

ENVIRONMENT PROTECTION LICENCE 20350 MONITORING DATA

Licence Holder:	Santos NSW (Eastern) Pty Ltd
Premises:	Narrabri Gas Field X-Line Road, Narrabri, NSW 2390
Licence No:	20350
EPL LINK:	https://apps.epa.nsw.gov.au/prpoeoapp/Detail.aspx?instid=20350&id=20350&option=licence&searchrange=licence&range=POEO%20lice Version 28SEP2023
EPL Period:	May 1st 2023 to April 30th 2024
Reporting Period:	Quarter 2 - August 2023 - October 2023
Published Date:	Nov-23
Monitoring Location:	Refer to Table 1
Scheduled Activity:	Coal seam gas exploration, assessment and production
General Notes:	Monitoring Point 80, 81 & 82 - no sample required in accordance with EPL20350 Condition M2.7 . Monitoring Point 77 - no sample required in accordance with EPL20350 Condition M2.7 (Plant not operating). Monitoring Point 69, 70 & 76 - no sample required in accordance with EPL20350 Condition M2.8 and M2.9. Monitoring Point 83, 84, 85 & 86 - no sample required in accordance with EPL20350 Condition M2.6. Monitoring points visited and reported dry : 18,26, 28, 38, 39, 40, 43, 62, 66 and 78. Monitoring points 47, 48 and 49: water pressure recorded in PSI. Water level results (SWL) have been calculated. Equipment fai Locations 87-116 not yet commissioned. Grab samples for monitoring points with "Special Frequency 2" are taken annually in June unless results trigger above baseline

Table 1: EPL20350 Water Monitoring Locations

EPA Identification No	Monitoring Type	Location	Latitude	Longitude
7	Groundwater Quality Monitoring	BWD27PRUPS02	-30.66325	149.66586
8	Groundwater Quality Monitoring	BWD27PRLPS03	-30.66313	149.66589
9	Groundwater Quality Monitoring	BWD26PRUPS01	-30.62224	149.60153
10	Groundwater Quality Monitoring	BWD26PRLPS02	-30.62236	149.60145
11	Groundwater Quality Monitoring	DWH14PRUPS01	-30.54892	149.75932
12	Groundwater Quality Monitoring	DWH14PRLPS02	-30.54917	149.75918
13	Groundwater Quality Monitoring	DWH14PRPUR03	-30.54904	149.75925
14	Groundwater Quality Monitoring	DWH3PRUPS01	-30.65363	149.73657
15	Groundwater Quality Monitoring	DWH3PRLPS02	-30.65354	149.73671
18	Groundwater Quality Monitoring	BWD27PRORA01	-30.66339	149.66583
20	Groundwater Quality Monitoring	BHN14PRORA01	-30.47186	149.57446
21	Groundwater Quality Monitoring	BHN14PRUPS02	-30.47173	149.57440
26	Groundwater Quality Monitoring	BWDMW12S	-30.63189	149.64828
27	Groundwater Quality Monitoring	BWDMW12D	-30.63188	149.64829
28	Groundwater Quality Monitoring	BWDMW12I	-30.63189	149.64830
37	Groundwater Quality Monitoring	LWDMW1D	-30.49124	149.61902
38	Groundwater Quality Monitoring	LWDMW1S	-30.49124	149.61903
39	Groundwater Quality Monitoring	LWDMW1I	-30.49125	149.61905
40	Groundwater Quality Monitoring	LWDMW2S	-30.50545	149.61643
41	Groundwater Quality Monitoring	LWDMW2D	-30.50545	149.61642
42	Groundwater Quality Monitoring	LWDMW3D	-30.50645	149.62451
43	Groundwater Quality Monitoring	LWDMW3S	-30.50644	149.62452
44	Groundwater Level Monitoring	DWH8AQGDGY01	-30.55016	149.76832
45	Groundwater Level Monitoring	DWH8AQGARK02	-30.55016	149.76832
46	Groundwater Level Monitoring	DWH8AQGPOR03	-30.55016	149.76832
47	Groundwater Level Monitoring	BWD28QGUPS01	-30.66802	149.64007
48	Groundwater Level Monitoring	BWD28QGLPS01	-30.66802	149.64007
49	Groundwater Level Monitoring	BWD28QGPUR01	-30.66802	149.64007
56	Groundwater Quality Monitoring	WPKMW9D	-30.36301	149.66006
57	Groundwater Quality Monitoring	WPKMW9S	-30.36299	149.66007
59	Groundwater Quality Monitoring	WPKMW13I	-30.36122	149.65886
60	Groundwater Quality Monitoring	WPKMW13S	-30.36122	149.65889
61	Groundwater Quality Monitoring	WPKMW14D	-30.36252	149.65694
62	Groundwater Quality Monitoring	WPKMW14S	-30.36253	149.65695
63	Groundwater Quality Monitoring	WPKMW15D	-30.36086	149.65691
64	Groundwater Quality Monitoring	WPKMW15S	-30.36088	149.65691
65	Groundwater Quality Monitoring	WPKMW16D	-30.36313	149.65370
66	Groundwater Quality Monitoring	WPKMW16S	-30.36315	149.65369
69	Produced Water Storage Pond	BWDPD2	-30.63370	149.64930
70	Produced Water Storage Pond	BWDPD3	-30.63240	149.64890
71	Produced Water Storage Pond	LWDPD1CELL4	-30.49437	149.62000
72	Produced Water Storage Pond	LWDPD1CELL3	-30.49608	149.61991
73	Produced Water Storage Pond	LWDPD1CELL2	-30.49788	149.61962

