fraction minus Naphthalene (F2)	N	1440	µg/L					204000								
USEPA_8015	>C10 - C16 Fraction minus Naphthalene (F2)	N	1500	µg/L						134000							
USEPA_8015	>C10 - C16 Fraction minus Naphthalene (F2)	N	1830	µg/L								558000					
USEPA_8015	>C10 - C16 Fraction minus Naphthalene (F2)	N	280	µg/L									61300	26300			
USEPA_8015	>C10 - C16 Fraction minus Naphthalene (F2)	N	3950	µg/L													
USEPA_8015	>C10 - C16 Fraction minus Naphthalene (F2)	N	300	µg/L													318000
USEPA_8015	>C10 - C40 Fraction (sum)	N	100	µg/L	4360	13000	8080										
USEPA_8015	>C10 - C40 Fraction (sum)	N	140	µg/L									204000				
USEPA_8015	>C10 - C40 Fraction (sum)	N	1400	µg/L													
USEPA_8015	>C10 - C40 Fraction (sum)	N	1420	µg/L							474000						
USEPA_8015	>C10 - C40 Fraction (sum)	N	1440	µg/L					214000								
USEPA_8015	>C10 - C40 Fraction (sum)	N	1500	µg/L						142000							
USEPA_8015	>C10 - C40 Fraction (sum)	N	1830	µg/L							586000						
USEPA_8015	>C10 - C40 Fraction (sum)	N	280	µg/L									65700	28400			
USEPA_8015	>C10 - C40 Fraction (sum)	N	3950	µg/L													
USEPA_8015	>C10 - C40 Fraction (sum)	N	300	µg/L													372000
USEPA_8015	>C10 - C40 Fraction (sum)	N	100	µg/L	1340	3370	3700										
USEPA_8015	>C16 - C34 Fraction	N	140	µg/L									5910				
USEPA_8015	>C16 - C34 Fraction	N	1400	µg/L													



**Attachment A-1**  
**Tanumbirini Wells 2H and 3H Weekly Samples**  
**Tanumbirini 2H/3H Flowback Wastewater - Risk Assessment, EP-161, McArthur Basin**  
**Katherine, Northern Territory**  
**Santos Ltd.**

METHOD	PARAMETER-CHEMICAL	FRACTION	LOR	UNIT	FACILITY	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN		
					SAMPLE_DATE	3/22/2022	3/29/2022	4/8/2022	5/4/2022	1/1/2022	1/4/2022	1/11/2022	1/19/2022	1/26/2022	2/2/2022	2/11/2022	2/15/2022
					LOCATION	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN3FB	TAN3FB	TAN3FB	TAN3FB	TAN3FB	TAN3FB		
					DESCRIPTION	TANUMBIRINI 2 FLOWBACK	TANUMBIRINI 2 FLOWBACK	TANUMBIRINI 2 FLOWBACK	TANUMBIRINI 2 FLOWBACK	TANUMBIRINI 3 FLOWBACK	TANUMBIRINI 3 FLOWBACK	TANUMBIRINI 3 FLOWBACK	TANUMBIRINI 3 FLOWBACK	TANUMBIRINI 3 FLOWBACK	TANUMBIRINI 3 FLOWBACK		
					WORK ORDER	EB2208281	EB2209123	EB2210202	N	EB2200426	EB2200425	EB2200626	EB2201600	EB2202044	EB2203092	EB2204027	EB2204324
					SAMPLE TYPE	N	N	N	N	N	N	N	N	N	N	N	N
					RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT
USEPA_8015	>C16 - C34 Fraction	N	1420	µg/L								14700					
USEPA_8015	>C16 - C34 Fraction	N	1440	µg/L						9720							
USEPA_8015	>C16 - C34 Fraction	N	1500	µg/L						7820							
USEPA_8015	>C16 - C34 Fraction	N	1830	µg/L								23600					
USEPA_8015	>C16 - C34 Fraction	N	280	µg/L										4270	2130		
USEPA_8015	>C16 - C34 Fraction	N	3950	µg/L													
USEPA_8015	>C16 - C34 Fraction	N	300	µg/L													52900
USEPA_8015	>C34 - C40 Fraction	N	100	µg/L	< 100	< 100		290									
USEPA_8015	>C34 - C40 Fraction	N	110	µg/L											150	< 110	
USEPA_8015	>C34 - C40 Fraction	N	140	µg/L									300				
USEPA_8015	>C34 - C40 Fraction	N	1420	µg/L													
USEPA_8015	>C34 - C40 Fraction	N	1440	µg/L					< 1440								
USEPA_8015	>C34 - C40 Fraction	N	1500	µg/L						< 1500							
USEPA_8015	>C34 - C40 Fraction	N	1830	µg/L								4610					
USEPA_8015	>C34 - C40 Fraction	N	280	µg/L													
USEPA_8015	>C34 - C40 Fraction	N	300	µg/L													780
USEPA_8015	>C34 - C40 Fraction	N	3950	µg/L													
USEPA_8015	>C34 - C40 Fraction	N	560	µg/L													
USEPA_8015	>C34 - C40 Fraction	N	570	µg/L						< 570							
USEPA_8015	C6 - C36 Fraction (Sum)	N	110	µg/L										65300	28400		
USEPA_8015	C6 - C36 Fraction (Sum)	N	120	µg/L													371000
USEPA_8015	C6 - C36 Fraction (Sum)	N	1580	µg/L													
USEPA_8015	C6 - C36 Fraction (Sum)	N	20	µg/L		4440	13100	7930									
USEPA_8015	C6 - C36 Fraction (Sum)	N	560	µg/L													
USEPA_8015	C6 - C36 Fraction (Sum)	N	570	µg/L							473000						
USEPA_8015	C6 - C36 Fraction (Sum)	N	580	µg/L					212000								
USEPA_8015	C6 - C36 Fraction (Sum)	N	60	µg/L									203000				
USEPA_8015	C6 - C36 Fraction (Sum)	N	600	µg/L						141000							
USEPA_8015	C6 - C36 Fraction (Sum)	N	730	µg/L								585000					
USEPA_8260	Benzene	N	1	µg/L	< 1	< 1	< 1				< 1	< 1	< 1	< 1	< 1	< 1	< 1
USEPA_8260	Benzene	N	2	µg/L						< 2							
USEPA_8260	Benzene	N	25	µg/L						< 25							
USEPA_8260	C6 - C10 Fraction	N	100	µg/L						< 100					< 100		
USEPA_8260	C6 - C10 Fraction	N	1000	µg/L						< 1000							
USEPA_8260	C6 - C10 Fraction	N	20	µg/L	< 20	< 20	< 20				< 20	< 20	< 20	< 20			< 20
USEPA_8260	C6 - C10 Fraction	N	40	µg/L													
USEPA_8260	C6 - C10 Fraction minus BTEX (F1)	N	100	µg/L						< 100						< 100	
USEPA_8260	C6 - C10 Fraction minus BTEX (F1)	N	1000	µg/L						< 1000							
USEPA_8260	C6 - C10 Fraction minus BTEX (F1)	N	20	µg/L	< 20	< 20	< 20				< 20	< 20	< 20	< 20			< 20
USEPA_8260	C6 - C10 Fraction minus BTEX (F1)	N	40	µg/L													
USEPA_8260	Ethylbenzene	N	2	µg/L	< 2	< 2	< 2			< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
USEPA_8260	Ethylbenzene	N	25	µg/L						< 25							
USEPA_8260	meta- & para-Xylene	N	2	µg/L	< 2	< 2	< 2				< 2	< 2	< 2	< 2	< 2	< 2	< 2
USEPA_8260	meta- & para-Xylene	N	5	µg/L						< 5							
USEPA_8260	meta- & para-Xylene	N	50	µg/L						< 50							
USEPA_8260	ortho-Xylene	N	2	µg/L	< 2	< 2	< 2			< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
USEPA_8260	ortho-Xylene	N	25	µg/L						< 25							
USEPA_8260	Toluene	N	2	µg/L	< 2	< 2	< 2			< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
USEPA_8260	Toluene	N	25	µg/L						< 25							
USEPA_8260	Total Xylenes	N	2	µg/L	< 2	< 2	< 2			< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
USEPA_8260	Total Xylenes	N	25	µg/L						< 25							
USEPA_8270_UT	2-Nitrophenol	N	0.1	µg/L													
USEPA_8270_UT	2-Nitrophenol	N	0.2	µg/L	< 0.2	< 0.2	< 0.2									< 0.2	< 0.2
USEPA_8270_UT	2-Nitrophenol	N	1.9	µg/L						< 1.9	< 1.9	< 1.9			< 1.9		

**Attachment A-1**  
**Tanumbirini Wells 2H and 3H Weekly Samples**  
**Tanumbirini 2H/3H Flowback Wastewater - Risk Assessment, EP-161, McArthur Basin**  
**Katherine, Northern Territory**  
**Santos Ltd.**

METHOD	PARAMETER-CHEMICAL	FRACTION	LOR	UNIT	FACILITY	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN		
					SAMPLE_DATE	3/22/2022	3/29/2022	4/8/2022	5/4/2022	1/1/2022	1/4/2022	1/11/2022	1/19/2022	1/26/2022	2/2/2022	2/11/2022	2/15/2022
					LOCATION	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN3FB	TAN3FB	TAN3FB	TAN3FB	TAN3FB	TAN3FB		
					DESCRIPTION	TANUMBIRINI 2 FLOWBACK	TANUMBIRINI 2 FLOWBACK	TANUMBIRINI 2 FLOWBACK	TANUMBIRINI 2 FLOWBACK	TANUMBIRINI 3 FLOWBACK	TANUMBIRINI 3 FLOWBACK	TANUMBIRINI 3 FLOWBACK	TANUMBIRINI 3 FLOWBACK	TANUMBIRINI 3 FLOWBACK	TANUMBIRINI 3 FLOWBACK		
					WORK ORDER	EB2208281	EB2209123	EB2210202	N	EB2200426	EB2200425	EB2200626	EB2201600	EB2202044	EB2203092	EB2204027	EB2204324
					SAMPLE TYPE	N	N	N	N	N	N	N	N	N	N	N	N
					RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT
USEPA_8270_UT	2-Nitrophenol	N	2.0	µg/L									< 2.0	< 2.0			
USEPA_8270_UT	3-Methylcholanthrene	N	0.1	µg/L													
USEPA_8270_UT	3-Methylcholanthrene	N	0.2	µg/L	< 0.2	< 0.2	< 0.2								< 0.2	< 0.2	
USEPA_8270_UT	3-Methylcholanthrene	N	1.9	µg/L					< 1.9	< 1.9	< 1.9			< 1.9			
USEPA_8270_UT	3-Methylcholanthrene	N	2.0	µg/L									< 2.0	< 2.0			
USEPA_8270_UT	7.12-Dimethylbenz(a)anthracene	N	0.1	µg/L													
USEPA_8270_UT	7.12-Dimethylbenz(a)anthracene	N	0.2	µg/L	< 0.2	< 0.2	< 0.2								< 0.2	< 0.2	
USEPA_8270_UT	7.12-Dimethylbenz(a)anthracene	N	1.9	µg/L					< 1.9	< 1.9	< 1.9			< 1.9			
USEPA_8270_UT	7.12-Dimethylbenz(a)anthracene	N	2.0	µg/L									< 2.0	< 2.0			
USEPA_8270_UT	Acenaphthene	N	0.1	µg/L													
USEPA_8270_UT	Acenaphthene	N	0.2	µg/L	< 0.2	< 0.2	< 0.2								< 0.2	< 0.2	
USEPA_8270_UT	Acenaphthene	N	1.9	µg/L					< 1.9	< 1.9	< 1.9			< 1.9			
USEPA_8270_UT	Acenaphthene	N	2.0	µg/L									< 2.0	< 2.0			
USEPA_8270_UT	Acenaphthylene	N	0.1	µg/L													
USEPA_8270_UT	Acenaphthylene	N	0.2	µg/L	< 0.2	< 0.2	< 0.2								< 0.2	< 0.2	
USEPA_8270_UT	Acenaphthylene	N	1.9	µg/L					< 1.9	< 1.9	< 1.9			< 1.9			
USEPA_8270_UT	Acenaphthylene	N	2.0	µg/L									< 2.0	< 2.0			
USEPA_8270_UT	Anthracene	N	0.1	µg/L													
USEPA_8270_UT	Anthracene	N	0.2	µg/L	< 0.2	< 0.2	< 0.2								< 0.2	< 0.2	
USEPA_8270_UT	Anthracene	N	1.9	µg/L					< 1.9	< 1.9	< 1.9			< 1.9			
USEPA_8270_UT	Anthracene	N	2.0	µg/L									< 2.0	< 2.0			
USEPA_8270_UT	Benzo(a)anthracene	N	0.1	µg/L													
USEPA_8270_UT	Benzo(a)anthracene	N	0.2	µg/L	< 0.2	< 0.2	< 0.2								< 0.2	< 0.2	
USEPA_8270_UT	Benzo(a)anthracene	N	1.9	µg/L					< 1.9	< 1.9	< 1.9			< 1.9			
USEPA_8270_UT	Benzo(a)anthracene	N	2.0	µg/L									< 2.0	< 2.0			
USEPA_8270_UT	Benzo(a)pyrene	N	0.05	µg/L													
USEPA_8270_UT	Benzo(a)pyrene	N	0.19	µg/L	< 0.19		< 0.19								< 0.19	< 0.19	
USEPA_8270_UT	Benzo(a)pyrene	N	0.20	µg/L													
USEPA_8270_UT	Benzo(a)pyrene	N	0.22	µg/L		< 0.22											
USEPA_8270_UT	Benzo(a)pyrene	N	1.89	µg/L					< 1.89	< 1.89	< 1.89			< 1.89			
USEPA_8270_UT	Benzo(a)pyrene	N	2.00	µg/L									< 2.00	< 2.00			
USEPA_8270_UT	Benzo(a)pyrene TEQ (zero)	N	0.1	µg/L													
USEPA_8270_UT	Benzo(a)pyrene TEQ (zero)	N	0.2	µg/L	< 0.2	< 0.2	< 0.2								< 0.2	< 0.2	
USEPA_8270_UT	Benzo(a)pyrene TEQ (zero)	N	1.9	µg/L					< 1.9	< 1.9	< 1.9			< 1.9			
USEPA_8270_UT	Benzo(a)pyrene TEQ (zero)	N	2.0	µg/L									< 2.0	< 2.0			
USEPA_8270_UT	Benzo(b+j)fluoranthene	N	0.1	µg/L													
USEPA_8270_UT	Benzo(b+j)fluoranthene	N	0.2	µg/L	< 0.2	< 0.2	< 0.2								< 0.2	< 0.2	
USEPA_8270_UT	Benzo(b+j)fluoranthene	N	1.9	µg/L					< 1.9	< 1.9	< 1.9			< 1.9			
USEPA_8270_UT	Benzo(b+j)fluoranthene	N	2.0	µg/L									< 2.0	< 2.0			
USEPA_8270_UT	Benzo(g,h,i)perylene	N	0.1	µg/L													
USEPA_8270_UT	Benzo(g,h,i)perylene	N	0.2	µg/L	< 0.2	< 0.2	< 0.2								< 0.2	< 0.2	
USEPA_8270_UT	Benzo(g,h,i)perylene	N	1.9	µg/L					< 1.9	< 1.9	< 1.9			< 1.9			
USEPA_8270_UT	Benzo(g,h,i)perylene	N	2.0	µg/L									< 2.0	< 2.0			
USEPA_8270_UT	Benzo(k)fluoranthene	N	0.1	µg/L													
USEPA_8270_UT	Benzo(k)fluoranthene	N	0.2	µg/L	< 0.2	< 0.2	< 0.2								< 0.2	< 0.2	
USEPA_8270_UT	Benzo(k)fluoranthene	N	1.9	µg/L					< 1.9	< 1.9	< 1.9			< 1.9			
USEPA_8270_UT	Benzo(k)fluoranthene	N	2.0	µg/L									< 2.0	< 2.0			
USEPA_8270_UT	Chrysene	N	0.1	µg/L													
USEPA_8270_UT	Chrysene	N	0.2	µg/L	< 0.2	< 0.2	< 0.2								< 0.2	< 0.2	
USEPA_8270_UT	Chrysene	N	1.9	µg/L					< 1.9	< 1.9	< 1.9			< 1.9			
USEPA_8270_UT	Chrysene	N	2.0	µg/L									< 2.0	< 2.0			
USEPA_8270_UT	Dibenz(a,h)anthracene	N	0.1	µg/L													
USEPA_8270_UT	Dibenz(a,h)anthracene	N	0.2	µg/L	< 0.2	< 0.2	< 0.2								< 0.2	< 0.2	
USEPA_8270_UT	Dibenz(a,h)anthracene	N	1.9	µg/L					< 1.9	< 1.9	< 1.9			< 1.9			

**Attachment A-1**  
**Tanumbirini Wells 2H and 3H Weekly Samples**  
**Tanumbirini 2H/3H Flowback Wastewater - Risk Assessment, EP-161, McArthur Basin**  
**Katherine, Northern Territory**  
**Santos Ltd.**

