

Regulatory review of coal seam gas-induced subsidence

Report

November 2022



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Executive Summary

Over the past two years, coal seam gas-induced (CSG-induced) subsidence has emerged as a significant concern for landholders in areas of dryland and irrigating farming located on the Condamine River floodplain near Dalby.

The independent Office of Groundwater Impact Assessment (OGIA) currently produces regional scale predictions and a monitoring framework for CSG-induced subsidence in the Underground Water Impact Report 2021 for the Surat Cumulative Management Area (UWIR 2021). The assessment has confirmed that CSG-induced subsidence has occurred and is predicted to occur in the future based on current CSG development patterns.

However, this has limitations because it is designed for environmental assessment and does not consider or assess the consequences of CSG-induced subsidence to farming operations.

Of particular concern to landholders are the potential impacts of CSG-induced subsidence on those farming enterprises where slope and drainage are critically important for irrigation practices and maintaining overland flow, the key focus here being irrigated and dryland cropping enterprises.

Landholders and agricultural peak bodies have also raised concerns about the adequacy of the regulatory framework to protect landholders from the potential impacts of CSG-induced subsidence on farming operations.

In response to the concerns, the GasFields Commission Queensland (the Commission) committed to review the adequacy of the current regulatory framework with a view to identifying potential regulatory or other enhancements relating to CSG-induced subsidence.

The outcomes being sought by the Commission are:

- to ensure that there are appropriate protections for landholders materially impacted by CSG-induced subsidence; and
- that there are clear processes available to landholders to gain greater certainty around regulatory obligations for the onshore gas industry.

In May 2022, the Commission released its '[Regulatory review of coal seam gas-induced subsidence](#)' discussion paper (the Discussion Paper) for targeted stakeholder consultation for a six-week period. The Discussion Paper outlined the current regulatory framework related to CSG-induced subsidence, findings in relation to the application of the framework, and a set of principles for reform to the framework.

A summary of the review findings are as follows:

- the regulatory framework that applies to CSG-induced subsidence is complex and there is no clear jurisdictional responsibility to regulate CSG-induced subsidence;
- there are existing protections under the regulatory framework, including for economic, environmental and land use impacts, however these remain untested;
- there is a current knowledge gap in relation to the potential on-farm consequence and material impacts of current and predicted CSG-induced subsidence;
- depending on the circumstances, not all farming operations are afforded the same protections under the existing framework;
- there is no clear pathway for impact assessment or dispute resolution in relation to the potential impacts of CSG-induced subsidence (other than the Land Court); and

- there is an opportunity to enhance the existing regulatory regime to improve protections for landholders and provide greater certainty to the onshore gas industry.

A total of 19 submissions were received to the discussion paper from key stakeholders to inform the Commission's review including 8 landholder submissions, 4 agriculture industry submissions, 2 resource industry submissions, 2 legal profession submissions, 1 advocacy organisation submission, 1 research institution submission, and 1 state government submission.

The knowledge base in relation to CSG-induced subsidence continues to grow as further research is undertaken and a greater understanding of the phenomenon is gained through monitoring. Whilst the research into the consequences of CSG-induced subsidence is ongoing, the Commission believes there is enough evidence to warrant clarification and enhancement of existing protections for landholders should they be exposed to material impact.

In undertaking this regulatory review, the Commission identified areas requiring clarification as well as opportunities to enhance the framework and recommends the Queensland Government:

1. Implement a management framework to establish a process for the assessment and management of CSG-induced subsidence at a regional and farm scale.
2. Incorporate independent assessment and alternative dispute resolution processes in instances where an alleged impact has occurred or to resolve disputes.
3. Expand OGIA's functions to enable further determinations relating to CSG-induced subsidence.
4. Investigate mechanisms to ensure the protection of landholders from the impacts of CSG-induced subsidence outside of tenure boundaries.
5. Ensure appropriate agronomy and irrigation specialist services are available to landholders in negotiations.
6. Investigate potential impacts to regional overland flow caused by CSG-induced subsidence.
7. Consider how the management framework would treat cases where on-farm impacts are found to be critical.
8. Provide additional information and support to landholders including the Commission developing information and fact sheet materials for landholders and investigate the provision of one-on-one information support services.

