Proceedings of the National Academy of Sciences of the United States of America

PNAS

The integrity of oil and gas wells

Robert B. Jackson[a,b,1]

Author Affiliations

Public concerns about oil and natural gas extraction these days inevitably turn to hydraulic fracturing, where millions of gallons of water, sand, and chemicals are pumped underground at high pressures to crack open rocks. Hydraulic fracturing often occurs a mile or more down, far from the water we drink or the air we breathe. The focus for safety and environmental stewardship should often be somewhere else—nearer the surface—emphasizing risks from spills, wastewater disposal, and the integrity of oil and natural gas wells passing through drinking-water aquifers (1⇓⇓–4). In PNAS, Ingraffea et al. (5) examine one of these factors, well integrity, across the Marcellus region of Pennsylvania, using inspection records from the state Department of Environmental Protection (DEP).

In a technical sense, "well integrity" refers to the zonal isolation of liquids and gases from the target formation or from intermediate layers through which the well passes. In a practical sense, it means that a well doesn't leak. Drilling companies emphasize well integrity because a faulty well is expensive to repair and, in the rarest of cases, costs lives, as in the *Deepwater Horizon* disaster in the Gulf of Mexico. Drillers use steel casing (pipes), cement between nested casings and between the outside casing and rock wall, and mechanical devices to keep fluids inside the well.

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July 29, 2014
vol. 111 no. 30
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Outline

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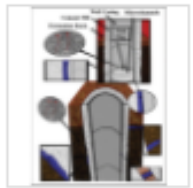
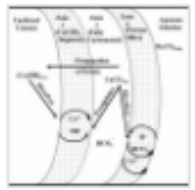


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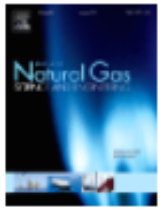
Table 1

Journal of Natural Gas Science and Engineering
Volume 45, September 2017, Pages 511-526



Identification and evaluation of well integrity and causes of failure of well integrity barriers (A review)

Raj Kiran [a], Catalin Teodoriu [a], Younas Dadmohammadi [a], Runar Nygaard [b], David Wood [c], Mehdi Mokhtari [d], Saeed Salehi [a]

Show more

https://doi.org/10.1016/j.jngse.2017.05.009

Highlights

- Extensive description regarding specific well integrity issues in conventional and unconventional reservoirs.
- Detailed review of well integrity issues in wells such as gas and water injection, geothermal, and HPHT.
- Comprehensive description of well integrity issues in operations such as EOR, deep-water drilling, plugging and abandonment.

Reference links: Well integrity

NSW Department of Trade and investment, (2012, September). **Code of Practice for Coal Seam Gas**. Retrieved February 2015, from NSW.gov.au

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Cross Navigation

Oil & Gas Explained

What we produce, where we find it, how we produce it and how it is used.

Industry In Depth

Industry statistics, expert reports, APPEA submissions & policy positions.

Safety & Environment

Driving continued improvement in health, safety and environmental management.

George E King Consulting

Downloads

The information posted on this site is offered for basic information only and is free of charge or obligation. Energy related technology is constantly changing, thus more current materials may be available elsewhere. There is no company affiliation with this information other than my own and the comments associated with the technology on this site are mine alone. No warranty of any type is expressed or implied and no responsibility for accuracy is intended or accepted. The properties of natural formations vary widely and simple statements of theory without detailed sample analysis and monitoring will not be accurate. Results of even the best designed operations in the subsurface vary widely and no concepts or model prediction of physical or chemical behavior in formations can be assumed to be accurate without extensive evaluation and testing.

Recently Updated Files:

ARMA-Presentation-25-June-2016
Chemicals used in Well Developments
Culture of Maintenance
How a Well is Built
Hydraulic Fracturing: What is it?
Naturally Occurring Radioactive Materials
Naturally Occurring Radioactive Materials in produced waters
Natural Methane Seeps and Methane in Ground Water
Protecting Ground Water
Questions to ask before Leasing Land
Seismic: What is the Risk?
Water Use of Drilling and Hydraulic Fracturing
Well Development: How long does it take?

Free pdf Download Files:

Squeeze Cementing – channel repair

- Objectives
  1. Locate the channel
  2. Perforate into the channel
  3. Inject cement and fill the channel

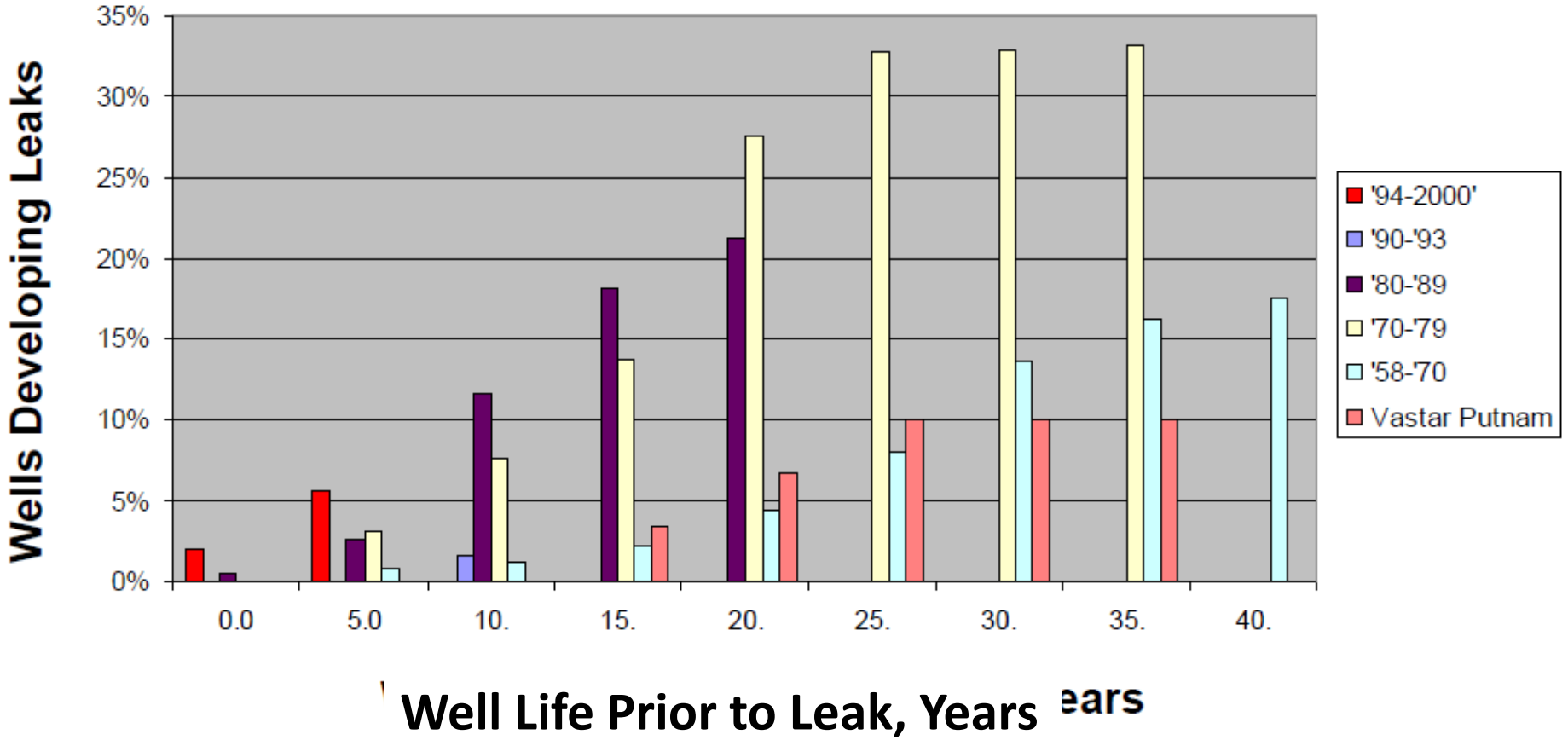
Problems

1. locating the channel
2. squeezing into the channel

Squeeze Success?

- Usually about 50% - but conditions make success vary widely.
- Increases when:
  - circulation is possible through the channel,
  - Isolation is used fro cement injection,
  - cement blending is pod mix,
  - the operator is experienced.