METHOD	PARAMETER-CHEMICAL	FRACTION	LOR	UNIT	FACILITY	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN		
					SAMPLE_DATE	3/22/2022	3/29/2022	4/8/2022	5/4/2022	1/1/2022	1/4/2022	1/11/2022	1/19/2022	1/26/2022	2/2/2022	2/11/2022	2/15/2022
					LOCATION	TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN3FB	TAN3FB	TAN3FB	TAN3FB	TAN3FB	TAN3FB		
					DESCRIPTION	TANUMBIRINI 2 FLOWBACK	TANUMBIRINI 2 FLOWBACK	TANUMBIRINI 2 FLOWBACK	TANUMBIRINI 2 FLOWBACK	TANUMBIRINI 3 FLOWBACK	TANUMBIRINI 3 FLOWBACK	TANUMBIRINI 3 FLOWBACK	TANUMBIRINI 3 FLOWBACK	TANUMBIRINI 3 FLOWBACK	TANUMBIRINI 3 FLOWBACK		
					WORK ORDER	EB2208281	EB2209123	EB2210202	N	EB2200426	EB2200425	EB2200626	EB2201600	EB2202044	EB2203092	EB2204027	EB2204324
					SAMPLE TYPE	N	N	N	N	N	N	N	N	N	N	N	N
					RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT
USEPA_8270_UT	Dibenz(a,h)anthracene	N	2.0	µg/L									< 2.0	< 2.0			
USEPA_8270_UT	Fluoranthene	N	0.1	µg/L													
USEPA_8270_UT	Fluoranthene	N	0.2	µg/L	< 0.2	< 0.2	< 0.2								< 0.2	< 0.2	
USEPA_8270_UT	Fluoranthene	N	1.9	µg/L					< 1.9	< 1.9	< 1.9			< 1.9			
USEPA_8270_UT	Fluoranthene	N	2.0	µg/L									< 2.0	< 2.0			
USEPA_8270_UT	Fluorene	N	0.1	µg/L													
USEPA_8270_UT	Fluorene	N	0.2	µg/L	< 0.2	< 0.2	< 0.2								< 0.2	< 0.2	
USEPA_8270_UT	Fluorene	N	1.9	µg/L					< 1.9	< 1.9	< 1.9				< 1.9		
USEPA_8270_UT	Fluorene	N	2.0	µg/L									< 2.0	< 2.0			
USEPA_8270_UT	Indeno(1.2.3.cd)pyrene	N	0.1	µg/L													
USEPA_8270_UT	Indeno(1.2.3.cd)pyrene	N	0.2	µg/L	< 0.2	< 0.2	< 0.2								< 0.2	< 0.2	
USEPA_8270_UT	Indeno(1.2.3.cd)pyrene	N	1.9	µg/L					< 1.9	< 1.9	< 1.9				< 1.9		
USEPA_8270_UT	Indeno(1.2.3.cd)pyrene	N	2.0	µg/L									< 2.0	< 2.0			
USEPA_8270_UT	m & p-Cresol	N	0.2	µg/L		0.3	0.4	< 0.2									
USEPA_8270_UT	m-Cresol	N	0.1	µg/L													
USEPA_8270_UT	m-Cresol	N	0.2	µg/L		0.3	0.4	< 0.2							< 0.2	< 0.2	
USEPA_8270_UT	m-Cresol	N	1.9	µg/L					< 1.9	< 1.9	< 1.9				< 1.9		
USEPA_8270_UT	m-Cresol	N	2.0	µg/L									< 2.0	< 2.0			
USEPA_8270_UT	Naphthalene	N	0.1	µg/L													
USEPA_8270_UT	Naphthalene	N	0.2	µg/L	< 0.2	< 0.2	< 0.2								< 0.2	< 0.2	
USEPA_8270_UT	Naphthalene	N	1.9	µg/L					< 1.9	< 1.9	< 1.9				< 1.9		
USEPA_8270_UT	Naphthalene	N	2.0	µg/L									< 2.0	< 2.0			
USEPA_8270_UT	p-Cresol	N	0.1	µg/L													
USEPA_8270_UT	p-Cresol	N	0.2	µg/L	< 0.2	< 0.2	< 0.2									1.4	< 0.2
USEPA_8270_UT	p-Cresol	N	1.9	µg/L					< 1.9	< 1.9	< 1.9				< 1.9		
USEPA_8270_UT	p-Cresol	N	2.0	µg/L									< 2.0	< 2.0			
USEPA_8270_UT	Phenanthrene	N	0.1	µg/L													
USEPA_8270_UT	Phenanthrene	N	0.2	µg/L	< 0.2	< 0.2	< 0.2								< 0.2	< 0.2	
USEPA_8270_UT	Phenanthrene	N	1.9	µg/L					< 1.9	< 1.9	< 1.9				< 1.9		
USEPA_8270_UT	Phenanthrene	N	2.0	µg/L									< 2.0	< 2.0			
USEPA_8270_UT	Pyrene	N	0.1	µg/L													
USEPA_8270_UT	Pyrene	N	0.2	µg/L	< 0.2	< 0.2	< 0.2								< 0.2	< 0.2	
USEPA_8270_UT	Pyrene	N	1.9	µg/L					< 1.9	< 1.9	< 1.9				< 1.9		
USEPA_8270_UT	Pyrene	N	2.0	µg/L									< 2.0	< 2.0			
USEPA_8270_UT	Sum of polycyclic aromatic hydrocarbons (PAHs)	N	0.1	µg/L													
USEPA_8270_UT	Sum of polycyclic aromatic hydrocarbons (PAHs)	N	0.2	µg/L	< 0.2	< 0.2	< 0.2								< 0.2	< 0.2	
USEPA_8270_UT	Sum of polycyclic aromatic hydrocarbons (PAHs)	N	1.9	µg/L					< 1.9	< 1.9	< 1.9				< 1.9		
USEPA_8270_UT	Sum of polycyclic aromatic hydrocarbons (PAHs)	N	2.0	µg/L									< 2.0	< 2.0			
USEPA_8270B_PAH	2,3,4,6-Tetrachlorophenol	N	1.0	µg/L		< 1.0	< 1.0										
USEPA_8270B_PAH	2,3,4,6-Tetrachlorophenol	N	10.0	µg/L						< 10.0							
USEPA_8270B_PAH	2,3,4,6-Tetrachlorophenol	N	12.2	µg/L									< 12.2				
USEPA_8270B_PAH	2,3,4,6-Tetrachlorophenol	N	20.0	µg/L												< 20.0	
USEPA_8270B_PAH	2,3,4,6-Tetrachlorophenol	N	2.3	µg/L	< 2.3												
USEPA_8270B_PAH	2,3,4,6-Tetrachlorophenol	N	2.4	µg/L													
USEPA_8270B_PAH	2,3,4,6-Tetrachlorophenol	N	26.3	µg/L													
USEPA_8270B_PAH	2,3,4,6-Tetrachlorophenol	N	4.7	µg/L													
USEPA_8270B_PAH	2,3,4,6-Tetrachlorophenol	N	9.2	µg/L									< 9.2		< 9.2		
USEPA_8270B_PAH	2,3,4,6-Tetrachlorophenol	N	9.3	µg/L													
USEPA_8270B_PAH	2,3,4,6-Tetrachlorophenol	N	9.4	µg/L						< 9.4					< 9.4		
USEPA_8270B_PAH	2,3,4,6-Tetrachlorophenol	N	9.5	µg/L													
USEPA_8270B_PAH	2,3,4,6-Tetrachlorophenol	N	9.6	µg/L					< 9.6								
USEPA_8270B_PAH	2,4,5-Trichlorophenol	N	10.0	µg/L						< 10.0							
USEPA_8270B_PAH	2,4,5-Trichlorophenol	N	12.2	µg/L									< 12.2				
USEPA_8270B_PAH	2,4,5-Trichlorophenol	N	20.0	µg/L													< 20.0

**Attachment A-1**  
**Tanumbirini Wells 2H and 3H Weekly Samples**  
**Tanumbirini 2H/3H Flowback Wastewater - Risk Assessment, EP-161, McArthur Basin**  
**Katherine, Northern Territory**  
**Santos Ltd.**

		FACILITY		MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN
		SAMPLE_DATE	LOCATION	3/22/2022	3/29/2022	4/8/2022	5/4/2022	1/1/2022	1/4/2022	1/11/2022	1/19/2022	1/26/2022	2/2/2022	2/11/2022	2/15/2022
		DESCRIPTION		TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN3FB	TAN3FB	TAN3FB	TAN3FB	TAN3FB	TAN3FB	TAN3FB	TAN3FB
		WORK ORDER		EB2208281	EB2209123	EB2210202		EB2200426	EB2200425	EB2200626	EB2201600	EB2202044	EB2203092	EB2204027	EB2204324
		SAMPLE TYPE		N	N	N	N	N	N	N	N	N	N	N	N
METHOD	PARAMETER-CHEMICAL	FRACTION	LOR	UNIT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT
USEPA_8270B_PAH	2.4.5-Trichlorophenol	N	1.0	µg/L		< 1.0	< 1.0								
USEPA_8270B_PAH	2.4.5-Trichlorophenol	N	2.3	µg/L	< 2.3										
USEPA_8270B_PAH	2.4.5-Trichlorophenol	N	2.4	µg/L											
USEPA_8270B_PAH	2.4.5-Trichlorophenol	N	26.3	µg/L											
USEPA_8270B_PAH	2.4.5-Trichlorophenol	N	4.7	µg/L											
USEPA_8270B_PAH	2.4.5-Trichlorophenol	N	9.2	µg/L								< 9.2		< 9.2	
USEPA_8270B_PAH	2.4.5-Trichlorophenol	N	9.3	µg/L											
USEPA_8270B_PAH	2.4.5-Trichlorophenol	N	9.4	µg/L						< 9.4				< 9.4	
USEPA_8270B_PAH	2.4.5-Trichlorophenol	N	9.6	µg/L				< 9.6							
USEPA_8270B_PAH	2.4.5-Trichlorophenol	N	9.5	µg/L											
USEPA_8270B_PAH	2.4.6-Trichlorophenol	N	10.0	µg/L					< 10.0						
USEPA_8270B_PAH	2.4.6-Trichlorophenol	N	12.2	µg/L							< 12.2				
USEPA_8270B_PAH	2.4.6-Trichlorophenol	N	20.0	µg/L											< 20.0
USEPA_8270B_PAH	2.4.6-Trichlorophenol	N	1.0	µg/L		< 1.0	< 1.0								
USEPA_8270B_PAH	2.4.6-Trichlorophenol	N	2.3	µg/L	< 2.3										
USEPA_8270B_PAH	2.4.6-Trichlorophenol	N	2.4	µg/L											
USEPA_8270B_PAH	2.4.6-Trichlorophenol	N	26.3	µg/L											
USEPA_8270B_PAH	2.4.6-Trichlorophenol	N	4.7	µg/L											
USEPA_8270B_PAH	2.4.6-Trichlorophenol	N	9.2	µg/L								< 9.2		< 9.2	
USEPA_8270B_PAH	2.4.6-Trichlorophenol	N	9.3	µg/L											
USEPA_8270B_PAH	2.4.6-Trichlorophenol	N	9.4	µg/L						< 9.4				< 9.4	
USEPA_8270B_PAH	2.4.6-Trichlorophenol	N	9.5	µg/L											
USEPA_8270B_PAH	2.4.6-Trichlorophenol	N	9.6	µg/L				< 9.6							
USEPA_8270B_PAH	2.4-Dichlorophenol	N	10.0	µg/L					< 10.0						
USEPA_8270B_PAH	2.4-Dichlorophenol	N	12.2	µg/L							< 12.2				
USEPA_8270B_PAH	2.4-Dichlorophenol	N	20.0	µg/L											< 20.0
USEPA_8270B_PAH	2.4-Dichlorophenol	N	1.0	µg/L		< 1.0	< 1.0								
USEPA_8270B_PAH	2.4-Dichlorophenol	N	1.2	µg/L											
USEPA_8270B_PAH	2.4-Dichlorophenol	N	2.3	µg/L	< 2.3										
USEPA_8270B_PAH	2.4-Dichlorophenol	N	2.4	µg/L											
USEPA_8270B_PAH	2.4-Dichlorophenol	N	26.3	µg/L											
USEPA_8270B_PAH	2.4-Dichlorophenol	N	4.6	µg/L										< 4.6	
USEPA_8270B_PAH	2.4-Dichlorophenol	N	4.7	µg/L											
USEPA_8270B_PAH	2.4-Dichlorophenol	N	4.8	µg/L											
USEPA_8270B_PAH	2.4-Dichlorophenol	N	9.2	µg/L								< 9.2			
USEPA_8270B_PAH	2.4-Dichlorophenol	N	9.3	µg/L											
USEPA_8270B_PAH	2.4-Dichlorophenol	N	9.4	µg/L						< 9.4				< 9.4	
USEPA_8270B_PAH	2.4-Dichlorophenol	N	9.6	µg/L				< 9.6							
USEPA_8270B_PAH	2.4-Dimethylphenol	N	10.0	µg/L					< 10.0						
USEPA_8270B_PAH	2.4-Dimethylphenol	N	12.2	µg/L							< 12.2				
USEPA_8270B_PAH	2.4-Dimethylphenol	N	20.0	µg/L											< 20.0
USEPA_8270B_PAH	2.4-Dimethylphenol	N	1.0	µg/L		< 1.0									
USEPA_8270B_PAH	2.4-Dimethylphenol	N	2.1	µg/L			< 2.1								
USEPA_8270B_PAH	2.4-Dimethylphenol	N	2.3	µg/L	< 2.3										
USEPA_8270B_PAH	2.4-Dimethylphenol	N	2.4	µg/L											
USEPA_8270B_PAH	2.4-Dimethylphenol	N	26.3	µg/L											
USEPA_8270B_PAH	2.4-Dimethylphenol	N	4.7	µg/L											
USEPA_8270B_PAH	2.4-Dimethylphenol	N	9.2	µg/L								< 9.2		< 9.2	
USEPA_8270B_PAH	2.4-Dimethylphenol	N	9.3	µg/L											
USEPA_8270B_PAH	2.4-Dimethylphenol	N	9.4	µg/L						< 9.4				< 9.4	
USEPA_8270B_PAH	2.4-Dimethylphenol	N	9.5	µg/L											
USEPA_8270B_PAH	2.4-Dimethylphenol	N	9.6	µg/L				< 9.6							
USEPA_8270B_PAH	2.6-Dichlorophenol	N	10.0	µg/L					< 10.0						
USEPA_8270B_PAH	2.6-Dichlorophenol	N	12.2	µg/L							< 12.2				

**Attachment A-1**  
**Tanumbirini Wells 2H and 3H Weekly Samples**  
**Tanumbirini 2H/3H Flowback Wastewater - Risk Assessment, EP-161, McArthur Basin**  
**Katherine, Northern Territory**  
**Santos Ltd.**