EPA Identification No	Monitoring Type	Location	Latitude	Longitude
74	Produced Water Storage Pond	LWDPD1CELL1	-30.49960	149.61927
75	Produced Water Storage Pond	TFDPD1	-30.36180	149.65950
76	Produced Water Storage Pond	TFDPD2	-30.36130	149.65830
77	Treated Water Quality Monitoring	LWWTTPDM1	-30.50339	149.62206
78	Groundwater Quality Monitoring	WPKMW18S	-30.36193	149.66295
79	Groundwater Quality Monitoring	WPKMW18I	-30.36189	149.66296
80	Groundwater Quality Monitoring	LWDMW4	-30.49852	149.62643
81	Groundwater Quality Monitoring	LWDMW5	-30.49607	149.63064
82	Groundwater Quality Monitoring	LWDMW6	-30.49726	149.63251
83	Soil Quality Monitoring	LWDSMP1	-30.49943	149.62502
84	Soil Quality Monitoring	LWDSMP2	-30.49756	149.62727
85	Soil Quality Monitoring	LWDSMP3	-30.49763	149.63153
86	Soil Quality Monitoring	LWDSMP4	-30.50092	149.63042
87	Groundwater Level Monitoring	BHNS1PRLPS01		
88	Groundwater Level Monitoring	BHNS1PRDGY02		
89	Groundwater Level Monitoring	BHNS1PRPOR03		
90	Groundwater Level Monitoring	BHNS1PRMCF04		
91	Groundwater Level Monitoring	BHNS1PRMCF05		
92	Groundwater Level Monitoring	BHNS1PRMCF06		
93	Groundwater Level Monitoring	BWD6PRLPS01		
94	Groundwater Level Monitoring	BWD6PRDGY02		
95	Groundwater Level Monitoring	BWD6PRMCF03C		
96	Groundwater Level Monitoring	BWD6PRMCF03D		
97	Groundwater Level Monitoring	BWD6PRMCF04		
98	Groundwater Level Monitoring	BWD6PRMCF05		
99	Groundwater Level Monitoring	DWH9PRLPS01		
100	Groundwater Level Monitoring	DWH9PRDGY02		
101	Groundwater Level Monitoring	DWH9PRPOPO3		
102	Groundwater Level Monitoring	DWH9PRMCF03		
103	Groundwater Level Monitoring	DWH9PRMCF04		
104	Groundwater Level Monitoring	DWH9PRMCF05		
105	Groundwater Level Monitoring	DWH43PRLPS01		
106	Groundwater Level Monitoring	DWH43PRDGY02		
107	Groundwater Level Monitoring	DWH43PRPOR03		
108	Groundwater Level Monitoring	DWH43PRMCF03		
109	Groundwater Level Monitoring	DWH43PRMCF04		
110	Groundwater Quality Monitoring	DWH43PRMCF05		
111	Groundwater Quality Monitoring	DWH35PRLPS01		
112	Groundwater Quality Monitoring	DWH35PRDGY02		
113	Groundwater Quality Monitoring	DWH35PRPOR03		
114	Groundwater Quality Monitoring	DWH35PRMCF04		
115	Groundwater Quality Monitoring	DWH35PRMCF05		
116	Groundwater Quality Monitoring	DWH35PRMCF06		