The Commission is also leading a research project to assess the potential consequence and materiality of CSG-induced subsidence on farming enterprises, and to provide a framework for assessing the potential consequence of predicted subsidence on the individual farming enterprises.

The consequence work is ongoing, and the Commission will release a report on the consequence research following completion of the project early next year.

Context and Purpose

The Commission is an independent statutory body established under the *Gasfields Commission Act 2013*. The statutory purpose of the Commission is to manage and improve the sustainable coexistence of landholders, regional communities and the onshore gas industry in Queensland.

The Commission has 14 legislative functions which can be summarised as:

- **facilitate** effective stakeholder relationships, collaborations and partnerships to support information-sharing related to the onshore gas industry;
- **review** the effectiveness of government entities in implementing regulatory frameworks related to the onshore gas industry; and
- **advise** agriculture and gas industry peak bodies, government ministers and regulators, and landholders and community groups on matters relating to sustainable coexistence, leading practice and management of the onshore gas industry.

In response to landholder concerns about CSG-induced subsidence, the Commission has reviewed the regulatory frameworks associated with CSG-induced subsidence consistent with section 7(1)(b) and 7(1)(e) of the *Gasfields Commission Act 2013*.

The purpose of this report is for the Commission to outline the results of its regulatory review and make recommendations to the Queensland Government about clarification and enhancing existing protections for landholders from the potential material impacts of CSG-induced subsidence.

In the context of this review, the Commission has focused on the economic impacts of CSG-induced subsidence to farming enterprises, particularly irrigated and dryland farming enterprises where slope and drainage are critically important for irrigation practices and maintaining overland flow.

Background

After extensive engagement with landholders, agricultural peak bodies, government and industry the Commission has identified the issue of CSG-induced subsidence as a significant concern in areas of land used for irrigated and dryland cropping, particularly on the Condamine floodplain.

In this instance, CSG-induced ‘subsidence’ is described as a component of ground movement that is induced by CSG depressurisation. In the context of CSG activities, it occurs due to lowering of pressure in the underlying coal seams which, in turn, allows the seams to compress under the weight of the overlying formations¹. The resultant ‘ground movement’ at the land surface is known as CSG-induced subsidence.

Subsidence is one of the causes of ground movement, but there are other causes mostly related to the swelling and shrinking of soil due to changes in soil moisture content. Soil moisture content changes as a result of factors such as climatic or seasonal conditions, soil moisture profile, crop type and rotation. Ground movement due to soil moisture changes is temporary, however ground movement due to subsidence is permanent.

¹ [Underground Water Impact Report 2021 for the Surat Cumulative Management Area – Consultation Draft](#)

Farmers manage ground movement on a routine basis as part of their farming systems. However, those carrying out intensive dryland and irrigated cropping activities on the Condamine Alluvium, where the land has a low and managed slope, are concerned that even small amounts of permanent ground movement may impact their farming operations.

Farmers are concerned that any unevenness in subsidence, and resultant slope change, at the farm scale may be sufficient enough to significantly impact on-farm drainage requiring additional farm management or potentially placing farm viability at risk.

Many farming operations in the area rely heavily on irrigation practices and these properties are often 'laser-levelled' to optimise overland flow and drainage. According to these landholders, a change in slope as a result of CSG-induced subsidence has the potential to have an impact on the productivity and profitability of their farming operations.

Additionally, there are concerns about the potential for CSG-induced subsidence to change the way water moves more broadly over the landscape and the impacts this could have on those farming enterprises that harvest water from overland flow.

The independent [Office of Groundwater Impact Assessment](#) (OGIA) undertook the first comprehensive regional scale assessment of subsidence in late 2021 with extensive stakeholder engagement and support. The assessment is detailed in the [Underground Water Impact Report 2021 for the Surat Cumulative Management Area](#) (released in March 2022).

Importantly, OGIA has confirmed that CSG-induced subsidence has occurred and is predicted to occur in the future based on current CSG development patterns. However, OGIA's assessment of subsidence did not include the consequential risk of impact on farming operations and management measures as they are outside its legislative scope.