		FACILITY		MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN
		SAMPLE_DATE	LOCATION	3/22/2022	3/29/2022	4/8/2022	5/4/2022	1/1/2022	1/4/2022	1/11/2022	1/19/2022	1/26/2022	2/2/2022	2/11/2022	2/15/2022
		DESCRIPTION		TAN2FB	TAN2FB	TAN2FB	TAN2FB	TAN3FB	TAN3FB	TAN3FB	TAN3FB	TAN3FB	TAN3FB	TAN3FB	TAN3FB
		WORK ORDER		EB2208281	EB2209123	EB2210202		EB2200426	EB2200425	EB2200626	EB2201600	EB2202044	EB2203092	EB2204027	EB2204324
		SAMPLE TYPE		N	N	N	N	N	N	N	N	N	N	N	N
METHOD	PARAMETER-CHEMICAL	FRACTION	LOR	UNIT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT
USEPA_8270B_PAH	2,6-Dichlorophenol	N	20.0	µg/L											< 20.0
USEPA_8270B_PAH	2,6-Dichlorophenol	N	1.0	µg/L		< 1.0	< 1.0								
USEPA_8270B_PAH	2,6-Dichlorophenol	N	2.3	µg/L	< 2.3										
USEPA_8270B_PAH	2,6-Dichlorophenol	N	2.4	µg/L											
USEPA_8270B_PAH	2,6-Dichlorophenol	N	26.3	µg/L											
USEPA_8270B_PAH	2,6-Dichlorophenol	N	4.7	µg/L											
USEPA_8270B_PAH	2,6-Dichlorophenol	N	9.2	µg/L								< 9.2		< 9.2	
USEPA_8270B_PAH	2,6-Dichlorophenol	N	9.3	µg/L											
USEPA_8270B_PAH	2,6-Dichlorophenol	N	9.4	µg/L						< 9.4			< 9.4		
USEPA_8270B_PAH	2,6-Dichlorophenol	N	9.5	µg/L											
USEPA_8270B_PAH	2,6-Dichlorophenol	N	9.6	µg/L				< 9.6							
USEPA_8270B_PAH	2-Chlorophenol	N	10.0	µg/L					< 10.0						
USEPA_8270B_PAH	2-Chlorophenol	N	12.2	µg/L							< 12.2				
USEPA_8270B_PAH	2-Chlorophenol	N	20.0	µg/L											< 20.0
USEPA_8270B_PAH	2-Chlorophenol	N	1.0	µg/L		< 1.0	< 1.0								
USEPA_8270B_PAH	2-Chlorophenol	N	2.3	µg/L	< 2.3										
USEPA_8270B_PAH	2-Chlorophenol	N	2.4	µg/L											
USEPA_8270B_PAH	2-Chlorophenol	N	26.3	µg/L											
USEPA_8270B_PAH	2-Chlorophenol	N	4.7	µg/L											
USEPA_8270B_PAH	2-Chlorophenol	N	9.2	µg/L								< 9.2		< 9.2	
USEPA_8270B_PAH	2-Chlorophenol	N	9.3	µg/L											
USEPA_8270B_PAH	2-Chlorophenol	N	9.4	µg/L						< 9.4			< 9.4		
USEPA_8270B_PAH	2-Chlorophenol	N	9.5	µg/L											
USEPA_8270B_PAH	2-Chlorophenol	N	9.6	µg/L				< 9.6							
USEPA_8270B_PAH	Pentachlorophenol	N	18.5	µg/L								< 18.5		< 18.5	
USEPA_8270B_PAH	Pentachlorophenol	N	18.7	µg/L											
USEPA_8270B_PAH	Pentachlorophenol	N	18.9	µg/L						< 18.9			< 18.9		
USEPA_8270B_PAH	Pentachlorophenol	N	19.0	µg/L											
USEPA_8270B_PAH	Pentachlorophenol	N	19.2	µg/L				< 19.2							
USEPA_8270B_PAH	Pentachlorophenol	N	2.0	µg/L		< 2.0	< 2.0								
USEPA_8270B_PAH	Pentachlorophenol	N	20.0	µg/L					< 20.0						
USEPA_8270B_PAH	Pentachlorophenol	N	24.4	µg/L							< 24.4				
USEPA_8270B_PAH	Pentachlorophenol	N	40.0	µg/L											< 40.0
USEPA_8270B_PAH	Pentachlorophenol	N	4.7	µg/L	< 4.7										
USEPA_8270B_PAH	Pentachlorophenol	N	4.8	µg/L											
USEPA_8270B_PAH	Pentachlorophenol	N	52.6	µg/L											
USEPA_8270B_PAH	Pentachlorophenol	N	9.4	µg/L											
USEPA_8270B_PAH	Phenol	N	1.0	µg/L		3.1	3.9								
USEPA_8270B_PAH	Phenol	N	10.0	µg/L					< 10.0						
USEPA_8270B_PAH	Phenol	N	12.2	µg/L							< 12.2				
USEPA_8270B_PAH	Phenol	N	2.3	µg/L	3.3										
USEPA_8270B_PAH	Phenol	N	2.4	µg/L											
USEPA_8270B_PAH	Phenol	N	20.0	µg/L											< 20.0
USEPA_8270B_PAH	Phenol	N	26.3	µg/L											
USEPA_8270B_PAH	Phenol	N	4.7	µg/L											
USEPA_8270B_PAH	Phenol	N	9.2	µg/L								< 9.2		< 9.2	
USEPA_8270B_PAH	Phenol	N	9.3	µg/L											
USEPA_8270B_PAH	Phenol	N	9.4	µg/L						< 9.4			< 9.4		
USEPA_8270B_PAH	Phenol	N	9.5	µg/L											
USEPA_8270B_PAH	Phenol	N	9.6	µg/L				< 9.6							

**Attachment A-1**  
**Tanumbirini Wells 2H and 3H Weekly Samples**  
**Tanumbirini 2H/3H Flowback Wastewater - Risk Assessment, EP-161, McArthur Basin**  
**Katherine, Northern Territory**  
**Santos Ltd.**

Notes	
BLANK CELL	Information not available
FRACTION	T - Total
	D - Dissolved
	N - Null
SAMPLE TYPE	N - Normal Grab Sample
	TB - Trip Blank
	NST - No Sample Taken
	FD - Field Duplicate
WORKORDER (Empty)	Field measurement only

< less than limit of report  
 NC = no criteria  
 °C = degrees Celsius    PAH = polycyclic aromatic hydrocarbons  
 µg/L = micrograms per litre  
 µS/cm = microsiemen per centimetre  
 TEQ = toxic equivalence quotient  
 Bq/L = becquerel per litre  
 BTEX = benzene, toluene, ethylbenzene, xylene  
 CaCO<sub>3</sub> = calcium carbonate  
 LOR = limit of reporting  
 meq/L = milliequivalents per litre  
 mg/L = milligrams per litre

Attachment A-2  
 Tanumbirini Wells 2H and 3H Tank Samples  
 Tanumbirini 2H/3H Flowback Wastewater - Risk Assessment, EP-161, McArthur Basin  
 Katherine, Northern Territory  
 Santos Ltd.

FACILITY		MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN		
SAMPLE_DATE		5/17/2022	5/17/2022	2/2/2022	2/2/2022	5/2/2022	5/17/2022		
LOCATION		TAN1FBCT1	TANFBCT3	TANFBCT4	TANFBCT4	TANFBCT4	TANFBCT5		
DESCRIPTION		TANUMBIRINI 1 WELL FLOWBACK STORAGE CONCEPT TANK/POND 1 - 4m BOTTOM - 0.2m TOP	TANUMBIRINI CONCEPT TANK/POND 3	TANUMBIRINI CONCEPT TANK/POND 4	TANUMBIRINI CONCEPT TANK/POND 4	TANUMBIRINI CONCEPT TANK/POND 4	TANUMBIRINI CONCEPT TANK/POND 5		
WORK ORDER		EB2214212	EB2214212	EB2203220	EB2203220		EB2214212		
SAMPLE TYPE		N	N	N	N	N	N		
METHOD	PARAMETER-CHEMICAL	FRACTION	LOR	UNIT	RESULT	RESULT	RESULT	RESULT	
APHA 3125 B	Boron	D	100	µg/L	17200				
APHA 3125 B	Boron	D	5	µg/L		4340	7680	8160	
APHA 3125 B	Boron	D	500	µg/L				3920	
APHA 3125 B	Boron	T	100	µg/L					
APHA 3125 B	Boron	T	105	µg/L	23400				
APHA 3125 B	Boron	T	5	µg/L		10900	8190	8420	
APHA 3125 B	Boron	T	525	µg/L				9900	
APHA 3125 B	Lithium	D	1	µg/L					
APHA 3125 B	Lithium	T	1	µg/L					
APHA 3125 B	Selenium	D	0.2	µg/L		1.8		1.4	
APHA 3125 B	Selenium	D	0.5	µg/L		1.5	2.1		
APHA 3125 B	Selenium	D	2	µg/L	3				
APHA 3125 B	Selenium	T	0.2	µg/L		0.3		0.4	
APHA 3125 B	Selenium	T	0.5	µg/L		1.6	1.6		
APHA 3125 B	Selenium	T	2	µg/L	4				
APHA 3125 B	Zinc	D	1	µg/L		16		14	
APHA 3125 B	Zinc	D	2	µg/L			4	5	
APHA 3125 B	Zinc	D	5	µg/L	< 5				
APHA 3125 B	Zinc	T	1	µg/L		43		18	
APHA 3125 B	Zinc	T	2	µg/L					
APHA 3125 B	Zinc	T	5	µg/L	17		10	5	
APHA_1030F	Ionic Balance	N	0.01	%	0.29	8.07	4.25	3.47	10.3
APHA_1030F	Total Anions	N	0.01	meq/L	199	124	96	96.6	99.4
APHA_1030F	Total Cations	N	0.01	meq/L	198	106	88.2	90.2	80.8
APHA_2320_B	Bicarbonate Alkalinity as CaCO3	N	1	mg/L	658	674	733	743	616
APHA_2320_B	Carbonate Alkalinity as CaCO3	N	1	mg/L	246	< 1	23	15	14
APHA_2320_B	Hydroxide Alkalinity as CaCO3	N	1	mg/L	< 1	< 1	< 1	< 1	< 1
APHA_2320_B	Total Alkalinity as CaCO3	N	1	mg/L	903	674	756	758	630
APHA_2510_B	Electrical Conductivity @ 25°C	N	1	µS/cm	17500	10600	9020	9500	8600
APHA_2540_C	Total Dissolved Solids @180°C	T	10	mg/L	11000	6570	5540	5540	5240
APHA_2540_D	Suspended Solids	N	5	mg/L	83	< 5	8	8	< 5
APHA_3112_CV_FIMS	Mercury	D	0.0001	mg/L	< 0.0001	< 0.0001			< 0.0001
APHA_3112_CV_FIMS	Mercury	D	0.0005	mg/L			< 0.0005		
APHA_3112_CV_FIMS	Mercury	D	0.0010	mg/L					
APHA_3112_CV_FIMS	Mercury	D	0.0020	mg/L					
APHA_3112_CV_FIMS	Mercury	D	0.0025	mg/L			< 0.0025		
APHA_3112_CV_FIMS	Mercury	D	0.0050	mg/L					
APHA_3112_CV_FIMS	Mercury	T	0.0001	mg/L					
APHA_3112_CV_FIMS	Mercury	T	0.0005	mg/L	< 0.0005	< 0.0005	< 0.0005		< 0.0005
APHA_3112_CV_FIMS	Mercury	T	0.0010	mg/L					
APHA_3112_CV_FIMS	Mercury	T	0.0020	mg/L					
APHA_3112_CV_FIMS	Mercury	T	0.0025	mg/L			< 0.0025		
APHA_3112_CV_FIMS	Mercury	T	0.0050	mg/L					
APHA_3120	Calcium	D	1	mg/L	102	148	130	132	124
APHA_3120	Magnesium	D	1	mg/L	106	68	69	70	59
APHA_3120	Potassium	D	1	mg/L	111	39	48	49	41
APHA_3120	Sodium	D	1	mg/L	4170	2110	1720	1760	1530
APHA_4110	Bromide	N	0.100	mg/L					
APHA_4110	Bromide	N	0.500	mg/L		46.9	33.8	33.4	35
APHA_4110	Bromide	N	1.00	mg/L	68.2				
APHA_4110	Bromide	N	2.00	mg/L					
APHA_4110	Bromide	N	5.00	mg/L					
APHA_4500_CI	Chloride	N	1	mg/L			2830	2850	
APHA_4500_CI	Chloride	N	10	mg/L	6270	3900			3000
APHA_4500_CI_G	Free Chlorine	N	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
APHA_4500_CI_G	Free Chlorine	N	0.10	mg/L					
APHA_4500_CI_G	Total Residual Chlorine	N	0.02	mg/L	< 0.02	0.02	0.02	< 0.02	< 0.02
APHA_4500_CI_G	Total Residual Chlorine	N	0.10	mg/L					
APHA_4500_CN_O	Total Cyanide	T	0.004	mg/L			< 0.004	< 0.004	

Attachment A-2  
 Tanumbirini Wells 2H and 3H Tank Samples  
 Tanumbirini 2H/3H Flowback Wastewater - Risk Assessment, EP-161, McArthur Basin  
 Katherine, Northern Territory  
 Santos Ltd.

FACILITY		MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN		
SAMPLE DATE		5/17/2022	5/17/2022	2/2/2022	2/2/2022	5/2/2022	5/17/2022		
LOCATION		TAN1FBCT1	TANFBCT3	TANFBCT4	TANFBCT4	TANFBCT4	TANFBCT5		
DESCRIPTION		TANUMBIRINI 1 WELL FLOWBACK STORAGE CONCEPT TANK/POND 1 - 4m BOTTOM - 0.2m TOP	TANUMBIRINI CONCEPT TANK/POND 3	TANUMBIRINI CONCEPT TANK/POND 4	TANUMBIRINI CONCEPT TANK/POND 4	TANUMBIRINI CONCEPT TANK/POND 4	TANUMBIRINI CONCEPT TANK/POND 5		
WORK ORDER		EB2214212	EB2214212	EB2203220	EB2203220		EB2214212		
SAMPLE TYPE		N	N	N	N	N	N		
METHOD	PARAMETER-CHEMICAL	FRACTION	LOR	UNIT	RESULT	RESULT	RESULT		
APHA_4500_F_C	Fluoride	N	0.1	mg/L	2.1	1.3	1.1	1.2	1.3
APHA_4500_H_B	pH - Lab	N	0.01	pH Unit	8.86	8.29	8.35	8.32	8.34
APHA_4500_NH3_G	Ammonia as N	N	0.01	mg/L		8.95	8.81		
APHA_4500_NH3_G	Ammonia as N	N	0.10	mg/L	2.68	22.4			14.4
APHA_4500_NO2_B	Nitrite as N	N	0.01	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
APHA_4500_NO2_B	Nitrite as N	N	0.10	mg/L					
APHA_4500_NO3_F	Nitrate as N	N	0.01	mg/L	< 0.01	< 0.01	< 0.01	0.04	< 0.01
APHA_4500_NO3_F	Nitrate as N	N	0.1	mg/L					
APHA_4500_NORG_D	Total Kjeldahl Nitrogen as N	N	0.1	mg/L		25.4	15.4	14.6	17.5
APHA_4500_NORG_D	Total Kjeldahl Nitrogen as N	N	0.5	mg/L	31				
APHA_4500_NORG_D	Total Kjeldahl Nitrogen as N	N	1.0	mg/L					
APHA_4500_NORG+NO3	Total Nitrogen as N	N	0.1	mg/L		25.4	15.4	14.6	17.5
APHA_4500_NORG+NO3	Total Nitrogen as N	N	0.5	mg/L	31				
APHA_4500_NORG+NO3	Total Nitrogen as N	N	1	mg/L					
APHA_4500_P_E	Reactive Phosphorus as P	T	0.01	mg/L	< 0.01		0.08	0.08	
APHA_4500_P_E	Reactive Phosphorus as P	T	0.05	mg/L		0.6			0.45
APHA_4500_P_H	Total Phosphorus as P	T	0.01	mg/L		0.65	0.24	0.24	0.5
APHA_4500_P_H	Total Phosphorus as P	T	0.05	mg/L	1.46				
APHA_4500_P_H	Total Phosphorus as P	T	0.10	mg/L					
APHA_4500_SIO2	Reactive Silica	N	0.05	mg/L	74	85.5	83.4	83.9	81.2
APHA_4500_SIO2	Reactive Silica	N	0.50	mg/L					
APHA_4500_SIO2	Reactive Silica	N	1.00	mg/L					
APHA_4500_SO4_E	Sulfate as SO4 2-	D	1	mg/L			53	53	
APHA_4500_SO4_E	Sulfate as SO4 2-	D	10	mg/L	206	41			106
APHA_5310_B_DOC	Dissolved Organic Carbon	N	1	mg/L					
APHA_5310_B_DOC	Dissolved Organic Carbon	N	10	mg/L					
APHA_5310_B_DOC	Dissolved Organic Carbon	N	5	mg/L	128	23	30	32	23
APHA_5310_B_DOC	Total Organic Carbon	N	10	mg/L					
APHA_5310_B_DOC	Total Organic Carbon	N	2	mg/L					
APHA_5310_B_DOC	Total Organic Carbon	N	5	mg/L	119	27	32	32	20
ASTM_D_6303-98	Formaldehyde	N	0.1	mg/L	0.3	0.3	0.2	0.2	0.2
CSN_75_7611_75_7612	Gross alpha	N	0.05	Bq/L					
CSN_75_7611_75_7612	Gross alpha	N	0.13	Bq/L					
CSN_75_7611_75_7612	Gross alpha	N	0.14	Bq/L					0.6
CSN_75_7611_75_7612	Gross alpha	N	0.15	Bq/L			0.74	0.76	
CSN_75_7611_75_7612	Gross alpha	N	0.16	Bq/L					
CSN_75_7611_75_7612	Gross alpha	N	0.18	Bq/L		0.64			
CSN_75_7611_75_7612	Gross alpha	N	0.23	Bq/L					
CSN_75_7611_75_7612	Gross alpha	N	0.24	Bq/L					
CSN_75_7611_75_7612	Gross alpha	N	0.26	Bq/L					
CSN_75_7611_75_7612	Gross alpha	N	0.28	Bq/L					
CSN_75_7611_75_7612	Gross alpha	N	0.29	Bq/L	< 0.29				
CSN_75_7611_75_7612	Gross alpha	N	0.30	Bq/L					
CSN_75_7611_75_7612	Gross alpha	N	0.32	Bq/L					
CSN_75_7611_75_7612	Gross alpha	N	0.57	Bq/L					
CSN_75_7611_75_7612	Gross alpha	N	1.14	Bq/L					
CSN_75_7611_75_7612	Gross beta activity - 40K	N	0.10	Bq/L					
CSN_75_7611_75_7612	Gross beta activity - 40K	N	0.26	Bq/L					
CSN_75_7611_75_7612	Gross beta activity - 40K	N	0.29	Bq/L					0.37
CSN_75_7611_75_7612	Gross beta activity - 40K	N	0.30	Bq/L			0.73	0.3	
CSN_75_7611_75_7612	Gross beta activity - 40K	N	0.32	Bq/L					
CSN_75_7611_75_7612	Gross beta activity - 40K	N	0.36	Bq/L		< 0.36			
CSN_75_7611_75_7612	Gross beta activity - 40K	N	0.46	Bq/L					
CSN_75_7611_75_7612	Gross beta activity - 40K	N	0.49	Bq/L					
CSN_75_7611_75_7612	Gross beta activity - 40K	N	0.52	Bq/L					
CSN_75_7611_75_7612	Gross beta activity - 40K	N	0.53	Bq/L					
CSN_75_7611_75_7612	Gross beta activity - 40K	N	0.55	Bq/L					
CSN_75_7611_75_7612	Gross beta activity - 40K	N	0.58	Bq/L	< 0.58				
CSN_75_7611_75_7612	Gross beta activity - 40K	N	0.59	Bq/L					



Attachment A-2  
 Tanumbirini Wells 2H and 3H Tank Samples  
 Tanumbirini 2H/3H Flowback Wastewater - Risk Assessment, EP-161, McArthur Basin  
 Katherine, Northern Territory  
 Santos Ltd.