Worldwide Leaky Well Industry Statistics



From George E King Consulting Inc.: http://gekengineering.com/id6.html

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

Water Supply Determination Letters

The following list identifies cases where DEP determined that a private water supply was impacted by oil and gas activities. The oil and gas activities referenced in the list below include operations associated with both conventional and unconventional drilling activities that either resulted in a water diminution event or an increase in constituents above background conditions. This list is intended to identify historic water supply impacts and does not necessarily represent ongoing impacts. Many of the water supply complaints listed below have either returned to background conditions, have been mitigated through the installation of water treatment controls or have been addressed through the replacement of the original water supply. This list is dynamic in nature and will be updated to reflect new water supply impacts as they are reported to DEP and a determination is made; however, the list will retain cases of water supply impacts even after the impact has been resolved.

There are now 287 confirmed cases of Water Supply contamination in PA

	DOGO	Complaint #	County	Twp/Boro	Date Letter Sent
1	East	258482	Susquehanna	Dimock	Jan. 2009
2	East	ORDER	Susquehanna	Dimock	12/15/2010
3	East	ORDER	Susquehanna	Dimock	12/15/2010
4	East	ORDER	Susquehanna	Dimock	12/15/2010
5	East	ORDER	Susquehanna	Dimock	12/15/2010
6	East	ORDER	Susquehanna	Dimock	12/15/2010
7	East	ORDER	Susquehanna	Dimock	12/15/2010
8	East	ORDER	Susquehanna	Dimock	12/15/2010
9	East	ORDER	Susquehanna	Dimock	12/15/2010
10	East	ORDER	Susquehanna	Dimock	12/15/2010
11	East	ORDER	Susquehanna	Dimock	12/15/2010
12	East	ORDER	Susquehanna	Dimock	12/15/2010

http://files.dep.state.pa.us/OilGas/BOGM/BOGMPortalFiles/OilGasReports/Determination_Letters/Regional_Determination_Letters.pdf

AGL's irrigation trial using CSG waste water found to be 'unsustainable'

Peter Hannam

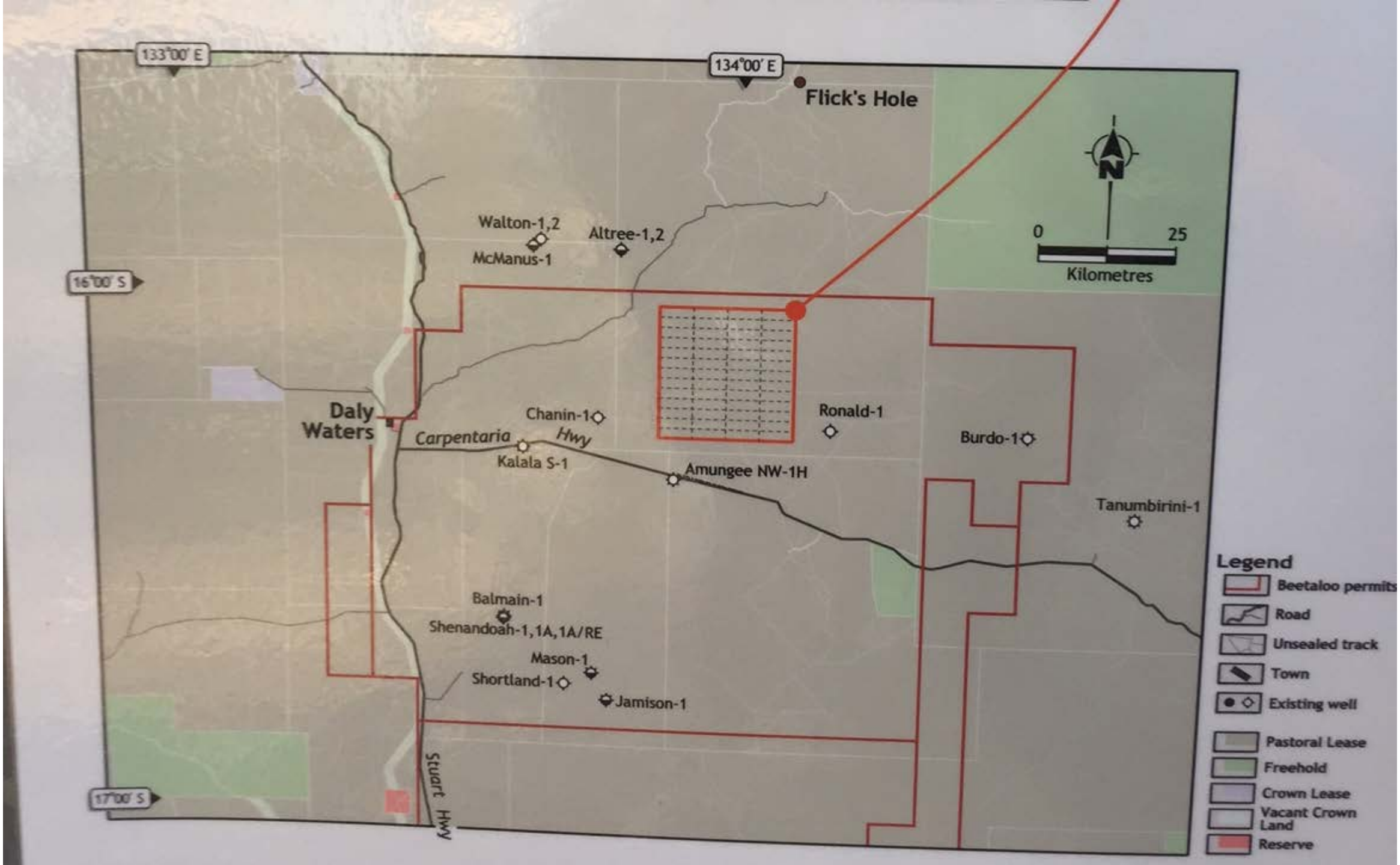
- Gas leak prompts fresh investigation

AGL has ended its trial of using coal seam gas waste water for irrigation in northern NSW after regulators found it left behind unacceptably high levels of salt and heavy metals.

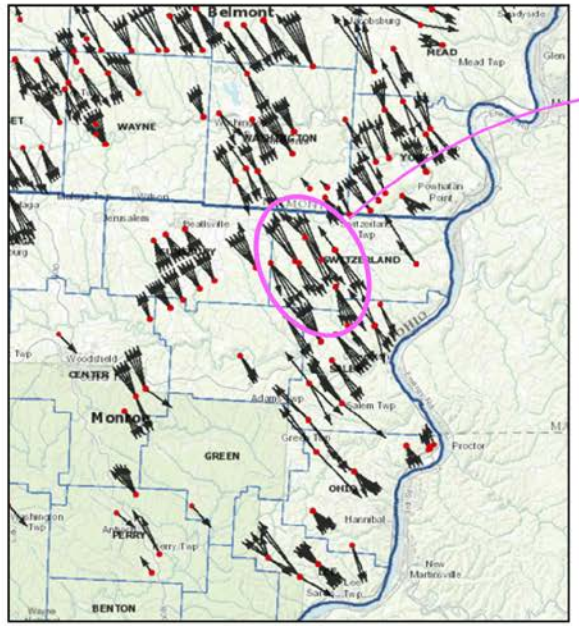
MOST POPULAR

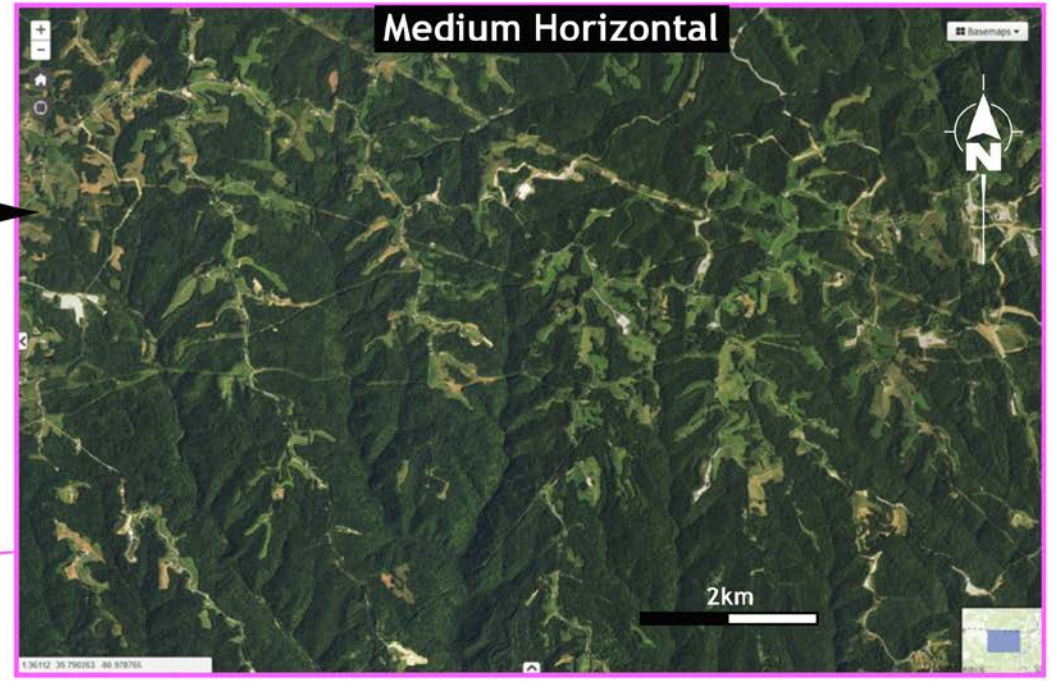
1 Winter heat wave expected to break July temperature record