Note:

Monitoring points removed in accordance with Environmental Protection Licence (EPL) 23050 amended 11th April 2021 (16, 17, 22, 23, 24, 25, 29, 30, 31, 32, 33, 34, 35, 36, 50, 51, 52, 53, 55, 58, 67 and 68).

Monitoring points 87-116 coordinates to be confirmed.

TABLE 2: GROUNDWATER QUALITY MONITORING (In situ - Quarterly)

		EPA Identification No	7	8	9	10	11	12
		Location	BWD27PRUPS02	BWD27PRLPS03	BWD26PRUPS01	BWD26PRLPS02	DWH14PRUPS01	DWH14PRLPS02
		Date	29/09/2023	29/09/2023	30/09/2023	30/09/2023	28/09/2023	28/09/2023
		Sample Method	in situ	in situ	in situ	in situ	in situ	in situ
Parameter	Units	LOR	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT
Dissolved Oxygen	mg/L	-	1.3	2.7	4.3	0.67	3.1	0.87
Electrical Conductivity	µS/cm	-	130	205	97	135	171	183
pH	pH Unit	-	5.3	5.21	4.93	5.57	5.13	5.23
Redox Potential	mV	-	27	10	43	-41	20	31
Standing Water Level	mTOC	-	38.99	38.48	29.69	29.1	53.38	54.18

		EPA Identification No	13	14	15	18	20	21
		Location	DWH14PRPUR03	DWH3PRUPS01	DWH3PRLPS02	BWD27PRORA01	BHN14PRORA01	BHN14PRUPS02
		Date	28/09/2023	27/09/2023	27/09/2023	29/09/2023	30/09/2023	30/09/2023
		Sample Method	in situ	in situ	in situ	No sample - dry	in situ	in situ
Parameter	Units	LOR	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT
Dissolved Oxygen	mg/L	-	5.96	1.6	1.8	-	2.81	4.3
Electrical Conductivity	µS/cm	-	741	120	137	-	472	458
pH	pH Unit	-	6.56	5.1	5	-	6.99	6.27
Redox Potential	mV	-	-84	19	21	-	-20	22
Standing Water Level	mTOC	-	53.58	67.48	67.63	-	26.44	15.11

		EPA Identification No	26	27	28	37	38	39
		Location	BWDMW12S	BWDMW12D	BWDMW12I	LWDMW1D	LWDMW1S	LWDMW1I
		Date	26/09/2023	26/09/2023	26/09/2023	27/09/2023	27/09/2023	27/09/2023
		Sample Method	No sample - dry	Grab Sample	No sample - dry	in situ	No sample - dry	No sample - dry
Parameter	Units	LOR	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT
Dissolved Oxygen	mg/L	-	-	2.4	-	1.38	-	-
Electrical Conductivity	µS/cm	-	-	4504	-	2236	-	-
pH	pH Unit	-	-	6.61	-	6.53	-	-
Redox Potential	mV	-	-	12	-	27.6	-	-
Standing Water Level	mTOC	-	-	31.09	-	29.92	-	-