FACILITY		MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN
SAMPLE DATE		5/17/2022	5/17/2022	2/2/2022	2/2/2022	5/2/2022	5/17/2022
LOCATION		TAN1FBCT1	TANFBCT3	TANFBCT4	TANFBCT4	TANFBCT4	TANFBCT5
DESCRIPTION		TANUMBIRINI 1 WELL FLOWBACK STORAGE CONCEPT TANK/POND 1 - 4m BOTTOM - 0.2m TOP	TANUMBIRINI CONCEPT TANK/POND 3	TANUMBIRINI CONCEPT TANK/POND 4	TANUMBIRINI CONCEPT TANK/POND 4	TANUMBIRINI CONCEPT TANK/POND 4	TANUMBIRINI CONCEPT TANK/POND 5
WORK ORDER		EB2214212	EB2214212	EB2203220	EB2203220		EB2214212
SAMPLE TYPE		N	N	N	N	N	N
METHOD	PARAMETER-CHEMICAL	FRACTION	LOR	UNIT	RESULT	RESULT	RESULT
CSN_75_7611_75_7612	Gross beta activity - 40K	N	0.61	Bq/L			
CSN_75_7611_75_7612	Gross beta activity - 40K	N	0.65	Bq/L			
CSN_75_7611_75_7612	Gross beta activity - 40K	N	1.14	Bq/L			
CSN_75_7611_75_7612	Gross beta activity - 40K	N	2.27	Bq/L			
Field Measure	Carbon Dioxide - Field	T		mg/L		10	15
Field Measure	Clarity - Field	N		No Unit		Clear	Clear
Field Measure	Colour - Field	N		No Unit		NA	NA
Field Measure	Dissolved Oxygen - Field	N		mg/L			GREEN
Field Measure	Electrical Conductivity - Field	N		µS/cm	1801	710	8338
Field Measure	Field Ambient Temperature	N		°C	28	29.7	27.4
Field Measure	Odour - Field	N		No Unit			28.2
Field Measure	pH - Field	N		pH Unit	8.9	7.3	8.27
Field Measure	Redox - Field	N		mV	-119	-34	
FIELD MEASURE	Total Dissolved Solids - Field	N		mg/L			29.8
Field Measure	Standing Water Level - Field	N		mbTOC			29
Field Measure	Total Alkalinity - Field	N		mg/L			
IN_HOUSE_LC-MSMS_EDC	2,4-Dinitrophenol	N	0.01	µg/L	< 0.01	< 0.01	< 0.01
IN_HOUSE_LC-MSMS_EDC	2-Methyl-4,6-dinitrophenol	N	0.05	µg/L	< 0.05	< 0.05	< 0.05
IN_HOUSE_LC-MSMS_EDC	2-Methyl-4,6-dinitrophenol	N	0.10	µg/L	< 0.10	< 0.10	< 0.10
IN_HOUSE_LC-MSMS_EDC	4-Chloro-3-Methylphenol	N	0.10	µg/L	< 0.10	< 0.10	< 0.10
IN_HOUSE_LC-MSMS_EDC	4-Nitrophenol	N	0.10	µg/L	< 0.10	< 0.10	< 0.10
IN_HOUSE_LC-MSMS_EDC	Dinoseb	N	0.10	µg/L	< 0.10	< 0.10	< 0.10
IN_HOUSE_LC-MSMS_EDC	Hexachlorophene	N	0.10	µg/L	< 0.10	< 0.10	< 0.10
IN_HOUSE_LC-MSMS_EDC	Hexachlorophene	N	0.50	µg/L	< 0.50	< 0.50	< 0.50
USEPA_6020	Aluminium	D	0.01	mg/L			
USEPA_6020	Aluminium	D	0.05	mg/L	< 0.05	< 0.05	< 0.05
USEPA_6020	Aluminium	T	0.01	mg/L	0.74	0.05	0.01
USEPA_6020	Aluminium	T	0.05	mg/L		< 0.05	< 0.05
USEPA_6020	Antimony	D	0.001	mg/L			
USEPA_6020	Antimony	D	0.005	mg/L	0.017	< 0.005	< 0.005
USEPA_6020	Antimony	T	0.001	mg/L	0.023	0.002	< 0.001
USEPA_6020	Antimony	T	0.005	mg/L		< 0.005	< 0.005
USEPA_6020	Arsenic	D	0.001	mg/L			
USEPA_6020	Arsenic	D	0.005	mg/L	0.04	0.01	0.014
USEPA_6020	Arsenic	T	0.001	mg/L	0.04	0.012	0.013
USEPA_6020	Arsenic	T	0.005	mg/L		0.013	0.013
USEPA_6020	Barium	D	0.001	mg/L			
USEPA_6020	Barium	D	0.005	mg/L	1.61	3.12	1.83
USEPA_6020	Barium	T	0.001	mg/L	1.6	3.37	1.89
USEPA_6020	Barium	T	0.005	mg/L		1.92	1.99
USEPA_6020	Beryllium	D	0.001	mg/L			
USEPA_6020	Beryllium	D	0.005	mg/L	< 0.005	< 0.005	< 0.005
USEPA_6020	Beryllium	T	0.001	mg/L	< 0.001	< 0.001	< 0.001
USEPA_6020	Beryllium	T	0.005	mg/L		< 0.005	< 0.005
USEPA_6020	Cadmium	D	0.0001	mg/L			
USEPA_6020	Cadmium	D	0.0005	mg/L	< 0.0005	< 0.0005	< 0.0005
USEPA_6020	Cadmium	T	0.0001	mg/L	< 0.0001	< 0.0001	< 0.0001
USEPA_6020	Cadmium	T	0.0005	mg/L		< 0.0005	< 0.0005
USEPA_6020	Chromium	D	0.001	mg/L			
USEPA_6020	Chromium	D	0.005	mg/L	0.017	0.045	0.033
USEPA_6020	Chromium	T	0.001	mg/L	0.028	0.047	0.041
USEPA_6020	Chromium	T	0.005	mg/L		0.043	0.043
USEPA_6020	Cobalt	D	0.001	mg/L			
USEPA_6020	Cobalt	D	0.005	mg/L	< 0.005	< 0.005	< 0.005
USEPA_6020	Cobalt	T	0.001	mg/L	0.002	< 0.001	< 0.001
USEPA_6020	Cobalt	T	0.005	mg/L		< 0.005	< 0.005
USEPA_6020	Copper	D	0.001	mg/L			
USEPA_6020	Copper	D	0.005	mg/L	< 0.005	< 0.005	< 0.005
USEPA_6020	Copper	T	0.001	mg/L	0.006	0.016	< 0.001

Attachment A-2  
 Tanumbirini Wells 2H and 3H Tank Samples  
 Tanumbirini 2H/3H Flowback Wastewater - Risk Assessment, EP-161, McArthur Basin  
 Katherine, Northern Territory  
 Santos Ltd.

		FACILITY		MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN
		SAMPLE_DATE		5/17/2022	5/17/2022	2/2/2022	2/2/2022	5/2/2022	5/17/2022
		LOCATION		TAN1FBCT1	TANFBCT3	TANFBCT4	TANFBCT4	TANFBCT4	TANFBCT5
		DESCRIPTION		TANUMBIRINI 1 WELL FLOWBACK STORAGE CONCEPT TANK/POND 1 - 4m BOTTOM - 0.2m TOP	TANUMBIRINI CONCEPT TANK/POND 3	TANUMBIRINI CONCEPT TANK/POND 4	TANUMBIRINI CONCEPT TANK/POND 4	TANUMBIRINI CONCEPT TANK/POND 4	TANUMBIRINI CONCEPT TANK/POND 5
		WORK ORDER		EB2214212	EB2214212	EB2203220	EB2203220		EB2214212
		SAMPLE TYPE		N	N	N	N	N	N
METHOD	PARAMETER-CHEMICAL	FRACTION	LOR	UNIT	RESULT	RESULT	RESULT	RESULT	RESULT
USEPA_6020	Copper	T	0.005	mg/L			< 0.005	< 0.005	
USEPA_6020	Iron	D	0.05	mg/L	0.38	1.37	1.07	2.01	0.32
USEPA_6020	Iron	T	0.05	mg/L	3.6	2.05	1.82	2.14	0.44
USEPA_6020	Lead	D	0.001	mg/L					
USEPA_6020	Lead	D	0.005	mg/L	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
USEPA_6020	Lead	T	0.001	mg/L	0.001	< 0.001			< 0.001
USEPA_6020	Lead	T	0.005	mg/L			< 0.005	< 0.005	
USEPA_6020	Manganese	D	0.001	mg/L					
USEPA_6020	Manganese	D	0.005	mg/L	0.042	0.438	0.326	0.353	0.324
USEPA_6020	Manganese	T	0.001	mg/L	0.125	0.548			0.398
USEPA_6020	Manganese	T	0.005	mg/L			0.358	0.363	
USEPA_6020	Molybdenum	D	0.001	mg/L					
USEPA_6020	Molybdenum	D	0.005	mg/L	0.042	0.005	0.006	0.006	< 0.005
USEPA_6020	Molybdenum	T	0.001	mg/L	0.044	0.002			0.001
USEPA_6020	Molybdenum	T	0.005	mg/L			0.006	0.007	
USEPA_6020	Nickel	D	0.001	mg/L					
USEPA_6020	Nickel	D	0.005	mg/L	0.028	0.005	0.005	0.007	< 0.005
USEPA_6020	Nickel	T	0.001	mg/L	0.03	0.009			0.003
USEPA_6020	Nickel	T	0.005	mg/L			0.006	0.006	
USEPA_6020	Silver	D	0.001	mg/L					
USEPA_6020	Silver	D	0.005	mg/L	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
USEPA_6020	Silver	T	0.001	mg/L	< 0.001	< 0.001			< 0.001
USEPA_6020	Silver	T	0.005	mg/L			< 0.005	< 0.005	
USEPA_6020	Strontium	D	0.001	mg/L					
USEPA_6020	Strontium	D	0.005	mg/L	5.65	7.36	5.46	5.48	4.68
USEPA_6020	Strontium	T	0.001	mg/L	5.89	9.3			5.85
USEPA_6020	Strontium	T	0.005	mg/L			5.61	5.67	
USEPA_6020	Thorium	D	0.001	mg/L					
USEPA_6020	Thorium	D	0.005	mg/L	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
USEPA_6020	Thorium	T	0.001	mg/L	0.001	< 0.001			< 0.001
USEPA_6020	Thorium	T	0.005	mg/L			< 0.005	< 0.005	
USEPA_6020	Tin	D	0.001	mg/L					
USEPA_6020	Tin	D	0.005	mg/L	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
USEPA_6020	Tin	T	0.001	mg/L	< 0.001	< 0.001			< 0.001
USEPA_6020	Tin	T	0.005	mg/L			< 0.005	< 0.005	
USEPA_6020	Uranium	D	0.001	mg/L					
USEPA_6020	Uranium	D	0.005	mg/L	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
USEPA_6020	Uranium	T	0.001	mg/L	0.001	< 0.001			< 0.001
USEPA_6020	Uranium	T	0.005	mg/L			< 0.005	< 0.005	
USEPA_6020	Vanadium	D	0.01	mg/L					
USEPA_6020	Vanadium	D	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
USEPA_6020	Vanadium	T	0.01	mg/L	< 0.01	< 0.01			< 0.01
USEPA_6020	Vanadium	T	0.05	mg/L			< 0.05	< 0.05	
USEPA_8015	>C10 - C16 Fraction	N	100	µg/L	3610	360	130	250	< 100
USEPA_8015	>C10 - C16 Fraction	N	570	µg/L					
USEPA_8015	>C10 - C16 Fraction minus Naphthalene (F2)	N	100	µg/L	3610	360	130	250	< 100
USEPA_8015	>C10 - C16 Fraction minus Naphthalene (F2)	N	570	µg/L					
USEPA_8015	>C10 - C40 Fraction (sum)	N	100	µg/L	5700	360	280	430	< 100
USEPA_8015	>C10 - C40 Fraction (sum)	N	570	µg/L					
USEPA_8015	>C16 - C34 Fraction	N	100	µg/L	1970	< 100	150	180	< 100
USEPA_8015	>C16 - C34 Fraction	N	570	µg/L					
USEPA_8015	>C34 - C40 Fraction	N	100	µg/L	120	< 100	< 100	< 100	< 100
USEPA_8015	>C34 - C40 Fraction	N	570	µg/L					
USEPA_8015	C6 - C36 Fraction (Sum)	N	20	µg/L	5650	480	260	410	70
USEPA_8015	C6 - C36 Fraction (Sum)	N	230	µg/L					
USEPA_8260	Benzene	N	1	µg/L	< 1	< 1	< 1	< 1	< 1
USEPA_8260	C6 - C10 Fraction	N	20	µg/L	< 20	< 20	< 20	< 20	< 20
USEPA_8260	C6 - C10 Fraction minus BTEX (F1)	N	20	µg/L	< 20	< 20	< 20	< 20	< 20
USEPA_8260	Ethylbenzene	N	2	µg/L	< 2	< 2	< 2	< 2	< 2

Attachment A-2  
 Tanumbirini Wells 2H and 3H Tank Samples  
 Tanumbirini 2H/3H Flowback Wastewater - Risk Assessment, EP-161, McArthur Basin  
 Katherine, Northern Territory  
 Santos Ltd.

FACILITY		MCARTHUR BASIN		MCARTHUR BASIN		MCARTHUR BASIN		MCARTHUR BASIN	
SAMPLE_DATE		5/17/2022		5/17/2022		2/2/2022		2/2/2022	
LOCATION		TAN1FBCT1		TANFBCT3		TANFBCT4		TANFBCT4	
DESCRIPTION		TANUMBIRINI 1 WELL FLOWBACK STORAGE CONCEPT TANK/POND 1 - 4m BOTTOM - 0.2m TOP		TANUMBIRINI CONCEPT TANK/POND 3		TANUMBIRINI CONCEPT TANK/POND 4		TANUMBIRINI CONCEPT TANK/POND 4	
WORK ORDER		EB2214212		EB2214212		EB2203220		EB2203220	
SAMPLE TYPE		N		N		N		N	
METHOD	PARAMETER-CHEMICAL	FRACTION	LOR	UNIT	RESULT	RESULT	RESULT	RESULT	RESULT
USEPA_8260	meta- & para-Xylene	N	2	µg/L	< 2	< 2	< 2	< 2	< 2
USEPA_8260	ortho-Xylene	N	2	µg/L	< 2	< 2	< 2	< 2	< 2
USEPA_8260	Toluene	N	2	µg/L	< 2	< 2	< 2	< 2	< 2
USEPA_8260	Total Xylenes	N	2	µg/L	< 2	< 2	< 2	< 2	< 2
USEPA_8270_UT	2-Nitrophenol	N	0.1	µg/L	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
USEPA_8270_UT	2-Nitrophenol	N	0.2	µg/L	< 0.2				
USEPA_8270_UT	3-Methylcholanthrene	N	0.1	µg/L	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
USEPA_8270_UT	3-Methylcholanthrene	N	0.2	µg/L	< 0.2				
USEPA_8270_UT	7,12-Dimethylbenz(a)anthracene	N	0.1	µg/L	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
USEPA_8270_UT	7,12-Dimethylbenz(a)anthracene	N	0.2	µg/L	< 0.2				
USEPA_8270_UT	Acenaphthene	N	0.1	µg/L	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
USEPA_8270_UT	Acenaphthene	N	0.2	µg/L	< 0.2				
USEPA_8270_UT	Acenaphthylene	N	0.1	µg/L	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
USEPA_8270_UT	Acenaphthylene	N	0.2	µg/L	< 0.2				
USEPA_8270_UT	Anthracene	N	0.1	µg/L	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
USEPA_8270_UT	Anthracene	N	0.2	µg/L	< 0.2				
USEPA_8270_UT	Benzo(a)anthracene	N	0.1	µg/L	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
USEPA_8270_UT	Benzo(a)anthracene	N	0.2	µg/L	< 0.2				
USEPA_8270_UT	Benzo(a)pyrene	N	0.05	µg/L	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
USEPA_8270_UT	Benzo(a)pyrene	N	0.19	µg/L					
USEPA_8270_UT	Benzo(a)pyrene	N	0.22	µg/L	< 0.22				
USEPA_8270_UT	Benzo(a)pyrene	N	0.25	µg/L					
USEPA_8270_UT	Benzo(a)pyrene	N	0.26	µg/L					
USEPA_8270_UT	Benzo(a)pyrene TEQ (zero)	N	0.1	µg/L	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
USEPA_8270_UT	Benzo(a)pyrene TEQ (zero)	N	0.2	µg/L	< 0.2				
USEPA_8270_UT	Benzo(b+j)fluoranthene	N	0.1	µg/L	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
USEPA_8270_UT	Benzo(b+j)fluoranthene	N	0.2	µg/L	< 0.2				
USEPA_8270_UT	Benzo(g,h,i)perylene	N	0.1	µg/L	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
USEPA_8270_UT	Benzo(g,h,i)perylene	N	0.2	µg/L	< 0.2				
USEPA_8270_UT	Benzo(k)fluoranthene	N	0.1	µg/L	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
USEPA_8270_UT	Benzo(k)fluoranthene	N	0.2	µg/L	< 0.2				
USEPA_8270_UT	Chrysene	N	0.1	µg/L	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
USEPA_8270_UT	Chrysene	N	0.2	µg/L	< 0.2				
USEPA_8270_UT	Dibenz(a,h)anthracene	N	0.1	µg/L	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
USEPA_8270_UT	Dibenz(a,h)anthracene	N	0.2	µg/L	< 0.2				
USEPA_8270_UT	Fluoranthene	N	0.1	µg/L	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
USEPA_8270_UT	Fluoranthene	N	0.2	µg/L	< 0.2				
USEPA_8270_UT	Fluorene	N	0.1	µg/L	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
USEPA_8270_UT	Fluorene	N	0.2	µg/L	< 0.2				
USEPA_8270_UT	Indeno(1,2,3.cd)pyrene	N	0.1	µg/L	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
USEPA_8270_UT	Indeno(1,2,3.cd)pyrene	N	0.2	µg/L	< 0.2				
USEPA_8270_UT	m & p-Cresol	N	0.1	µg/L	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
USEPA_8270_UT	m & p-Cresol	N	0.2	µg/L	< 0.2				
USEPA_8270_UT	m-Cresol	N	0.1	µg/L	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
USEPA_8270_UT	m-Cresol	N	0.2	µg/L	< 0.2				
USEPA_8270_UT	Naphthalene	N	0.1	µg/L	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
USEPA_8270_UT	Naphthalene	N	0.2	µg/L	< 0.2				
USEPA_8270_UT	p-Cresol	N	0.1	µg/L	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
USEPA_8270_UT	p-Cresol	N	0.2	µg/L	< 0.2				
USEPA_8270_UT	Phenanthrene	N	0.1	µg/L	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
USEPA_8270_UT	Phenanthrene	N	0.2	µg/L	< 0.2				
USEPA_8270_UT	Pyrene	N	0.1	µg/L	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
USEPA_8270_UT	Pyrene	N	0.2	µg/L	< 0.2				
USEPA_8270_UT	Sum of polycyclic aromatic hydrocarbons (PAHs)	N	0.1	µg/L	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
USEPA_8270_UT	Sum of polycyclic aromatic hydrocarbons (PAHs)	N	0.2	µg/L	< 0.2				
USEPA_8270B_PAH	2,3,4,6-Tetrachlorophenol	N	1.0	µg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
USEPA_8270B_PAH	2,3,4,6-Tetrachlorophenol	N	2.3	µg/L					
USEPA_8270B_PAH	2,3,4,6-Tetrachlorophenol	N	5.0	µg/L					
USEPA_8270B_PAH	2,4,5-Trichlorophenol	N	1.0	µg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