West Virginia
BA533770
APPORTIONED
DANGER
DO NOT ENTER

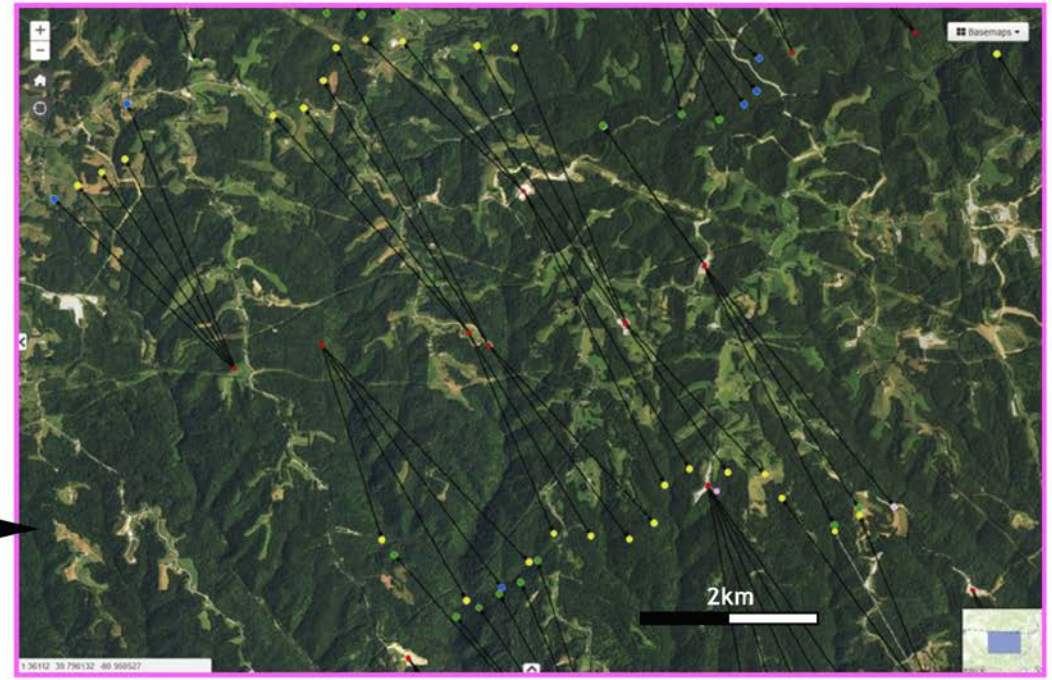

133°00' E
134°00' E
Flick's Hole
16°00' S
17°00' S
Walton-1,2
McManus-1
Altree-1,2
0
25
Kilometres
Daly Waters
Chanin-1
Carpentaria Hwy
Kalala S-1
Ronald-1
Burdo-1
Amungee NW-1H
Tanumbirini-1
Balmain-1
Shenandoah-1,1A,1A/RE
Mason-1
Shortland-1
Jamison-1
Stuart Hwy
Legend
Beetaloo permits
Road
Unsealed track
Town
Existing well
Pastoral Lease
Freehold
Crown Lease
Vacant Crown Land
Reserve

Surface Footprint





Sub-surface Footprint



Utica Shale Map (Ohio)

Updated September 10, 2016

The map below represent data from the Ohio DNR as of September 10, 2016. The map includes well paths and surface and bottom hole locations and is color coded by status.

Legend

Surface locations: White square

Bottom hole locations and well paths as follows.

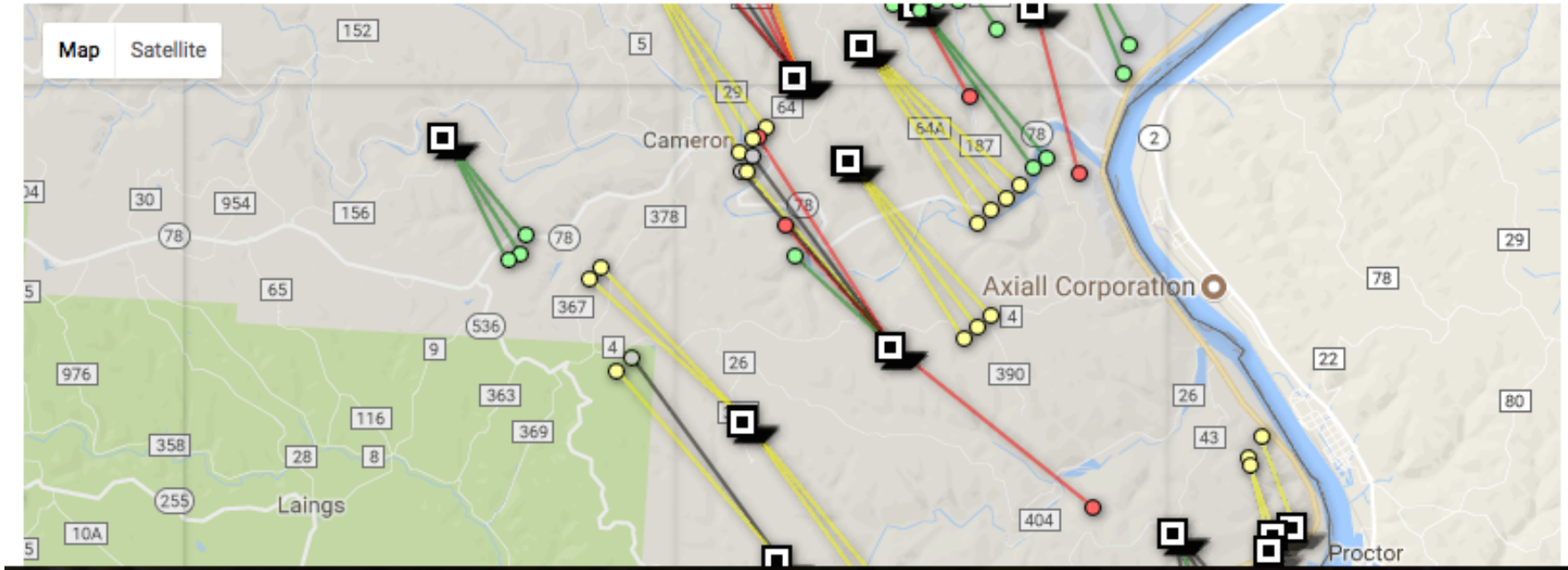
Permitted only: Yellow

Drilling: Red

Drilled but not yet producing: Gray bottom hole, black lines

Producing: Green

Select any element (surface, well path, bottom hole, county) to view more.
Pan and/or Zoom for more detail