Noting that the potential material impacts and consequences that CSG-induced subsidence presents to farming enterprises needs to be better understood, the Commission commenced a significant research project into the matter. This project is examining the potential impacts and consequences to farming operations resulting from CSG-induced subsidence and how these impacts may be assessed and remedied, should they occur.

Collectively, the work being undertaken in relation to CSG-induced subsidence can be divided into three separate components – modelling, monitoring, and management:

- Modelling of the predicted subsidence and existing impacts is being developed and improved by OGIA and undertaken as part of the UWIR;
- Monitoring of CSG-induced subsidence performed by OGIA as part of the UWIR, which includes establishing a baseline prior to the impacts of subsidence being experienced and ongoing trend monitoring of subsidence; and
- Management, which the Commission is leading with significant input from OGIA, is the third component made up of two pieces of work, namely the consequence assessment research and guideline, and a review of the regulatory framework for CSG-induced subsidence.

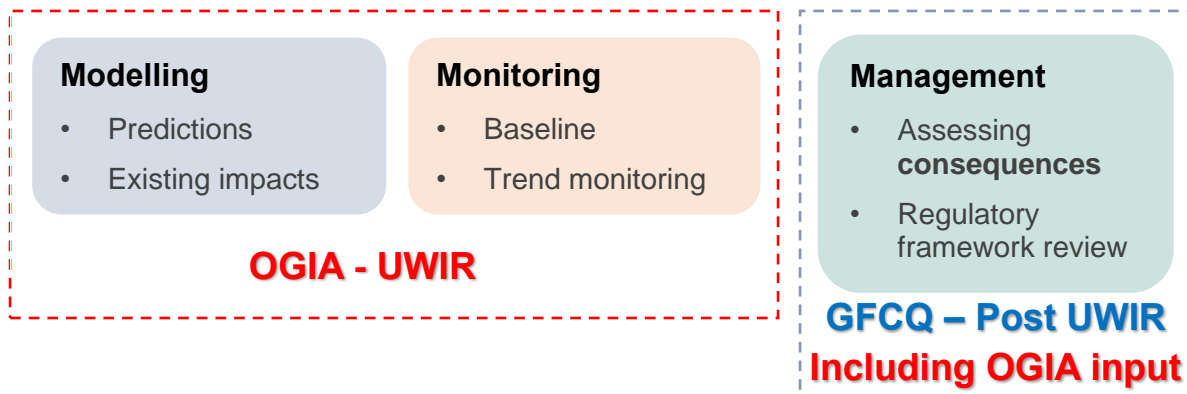


Figure 2 The work currently being undertaken by OGIA and the Commission, which describes the key components for predicting, identifying and managing subsidence.

This report makes recommendations to the state government regarding enhancements to the regulatory framework. Should the state government accept the recommendations, they will progress to implementing the recommendations.

Assessment of Consequence Research

The purpose of this consequence research project (the Project) is to assess the potential consequence and materiality of CSG-induced subsidence on farming enterprises and provide a framework for assessing the potential impact of predicted subsidence on the individual farm fields of a farming enterprise. The focus of the project is on the potential economic impacts of CSG-induced subsidence to farming enterprises, particularly those irrigated and dryland farming enterprises where slope and drainage are critically important for irrigation practices.

It is doing this by engaging with the landholders from several farms with different characteristics but which are likely to eventually experience subsidence of varying levels. The findings from engagement with the pilot site landholders, along with expert input, is being used to reach conclusions that can be applied more broadly.

The Project is directed at assisting landholders during the planning stage, and before CSG development and subsidence occurs. It seeks to inform the development of guidance materials and tools that will assist tenure holders in consultation with landholders to carry out a farm scale assessment of the consequence of predicted subsidence on farming operations. The materials and tools will enable informed decisions to be made on how to manage those consequences, should they materially affect farming operations.

There is general agreement on the monitoring strategy laid out by OGIA in the UWIR 2021 which includes monitoring of subsidence over time with InSAR and identify baseline conditions from LiDAR data. OGIA continue to develop a range of tools to support monitoring and is engaging extensively with landholders on this.

In terms of predictions, OGIA has presented its regional scale modelling in the UWIR 2021 and is now working on farm scale modelling tools. A proof-of-concept model has been developed and preliminary outputs are being shared with landholders.