		EPA Identification No	40	41	42	43	56	57
		Location	LWDMW2S	LWDMW2D	LWDMW3D	LWDMW3S	WPKMW9D	WPKMW9S
		Date	27/09/2023	27/09/2023	27/09/2023	27/09/2023	25/09/2023	25/09/2023
		Sample Method	No sample - dry	in situ	in situ	No sample - dry	in situ	in situ
Parameter	Units	LOR	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT
Dissolved Oxygen	mg/L	-	-	0.68	1.4	-	1.66	0.83
Electrical Conductivity	µS/cm	-	-	2056	935	-	1200	3538
pH	pH Unit	-	-	6.7	6.61	-	7.94	7.92
Redox Potential	mV	-	-	26	33	-	2.8	-58
Standing Water Level	mTOC	-	-	25.96	21.05	-	15.35	15.63

TABLE 2: GROUNDWATER QUALITY MONITORING (In situ - Quarterly)

		EPA Identification No	59	60	61	62	63	64
		Location	WPKMW13I	WPKMW13S	WPKMW14D	WPKMW14S	WPKMW15D	WPKMW15S
		Date	25/09/2023	25/09/2023	25/09/2023	25/09/2023	25/09/2023	25/09/2023
		Sample Method	in situ	in situ	in situ	No sample - dry	in situ	in situ
Parameter	Units	LOR	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT
Dissolved Oxygen	mg/L	-	0.93	1.13	1.97	-	0.7	2.48
Electrical Conductivity	µS/cm	-	1282	3082	1197	-	1289	8710
pH	pH Unit	-	8.11	7.68	8.06	-	7.99	7.96
Redox Potential	mV	-	25.9	53	58	-	8	45
Standing Water Level	mTOC	-	16.73	16.91	20.86	-	22.19	22.4

		EPA Identification No	65	66	78	79	87	93
		Location	WPKMW16D	WPKMW16S	WPKMW18S	WPKMW18I	BHNS1PRLPS01	BWD6PRLPS01
		Date	25/09/2023	25/09/2023	25/09/2023	25/09/2023	1/10/2023	1/10/2023
		Sample Method	in situ	No sample - dry	Insufficient Liquid	in situ	Insufficient Liquid	Insufficient Liquid
Parameter	Units	LOR	RESULT	RESULT	RESULT	RESULT	RESULT	RESULT
Dissolved Oxygen	mg/L	-	0.38	-	-	1.01	-	-
Electrical Conductivity	µS/cm	-	1257	-	-	1215	-	-
pH	pH Unit	-	7.51	-	-	7.59	-	-
Redox Potential	mV	-	23	-	-	18	-	-
Standing Water Level	mTOC	-	26.55	-	16.93	16	22.68	28.19

TABLE 2: GROUNDWATER QUALITY MONITORING (Representative Sample - Special Frequency 2)

		EPA Identification No	27
		Location	BWDMW12D
		Date	26/09/2023
		Sample Method	Grab Sample
Parameter	Units	LOR	RESULT
Aluminium	mg/L	0.01	<0.01
Ammonia as N	mg/L	0.01	0.04
Arsenic	mg/L	0.001	<0.001
Barium	mg/L	0.001	0.563
Beryllium	mg/L	0.001	<0.001
Bicarbonate Alkalinity as CaCO3	mg/L	1	1430
Boron	mg/L	0.05	<0.05
Bromide	mg/L	0.010	<0.2
Cadmium	mg/L	0.0001	<0.0001
Calcium	mg/L	1	12
Carbonate Alkalinity as CaCO3	mg/L	1	<1
Chloride	mg/L	1	741
Chromium	mg/L	0.001	<0.001
Cobalt	mg/L	0.001	0.002
Copper	mg/L	0.001	<0.001
Fluoride	mg/L	0.1	0.4
Iron	mg/L	0.05	0.32
Lead	mg/L	0.001	<0.001
Magnesium	mg/L	1	115
Manganese	mg/L	0.001	0.032
Mercury	mg/L	0.0001	<0.0001
Methane	mg/L	0.010	<0.01
Molybdenum	mg/L	0.001	<0.001
Nickel	mg/L	0.001	0.002
Nitrate as N	mg/L	0.01	0.22
Nitrite as N	mg/L	0.01	<0.01
Potassium	mg/L	1	31
Reactive Phosphorus	mg/L	0.01	<0.01
Selenium	mg/L	0.01	0.02
Sodium	mg/L	1	795
Strontium (Dissolved)	mg/L	0.001	0.343
Sulfate as SO4 2-	mg/L	1	85
Total Dissolved Solids @180°C	mg/L	10	2600
Uranium	mg/L	0.001	0.005
Vanadium	mg/L	0.01	<0.01
Zinc	mg/L	0.005	<0.005