Attachment A-2  
 Tanumbirini Wells 2H and 3H Tank Samples  
 Tanumbirini 2H/3H Flowback Wastewater - Risk Assessment, EP-161, McArthur Basin  
 Katherine, Northern Territory  
 Santos Ltd.

FACILITY		MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN	MCARTHUR BASIN		
SAMPLE_DATE		5/17/2022	5/17/2022	2/2/2022	2/2/2022	5/2/2022	5/17/2022		
LOCATION		TAN1FBCT1	TANFBCT3	TANFBCT4	TANFBCT4	TANFBCT4	TANFBCT5		
DESCRIPTION		TANUMBIRINI 1 WELL FLOWBACK STORAGE CONCEPT TANK/POND 1 - 4m BOTTOM - 0.2m TOP	TANUMBIRINI CONCEPT TANK/POND 3	TANUMBIRINI CONCEPT TANK/POND 4	TANUMBIRINI CONCEPT TANK/POND 4	TANUMBIRINI CONCEPT TANK/POND 4	TANUMBIRINI CONCEPT TANK/POND 5		
WORK ORDER		EB2214212	EB2214212	EB2203220	EB2203220		EB2214212		
SAMPLE TYPE		N	N	N	N	N	N		
METHOD	PARAMETER-CHEMICAL	FRACTION	LOR	UNIT	RESULT	RESULT	RESULT	RESULT	RESULT
USEPA_8270B_PAH	2.4.5-Trichlorophenol	N	2.3	µg/L					
USEPA_8270B_PAH	2.4.5-Trichlorophenol	N	5.0	µg/L					
USEPA_8270B_PAH	2.4.6-Trichlorophenol	N	1.0	µg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
USEPA_8270B_PAH	2.4.6-Trichlorophenol	N	2.3	µg/L					
USEPA_8270B_PAH	2.4.6-Trichlorophenol	N	5.0	µg/L					
USEPA_8270B_PAH	2.4-Dichlorophenol	N	1.0	µg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
USEPA_8270B_PAH	2.4-Dichlorophenol	N	2.3	µg/L					
USEPA_8270B_PAH	2.4-Dichlorophenol	N	2.5	µg/L					
USEPA_8270B_PAH	2.4-Dimethylphenol	N	1.0	µg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
USEPA_8270B_PAH	2.4-Dimethylphenol	N	2.3	µg/L					
USEPA_8270B_PAH	2.4-Dimethylphenol	N	5.0	µg/L					
USEPA_8270B_PAH	2.6-Dichlorophenol	N	1.0	µg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
USEPA_8270B_PAH	2.6-Dichlorophenol	N	2.3	µg/L					
USEPA_8270B_PAH	2.6-Dichlorophenol	N	5.0	µg/L					
USEPA_8270B_PAH	2-Chlorophenol	N	1.0	µg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
USEPA_8270B_PAH	2-Chlorophenol	N	2.3	µg/L					
USEPA_8270B_PAH	2-Chlorophenol	N	5.0	µg/L					
USEPA_8270B_PAH	Pentachlorophenol	N	10.0	µg/L					< 2.0
USEPA_8270B_PAH	Pentachlorophenol	N	2.0	µg/L	< 2.0	< 2.0	< 2.0	< 2.0	
USEPA_8270B_PAH	Pentachlorophenol	N	4.7	µg/L					
USEPA_8270B_PAH	Phenol	N	1.0	µg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
USEPA_8270B_PAH	Phenol	N	1.3	µg/L					
USEPA_8270B_PAH	Phenol	N	2.3	µg/L					
USEPA_8270B_PAH	Phenol	N	4.7	µg/L					
USEPA_8270B_PAH	Phenol	N	4.8	µg/L					
USEPA_8270B_PAH	Phenol	N	5.0	µg/L					

Notes	
BLANK CELL	Information not available
FRACTION	T - Total
	D - Dissolved
	N - Null
SAMPLE TYPE	N - Normal Grab Sample
	TB - Trip Blank
	NST - No Sample Taken
	FD - Field Duplicate
WORKORDER (Empty)	Field measurement only

< less than limit of reporting  
 °C = degrees Celsius  
 µg/L = micrograms per liter  
 µS/cm = microsiemen per centimetre  
 Bq/L = becquerel per litre  
 BTEX = benzene, toluene, ethylbenzene, xylene  
 CaCO3 = calcium carbonate  
 LOR = limit of reporting  
 meq/L = milliequivalents per litre  
 mg/L = milligrams per litre

NC = no criteria  
 PAH = polycyclic aromatic hydrocarbons  
 SO4 2- = sulfate  
 TEQ = toxic equivalence quotient  
 USEPA = United States Environmental Protection Agency

Santos Ltd.

Tanumbirini 2H/3H Flowback Wastewater - Risk Assessment, EP-161, McArthur Basin  
17 June 2022



## Attachment B Screening Assessment – Tanumbirini Wells 2H and 3H Tank Water













Attachment B  
Avian Risk Screening Assessment  
Tanumbirini 2H and 3H Flowbackwater - Avian Risk Assessment  
McArthur Basin  
Santos Ltd.

FACILITY	SAMPLE DATE	LOCATION	MCARTHUR BASIN		MCARTHUR BASIN		MCARTHUR BASIN		MCARTHUR BASIN		MCARTHUR BASIN		MCARTHUR BASIN		Freshwater Trigger Value (FTV)	Alternative SW Screening Criteria	Reference		
			5/17/2022	5/17/2022	2/2/2022	2/2/2022	5/2/2022	5/17/2022	TAN1FBCT1	TANFBCT3	TANFBCT4	TANFBCT4	TANFBCT4	TANFBCT5					
DESCRIPTION			TANUMBIRINI 1 WELL FLOWBACK STORAGE CONCEPT TANK/POND 1 - 4m BOTTOM - 0.2m TOP		TANUMBIRINI CONCEPT TANK/POND 3		TANUMBIRINI CONCEPT TANK/POND 4		TANUMBIRINI CONCEPT TANK/POND 4		TANUMBIRINI CONCEPT TANK/POND 4		TANUMBIRINI CONCEPT TANK/POND 5						
WORK ORDER			EB2214212		EB2214212		EB2203220		EB2203220				EB2214212		FTVs by Protection Level (% Species)				
SAMPLE TYPE			N		N		N		N		N		N		99%	95%	90%	80%	
METHOD	PARAMETER-CHEMICAL	FRACTION	LOR	UNIT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT	99%	95%	90%	80%	
USEPA_8270B_PAH	2,4,5-Trichlorophenol	N	2.3	µg/L										NC	0.5	NC	NC		
USEPA_8270B_PAH	2,4,5-Trichlorophenol	N	5.0	µg/L										NC	0.5	NC	NC		
USEPA_8270B_PAH	2,4,6-Trichlorophenol	N	1.0	µg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	3	20	40	95		
USEPA_8270B_PAH	2,4,6-Trichlorophenol	N	2.3	µg/L										3	20	40	95		
USEPA_8270B_PAH	2,4,6-Trichlorophenol	N	5.0	µg/L										3	20	40	95		
USEPA_8270B_PAH	2,4-Dichlorophenol	N	1.0	µg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	120	160	200	270		
USEPA_8270B_PAH	2,4-Dichlorophenol	N	2.3	µg/L										120	160	200	270		
USEPA_8270B_PAH	2,4-Dichlorophenol	N	2.5	µg/L										120	160	200	270		
USEPA_8270B_PAH	2,4-Dimethylphenol	N	1.0	µg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	NC	2	NC	NC	2	h
USEPA_8270B_PAH	2,4-Dimethylphenol	N	2.3	µg/L										NC	2	NC	NC	2	h
USEPA_8270B_PAH	2,4-Dimethylphenol	N	5.0	µg/L										NC	2	NC	NC	2	h
USEPA_8270B_PAH	2,6-Dichlorophenol	N	1.0	µg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	NC	34	NC	NC	34	h
USEPA_8270B_PAH	2,6-Dichlorophenol	N	2.3	µg/L										NC	34	NC	NC	34	h
USEPA_8270B_PAH	2,6-Dichlorophenol	N	5.0	µg/L										NC	34	NC	NC	34	h
USEPA_8270B_PAH	2-Chlorophenol	N	1.0	µg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	340	490	630	870		
USEPA_8270B_PAH	2-Chlorophenol	N	2.3	µg/L										340	490	630	870		
USEPA_8270B_PAH	2-Chlorophenol	N	5.0	µg/L										340	490	630	870		
USEPA_8270B_PAH	Pentachlorophenol	N	10.0	µg/L									< 2.0	3.6	10	17	27		
USEPA_8270B_PAH	Pentachlorophenol	N	2.0	µg/L	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	3.6	10	17	27		
USEPA_8270B_PAH	Pentachlorophenol	N	4.7	µg/L										3.6	10	17	27		
USEPA_8270B_PAH	Phenol	N	1.0	µg/L	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	85	320	600	1200	1	
USEPA_8270B_PAH	Phenol	N	1.3	µg/L										85	320	600	1200	1	
USEPA_8270B_PAH	Phenol	N	2.3	µg/L										85	320	600	1200	1	
USEPA_8270B_PAH	Phenol	N	4.7	µg/L										85	320	600	1200	1	
USEPA_8270B_PAH	Phenol	N	4.8	µg/L										85	320	600	1200	1	
USEPA_8270B_PAH	Phenol	N	5.0	µg/L										85	320	600	1200	1	

Notes	
BLANK CELL	Information not available
FRACTION	T - Total
	D - Dissolved
	N - Null
SAMPLE TYPE	N - Normal Grab Sample
	TB - Trip Blank
	NST - No Sample Taken
	FD - Field Duplicate
WORKORDER (Empty)	Field measurement only

< less than limit of reporting  
°C = degrees Celsius  
µg/L = micrograms per liter  
µS/cm = microsiemen per centimetre  
Bq/L = becquerel per litre  
BTEX = benzene, toluene, ethylbenzene, xylene  
CaCO3 = calcium carbonate  
LOR = limit of reporting  
meq/L = milliequivalents per litre  
mg/L = milligrams per litre

NC = no criteria  
PAH = polycyclic aromatic hydrocarbons  
SO4 2- = sulfate  
TEQ = toxic equivalence quotient  
USEPA = United States Environmental Protection Agency

WATER QUALITY SCREENING CRITERIA EXCEEDANCE KEY	
Results underlined exceeds Freshwater Trigger Value 80%	
Results in <i>italic</i> exceeds Freshwater Trigger Value 90%	
Results shaded exceeds Freshwater Trigger Value 95%	
Results in <b>bold red</b> exceeds Freshwater Trigger Value 99%	
<b>Green</b> exceeds alternative screening criterion	

ALTERNATIVE WATER SCREENING CRITERIA NOTES	
NC - No appropriate screening criterion	
1 - API Publication 4709 September 2001. Frequently Asked Questions About TPH Analytical Methods for Crude Oil	
a - Major ions of concern for livestock drinking water quality - <a href="https://www.waterquality.gov.au/sites/default/files/documents/anzecc-armcanz-2000-guidelines-vol1.pdf">https://www.waterquality.gov.au/sites/default/files/documents/anzecc-armcanz-2000-guidelines-vol1.pdf</a>	
b - Default trigger values for physical and chemical stressors for Tropical Australia for slightly disturbed ecosystems (Table 3.3.4). FW Lakes and Reservoirs. <a href="https://www.waterquality.gov.au/sites/default/files/documents/anzecc-armcanz-2000-guidelines-vol1.pdf">https://www.waterquality.gov.au/sites/default/files/documents/anzecc-armcanz-2000-guidelines-vol1.pdf</a>	
c - Chronic aquatic life water quality criterion from Hohreiter DW1, Rigg DK. Derivation of ambient water quality criteria for formaldehyde. Chemosphere. 2001. Chemosphere. Nov;45(4-5):471-86. <a href="https://www.ncbi.nlm.nih.gov/pubmed/11680743">https://www.ncbi.nlm.nih.gov/pubmed/11680743</a>	
d - Trigger values for radioactive contaminants for irrigation water. Australian and New Zealand Guidelines for Fresh and Marine Water Quality. <a href="https://www.waterquality.gov.au/sites/default/files/documents/anzecc-armcanz-2000-guidelines-vol1.pdf">https://www.waterquality.gov.au/sites/default/files/documents/anzecc-armcanz-2000-guidelines-vol1.pdf</a>	
e - Australian and New Zealand Guidelines for Fresh and Marine Water Quality Screening Benchmarks (October 2000) from (From Oak Ridge National Laboratory - Risk Assessment Information System) <a href="https://rais.ornl.gov/tools/eco_search.php">https://rais.ornl.gov/tools/eco_search.php</a>	
f - CRWQCB . 2007. Screening For Environmental Concerns at Sites	
g - Guidelines for chemical compounds in water found to cause tainting of fish flesh and other aquatic organisms - <a href="https://www.waterquality.gov.au/sites/default/files/documents/anzecc-armcanz-2000-guidelines-vol1.pdf">https://www.waterquality.gov.au/sites/default/files/documents/anzecc-armcanz-2000-guidelines-vol1.pdf</a>	
h - Freshwater trigger value with unknown level of species protection.	
i - Default short-term trigger value for irrigation (Table 4.2.10). <a href="https://www.waterquality.gov.au/sites/default/files/documents/anzecc-armcanz-2000-guidelines-vol1.pdf">https://www.waterquality.gov.au/sites/default/files/documents/anzecc-armcanz-2000-guidelines-vol1.pdf</a>	

Santos Ltd.