As a result, the focus of the project to date has been on working with farming expert advisors and landholders to identify, as clearly as possible, the matters to be considered when tenure holders and landholders engage to identify the consequences of predicted subsidence.

The preliminary findings of the research can be summarised as follows:

- the potential for subsidence to cause a change of slope of a farm field with resulting impairment of drainage and resulting crop damage, is the key concern;
- although the preferred slope for irrigation furrows is 0.1% there are many irrigation farm fields with slopes of 0.05% and even lower than that are successfully irrigated;
- tail drain and head ditch slopes typically have a slope of only 0.02% - if a tail drain does not drain efficiently, water will remain in the bottom part of the furrows for too long causing crop damage;
- tailwater return systems collect water for return to storages - they have low slopes and by progressive increase in depth of the drain can gravitate water upgradient to a collection point;
- if any levelling event is needed to manage the effect of subsidence, there is likely to be loss of productivity - the loss of productivity is due to compaction caused by the levelling machinery and loss of nutrient and organic matter from cut areas;
- dryland farm fields are usually not levelled to any significant extent, although there may be some land forming to connect natural drainage paths - for dryland farm fields, it is any increase in the area of internal drainage and resulting pondage, that is the important metric;
- if subsidence disrupts farming activities, there are likely to be consequential flow-on impacts to farm operations such as crop rotations, weed control programs and the scheduled movement of farm machinery;
- some landholders remain concerned that subsidence could cause small scale depressions that could cause local reversals in drainage paths - therefore, landholders seek modelling to identify predicted changes over short (30m) distances;
- landholders need predictions of the progression of subsidence through time, particularly near new CSG wells, to enable them to plan for progressive changes to subsidence;
- there is growing confidence in the ability of LiDAR data to show baseline slopes and drainage patterns. However, many landholders also collect GPS data during their farming operations which can supplement the LiDAR data;
- irrespective of model predictions used during a farm assessment, monitoring will show the subsidence that actually occurs, and that it is that actual subsidence which should be the final basis for identifying increases to farming costs resulting from subsidence; and
- even if modelling does not predict sufficient subsidence to trigger a farm assessment, if there is a possibility of there being subsidence then there should be an avenue by which a landholder can have an independent entity investigate drainage issues that the landholder believes are caused by subsidence.

The consequence work is ongoing and the Commission will release a final report on completion of the project early in 2023.

Regulatory Review Discussion Paper

The ['Regulatory review of coal seam gas-induced subsidence' discussion paper](#) (the Discussion Paper) outlined the current regulatory framework related to CSG-induced subsidence, findings in relation to the application of the framework, and a set of principles for reform to the framework.

A summary of the review findings are as follows:

- the regulatory framework that applies to CSG-induced subsidence is complex and there is no clear jurisdictional responsibility to regulate CSG-induced subsidence;
- there are existing protections under the regulatory framework, including for economic, environmental and land use impacts, however these remain untested;
- there is a current knowledge gap in relation to the potential on-farm consequence and material impacts of current and predicted CSG-induced subsidence;
- depending on the circumstances, not all farming operations are afforded the same protections under the existing framework;
- there is no clear pathway for impact assessment or dispute resolution in relation to the potential impacts of CSG-induced subsidence (other than the Land Court); and
- there is an opportunity to enhance the existing regulatory regime to improve protections for landholders and provide greater certainty to the onshore gas industry.

The Discussion Paper was released for targeted stakeholder consultation on 20 May 2022. The submission period was six weeks, closing on 30 June 2022.

The discussion paper was distributed to industry peak bodies (agricultural and resources sector), local government, state government agencies and landholders involved in previous Commission engagement activities. The paper was also made available via the Commission's website and a news article distributed to all contacts within the Commission's stakeholder network.

A total of 19 submission were received from key stakeholders to inform the Commission's review:

- 8 landholder submissions;
- 4 agriculture industry submissions;
- 2 resource industry submissions;
- 2 legal profession submissions;
- 1 advocacy organisation submission;
- 1 research institution submission; and
- 1 state government submission.

Following on from the review consultation, the Commission has continued to actively engage with key stakeholders and provide briefings and information on progress, findings and strategic direction. An outline of consultation activities undertaken can be found in the Appendix.