*Limit of reporting (LOR) has been adjusted due to matrix interference as per Australian Laboratory Services (ALS) certificate of analysis (COA) ES2332953.

TABLE 3: TREATED WATER QUALITY MONITORING

		EPA Identification No	77	77	77
		Location	LWWTPDM1	LWWTPDM1	LWWTPDM1
		Date	Aug-23	Sep-23	Oct-23
		Sample Method	No sample - plant not operating	No sample - plant not operating	No sample - plant not operating
Parameter	Units	LOR	RESULT	RESULT	RESULT
Ammonia as N	mg/L	0.01	-	-	-
Bicarbonate Alkalinity as CaCO3	mg/L	1	-	-	-
Boron	mg/L	0.05	-	-	-
Calcium	mg/L	1	-	-	-
Carbonate Alkalinity as CaCO3	mg/L	1	-	-	-
Chloride	mg/L	1	-	-	-
Electrical Conductivity	µS/cm	-	-	-	-
Fluoride	mg/L	0.1	-	-	-
Magnesium	mg/L	1	-	-	-
Nitrate as N	mg/L	0.01	-	-	-
Nitrite as N	mg/L	0.01	-	-	-
pH	pH Unit	-	-	-	-
Potassium	mg/L	1	-	-	-
Reactive Silica	mg/L	1	-	-	-
Sodium Adsorption Ratio	-	0.01	-	-	-
Sodium	mg/L	1	-	-	-
Sulfate as SO4 2-	mg/L	1	-	-	-
Total Alkalinity (as CaCO3)	mg/L	1	-	-	-
Total Dissolved Solids @180°C	mg/L	10	-	-	-
Total Hardness (as CaCO3)	mg/L	1	-	-	-
Total Nitrogen (as N)	mg/L	0.5	-	-	-
Total Phosphorus (as P)	mg/L	0.01	-	-	-
Total Residual Chlorine	mg/L		-	-	-
Turbidity	NTU	0.1	-	-	-