Tanumbirini 2H/3H Flowback Wastewater - Risk Assessment, EP-161, McArthur Basin  
17 June 2022



## Attachment C Quantitative Risk Assessment – Avian Receptors – Tanumbirini Wells 2H and 3H Flowback Water

**Attachment C - Table C-1**  
**Avian Receptor Summary**  
**Tanumbirini Flowback Water - Avian Risk Assessment**  
**McArthur Basin**  
**Santos Ltd.**

Common Name	Scientific Name	Body Mass								Drinking WIR (L/day) <sup>3,4</sup>
		Sex <sup>1</sup>	N	Mean (kg)	Standard Deviation (kg)	Min (kg)	Max (kg)	Location	Source ID <sup>2</sup>	Mean
Crested Pigeon	<i>Ocyphaps lophotes</i>	B	21	0.204	---	0.142	0.26	Australia	515a	0.020
Willie Wagtail	<i>Rhipidura leucophrys picata</i>	B	13	0.0201	---	0.0145	0.0255	Australia	518a	0.004
Peaceful Dove	<i>Geopelia placida</i>	B	38	0.0478	---	0.035	0.065	Australia	515a	0.008
Cattle Egret	<i>Bubulcus ibis</i>	M	27	0.372	---	0.296	0.46	FL, USA	1207	0.0304
Cattle Egret	<i>Bubulcus ibis</i>	F	59	0.36	---	0.27	0.512	FL, USA	1207	0.0298
Brown Honeyeater	<i>Lichmera indistincta</i>	M	37	0.0118	0.0015	0.009	0.015	Australia	517	0.0030
Brown Honeyeater	<i>Lichmera indistincta</i>	F	15	0.0106	0.0021	0.008	0.014	Australia	517	0.0028

**Notes:**

<sup>1</sup> Sex: M, Male; F, Female; B, Both

<sup>2</sup> Body mass statistics compiled in Dunning (2008); Original source documents based on Source ID in Dunning (2008) include: Dunning, J. 2008. CRC Handbook of Avian Body Masses 2nd Edition. CRC Press; 2 edition Boca Raton : CRC Press, [2008].

515a. Higgins, P.J. and S.J.J.F. Davies. 1996. *Handbook of Australian, New Zealand and Antarctic birds*. Oxford University Press, Melbourne, Australia. Volume 3.

518a. Higgins, P.J., J.M. Peter, and S.J. Cowling. 2006. *Handbook of Australian, New Zealand and Antarctic birds*. Oxford University Press, Melbourne, Australia. Volume 7.  
1207. Telfair, R.C. 1994. *Cattle Egret (Bubulcus ibis) In The Birds of North America*. A. Poole and F. Gill (editors). The Birds of North America, Inc., Philadelphia, PA, and The American Ornithologists' Union, Washington, DC. Number 113.

517. Higgins, P.J., J.M. Peter, and W.K. Steele. 2001. *Handbook of Australian, New Zealand and Antarctic birds*. Oxford University Press, Melbourne, Australia. Volume 5.

<sup>3</sup> Drinking WIR based on the allometric relationship developed by Calder and Braun (1983). *Scaling of osmotic regulation in mammals and birds*. Am J Physiol. 1983 May;244(5): R601-6., where WIR (L/day) = 0.059 x BW (Kg)<sup>0.67</sup>

<sup>4</sup> Proposed WIR shown in bold, estimated based on the arithmetic mean of female or combined body mass; WIR may be estimated based on other body mass statistics depending on the appropriate exposure scenario.

--- = no data

BW = body weight

N = number

kg = kilogram

L = litre

WIR = water ingestion rate

**Attachment C - Table C-2**  
**Crested Pigeon**  
**Tanumbirini Flowback Pond Wastewater - Avian Risk Assessment**  
**McArthur Basin**  
**Santos Ltd.**

Constituent Name	CAS No.	Mammal NOAEL (mg/kg-day)	Mammal NOAEL		Avian NOAEL <sup>1</sup> (mg/kg-day)	Avian NOAEL		Avian Receptor		
			Test Animal			Test Animal		Crested Pigeon		
			Animal	Body Weight (kg)		Animal	Body Weight (kg)	Body Weight (kg)	Derived TRV	
Boron (Released from disodium octaborate tetrahydrate)	12280-03-4	9.6	Rat	0.35	28.8	Mallard Duck	1.58	a	0.204	4.8E+01
Zinc (as ZnSO4 - ECHA)	7733-02-0	13	Rat	0.35	15	White Leghorn Hen	1.766	a	0.204	2.5E+01
Total Nitrogen as N	7727-37-9	6.7	Rat	0.35	NA	NA	NA		0.204	7.7E+00
Total Phosphorus as P (ECHA)	7723-14-0	1000	Rat	0.35	NA	NA	NA		0.204	1.1E+03
Aluminium (ECHA - as aluminium citrate)	7429-90-5	200	Rat	0.35	NA	NA	NA		0.204	2.3E+02
Antimony (ADWG)	7440-36-0	0.43	Rat	0.35	NA	NA	NA		0.204	4.9E-01
Arsenic (ECHA)	7440-38-2	NA	NA	NA	2.24	Mallard Duck	1.58	a	0.204	3.74E+00
Chromium (ECHA - as chromium III)	7440-47-3	1368.0	Rat	0.35	NA	NA	NA		0.204	1.6E+03
Copper (ECHA - copper sulphate pentahydrate)	7440-50-8	4.2	Mouse	0.012	NA	NA	NA		0.204	2.1E+00
Nickel (ADWG)	7440-02-0	5.0	Rat	0.35	NA	NA	NA		0.204	5.7E+00
Uranium (ADWG)	7439-98-7	0.0006	Rat	0.35					0.204	6.87E-04
Ammonia (ECHA - Ammonia, anhydrous)	7664-41-7	250	Rat	0.35	NA	NA	NA		0.204	2.9E+02
>C10 - C16 Fraction minus Naphthalene (ECHA: Surrogate as hydrocarbons, C9-16, hydrotreated, dearomatized )	93763-35-0	750	Rat	0.35	NA	Bobwhite Quail	0.178	a	0.204	8.58E+02
>C16 - C34 Fraction F3 (ECHA: Surrogate hydrocarbons, C18-C24, iso-alkanes <2% aromatics)	EC 940-734-7	50	Rat	0.35	125	Bobwhite Quail	0.178	a	0.204	1.21E+02

**Notes:**

<sup>1</sup> - If an avian NOAEL was not available, the mammal NOAEL was used to derive the TRV for the avian receptor.

a -Oak Ridge National Laboratory. 1996. Toxicological Benchmarks for Wildlife: 1996 Revision. Risk Assessment Program Health Sciences Research Division Oak Ridge, Tennessee 37831

ADWG = Australian Drinking Water Guidelines

CAS = Chemical Abstracts Service

ECHA = European Chemical Agency

kg = kilogram

mg = milligram

NA = not applicable

ND = no data available

NOAEL = No observed adverse effect level

NOAELtest = No observed adverse effect level test animal - mg/kg/day

TRV = toxicity reference value

$$Derived\ TRV = NOAEL_{test} * \left( \frac{Body\ Weight_{test}}{Body\ Weight_{Avian}} \right)^{(1/4)}$$

Exposure Route	Parameter Code	Parameter Definition	Units (a)	Parameter Value	Source (b)
Ingestion	IR	Ingestion rate	L/day	0.020	Table B-1
	EF <sub>shortterm</sub>	Exposure frequency	day/yr	21	BPJ
	EF <sub>longterm</sub>	Exposure frequency	day/yr	365	BPJ
	ED	Exposure duration	yr	1	BPJ
	BW	Body weight	kg	0.204	Table B-1
	AT-NC	Averaging time - noncancer	days	365	BPJ

**Notes:**

a/ Units:

L/day = litres per day

day/yr = days per year

yr = year

kg = kilogram

b/ Source:

BPJ = Best Professional Judgement

**Attachment C - Table C-2**  
**Crested Pigeon**  
**Tanumbirini Flowback Pond Wastewater - Avian Risk Assessment**  
**McArthur Basin**  
**Santos Ltd.**

Constituent Name	CAS No.	EPC <sup>1</sup>		Short-Term Storage (21 days)		Long-Term Storage (1 year)	
		Average CW (mg/L)	Toxicity TRVs	Total Intake (mg/kg/day)	Hazard Quotient Ingestion	Total Intake (mg/kg/day)	Hazard Quotient Ingestion
Boron (Released from disodium octaborate tetrahydrate)	12280-03-4	12.2	4.80E+01	6.98E-02	1.5E-03	1.21E+00	2.5E-02
Zinc (as ZnSO4 - ECHA)	7733-02-0	0.02	2.49E+01	1.1E-04	4.3E-06	1.85E-03	7.5E-05
Total Nitrogen as N	7727-37-9	20.78	7.67E+00	1.2E-01	1.6E-02	2.07E+00	2.7E-01
Total Phosphorus as P (ECHA)	7723-14-0	0.618	1.14E+03	3.5E-03	3.1E-06	6.16E-02	5.4E-05
Aluminium (ECHA - as aluminium citrate)	7429-90-5	0.270	2.29E+02	1.5E-03	6.8E-06	2.69E-02	1.2E-04
Antimony (ADWG)	7440-36-0	0.013	4.92E-01	7.2E-05	1.5E-04	1.25E-03	2.5E-03
Arsenic (ECHA)	7440-38-2	0.019	3.74E+00	1.1E-04	2.9E-05	1.89E-03	5.1E-04
Chromium (ECHA - as chromium III)	7440-47-3	0.041	1.57E+03	2.4E-04	1.5E-07	4.11E-03	2.6E-06
Copper (ECHA - copper sulphate pentahydrate)	7440-50-8	0.011	2.07E+00	6.3E-05	3.1E-05	1.10E-03	5.3E-04
Nickel (ADWG)	7440-02-0	0.014	5.72E+00	8.0E-05	1.4E-05	1.40E-03	2.4E-04
Uranium (ADWG)	7439-98-7	0.001	6.87E-04	5.7E-06	8.4E-03	9.97E-05	1.5E-01
Ammonia (ECHA - Ammonia, anhydrous)	7664-41-7	11.448	2.86E+02	6.6E-02	2.3E-04	1.14E+00	4.0E-03
>C10 - C16 Fraction minus Naphthalene (ECHA: Surrogate as hydrocarbons, C9-16, hydrotreated, dearomatized )	93763-35-0	1.088	8.58E+02	6.2E-03	7.3E-06	1.08E-01	1.3E-04
>C16 - C34 Fraction F3 (ECHA: Surrogate hydrocarbons, C18-C24, iso-alkanes <2% aromatics)	EC 940-734-7	0.767	1.21E+02	4.4E-03	3.6E-05	7.65E-02	6.3E-04
<b>Cumulative:</b>				<b>2.6E-02</b>	<b>Cumulative:</b>	<b>4.5E-01</b>	

**Notes:**

- ADWG = Australian Drinking Water Guidelines
- BW = body weight
- CAS = Chemical Abstracts Service
- CW = concentration in water
- ECHA = European Chemical Agency
- ED = exposure duration
- EF = exposure frequency
- EPC = exposure point concentration
- IR = ingestion rate
- mg/kg/day = milligrams per kilograms per day
- mg/L = milligrams per litre
- NA = not available/applicable
- TRV = toxicity reference value
- 1 - EPC is average detected concentration presented in Attachment A.

$$Total\ Intake = \frac{EPC \times IR \times EF \times ED}{BW \times ED \times 365 \frac{days}{year}}$$

$$Hazard\ Quotient = \frac{Total\ Intake \left( \frac{mg}{kg - day} \right)}{TRV \left( \frac{mg}{kg - day} \right)}$$

**Attachment C - Table C-3**  
**Willie Wagtail**  
**Tanumbirini Flowback Pond Wastewater - Avian Risk Assessment**  
**McArthur Basin**  
**Santos Ltd.**

Constituent Name	CAS No.	Mammal NOAEL (mg/kg-day)	Mammal NOAEL		Avian NOAEL <sup>1</sup> (mg/kg-day)	Avian NOAEL		Avian Receptor	
			Test Animal			Test Animal		Willie Wagtail	
			Animal	Body Weight (kg)		Animal	Body Weight (kg)	Body Weight (kg)	Derived TRV
Boron (Released from disodium octaborate tetrahydrate)	12280-03-4	9.6	Rat	0.35	28.8	Mallard Duck	1.58	0.0201	8.58E+01
Zinc (as ZnSO4 - ECHA)	7733-02-0	13	Rat	0.35	15	White Leghorn Hen	1.766	0.0201	4.44E+01
Total Nitrogen as N	7727-37-9	6.7	Rat	0.35	NA	NA	NA	0.0201	1.37E+01
Total Phosphorus as P (ECHA)	7723-14-0	1000	Rat	0.35	NA	NA	NA	0.0201	2.04E+03
Aluminium (ECHA - as aluminium citrate)	7429-90-5	200	Rat	0.35	NA	NA	NA	0.0201	4.09E+02
Antimony (ADWG)	7440-36-0	0.43	Rat	0.35	NA	NA	NA	0.0201	8.78E-01
Arsenic (ECHA)	7440-38-2	NA	NA	NA	2.24	Mallard Duck	1.58	0.0201	6.67E+00
Chromium (ECHA - as chromium III)	7440-47-3	1368.0	Rat	0.35	NA	NA	NA	0.0201	2.79E+03
Copper (ECHA - copper sulphate pentahydrate)	7440-50-8	4.2	Mouse	0.012	NA	NA	NA	0.0201	3.69E+00
Nickel (ADWG)	7440-02-0	5.0	Rat	0.35	NA	NA	NA	0.0201	1.02E+01
Uranium (ADWG)	7439-98-7	0.0006	Rat	0.35	NA	NA	NA	0.0201	1.23E-03
Ammonia (ECHA - Ammonia, anhydrous)	7664-41-7	250	Rat	0.35	NA	NA	NA	0.0201	5.11E+02
>C10 - C16 Fraction minus Naphthalene (ECHA: Surrogate as hydrocarbons, C9-16, hydrotreated, dearomatized )	93763-35-0	750	Rat	0.35	NA	Bobwhite Quail	0.178	0.0201	1.53E+03
>C16 - C34 Fraction F3 (ECHA: Surrogate hydrocarbons, C18-C24, iso-alkanes <2% aromatics)	EC 940-734-7	50	Rat	0.35	125	Bobwhite Quail	0.178	0.0201	2.16E+02

**Notes:**

ADWG = Australian Drinking Water Guidelines

CAS = Chemical Abstracts Service

ECHA = European Chemical Agency

kg = kilogram

mg = milligram

NA = not applicable

NOAEL = No observed adverse effect level

NOAELtest = No observed adverse effect level test animal

TRV = toxicity reference value

1/ If an avian NOAEL was not available, the mammal NOAEL was used to derive the TRV for the avian receptor.

$$Derived\ TRV = NOAEL_{test} * \left( \frac{Body\ Weight_{test}}{Body\ Weight_{Avian}} \right)^{1/4}$$

Exposure Route	Parameter Code	Parameter Definition	Units (a)	Parameter Value	Source (b)
Ingestion	IR	Ingestion rate	L/day	0.004	Table B-1
	EF <sub>shortterm</sub>	Exposure frequency	day/yr	21	BPJ
	EF <sub>longterm</sub>	Exposure frequency	day/yr	365	BPJ
	ED	Exposure duration	yr	1	BPJ
	BW	Body weight	kg	0.0201	Table B-1
	AT-NC	Averaging time - noncancer	days	365	BPJ

**Notes:**

a/ Units:

L/day = litres per day

day/yr = days per year

yr = year

kg = kilogram

b/ Source:

BPJ = Best Professional Judgement



**Attachment C - Table C-3**  
**Willie Wagtail**  
**Tanumbirini Flowback Pond Wastewater - Avian Risk Assessment**  
**McArthur Basin**  
**Santos Ltd.**

Constituent Name	CAS No.	EPC <sup>1</sup>		Short-Term Storage (21 days)		Long-Term Storage (1 year)	
		CW (mg/L)	Toxicity TRVs	Total Intake (mg/kg/day)	Hazard Quotient Ingestion	Total Intake (mg/kg/day)	Hazard Quotient Ingestion
Boron (Released from disodium octaborate tetrahydrate)	12280-03-4	12.2	8.58E+01	1.5E-01	1.7E-03	2.6E+00	3.0E-02
Zinc (as ZnSO4 - ECHA)	7733-02-0	0.02	4.44E+01	2.3E-04	5.2E-06	4.0E-03	9.0E-05
Total Nitrogen as N	7727-37-9	20.78	1.37E+01	2.6E-01	1.9E-02	4.5E+00	3.3E-01
Total Phosphorus as P (ECHA)	7723-14-0	0.618	2.04E+03	7.6E-03	3.7E-06	1.3E-01	6.5E-05
Aluminium (ECHA - as aluminium citrate)	7429-90-5	0.270	4.09E+02	3.3E-03	8.1E-06	5.8E-02	1.4E-04
Antimony (ADWG)	7440-36-0	0.013	8.78E-01	1.5E-04	1.8E-04	2.7E-03	3.0E-03
Arsenic (ECHA)	7440-38-2	0.019	6.67E+00	2.3E-04	3.5E-05	4.1E-03	6.1E-04
Chromium (ECHA - as chromium III)	7440-47-3	0.041	2.79E+03	5.1E-04	1.8E-07	8.8E-03	3.2E-06
Copper (ECHA - copper sulphate pentahydrate)	7440-50-8	0.011	3.69E+00	1.4E-04	3.7E-05	2.4E-03	6.4E-04
Nickel (ADWG)	7440-02-0	0.014	1.02E+01	1.7E-04	1.7E-05	3.0E-03	2.9E-04
Uranium (ADWG)	7439-98-7	0.001	1.23E-03	1.2E-05	1.0E-02	2.1E-04	1.7E-01
Ammonia (ECHA - Ammonia, anhydrous)	7664-41-7	11.448	5.11E+02	1.4E-01	2.8E-04	2.5E+00	4.8E-03
>C10 - C16 Fraction minus Naphthalene (ECHA: Surrogate as hydrocarbons, C9-16, hydrotreated, dearomatized )	93763-35-0	1.088	1.53E+03	1.3E-02	8.7E-06	2.3E-01	1.5E-04
>C16 - C34 Fraction F3 (ECHA: Surrogate hydrocarbons, C18-C24, iso-alkanes <2% aromatics)	EC 940-734-7	0.767	2.16E+02	9.5E-03	4.4E-05	1.6E-01	7.6E-04
				<b>Cumulative:</b>	<b>3.1E-02</b>	<b>Cumulative:</b>	<b>5.4E-01</b>