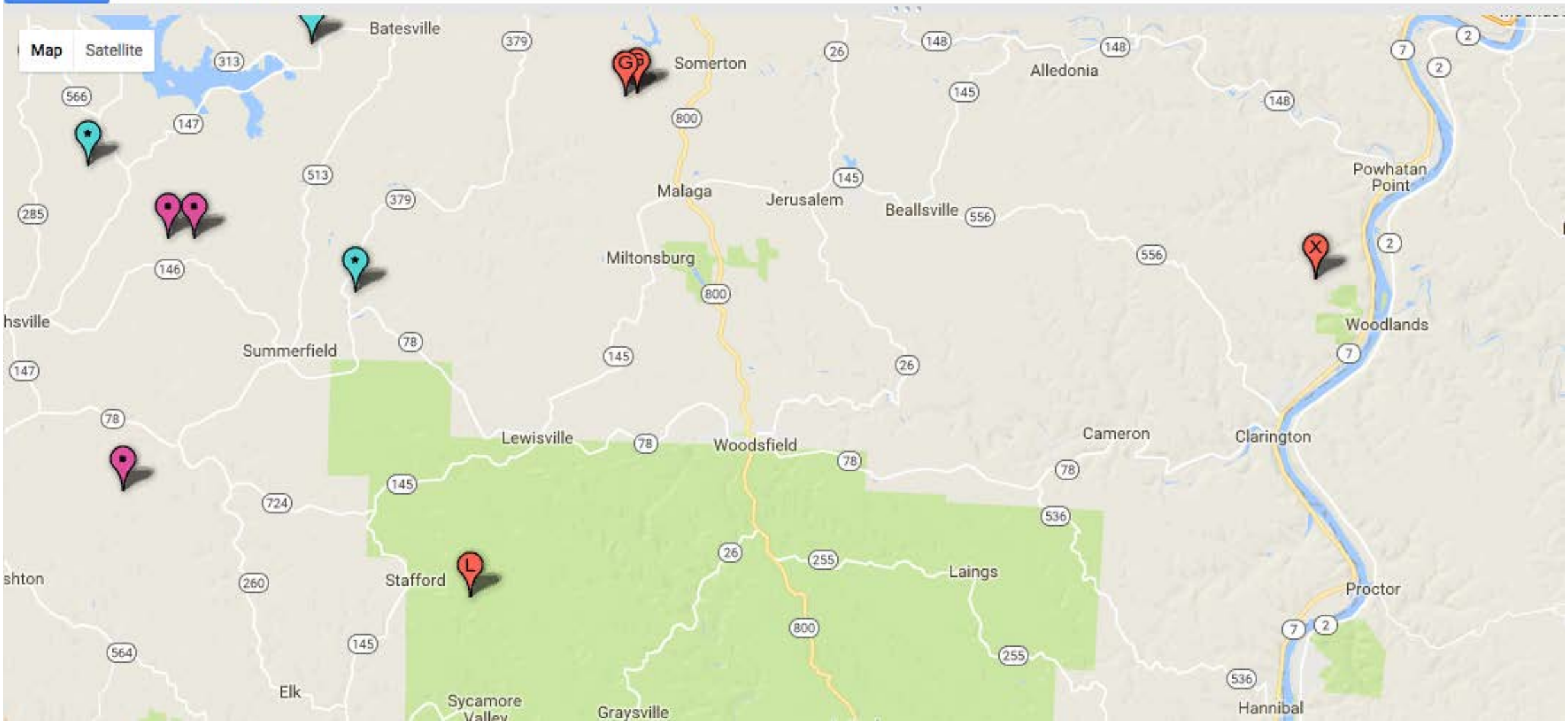
Utica Shale Wells (Ohio) "Drilling" (53 in Total) (By Operator) Updated July 27, 2013

Source: Ohio DNR, Updated 7/27/2013. NOTE: Many wells are associated with pads, zoom in to view.

www.uticashaleblog.com/p/maps.html - Edited on 2013 August 1

File Edit Tools Help | Map of Latitude

Filter | No filters applied



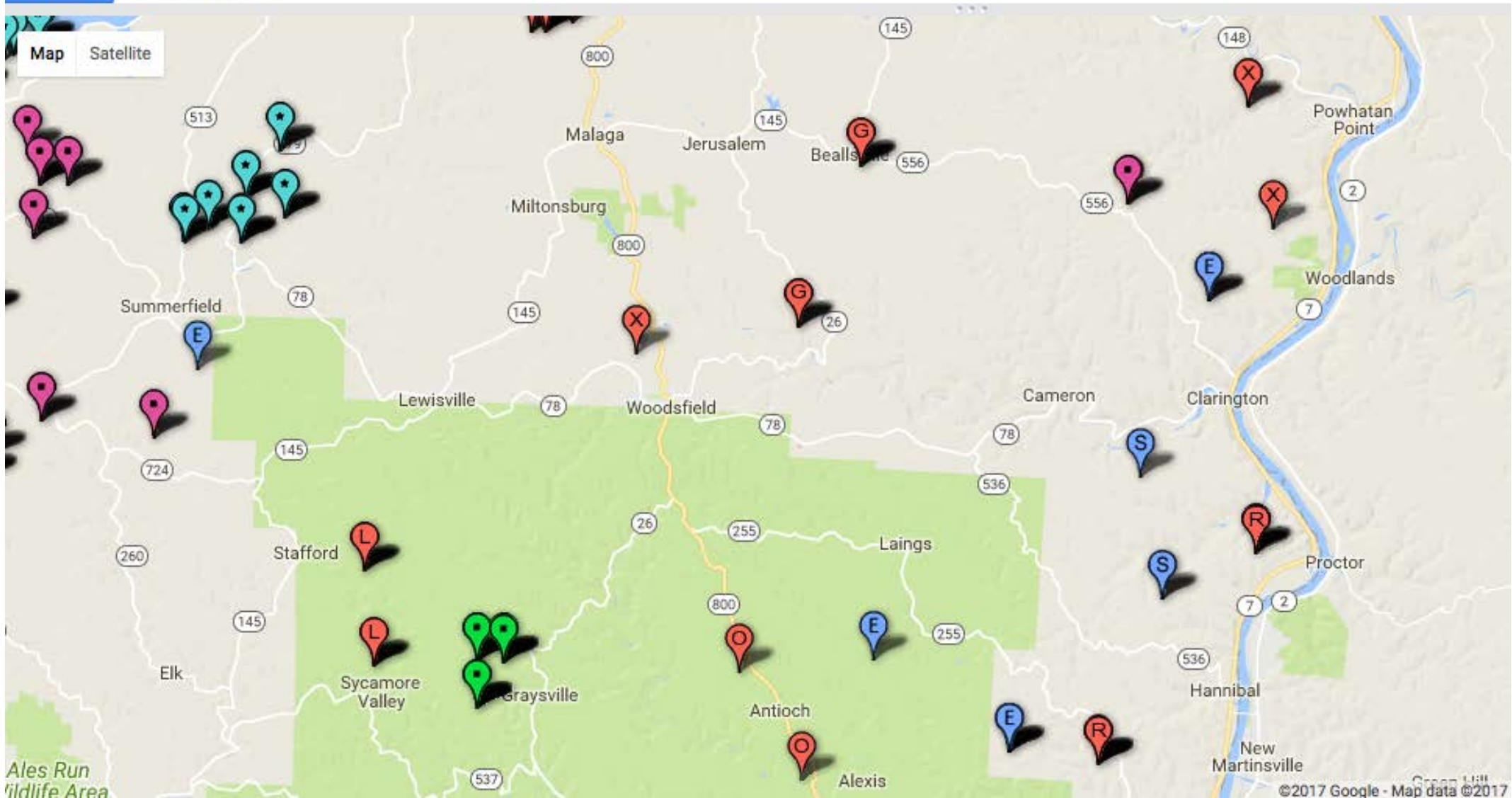
Utica Shale Activity Report - June 7, 2014