TABLE 4: PRODUCED WATER STORAGE QUALITY MONITORING

		EPA Identification No	71	72	73	74	75
		Location	LWDPD1CELL4	LWDPD1CELL3	LWDPD1CELL2	LWDPD1CELL1	TFDPD1
		Date	26/09/2023	26/09/2023	26/09/2023	26/09/2023	5/10/2023
		Sample Method	No sample - dry	Grab Sample	Grab Sample	Grab Sample	Grab Sample
Parameter	Units	LOR	RESULT	RESULT	RESULT	RESULT	RESULT
Aluminium	mg/L	0.1	-	<0.1	<0.1	<0.1	<0.1
Ammonia as N	mg/L	0.1	-	<0.1	<0.1	0.16	0.68
Arsenic	mg/L	0.01	-	<0.01	<0.01	<0.01	<0.01
Barium	mg/L	0.01	-	0.59	1.6	1.16	0.993
Beryllium	mg/L	0.01	-	<0.01	<0.01	<0.01	<0.01
Bicarbonate Alkalinity as CaCO3	mg/L	1	-	600	11000	9260	9200
Boron	mg/L	0.1	-	4.3	2.1	1.82	0.3
Bromide	mg/L	0.01	-	20.8	7.91	<2*	2.72
Cadmium	mg/L	0.001	-	<0.001	<0.001	<0.001	<0.001
Calcium	mg/L	10	-	6	6	4	5
Carbonate Alkalinity as CaCO3	mg/L	1	-	34000	14500	9180	2000
Chloride	mg/L	1	-	7490	3730	3050	1300
Chromium	mg/L	0.01	-	<0.01	<0.01	<0.01	<0.01
Cobalt	mg/L	0.01	-	<0.01	<0.01	<0.01	<0.01
Copper	mg/L	0.01	-	<0.01	<0.01	<0.01	<0.01
Dissolved Oxygen	mg/L	-	-	5.21	4.3	5.8	4.74
Electrical Conductivity	µS/cm	-	-	37850	41119	33347	17753
Iron	mg/L	0.1	-	<0.1	<0.1	<0.1	<0.1
Lead	mg/L	0.01	-	<0.01	<0.01	<0.01	<0.01
Magnesium	mg/L	10	-	13	10	5*	3*
Manganese	mg/L	0.01	-	<0.01	<0.01	<0.01	<0.01
Mercury	mg/L	0.0001	-	<0.0001	<0.0001	<0.0001	<0.0001
Molybdenum	mg/L	0.01	-	0.23	0.197	0.227	0.03
Nickel	mg/L	0.01	-	<0.01	<0.01	<0.01	<0.01
Nitrate as N	mg/L	0.1	-	<0.1	<0.1	<0.1	2.46
Nitrite as N	mg/L	0.01	-	<0.01	<0.01	<0.1*	0.32
pH	pH Unit	-	-	9.03	8.75	8.4	8.55
Potassium	mg/L	10	-	482	154	173	38
Redox potential	mV	-	-	-11	-4	1	25
Selenium	mg/L	0.1	-	<0.1	<0.1	<0.1	<0.1
Sodium Adsorption Ratio	-	0.1	-	1480	824	881	486
Sodium	mg/L	10	-	28100	14200	11200	5570
Strontium	mg/L	0.01	-	0.818	0.868	0.626	0.973
Sulfate as SO4 2-	mg/L	1	-	<100*	610	<10*	54
Total Dissolved Solids @180°C	mg/L	10	-	65500	35000	27100	13700
Total Organic Carbon	mg/L	1	-	148	92	93	8
Total Phosphorus as P	mg/L	0.1	-	1.44	0.1	0.18	0.01*
Uranium	mg/L	0.01	-	<0.01	<0.01	<0.01	<0.01
Vanadium	mg/L	0.1	-	<0.1	<0.1	<0.1	<0.1
Zinc	mg/L	0.05	-	<0.05	<0.05	<0.05	<0.05

Note: *Limit of reporting (LOR) has been adjusted due to the min matrix interference as per Australian Laboratory Services (ALS) certificate of analysis (COA) ES2332961 and ES2334120

TABLE 6: GROUNDWATER LEVEL MONITORING

EPA Identification No	44	45	46	47	48	49
Location	Dewhurst 8A-1 (DWH8AQGDGY01)	Dewhurst 8A-2 (DWH8AQGARK02)	Dewhurst 8A-3 (DWH8AQGPOR03)	Bibbiewindi 28A (BWD28QGUPS01)	Bibbiewindi 28B (BWD28QGLPS01)	Bibbiewindi 28C (BWD28QGPUR01)
Start Date	1/08/2023	1/08/2023	1/08/2023	1/08/2023	1/08/2023	1/08/2023
End Date	31/10/2023	31/10/2023	31/10/2023	31/10/2023	31/10/2023	31/10/2023
Sample Obtained	Standing Water Level	Standing Water Level	Standing Water Level	Standing Water Level	Standing Water Level	Standing Water Level
Number of Samples Required	Continuous	Continuous	Continuous	Continuous	Continuous	Continuous
Lowest sample value	-36.952	18.723	-43.512	-13.284	-1.269	-5.854*
Mean of sample	-36.918	19.0255	-43.004	-13.158	-0.941	-5.541*
Highest sample value	-36.892	19.327	-42.532	-13.072	-0.564	-5.149*

Note: Monitoring points 47,48 and 49: Sensor is recording pressure data in psi since 21 September 2022. The water levels (SWL) have been calculated.

*Equipment failure at BWD28QGPUR01 after the 3 September 2023.