**Notes:**

ADWG = Australian Drinking Water Guidelines  
 BW = body weight  
 CAS = Chemical Abstracts Service  
 CW = concentration in water  
 ECHA = European Chemical Agency  
 ED = exposure duration  
 EF = exposure frequency  
 EPC = exposure point concentration  
 IR = ingestion rate  
 mg/kg/day = milligrams per kilograms per day  
 mg/L = milligrams per litre  
 TRV = toxicity reference value  
 1 - EPC is average detected concentration presented in Attachment A.

$$Total\ Intake = \frac{EPC \times IR \times EF \times ED}{BW \times ED \times 365 \frac{days}{year}}$$

$$Hazard\ Quotient = \frac{Total\ Intake \left( \frac{mg}{kg - day} \right)}{TRV \left( \frac{mg}{kg - day} \right)}$$

**Attachment C - Table C-4**  
**Peaceful Dove**  
**Tanumbirini Flowback Pond Wastewater - Avian Risk Assessment**  
**McArthur Basin**  
**Santos Ltd.**

Constituent Name	CAS No.	Mammal NOAEL (mg/kg-day)	Mammal NOAEL		Avian NOAEL <sup>1</sup> (mg/kg-day)	Avian NOAEL		Avian Receptor	
			Test Animal			Test Animal		Peaceful Dove	
			Animal	Body Weight (kg)		Animal	Body Weight (kg)	Body Weight (kg)	Derived TRV
Boron (Released from disodium octaborate tetrahydrate)	12280-03-4	9.6	Rat	0.35	28.8	Mallard Duck	1.58	0.0478	6.91E+01
Zinc (as ZnSO4 - ECHA)	7733-02-0	13	Rat	0.35	15	White Leghorn Hen	1.766	0.0478	3.57E+01
Total Nitrogen as N	7727-37-9	6.7	Rat	0.35	NA	NA	NA	0.0478	1.10E+01
Total Phosphorus as P (ECHA)	7723-14-0	1000	Rat	0.35	NA	NA	NA	0.0478	1.64E+03
Aluminium (ECHA - as aluminium citrate)	7429-90-5	200	Rat	0.35	NA	NA	NA	0.0478	3.29E+02
Antimony (ADWG)	7440-36-0	0.43	Rat	0.35	NA	NA	NA	0.0478	7.07E-01
Arsenic (ECHA)	7440-38-2	NA	NA	NA	2.24	Mallard Duck	1.58	0.0478	5.37E+00
Chromium (ECHA - as chromium III)	7440-47-3	1368.0	Rat	0.35	NA	NA	NA	0.0478	2.25E+03
Copper (ECHA - copper sulphate pentahydrate)	7440-50-8	4.2	Mouse	0.012	NA	NA	NA	0.0478	2.97E+00
Nickel (ADWG)	7440-02-0	5.0	Rat	0.35	NA	NA	NA	0.0478	8.22E+00
Uranium (ADWG)	7439-98-7	0.0006	Rat	0.35				0.0478	9.87E-04
Ammonia (ECHA - Ammonia, anhydrous)	7664-41-7	250	Rat	0.35	NA	NA	NA	0.0478	4.11E+02
>C10 - C16 Fraction minus Naphthalene (ECHA: Surrogate as hydrocarbons, C9-16, hydrotreated, dearomatized )	93763-35-0	750	Rat	0.35	NA	Bobwhite Quail	0.178	0.0478	1.23E+03
>C16 - C34 Fraction F3 (ECHA: Surrogate hydrocarbons, C18-C24, iso-alkanes <2% aromatics)	EC 940-734-7	50	Rat	0.35	125	Bobwhite Quail	0.178	0.0478	1.74E+02

**Notes:**

ADWG = Australian Drinking Water Guidelines

CAS = Chemical Abstracts Service

ECHA = European Chemical Agency

kg = kilogram

mg = milligram

NA = not applicable

NOAEL = No observed adverse effect level

NOAELt = No observed adverse effect level test animal

TRV = toxicity reference value

1/ If an avian NOAEL was not available, the mammal NOAEL was used to derive the TRV for the avian receptor.

$$Derived\ TRV = NOAEL_{test} * \left( \frac{Body\ Weight_{test}}{Body\ Weight_{Avian}} \right)^{(1/4)}$$

Exposure Route	Parameter Code	Parameter Definition	Units (a)	Parameter Value	Source (b)
Ingestion	IR	Ingestion rate	L/day	0.008	Table B-1
	EF <sub>shortterm</sub>	Exposure frequency	day/yr	21	BPJ
	EF <sub>longterm</sub>	Exposure frequency	day/yr	365	BPJ
	ED	Exposure duration	yr	1	BPJ
	BW	Body weight	kg	0.0478	Table B-1
	AT-NC	Averaging time - noncancer	days	365	BPJ

**Notes:**

a/ Units:

L/day = litres per day

day/yr = days per year

yr = year

kg = kilogram

b/ Source:

BPJ = Best Professional Judgement

**Attachment C - Table C-4**  
**Peaceful Dove**  
**Tanumbirini Flowback Pond Wastewater - Avian Risk Assessment**  
**McArthur Basin**  
**Santos Ltd.**

Constituent Name	CAS No.	EPC <sup>1</sup>	Toxicity	Short-Term Storage (21 days)		Long-Term Storage (1 year)	
				Total Intake (mg/kg/day)	Hazard Quotient	Total Intake (mg/kg/day)	Hazard Quotient
					Ingestion		Ingestion
		CW (mg/L)	TRVs				
Boron (Released from disodium octaborate tetrahydrate)	12280-03-4	12.2	6.91E+01	1.1E-01	1.6E-03	2.0E+00	2.8E-02
Zinc (as ZnSO4 - ECHA)	7733-02-0	0.02	3.57E+01	1.7E-04	4.8E-06	3.0E-03	8.4E-05
Total Nitrogen as N	7727-37-9	20.78	1.10E+01	1.9E-01	1.7E-02	3.3E+00	3.0E-01
Total Phosphorus as P (ECHA)	7723-14-0	0.618	1.64E+03	5.7E-03	3.5E-06	9.9E-02	6.0E-05
Aluminium (ECHA - as aluminium citrate)	7429-90-5	0.270	3.29E+02	2.5E-03	7.6E-06	4.3E-02	1.3E-04
Antimony (ADWG)	7440-36-0	0.013	7.07E-01	1.2E-04	1.6E-04	2.0E-03	2.8E-03
Arsenic (ECHA)	7440-38-2	0.019	5.37E+00	1.8E-04	3.3E-05	3.1E-03	5.7E-04
Chromium (ECHA - as chromium III)	7440-47-3	0.041	2.25E+03	3.8E-04	1.7E-07	6.6E-03	2.9E-06
Copper (ECHA - copper sulphate pentahydrate)	7440-50-8	0.011	2.97E+00	1.0E-04	3.4E-05	1.8E-03	6.0E-04
Nickel (ADWG)	7440-02-0	0.014	8.22E+00	1.3E-04	1.6E-05	2.3E-03	2.7E-04
Uranium (ADWG)	7439-98-7	0.001	9.87E-04	9.3E-06	9.4E-03	1.6E-04	1.6E-01
Ammonia (ECHA - Ammonia, anhydrous)	7664-41-7	11.448	4.11E+02	1.1E-01	2.6E-04	1.8E+00	4.5E-03
>C10 - C16 Fraction minus Naphthalene (ECHA: Surrogate as hydrocarbons, C9-16, hydrotreated, dearomatized)	93763-35-0	1.088	1.23E+03	1.0E-02	8.2E-06	1.8E-01	1.4E-04
>C16 - C34 Fraction F3 (ECHA: Surrogate hydrocarbons, C18-C24, iso-alkanes <2% aromatics)	EC 940-734-7	0.767	1.74E+02	7.1E-03	4.1E-05	1.2E-01	7.1E-04
				<b>Cumulative:</b>	<b>2.9E-02</b>	<b>Cumulative:</b>	<b>5.0E-01</b>

**Notes:**

ADWG = Australian Drinking Water Guidelines  
 BW = body weight  
 CAS = Chemical Abstracts Service  
 CW = concentration in water  
 ECHA = European Chemical Agency  
 ED = exposure duration  
 EF = exposure frequency  
 EPC = exposure point concentration  
 IR = ingestion rate  
 mg/kg/day = milligrams per kilograms per day  
 mg/L = milligrams per litre  
 NA = not available/applicable  
 TRV = toxicity reference value  
 1 - EPC is average detected concentration presented in Attachment A.

$$Total\ Intake = \frac{EPC \times IR \times EF \times ED}{BW \times ED \times 365 \frac{days}{year}}$$

$$Hazard\ Quotient = \frac{Total\ Intake \left( \frac{mg}{kg - day} \right)}{TRV \left( \frac{mg}{kg - day} \right)}$$

**Attachment C - Table C-5**  
**Cattle Egret**  
**Tanumbirini Flowback Pond Wastewater - Avian Risk Assessment**  
**McArthur Basin**  
**Santos Ltd.**

Constituent Name	CAS No.	Mammal NOAEL (mg/kg-day)	Mammal NOAEL		Avian NOAEL <sup>1</sup> (mg/kg-day)	Avian NOAEL		Avian Receptor	
			Test Animal			Test Animal		Cattle Egret	
			Animal	Body Weight (kg)		Animal	Body Weight (kg)	Body Weight (kg)	Derived TRV
Boron (Released from disodium octaborate tetrahydrate)	12280-03-4	9.6	Rat	0.35	28.8	Mallard Duck	1.58	0.36	4.17E+01
Zinc (as ZnSO4 - ECHA)	7733-02-0	13	Rat	0.35	15	White Leghorn Her	1.766	0.36	2.16E+01
Total Nitrogen as N	7727-37-9	6.7	Rat	0.35	NA	NA	NA	0.36	6.65E+00
Total Phosphorus as P (ECHA)	7723-14-0	1000	Rat	0.35	NA	NA	NA	0.36	9.93E+02
Aluminium (ECHA - as aluminium citrate)	7429-90-5	200	Rat	0.35	NA	NA	NA	0.36	1.99E+02
Antimony (ADWG)	7440-36-0	0.43	Rat	0.35	NA	NA	NA	0.36	4.27E-01
Arsenic (ECHA)	7440-38-2	NA	NA	NA	2.24	Mallard Duck	1.58	0.36	3.24E+00
Chromium (ECHA - as chromium III)	7440-47-3	1368.0	Rat	0.35	NA	NA	NA	0.36	1.36E+03
Copper (ECHA - copper sulphate pentahydrate)	7440-50-8	4.2	Mouse	0.012	NA	NA	NA	0.36	1.79E+00
Nickel (ADWG)	7440-02-0	5.0	Rat	0.35	NA	NA	NA	0.36	4.96E+00
Uranium (ADWG)	7439-98-7	0.0006	Rat	0.35	NA	NA	NA	0.36	5.96E-04
Ammonia (ECHA - Ammonia, anhydrous)	7664-41-7	250	Rat	0.35	NA	NA	NA	0.36	2.48E+02
>C10 - C16 Fraction minus Naphthalene (ECHA: Surrogate as hydrocarbons, C9-16, hydrotreated, dearomatized )	93763-35-0	750	Rat	0.35	NA	Bobwhite Quail	0.178	0.36	7.45E+02
>C16 - C34 Fraction F3 (ECHA: Surrogate hydrocarbons, C18-C24, iso-alkanes <2% aromatics)	EC 940-734-7	50	Rat	0.35	125	Bobwhite Quail	0.178	0.36	1.05E+02

**Notes:**

ADWG = Australian Drinking Water Guidelines  
CAS = Chemical Abstracts Service  
ECHA = European Chemical Agency  
kg = kilogram  
mg = milligram  
NA = not applicable  
NOAEL = No observed adverse effect level  
NOAEL<sub>test</sub> = No observed adverse effect level test animal  
TRV = toxicity reference value  
1/ If an avian NOAEL was not available, the mammal NOAEL was used to derive the TRV for the avian receptor.

$$Derived\ TRV = NOAEL_{test} * \left( \frac{Body\ Weight_{test}}{Body\ Weight_{Avian}} \right)^{(1/4)}$$

Exposure Route	Parameter Code	Parameter Definition	Units (a)	Parameter Value	Source (b)
Ingestion	IR	Ingestion rate	L/day	0.0298	Table B-1
	EF <sub>shortterm</sub>	Exposure frequency	day/yr	21	BPJ
	EF <sub>longterm</sub>	Exposure frequency	day/yr	365	BPJ
	ED	Exposure duration	yr	1	BPJ
	BW	Body weight	kg	0.36	Table B-1
	AT-NC	Averaging time - noncancer	days	365	BPJ

**Notes:**

a/ Units:  
L/day = litres per day  
day/yr = days per year  
yr = year  
kg = kilogram  
b/ Source:  
BPJ = Best Professional Judgement

**Attachment C - Table C-5**  
**Cattle Egret**  
**Tanumbirini Flowback Pond Wastewater - Avian Risk Assessment**  
**McArthur Basin**  
**Santos Ltd.**

Constituent Name	CAS No.	EPC <sup>1</sup>	Toxicity	Short-Term Storage (21 days)		Long-Term Storage (1 year)	
				Total Intake (mg/kg/day)	Hazard Quotient	Total Intake (mg/kg/day)	Hazard Quotient
					Ingestion		Ingestion
Boron (Released from disodium octaborate tetrahydrate)	12280-03-4	12.2	4.17E+01	5.8E-02	1.4E-03	1.0E+00	2.4E-02
Zinc (as ZnSO4 - ECHA)	7733-02-0	0.0186	2.16E+01	8.8E-05	4.1E-06	1.5E-03	7.1E-05
Total Nitrogen as N	7727-37-9	20.78	6.65E+00	9.9E-02	1.5E-02	1.7E+00	2.6E-01
Total Phosphorus as P (ECHA)	7723-14-0	0.618	9.93E+02	2.9E-03	3.0E-06	5.1E-02	5.1E-05
Aluminium (ECHA - as aluminium citrate)	7429-90-5	0.270	1.99E+02	1.3E-03	6.5E-06	2.2E-02	1.1E-04
Antimony (ADWG)	7440-36-0	0.013	4.27E-01	5.9E-05	1.4E-04	1.0E-03	2.4E-03
Arsenic (ECHA)	7440-38-2	0.019	3.24E+00	9.0E-05	2.8E-05	1.6E-03	4.8E-04
Chromium (ECHA - as chromium III)	7440-47-3	0.041	1.36E+03	2.0E-04	1.4E-07	3.4E-03	2.5E-06
Copper (ECHA - copper sulphate pentahydrate)	7440-50-8	0.011	1.79E+00	5.2E-05	2.9E-05	9.1E-04	5.1E-04
Nickel (ADWG)	7440-02-0	0.014	4.96E+00	6.7E-05	1.3E-05	1.2E-03	2.3E-04
Uranium (ADWG)	7439-98-7	0.001	5.96E-04	4.8E-06	8.0E-03	8.3E-05	1.4E-01
Ammonia (ECHA - Ammonia, anhydrous)	7664-41-7	11.448	2.48E+02	5.4E-02	2.2E-04	9.5E-01	3.8E-03
>C10 - C16 Fraction minus Naphthalene (ECHA: Surrogate as hydrocarbons, C9-16, hydrotreated, dearomatized )	93763-35-0	1.088	7.45E+02	5.2E-03	6.9E-06	9.0E-02	1.2E-04
>C16 - C34 Fraction F3 (ECHA: Surrogate hydrocarbons, C18-C24, iso-alkanes <2% aromatics)	EC 940-734-7	0.767	1.05E+02	3.6E-03	3.5E-05	6.3E-02	6.0E-04
				<b>Cumulative:</b>	<b>2.5E-02</b>	<b>Cumulative:</b>	<b>4.3E-01</b>

**Notes:**

- ADWG = Australian Drinking Water Guidelines
- BW = body weight
- CAS = Chemical Abstracts Service
- CW = concentration in water
- ECHA = European Chemical Agency
- ED = exposure duration
- EF = exposure frequency
- EPC = exposure point concentration
- IR = ingestion rate
- mg/kg/day = milligrams per kilograms per day
- mg/L = milligrams per litre
- NA = not available/applicable
- TRV = toxicity reference value
- 1 - EPC is average detected concentration presented in Attachment A.

$$Total\ Intake = \frac{EPC \times IR \times EF \times ED}{BW \times ED \times 365\ days/year}$$

$$Hazard\ Quotient = \frac{Total\ Intake \left( \frac{mg}{kg - day} \right)}{TRV \left( \frac{mg}{kg - day} \right)}$$

**Attachment C - Table C-6**  
**Brown Honeyeater**  
**Tanumbirini Flowback Pond Wastewater - Avian Risk Assessment**  
**McArthur Basin**  
**Santos Ltd.**