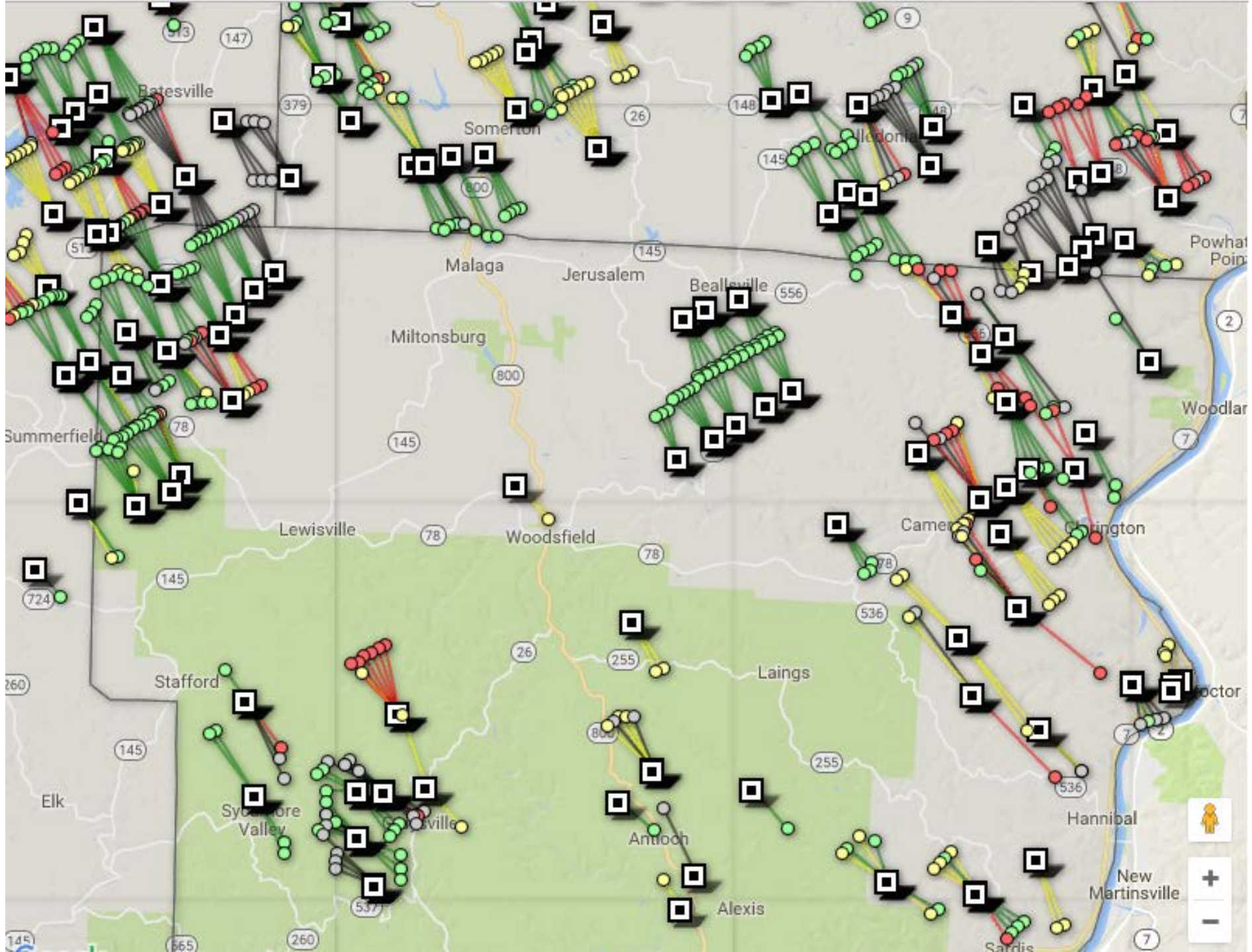
Map of Utica Shale well activity in Ohio. Updated June 7, 2014. Source: Ohio DNR data.

Utica Shale Blog (ODNR Data) - Edited on 2014 June 11

File Edit Tools Help | All wells | "Permitted" only | "Drilling" | "Drilled" | "Producing" | +

Filter | No filters applied




Batesville
Somerton
Malaga
Jerusalem
Bealleville
Miltonsburg
Summerfield
Lewisville
Woodsfield
Stafford
Laings
Elk
Antioch
Alexis
Hannibal
New Martinsville
Powhat
Woodlar
Camer
Charington
147
379
26
148
145
800
556
78
724
536
255
260
537
7
2

Oil & Gas Home
Well Information
Electronic Forms
Oil & Gas FAQ
Laws & Regulations
Regulatory Sections
Stay Informed
Contacts & About Us
Site Index

Violations, Investigations & Reports

General Information | Field Inspectors | Final Non-appealable Orders for Material & Substantial Violations

Oil & Gas Regulatory Enforcement

The division works to protect Ohio's oil and gas resources, the environment and the interests of citizens living near oil and gas wells. Inspectors investigate citizen's complaints, enforce and oversee well construction and waste disposal activities, and the plugging of wells and site restoration.

Responding to Citizen Complaints

The division responds to questions or complaints within 24 hours either by telephone or in person. Inspectors are available to act on emergencies, such as well or tank fires that are a threat to public health or safety. Some of the most common complaints include oil spills, gas leaks, brine disposal, safety, orphan wells, and well or tank fires.

Inspecting Restoration Approval

After a well is drilled or plugged, the owner is required by law to restore the site within designated time frames.

Enforcing the Law to Correct Violations

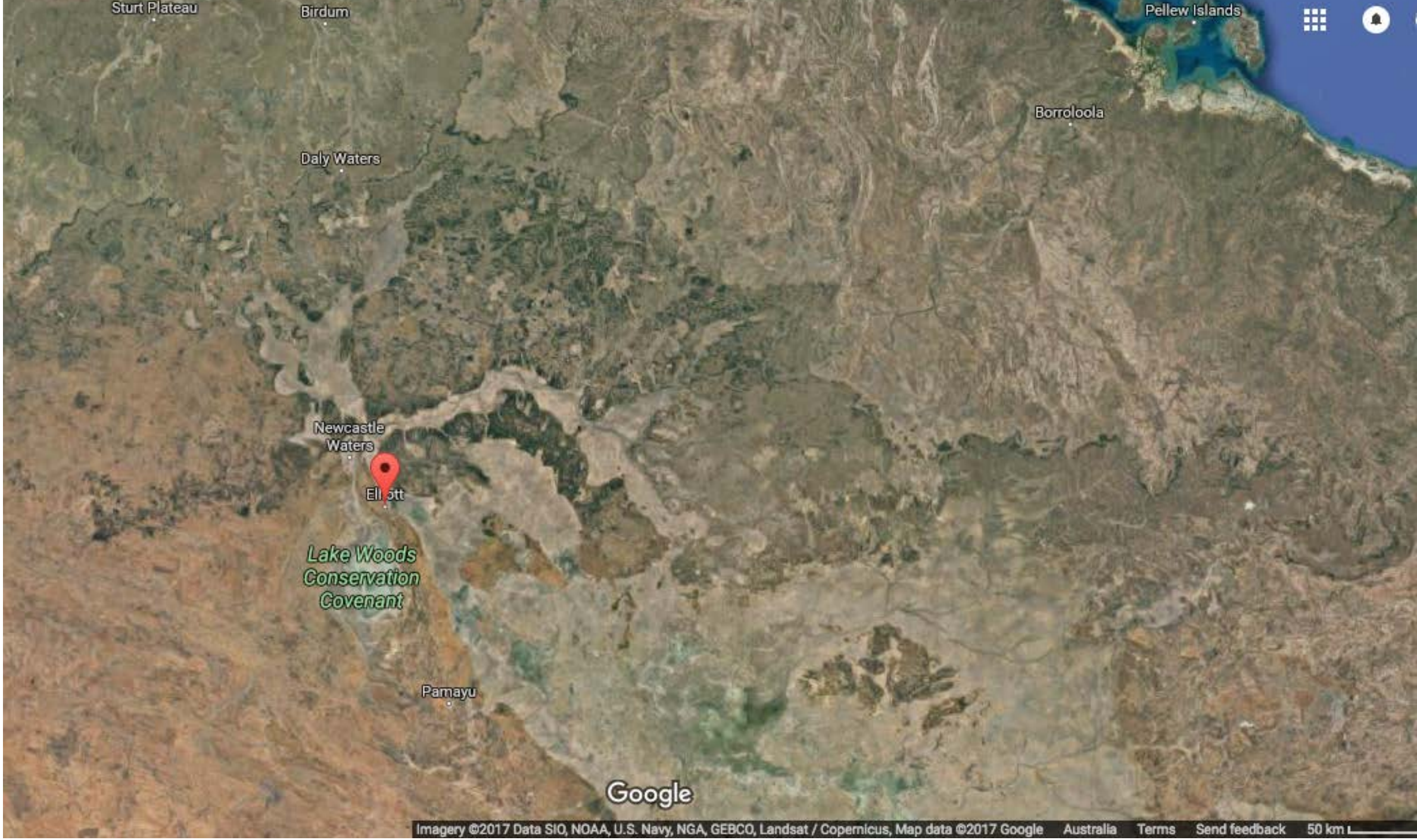
When a well owner fails to meet requirements established by law, the Division of Oil and Gas Resources Management has a variety of enforcement options to gain compliance. The division generally maintains a standard operating procedure of escalating enforcement measures from informal to formal, depending upon the nature of the violation.