High level summary of consultation results

The majority of stakeholder submissions supported the Commission’s findings and principles for reform. Submissions also included valuable stakeholder perspectives and additional matters for consideration.

Table 1 Common sentiments expressed in stakeholder submissions

Submitter group	Common sentiments expressed
Landholders, Agriculture Industry peak bodies	<ul style="list-style-type: none"> • The existing frameworks mean the onus of proof is on the landholder to prove claims of subsidence. • There is no clear pathway to compensation for subsidence. • The existing frameworks do not address baseline elevation survey requirements suitable for cultivated land in PAA and SCA areas. • A risk-based approach is appropriate, and should include the ability to consider where risk is deemed too high for development to proceed in certain areas i.e. ‘no-go areas’. • Landholders must be eligible for compensation for the full extent of the impacts from subsidence, irrespective of whether or not the subsidence occurred prior to the commencement of the framework. • Materiality of subsidence will have different thresholds for different operations so must remain flexible enough to still capture impacts that ‘don’t fit the standard mould’. • Drilling of deviated wells underneath a landholder’s property should only be authorised with the appropriate protections of a CCA, including ADR processes and legal certainty, that their interests will be protected. • The continued development of CSG on agricultural land under the current framework causes significant stress and mental health pressures on farmers.
Resources Industry peak bodies	<ul style="list-style-type: none"> • It is anticipated that most gas operations will not cause consequential subsidence impacts. • There is no defined mechanism to support the assessment and monitoring of subsidence, or a framework for resolving consequential impacts if they occur. • Evidence suggests the likelihood and consequential impacts from subsidence is low. • The industry supports the development of a risk-based management framework that provides clear protection for landholders, including rectification of consequential impacts should they occur. • Addressing landholder concerns will likely require: <ul style="list-style-type: none"> ○ determining risk at farm scale ○ determining risk at regional floodplain scale ○ developing and implementing a risk-based management framework. • The framework should focus on monitoring identified areas of higher risk and make clear that there is an obligation to rectify or compensate any consequential impact. CCAs may be the appropriate vehicle for resolution. • Subsidence consequences and rehabilitation actions cannot be predicted with the specificity needed to resolve upfront.

Matters raised in stakeholder submissions were categorised under themes. Appendix 1 has further details on the consultation that has been undertaken, including the themes raised in submissions by different stakeholder groups and insight into which recommendations and actions address each theme.

Justification for regulatory reform

The knowledge base in relation to CSG-induced subsidence continues to grow as further research is undertaken and a greater understanding of the phenomenon is gained through monitoring. Modelling and monitoring to date has identified that CSG-induced subsidence has and will continue to occur. To complement the modelling, the Commission is leading work to assess the potential consequence of subsidence impact at a farm scale.

Initial findings from the Commission's research into on-farm consequences are that there are a number of attributes of irrigation and dryland farming that are exposed to potential impact as a result of slope changes that may occur as a result of CSG-induced subsidence. Whilst it is not yet possible to categorically state the materiality of impacts, the Commission believes there is enough evidence to warrant clarification and enhancement of existing protections for landholders should they be exposed to material impacts.

The current regulatory framework for managing CSG-induced subsidence is complex and spans multiple jurisdictions and frameworks. There are a number of state-based regulatory levers in place, however their application with respect to landholders potentially impacted by CSG-induced subsidence is not clear or well understood. This means that there is confusion about the regulatory requirements, how impacts are assessed and remedied, and who is ultimately responsible for compliance. Due to these complexities, there is no clear jurisdictional responsibility to manage the potential impacts of CSG-induced subsidence.

Whilst there are existing protections under the *Mineral and Energy Resources (Common Provisions) Act 2014* (MERC Act) in relation to compensation for impact, the ability for landholders to access compensation remains untested. This is likely due to the fact that there is no assessment framework to determine the causality and impact and the burden of proof falls to the landholder to demonstrate damages.

Further, there is no clear pathway for impact assessment, determination or dispute resolution for landholders who believe they have been materially impacted by CSG-induced subsidence other than the Land Court.