Constituent Name	CAS No.	Mammal NOAEL (mg/kg-day)	Mammal NOAEL		Avian NOAEL <sup>1</sup> (mg/kg-day)	Avian NOAEL		Avian Receptor	
			Test Animal			Test Animal		Brown Honeyeater	
			Animal	Body Weight (kg)		Animal	Body Weight (kg)	Body Weight (kg)	Derived TRV
Boron (Released from disodium octaborate tetrahydrate)	12280-03-4	9.6	Rat	0.35	28.8	Mallard Duck	1.58	0.0106	1.0E+02
Zinc (as ZnSO4 - ECHA)	7733-02-0	13	Rat	0.35	15	White Leghorn Hen	1.766	0.0106	5.2E+01
Total Nitrogen as N	7727-37-9	6.7	Rat	0.35	NA	NA	NA	0.0106	1.6E+01
Total Phosphorus as P (ECHA)	7723-14-0	1000	Rat	0.35	NA	NA	NA	0.0106	2.4E+03
Aluminium (ECHA - as aluminium hydroxychloride)	7429-90-5	200	Rat	0.35	NA	NA	NA	0.0106	4.8E+02
Antimony (ADWG)	7440-36-0	0.43	Rat	0.35	NA	NA	NA	0.0106	1.0E+00
Arsenic (ECHA)	7440-38-2	NA	NA	NA	2.24	Mallard Duck	1.58	0.0106	7.8E+00
Chromium (ECHA - as chromium III)	7440-47-3	1368	Rat	0.35	NA	NA	NA	0.0106	3.3E+03
Copper (ECHA - copper sulphate pentahydrate)	7440-50-8	4.2	Mouse	0.012	NA	NA	NA	0.0106	4.3E+00
Nickel (ADWG)	7440-02-0	5.0	Rat	0.35	NA	NA	NA	0.0106	1.2E+01
Uranium (ADWG)	7439-98-7	0.0006	Rat	0.35				0.0106	1.4E-03
Ammonia (ECHA - Ammonia, anhydrous)	7664-41-7	250	Rat	0.35	NA	NA	NA	0.0106	6.0E+02
>C10 - C16 Fraction minus Naphthalene (ECHA: Surrogate as hydrocarbons, C9-16, hydrotreated, dearomatized)	93763-35-0	750	Rat	0.35	NA	Bobwhite Quail	0.178	0.0106	1.8E+03
>C16 - C34 Fraction F3 (ECHA: Surrogate hydrocarbons, C18-C24, iso-alkanes <2% aromatics)	EC 940-734-7	50	Rat	0.35	125	Bobwhite Quail	0.178	0.0106	2.5E+02

**Notes:**

ADWG = Australian Drinking Water Guidelines

CAS = Chemical Abstracts Service

ECHA = European Chemical Agency

kg = kilogram

mg = milligram

NA = not applicable

NOAEL = No observed adverse effect level

NOAEL<sub>test</sub> = No observed adverse effect level test animal

TRV = toxicity reference value

1/ If an avian NOAEL was not available, the mammal NOAEL was used to derive the TRV for the avian receptor.

2/ LOAEL for copper used.

$$Derived\ TRV = NOAEL_{test} * \left( \frac{Body\ Weight_{test}}{Body\ Weight_{Avian}} \right)^{(1/4)}$$

Exposure Route	Parameter Code	Parameter Definition	Units (a)	Parameter Value	Source (b)
Ingestion	IR	Ingestion rate	L/day	0.0028	Table B-1
	EF <sub>shortterm</sub>	Exposure frequency	day/yr	21	BPJ
	EF <sub>longterm</sub>	Exposure frequency	day/yr	365	BPJ
	ED	Exposure duration	yr	1	BPJ
	BW	Body weight	kg	0.0106	Table B-1
	AT-NC	Averaging time - noncancer	days	365	BPJ

**Notes:**

a/ Units:

L/day = litres per day

day/yr = days per year

yr = year

kg = kilogram

b/ Source:

BPJ = Best Professional Judgement

**Attachment C - Table C-6**  
**Brown Honeyeater**  
**Tanumbirini Flowback Pond Wastewater - Avian Risk Assessment**  
**McArthur Basin**  
**Santos Ltd.**

Constituent Name	CAS No.	EPC <sup>1</sup>	Toxicity	Short-Term Storage (21 days)		Long-Term Storage (1 year)	
				Total Intake (mg/kg/day)	Hazard Quotient	Total Intake (mg/kg/day)	Hazard Quotient
					Ingestion		Ingestion
		CW (mg/L)	TRVs				
Boron (Released from disodium octaborate tetrahydrate)	12280-03-4	12.2	1.0E+02	1.9E-01	1.8E-03	3.2E+00	3.2E-02
Zinc (as ZnSO4 - ECHA)	7733-02-0	0.0186	5.2E+01	2.8E-04	5.4E-06	4.9E-03	9.4E-05
Total Nitrogen as N	7727-37-9	20.78	1.6E+01	3.2E-01	2.0E-02	5.5E+00	3.4E-01
Total Phosphorus as P (ECHA)	7723-14-0	0.618	2.4E+03	9.4E-03	3.9E-06	1.6E-01	6.8E-05
Aluminium (ECHA - as aluminium citrate)	7429-90-5	0.270	4.8E+02	4.1E-03	8.6E-06	7.1E-02	1.5E-04
Antimony (ADWG)	7440-36-0	0.013	1.0E+00	1.9E-04	1.8E-04	3.3E-03	3.2E-03
Arsenic (ECHA)	7440-38-2	0.019	7.8E+00	2.9E-04	3.7E-05	5.0E-03	6.4E-04
Chromium (ECHA - as chromium III)	7440-47-3	0.041	3.3E+03	6.3E-04	1.9E-07	1.1E-02	3.3E-06
Copper (ECHA - copper sulphate pentahydrate)	7440-50-8	0.011	4.3E+00	1.7E-04	3.9E-05	2.9E-03	6.7E-04
Nickel (ADWG)	7440-02-0	0.014	1.2E+01	2.1E-04	1.8E-05	3.7E-03	3.1E-04
Uranium (ADWG)	7439-98-7	0.001	1.4E-03	1.5E-05	1.1E-02	2.6E-04	1.8E-01
Ammonia (ECHA - Ammonia, anhydrous)	7664-41-7	11.448	6.0E+02	1.7E-01	2.9E-04	3.0E+00	5.1E-03
>C10 - C16 Fraction minus Naphthalene (ECHA: Surrogate hydrocarbon)	93763-35-0	1.088	1.8E+03	1.7E-02	9.2E-06	2.9E-01	1.6E-04
>C16 - C34 Fraction F3 (ECHA: Surrogate hydrocarbon)	EC 940-734-7	0.767	2.5E+02	1.2E-02	4.6E-05	2.0E-01	8.0E-04
<b>Cumulative:</b>				<b>3.3E-02</b>	<b>Cumulative:</b>		<b>5.7E-01</b>

**Notes:**

- ADWG = Australian Drinking Water Guidelines
- BW = body weight
- CAS = Chemical Abstracts Service
- CW = concentration in water
- ECHA = European Chemical Agency
- ED = exposure duration
- EF = exposure frequency
- EPC = exposure point concentration
- IR = ingestion rate
- mg/kg/day = milligrams per kilograms per day
- mg/L = milligrams per litre
- NA = not available/applicable
- TRV = toxicity reference value
- 1 - EPC is average detected concentration presented in Attachment A.

$$Total\ Intake = \frac{EPC \times IR \times EF \times ED}{BW \times ED \times 365\ days/year}$$

$$Hazard\ Quotient = \frac{Total\ Intake \left( \frac{mg}{kg-day} \right)}{TRV \left( \frac{mg}{kg-day} \right)}$$

Santos Ltd.

Tanumbirini 2H/3H Flowback Wastewater - Risk Assessment, EP-161, McArthur Basin  
17 June 2022



## Attachment D Terrestrial Risk Assessment – Tanumbirini Wells 2H and 3H Flowback Water



**Attachment D, Table D-1**  
**Screening Assessment of Soils Potentially Impacted by Tanumbirini 2H/3H Flowback Water**  
**McArthur Basin**  
**Santos Ltd.**

Chemical	Maximum Detected Concentration in Water (mg/L)	Maximum Calculated Concentration in Soil (mg/kg)	Soil Screening Level (mg/kg)	Note	Maximum Concentration/ Soil Screening Level Ratio	Median Detected Concentration in Water (mg/L)	Median Calculated Concentration in Soil (mg/kg)	Soil Screening Level (mg/kg)	Note	Median Concentration/ Soil Screening Level Ratio
>C10 - C16 Fraction minus Naphthalene (F2)	3.61	8.66E-01	2.50E+01	1	3.5E-02	0.305	7.32E-02	2.50E+01	1	2.90E-03
>C16 - C34 Fraction	1.97	4.73E-01	3.00E+02	2	1.6E-03	0.18	4.32E-02	3.00E+02	2	1.40E-04
>C34 - C40 Fraction	0.12	2.88E-02	2.80E+03	2	1.0E-05	0.12	2.88E-02	2.80E+03	2	1.00E-05
Formaldehyde	0.3	7.20E-02	NV		NA	0.2	4.80E-02	NV		NA
Aluminium	0.74	1.78E-01	NV		NA	0.05	1.20E-02	NV		NA
Antimony	0.023	5.52E-03	2.70E-01	3	2.0E-02	0.0125	3.00E-03	2.70E-01	3	1.10E-02
Arsenic	0.04	9.60E-03	4.00E+01	4	2.4E-04	0.013	3.12E-03	4.00E+01	4	7.80E-05
Barium	3.37	8.09E-01	8.20E+02	5	9.9E-04	1.98	4.75E-01	8.20E+02	5	5.80E-04
Boron	23.4	5.62E+00	5.70E+00	6	9.9E-01	9.9	2.38E+00	5.70E+00	6	4.20E-01
Bromide	68.2	1.64E+01	5.00E+01	7	3.3E-01	35	8.40E+00	5.00E+01	7	1.70E-01
Calcium	148	3.55E+01	NV		NA	130	3.12E+01	NV		NA
Chloride	6270	1.50E+03	NV		NA	3000	7.20E+02	NV		NA
Chromium	0.047	1.13E-02	1.00E+02	8	1.1E-04	0.043	1.03E-02	1.00E+02	8	1.00E-04
Cobalt	0.002	4.80E-04	1.20E+02	5	4.0E-06	0.002	4.80E-04	1.20E+02	5	4.00E-06
Copper	0.016	3.84E-03	2.00E+01	9	1.9E-04	0.011	2.64E-03	2.00E+01	9	1.30E-04
Fluoride	2.1	5.04E-01	1.20E+02	5	4.2E-03	1.3	3.12E-01	1.20E+02	5	2.60E-03
Iron	3.6	8.64E-01	1.96E+04	10	4.4E-05	2.05	4.92E-01	1.96E+04	10	2.50E-05
Lead	0.001	2.40E-04	4.70E+02	16	5.1E-07	0.001	2.40E-04	4.70E+02	16	5.10E-07
Magnesium	106	2.54E+01	1.47E+03	10	1.7E-02	69	1.66E+01	1.47E+03	10	1.10E-02
Manganese	0.548	1.32E-01	4.30E+03	11	3.1E-05	0.363	8.71E-02	4.30E+03	11	2.00E-05
Molybdenum	0.044	1.06E-02	9.90E+00	12	1.1E-03	0.006	1.44E-03	9.90E+00	12	1.50E-04
Nickel	0.03	7.20E-03	5.00E+00	13	1.4E-03	0.006	1.44E-03	5.00E+00	13	2.90E-04
Potassium	111	2.66E+01	NV		NA	48	1.15E+01	NV		NA
Selenium	0.004	9.60E-04	2.00E+02	14	4.8E-06	0.0016	3.84E-04	2.00E+02	14	1.90E-06
Sodium	4170	1.00E+03	NV		NA	1760	4.22E+02	NV		NA
Strontium	9.3	2.23E+00	9.50E+01	5	2.3E-02	5.85	1.40E+00	9.50E+01	5	1.50E-02
Thorium	0.001	2.40E-04	NV		NA	0.001	2.40E-04	NV		NA
Uranium	0.001	2.40E-04	4.80E+02	3	5.0E-07	0.001	2.40E-04	4.80E+02	3	5.00E-07
Zinc	0.043	1.03E-02	1.50E+01	15	6.9E-04	0.017	4.08E-03	1.50E+01	15	2.70E-04

**Attachment D, Table D-1**  
**Screening Assessment of Soils Potentially Impacted by Tanumbirini 2H/3H Flowback Water**  
**McArthur Basin**  
**Santos Ltd.**

**Notes:**

ACL = Added contaminant limits	mg/kg = milligrams per kilogram
As = Arsenic	mg/L = milligrams per litre
BTEX = Benzene, Toluene, Ethylbenzene, and Xylene	N = null
CEC = Cation Exchange Capacity	NEPM = National Environment Protection Measures
Cu = Copper	NOAEL = no-observed-adverse-effect-level
D = dissolved	NV = No readily available screening criterion
DDT = dichlorodiphenyltrichloroethane	PNEC = predicted no effect concentration
ECHA = European Chemical Agency	T = total
EIL = Ecological Investigation Level	TPH = total petroleum hydrocarbons
ESL = Ecological Screening Level	UCL = upper confidence limit
HQ = hazard quotient	USEPA = United States Environmental Protection Agency

- 1 = NEPM. 2011. Guideline on Investigation Levels for Soil and Groundwater. National Environment Protection (Assessment of Site Contamination) Measure April 2011 National Environment Protection (Assessment of Site Contamination) Measure. Table 1B(6) ESLs for TPH fractions F1 – F4, BTEX and benzo(a)pyrene in soil. Areas of ecological significance.
- 2 = NEPM. 2011. Guideline on Investigation Levels for Soil and Groundwater. National Environment Protection (Assessment of Site Contamination) Measure April 2011 National Environment Protection (Assessment of Site Contamination) Measure Table 1B(6) Schedule B (1) - ESLs for TPH fractions F1 – F4, BTEX and benzo(a)pyrene in soil Urban residential and public open spaces.
- 3 = USEPA 2018. Region 4 Ecological Risk Assessment Supplemental Guidance. Table 3 Region 4 Soil Screening Values for Hazardous Waste Sites Value for mammalian species
- 4 = NEPM 2011. Guideline on Investigation Levels for Soil and Groundwater. National Environment Protection (Assessment of Site Contamination) Measure April 2011 National Environment Protection (Assessment of Site Contamination) Measure Table 1B(5) Table 1B(6) Schedule B (1) - Generic EILs for aged As, fresh DDT and fresh naphthalene in soils irrespective of their physicochemical properties.
- 5 = USEPA 2018. Region 4 Ecological Risk Assessment Supplemental Guidance. Table 3 Region 4 Soil Screening Values for Hazardous Waste Sites Value for avian species.
- 6 = ECHA 2020. Boron Predicted no effect concentration (PNEC) in soil for terrestrial species. <https://echa.europa.eu/brief-profile/-/briefprofile/100.028.319>
- 7 = ECHA 2020. NOAEL as concentration in food source for Wistar Han rat
- 8 = NEPM 2011. Guideline on Investigation Levels for Soil and Groundwater. National Environment Protection (Assessment of Site Contamination) Measure April 2011
- 9 = NEPM 2011. Guideline on Investigation Levels for Soil and Groundwater. National Environment Protection (Assessment of Site Contamination) Measure April 2011
- 10 = Background threshold value based on 95 percent upper confidence limit (UCL) of mean for McArthur Basin surficial soils. Note, UCL of the mean represents a central tendency and is conservative to use a central tendency value for comparison.
- 11 = USEPA 2007. Ecological Soil Screening Levels for Manganese Interim Final OSWER Directive 9285.7-71. Table 2.1-Avian Wildlife Manganese Eco-SSLs (mg/kg dry weight in
- 12 = ECHA 2020. Molybdenum predicted no effect concentration (PNEC) in soil for terrestrial species. Hazard for Terrestrial Organism.
- 13 = NEPM 2011. Guideline on Investigation Levels for Soil and Groundwater. National Environment Protection (Assessment of Site Contamination) Measure April 2011 National Environment Protection (Assessment of Site Contamination) Measure Table 1B(3) Soil-specific added contaminant limits for aged chromium III and nickel in soil. Areas of ecological significance Schedule B (1)
- 14 = NEPM 2011. Guideline on Investigation Levels for Soil and Groundwater. National Environment Protection (Assessment of Site Contamination) Measure April 2011 National Environment Protection (Assessment of Site Contamination) Measure. Schedule B (1), Table 1B(3) Soil-specific added contaminant limits for aged chromium III and nickel in soil. Areas of ecological significance
- 15 = NEPM 2011. Guideline on Investigation Levels for Soil and Groundwater. National Environment Protection (Assessment of Site Contamination) Measure April 2011 National Environment Protection (Assessment of Site Contamination) Measure. Schedule B (1), Table 1B(1) Soil-specific added contaminant limits for aged zinc in soil at pH 4
- 16 = NEPM 2011. Guideline on Investigation Levels for Soil and Groundwater. National Environment Protection (Assessment of Site Contamination) Measure April 2011 National Environment Protection (Assessment of Site Contamination) Measure. Schedule B (1) Table 1B(4) Generic added contaminant limits for lead in soils irrespective of their physicochemical properties. Areas of ecological significance.