Groundwater Contamination or Disruption Complaint

If a person/family believes their domestic water well has been adversely impacted by an oil and gas well, complete the appropriate form(s) and submit to:
oilandgas@dnr.state.oh.us

- Groundwater Contamination Disruption Questionnaire [pdf 1.7Mb]
- Groundwater Decreased Supply & Siltation [pdf 76Kb]
- Groundwater Contamination Presence of Gas [pdf 71Kb]
- Groundwater Contamination Presence of Oil [pdf 77Kb]
- Groundwater Contamination Presence of Salty Water [pdf 76Kb]

Water


Sturt Plateau
Birdum
Pellew Islands
Borroloola
Daly Waters
Newcastle Waters
Elliott
Lake Woods Conservation Covenant
Pamayu
Google
Imagery ©2017 Data SIO, NOAA, U.S. Navy, NGA, GEBCO, Landsat / Copernicus, Map data ©2017 Google
Australia
Terms
Send feedback
50 km

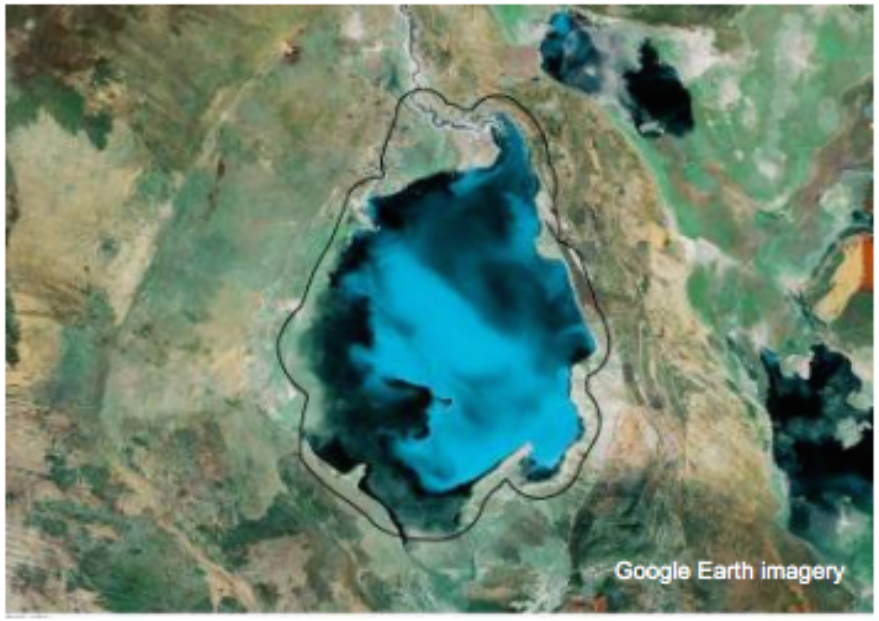
Northern Territory Government

SITES OF CONSERVATION SIGNIFICANCE

Lake Woods

Location and Description

Lake Woods is a large ephemeral wetland located on the western edge of the Barkly Tableland and 220 km north of Tennant Creek. The Lake most frequently occupies an area of about 350 km², but during periods of major flooding (such as 1993 and 2001) it is broadly contiguous with the lower reaches of Newcastle Creek, and can reach 850 km² and, at times, nearer 1000 km², making it one of the largest temporary freshwater lakes in the Northern Territory and tropical Australia. The lake basin supports grass/sedge communities, including broad bands of lignum which comprise one of the largest areas of lignum swamp in the Northern Territory. The northern edge of the Lake and Newcastle Creek are fringed by river red gum and coolibah. The slopes of the Ashburton Range to the east are dominated by spinifex communities.



Tenure and Land Use

Lake Woods is located on pastoral leasehold land and encompasses two pastoral properties (Powell Creek and Newcastle Waters). The main land use within the Site is pastoral operations, but a fenced enclosure on the northern part of the lake is managed as the Longreach Waterhole Protected Area (approximately 7% of Site) by Parks and Wildlife Service NT in cooperation with the pastoral lease managers. The reserve is popular for conservation and recreation purposes.

Significance Rating

International Significance

Condition

Apart from weed infestations, Lake Woods seems to be relatively resilient to grazing. Some bank erosion is apparent around the Longreach and South Newcastle Waterholes, and streamline erosion occurs in lighter-soil areas of the south-east of the site.

Current Conservation Initiatives

The Longreach Waterhole Protected Area was fenced in 1984 to exclude stock, but maintenance is difficult as the fence is effectively destroyed by each flood event.

Figure 7.1: Cambrian Limestone Aquifer overlying the three main Basins (Daly, Wiso, Georgina) and the Beetaloo Sub-basin. Source: DENR.

A qualitative water-tracing experiment using the non-toxic ‘Tinopal’ dye was undertaken between May and November 1998 in karst terranes in the Katherine Town area.

A sinkhole located 2.8km north east of Katherine River was selected as the dye injection point.

3 days later found in the Katherine River

1000m per day

Quick traveling contaminants in karstic limestone environment

- Conversely, it has been stated that the likelihood of this occurring is low given the large distance (1,000 to 2,000 m) between the shale layer and the high quality aquifer, and the very low permeability of the intervening strata.
- APPEA submission; Origin submission; Santos submission.

- Induced fractures do not create communication pathways between reservoir and aquifer levels, because:
  - Physcial distance between Velkerri formation and Tindall aquifer
  - Aquitard properties of the intervening geological layers
  - Volume of water and sand is insufficient to create the energy/pressure require to create pathways
- Potential for existing conduits (for example, natural vertical fractures or old abandoned wellbores) providing a pathway for injected fluid to reach a fresh water zone

  Unlikely because:
  - Pressure required to overcome hydrostatic head and frictional losses between reservoir and fresh water
  - High leak off into faults and natural fracture systems
  - Extremely low density of existing wells

  Mitigation techniques:
  - Mapping of large structures/faults - avoidance
  - Use of microseismic to monitor completions in areas where potential conduits have been identified

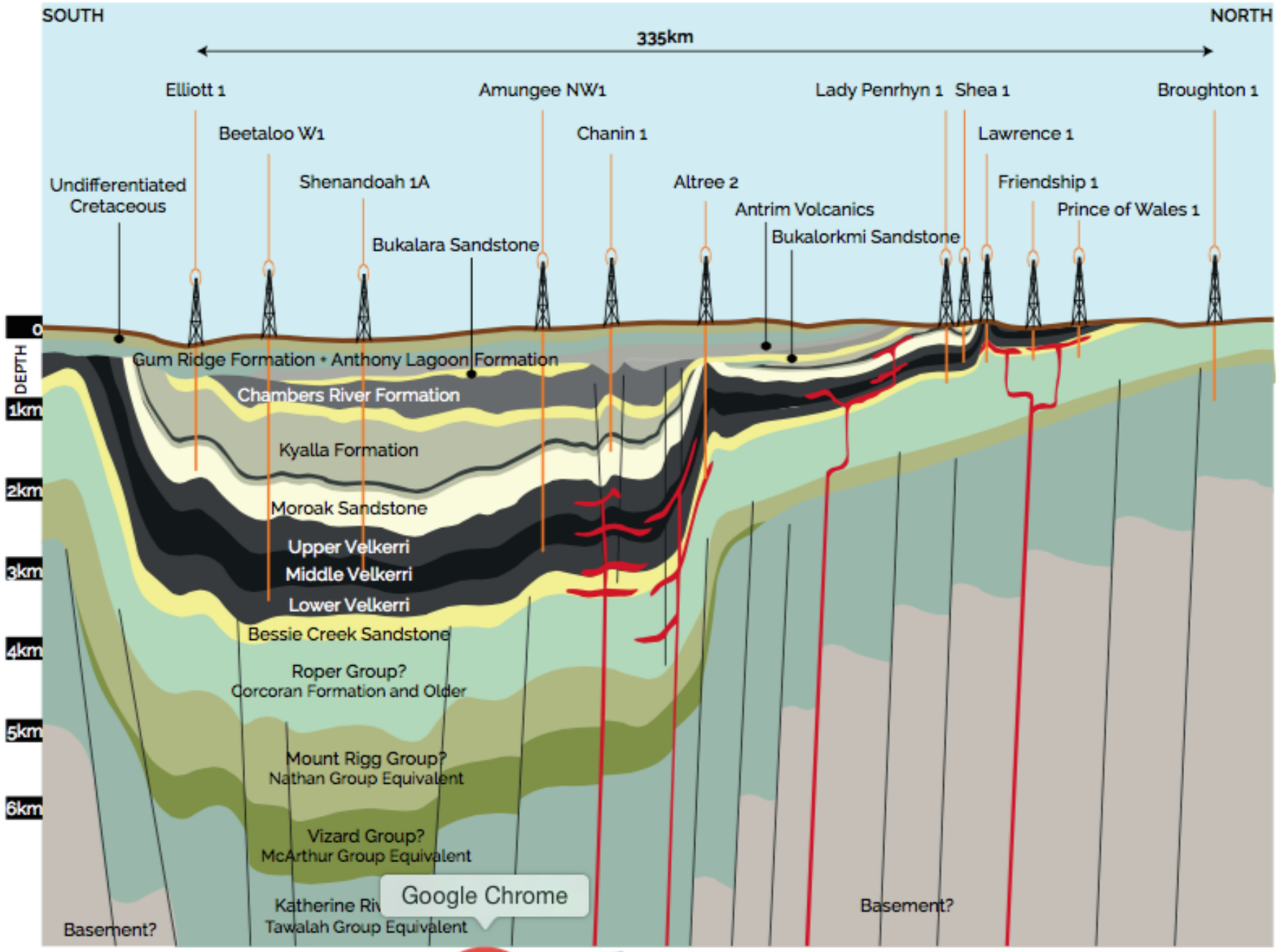
MINING & ENERGY

Origin sitting on Beetaloo shale gas bonanza

Origin Energy estimates it has 6.6 trillion cubic feet of contingent gas resources in Beetaloo Basin.