At this stage, regional scale predictions and a monitoring framework exist for the Surat CMA as outlined in the UWIR 2021 but there are three key statutory limitations:

1. the assessment is designed to identify environmental impacts and not the economic impacts;
2. there is no complementary management framework to assess consequences to farming areas and economic assets; and
3. the assessment is regional in nature and not suitable for assessing impacts to individual farm fields.

A critical knowledge gap has been identified in relation to the consequence and potential economic impacts of current and predicted CSG-induced subsidence. This limits the ability of the State to implement a risk-based approach to regulate the potential economic impacts of CSG-induced subsidence under the existing regulatory framework. The Commission is

leading research to investigate the consequence of CSG-induced subsidence and produce guidelines to inform a farm scale assessment of the likely impacts.

This research work, combined with the Commission's regulatory review, has confirmed there is a need to provide landholders and the onshore gas industry with certainty around the process for assessing, remediating, and compensating for any material impact to farming operations caused by CSG-induced subsidence. The Commission's view is that there are opportunities to clarify and enhance the existing regulatory protections for landholders and provide greater certainty around regulatory obligations for the onshore gas industry.

Principles for Implementation

The Commission recommends that the State Government adopt the principles identified and consulted upon via the discussion paper in implementing the recommendations stated in this section. There was broad support for the principles in the majority of stakeholder submissions to the Discussion Paper.

The recommendations in this report have been informed by these principles, and they should continue to guide implementation of the review recommendations as appropriate.

Principles for implementation of the CSG-induced subsidence regulatory review recommendations

- **Landholder protection** - provide a statutory framework that ensures appropriate protection for landholders where CSG-induced subsidence can be demonstrated to have a material impact on-farm in areas where the agricultural land use is sensitive to potential subsidence impact;
- **Protection of productive capacity** - the long-term productive capacity of agricultural land should be maintained, and any material impacts in the shorter term should be compensated for;
- **Clear roles and responsibilities** - provide clear roles and responsibilities in relation to various entities involved in the assessment, monitoring and management of CSG-induced subsidence;
- **Risk-based approach** - take a risk-based approach to the management response, informed by an assessment of the likelihood, consequence, and materiality of CSG-induced subsidence;
- **Proactive management** - where possible, include proactive management actions so that arrangements are in place before impacts occur in high-risk areas;
- **Off-tenure impacts** - ensure that management actions are not limited by tenure boundaries;
- **Evidence-based approach** - take an evidence-based approach, relying on independent monitoring, assessment and advice in assessing risks and resolving disputes using the best available science;
- **Clear pathway** - provide a pathway to impact assessment and resolving disputes, including alternative dispute resolution with an ultimate determination through the Land Court as a last resort; and
- **Costs borne by tenure holder** - ensure reasonable and necessary costs are borne by the responsible tenure holder in relation to assessment and dispute resolution.