The Australian | 12:00AM July 20, 2017

Figure 6.3: Schematic cross-section across the Beetaloo Sub-basin, showing exploration wells drilled to date[85]



20nd 26/3/13

numbers above the guidelines
to also F the stock
Mi above F the risk
St
or 350 mg/L 700 mg/L
Be ?
not in ponds.
shallow ponds 15m deep no
1^

1523 s 152 notif

port 5-7 is it trivial.

1547 Cl 3(a) & (b) - you need to make a decision about wether it is trivial

NSW EPA

SITE VISIT REPORT

Date/s of Site Visit:	22 and 23 May 2013
Owner/Occupier:	Santos
Premises/PEL:	Gunnedah, NSW PEL 1; Pilliga, NSW PEL 238
Region:	North Coast Region
LGA:	Gunnedah Shire Council, Narrabri Shire Council
EPA and OCSG Officers participating in review:	Winston Wickremeratne (Head Environmental Audit Unit, EPA), Edwina Howard (Senior Compliance Audit Officer, EPA), Nicole Wilmot (Senior Compliance Audit Officer, EPA), Lucy Riding (Senior Compliance Audit Officer, EPA), Jessica Creed (Regional Operations Officer, EPA - Armidale), Samantha Wynn (Regional Operations Officer, EPA - Dubbo) Greg Summerhayes (Manager Licensing and Approvals, OCSG)

A resistivity survey has been conducted across the pond and the findings of the survey indicated that the integrity of the pond may be compromised. A series of nested ground water monitoring bores (at 11m, 22m and 33m) were installed around the pond in November/December 2012. Analysis results obtained from samples collected from these bores indicated that the pond is leaking. In February 2013, the company found that there was saline water at the 11 metre level and there were elevated levels of uranium. Uranium is apparently naturally occurring in the area but the company suspects that that saline water has assisted the uranium to leech out of the clay soil. The company informed EPA that the ponds were leaking on 26 March 2013. The EPA is currently investigating the leaking ponds. The company proposes to pump the perched water at 11 m back into Bibblewindi Pond 3.

Emissions

From: Baddeley, Tom
Sent: Thursday, 1 June 2017 10:20 AM
To: [redacted]
Subject: csiro: emissions

One the Committee might be interested in – see link to CSIRO report at the bottom of the APPEA release.

Cheers for now

Santos

We have the energy.

appea the voice of australia's oil and gas industry

Media Release

1 June 2017

Low methane emissions from CSG well completions: new CSIRO report

The environmental credentials of cleaner-burning natural gas have been further boosted with new research from the CSIRO confirming fugitive methane (CH_4) emissions from Australian coal seam gas (CSG) well completions to be low.

The report, *Methane Emissions from CSG Well Completion Activities*, was prepared for the Department of the Environment and Energy. It measured methane emissions at nine well completions and one well workover at two CSG sites in Queensland.

The measurements found total methane emissions from well completions were low, ranging from virtually zero to a maximum of 373kg CH_4 for the entire completion. No further emissions were detected on completed wells after they had been fitted with the wellhead.

While the sample size is small, these actual measurements obtained by the CSIRO provide further support for the veracity of estimating methodologies used under the National Greenhouse and Energy Reporting Scheme (NGERs)[1].

APPEA Chief Executive Dr Malcolm Roberts said the research would help address concerns about fugitive emissions from CSG production.

"This is another important and rigorous study from the CSIRO whose previous research in 2014 found that fugitive emissions from CSG wells were only a tiny fraction (0.02 per cent) of CSG production," he said.

"While the study notes there are a number of other areas requiring further investigation, it is significant that these initial findings based on actual measurements show emissions from well completion operations are relatively small, and in some cases negligible.

"It continues the range of reports in recent years that have shown that the environmental concerns about CSG raised by various activist groups do not stand up to scrutiny.

CSIRO ENERGY
www.csiro.au

Methane Emissions from CSG Well Completion Activities

Report for the Department of the Environment and Energy

Stuart Day, Paul Marvig, Stephen White, Brendan Halliburton

May 2017

Health

OPEN ACCESS PEER-REVIEWED

RESEARCH ARTICLE

Comparison of chemical-use between hydraulic fracturing, acidizing, and routine oil and gas development

William T. Stringfellow, Mary Kay Camarillo, Jeremy K. Domen, Seth B. C. Shonkoff

Published: April 19, 2017 • https://doi.org/10.1371/journal.pone.0175344

Abstract

The potential hazards and risks associated with well-stimulation in unconventional oil and gas development (hydraulic fracturing, acid fracturing, and matrix acidizing) have been investigated and evaluated and federal and state regulations requiring chemical disclosure for well-stimulation have been implemented as part of an overall risk management strategy for unconventional oil and gas development. Similar evaluations for chemicals used in other routine oil and gas development activities, such as maintenance acidizing, gravel packing, and well drilling, have not been previously conducted, in part due to a lack of reliable information

AMERICAN ECONOMIC REVIEW
VOL. 107, NO. 5, MAY 2017
(pp. 522-25)

Download Full Text PDF

Article Information

Abstract

Recent studies have linked shale gas development (SGD) to ground water contamination. The extent of these environmental externalities, to date, remains uncertain. To address this gap, we examine whether shale gas development systematically affects drinking water quality by creating a novel dataset that relates SGD to public drinking water samples in Pennsylvania. Our difference-in-differences strategy finds evidence that additional well pads drilled within 1 kilometer of a community water system intake increases shale gas-related contaminants in drinking water. These results are striking considering that our data are based on water sampling measurements taken after municipal treatment.

Citation

Hill, Elaine, and Lala Ma. 2017. "Shale Gas Development and Drinking Water Quality." *American Economic Review*, 107(5): 522-25.

Gas company fined over radiation exposure

Christine Flatley

Published: July 17 2017 - 1:19PM

An oil and gas company has been fined $162,500 after a worker at a Queensland drilling site was burned when exposed to unsafe levels of radiation.

Schlumberger Oilfield Australia Pty Ltd was convicted in the Brisbane Magistrates Court this month of two breaches of the Radiation Safety Act over the incident near Dalby on the Darling Downs.

The court heard the worker received leg burns when he was exposed to an unshielded radioactive source during a borehole logging operation at a coal seam gas site in February 2014.

Magistrate Elizabeth Hall found Schlumberger, the world's largest provider of technology to the oil and gas industry, failed to ensure adequate safeguards were in place when radiation sources were used.

The company was also found guilty of failing to ensure only appropriately licensed people handled radiation sources.

They were fined and ordered to pay $31,000 in costs.

The conviction followed an extensive Queensland Health investigation into the incident.

Chief health officer Jeannette Young said the prosecution highlighted the government's tough stance on safety breaches in the industry.

"We work closely with businesses that use radiation to ensure safety measures are in place and implemented, but this result shows that we will not hesitate to take strong regulatory measures when there is a concern for people's safety," Dr Young said.

AAP

Social Impact Assessment

- Versus Economic Modelling

Regulation

DEPARTMENT OF THE ENVIRONMENT AND ENERGY

To: James Barker, Assistant Secretary, Assessments and Sea Dumping Branch (for decision)

Proposed Approval Decision Brief (recommendation report) – Construction and operation of the Jemena Northern Gas Pipeline, Tennant Creek (Northern Territory) to Mt Isa (Queensland) (2015/7569)

Timing: 13 February 2017 – to allow for consultation on the proposed decision. The statutory deadline for a final decision on whether or not to approve the proposed action is 15 March 2017.