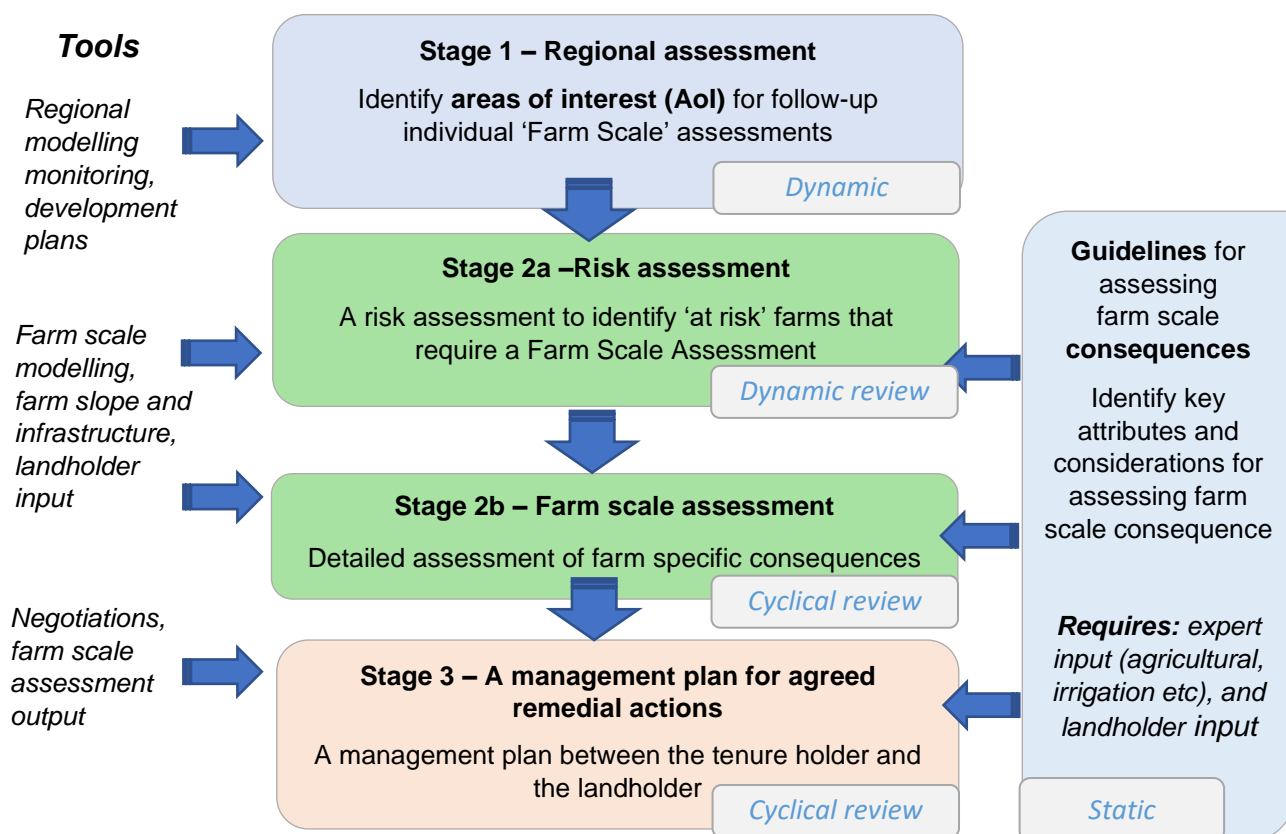
Recommendations

1. Implement a management framework to establish a process for the assessment and management of CSG-induced subsidence at a regional and farm scale

The Commission proposes a three-stage process for the assessment and management of CSG-induced subsidence (Figure 3). These stages are:

- a regional assessment to identify areas of interest;
- risk assessment of properties within those areas of interest and farm scale assessment where risk of consequence identified; and
- the negotiation of an agreed management plan for remedial actions developed in agreement between the tenure holder and the landholder.

It is intended that this framework applies to areas where gas development has already occurred and where it is planned to occur in the future. It is envisaged it would apply regardless of whether or not the landholder hosts surface gas infrastructure.



It is important to emphasise that resource companies are already legally liable to compensate landholders for any past, current and future material impacts associated with CSG-induced subsidence in accordance with section 81 of the MERCP Act. The purpose of the Commission’s recommended management framework is to develop a clear and evidence-based statutory process for determining impact, how this impact is managed, and ultimately compensation liability, therefore provide greater certainty to both landholders and resource companies.

Importantly, the type of framework described here is only recommended to be established in the Surat CMA identified in the UWIR. This is due to the unique overlap of significant CSG

development, observed and predicted subsidence impact, and prominence of farming operations where slope and drainage are critically important for irrigation and other farming practices. In the Surat CMA there is a robust scientific understanding of the regional, cumulative CSG-induced subsidence impact likely to occur due to CSG development.

The Commission has examined and taken learnings from a range of existing frameworks, including those under the MERCP Act and Chapter 3 of the *Water Act 2000*, in developing the recommendations for the management of CSG-induced subsidence.

Stage 1 – Regional assessment

The first component of the management framework is proposed to consist of a regional scale assessment of CSG-induced subsidence with the purpose of identifying areas within the region that are at higher risk of experiencing CSG-induced subsidence impacts that may be material from an on-farm perspective.

Principles

- Risk-based approach
- Evidence-based approach
- Productive capacity

The regional assessment is proposed to identify ‘areas of interest’ and nominated properties that would be subject to a further risk assessment.