Summary of recommendations on each controlling provision:		
Controlling Provisions for the action	**Recommendation**	
	Approve	**Refuse to Approve**
Listed threatened species and communities		
Section 18	Approve	
Section 18A	Approve	

James Barker
Assistant Secretary
Assessments and Sea Dumping Branch

Date: 13/2/17

Comments:

Key Points:

1. This brief seeks your consideration of the proposed decision under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) on whether or not to approve the Jemena Northern Gas Pipeline from Tennant Creek (Northern Territory) to Mt Isa (Queensland) (EPBC 2015/7569) (proposed action). The proponent for the proposed action is Jemena Northern Gas Pipeline Pty Ltd (proponent).

15. On 14 September 2016, the Northern Territory Government announced a moratorium on hydraulic fracturing of onshore unconventional gas reservoirs, including the use of hydraulic

fracturing for exploration, extraction and production. The moratorium will remain in place for the term of an independent scientific inquiry into hydraulic fracturing of onshore unconventional gas reservoirs and associated activities in the Northern Territory.

16. The proponent is not currently contracted to transport gas from any new unconventional gas sources and states the proposed action will not involve hydraulic fracturing for the exploration or extraction of gas. The proponent further states the proposed action can proceed without a guarantee of future development of unconventional onshore gas reservoirs in the Northern Territory.

Jemena gas pipeline needs fracking for sustainability: APPEA

Construction for the Jemena Northern Gas Pipeline connecting the NT gas fields from Tennant Creek with the east-coast gas market at Mount Isa in Queensland, is expected to get underway in mid-2017.

Mr Doman said even though offshore gas could be made available to that pipeline, as well as sources of gas in Central Australia, fracking would still be required to sustain it.

> "For the long-term viability of the first pipeline, let alone the construction of a second pipeline, we must be able to proceed with the use of fracking to produce identified resources of shale gas in the NT," he said.

NT Chief Minister Michael Gunner said he welcomed discussion about a new pipeline from the Territory, and said its viability without fracking would be determined by the feasibility study.

Regulation

- Do not lift the moratorium before critical studies are complete
- Participatory Democracy to determine outcomes best for a region
- Risks and impacts inherent – expansive no go zones – more evidence and science needed – groundwater/surface water interactions
- Bioregional assessments – catchment scale
- Ban “stacked play” extraction
- Back to the drawing board for exploration approvals – all stakeholders require the full information, updated in peer review all the time, plus need to consider the outcomes of the studies
- Veto rights

News Release

March XX 2013

DRAFT

Xxxxx insert title ie -Pilliga coal seam gas incident

The Environment Protection Authority (EPA) is investigating xxxxxx (insert incident ie *potential groundwater contamination)* at the SANTOS coal seam gas facility in the Pilliga State Forest located approximately 20km south west of Narrabri.

On Tuesday 26 March SANTOS reported to the EPA that routine water monitoring of the aquifers surrounding the Bibblewindi water treatment facility have shown elevated levels of contaminants, including Lead, Uranium, Nickel, Cadmium, Strontium and Beryllium in two bores north of the water treatment facility.

The EPA, as the new lead regulator of environmental and health impacts of coal seam gas activities, commenced an immediate investigation.

(Initial investigations suggest that) The contamination has occurred due to xxxxxx (insert ie leaking ponds). The EPA has required SANTOS to immediately xxxxxxxxxxxxx.

The EPA has xxxxxxxxxxxxxx and has sent water samples taken from the aquifers on site for urgent laboratory assessment.

The results from tests show that the levels xxxxxxxxxxxx.

These are naturally occurring pollutants and xxxxxxx (insert health advice and stock and domestic).

From: Creed Jessica
To: Clauses 3(a) and 3(b), Table, section 14, GIPA Act
Cc: Dwyer, Carmen
Subject: FW: Bibblewindi monitoring
Date: Wednesday, 1 May 2013 2:41:26 PM

Hi Clauses 3(a) and 3(b), Table, section 14, GIPA Act

I noted your response to Carmen earlier about the three bores. NSW Health is requiring more information in order to be able to make a statement about possible health risks. They are requiring information about the hydrogeology of the area in order to be able to comment.

Does Santos have an issue if the EPA forwards to NSW Health a copy of the Technical Memorandum that was initially provided to the EPA as a response to the Notice on 28 March 2013?

Also does Santos have an issued if the EPA provides NSW Health with a copy of the map showing the location of Santos owned bores and privately owned bores (provided as a response to section 1(c) of the Notice) as well as the table provided in response to 1(d) of the Notice?

Regards

From: Philippe G. Porigneaux
To: Creed Jessica
Cc: Dwyer Carmen; sandy.leask@doh.health.nsw.gov.au; David Durrheim; wayne.smith@doh.health.nsw.gov.au; Richard BROOME; Paul BYLEVELD; WATERQUAL (WATERQUAL@doh.health.nsw.gov.au); Kerry SPRATT; Tony Merritt; Craig Dalton; Fidelis G. Jaravani; Ruth K. Williams; Glenn Pearce
Subject: RE: Ground Water at Bibblewindi, Pilliga (Narrabri)
Date: Tuesday, 14 May 2013 3:03:49 PM
Attachments: image001.jpg

Dear Jessica,

Currently I have insufficient information to make a determination with respect to water quality for water accessed through bores within the area of Bibblewindi.

In additional to modelling, it would be appropriate for samples of water to be analysed in a NATA accredited lab with results compared to the *Australian Drinking Water Guideline 2011.*

Regards

Philippe

From: Jessica Creed [mailto:Jessica.Creed@epa.nsw.gov.au]
Sent: Wednesday, 8 May 2013 10:03 AM
To: Philippe G. Porigneaux
Cc: Carmen Dwyer; sandy.leask@doh.health.nsw.gov.au
Subject: RE: Ground Water at Bibblewindi, Pilliga (Narrabri)

Hi Philippe,

Thank you for your comments about the information you have received.

I realise that we have limited data but from what you do have does health feel that a health alert or

Sent: Wednesday, 22 May 2013 11:24 AM
To: [redacted]
Subject: SANTOS ' Pilliga Reports

Categories: Agendas [redacted]

[redacted] thanks.

I spoke to [redacted] yesterday and she is keen to put a short note up on our website about the Santos monitoring bores' data issue. I was concerned about singling out a particular operator, but [redacted] was equally concerned that the EPA was not caught on the back foot, particularly given possible health implications.

Still not sure I totally agree, but a draft paragraph should come our way for comment.

Cheers [redacted].

From: Dwyer Carmen
Sent: Thursday, 23 May 2013 1:44 PM
To: Ritchie Katie; Creed Jessica
Cc: Davey Gary
Subject: RE: CSG santos investigation

Hi Katie, I think the statement is fine as it is, but I'm concerned about the precedent. Do you think we will put an announcement out for every investigating that we undertake – considering this isn't a breach or an alleged breach? Carmen

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From: Ritchie Katie
Sent: Wednesday, 22 May 2013 11:00 AM
To: Creed Jessica; Dwyer Carmen
Subject: CSG santos investigation

Hi Jessica and Carmen,

After seeing the early alert last week, Liza Cassidy suggested I update the holding statement on the Santos investigation and send it up to Barry for consideration.

Please see attached, for edits and updates. Let me know if there is anything further/stronger we can say.

Thanks Katie

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Santos fined $1,500 for water pollution

Media release: 18 February 2014

The NSW Environment Protection Authority (EPA) has issued a $1,500 fine to Santos NSW (Eastern) Pty Ltd following a pollution incident at their Narrabri Gas Field operations in the Pilliga.

In March 2013 Santos notified the EPA after results from routine ground water sampling around the Bibblewindi Water Treatment Plant showed elevated levels of total dissolved solids and slightly elevated levels of others elements.

EPA Chief Environmental Regulator, Mark Gifford said EPA staff immediately began an investigation into the cause of the elevated readings.

"Our investigation into the matter revealed the installation of the liner within Pond 3 was of poor quality which resulted in the integrity of the liner being questionable.

Pond 3 had historically been used to contain the water and brine generated by the gas field. Water quality testing by Santos of the surrounding aquifers showed elevated levels of total dissolved solids and other elements outside the average readings for the aquifers in the area," Mr Gifford said.

"Further investigation showed the pond had been installed in 2007 by the site's previous owner, Eastern Star Gas. A report Santos provided to the EPA showed there was no evidence that contractors, engaged by Eastern Star Gas, had carried out the necessary field testing, quality control or quality assurance during the installation, as is required by current government standards.

Santos has applied to the EPA for an Environment Protection Licence for this site. The EPA is close to finalising this application and has put in place strict conditions to ensure an incident of this nature is