A risk-based approach to the regional scale assessment is considered appropriate as all areas will not be subject to the same degree of impact or susceptibility to impact. The attributes and characteristics of an area, such as land use sensitivity to slope change and magnitude of subsidence predicted, determine the risks posed to that area by CSG-induced subsidence and therefore the degree of attention that is warranted to that area.

In particular, the focus here is on very flat land that is utilised for irrigated and dryland cropping activities.

It is proposed the following criteria should be utilised to establish ‘areas of interest’ where there is a heightened risk of material impact:

- magnitude of CSG-induced subsidence;
- magnitude of slope change;
- land use - dryland and irrigated cropping.

Thresholds in relation to these criteria will need to be established and may be informed by the consequence research project and further knowledge as it develops.

The OGIA regional-scale modelling and monitoring contained in the UWIR will be the key input to the identification of areas of interest. The modelling outputs established predict magnitude of CSG-induced subsidence and slope change.

The regional assessment would be updated as new information becomes available to ensure that it remains contemporary and appropriately identifies areas at risk of being impacted by CSG-induced subsidence. Given links to modelling activity undertaken under the auspices of the UWIR, it would be appropriate for updating to occur on a similar cycle (annual report and major review every three years) to ensure changes to industry development plans and any other new information is taken into account.

Under the current regulatory framework, the UWIR would not be able to give statutory force to the process of identifying the areas of interest, as the UWIR focus is solely on managing groundwater impacts. Therefore, an alternative statutory mechanism would be required to give it the area of interest statutory force.

Stage 2 – Risk and Farm scale assessment

The second stage to the management framework involves assessing the risk of impact and materiality of consequence of CSG-induced subsidence at a farm scale.

Stage 2a – Risk assessment

While the regional impact assessment process defines ‘areas of interest’ where impact is most likely based on modelling outputs, it does not incorporate consideration of characteristics unique to type of land use (i.e. dryland or irrigating cropping) and how this relates to consequence.

This stage is proposed to identify, based on risk, where a ‘Farm Scale Assessment’ is required to be undertaken. This risk assessment process would allow for the further narrowing of the area of interest based on assessment of risk of consequential impact occurring.

Stage 2a is proposed to involve utilising a likelihood and consequence risk assessment framework to further determine the risk of material impact on properties identified as in an ‘Area of Interest’.

Risk criteria for potential consequences may include land use types and inherent slope. As with Stage 1, thresholds in relation to these risk and likelihood criteria will need to be established and may be informed by the consequence research project and further knowledge as it develops.

Stages 1 and 2a are proposed to be undertaken by government, informed by technical advice provided by OGIA, while the next stage (2b) is envisaged to be undertaken by the relevant tenure holder.

Stage 2b – Farm scale assessment

Where a property is identified as at risk of material impact in Stage 2b, it is proposed a farm scale assessment would be required. This stage of assessment would seek to determine the likely consequences on a farm as a result of predicted CSG-induced subsidence.

The farm scale assessment would:

- determine if farm scale predicted impacts would have consequential impacts to the farming enterprise; and
- if a material consequence was determined, quantify the consequences such as;
 - farm area affected,
 - predicted timing of material impact,
 - dependencies (gas development plan etc).

The farm scale assessment would utilise farm scale modelling of CSG-induced subsidence predictions (currently under development by OGIA) on that property to assess the potential materiality of impacts to farming operations. The assessment would also be informed by the proposed statutory guidelines to ensure a consistent approach and methodology.

Tools such as predictive modelling, LiDAR integration and monitoring, and assessment methodologies will need to be further developed to ensure a consistent approach to farm scale assessment. OGIA is currently developing these tools.

Principles

- Landholder protection
- Risk-based approach
- Evidence-based approach
- Proactive management
- Productive capacity

The landholder’s input would be required at this stage to ensure that the factors required for the agricultural land use on that property are considered. It is acknowledged that each farm has unique physical characteristics and operating practices that should be considered. However, the farm scale assessment is not proposed to require agreement with the landholder.

The farm scale assessment is intended to be undertaken by the resource authority holder. The assessment itself would be conducted against the statutory guidelines which are to be developed and endorsed by the relevant government agencies and OGIA. The purpose of this is to ensure that the landholder has input into the assessment and the government would have oversight of the assessment to ensure consistency in process and methodology.

This determination would be reviewed periodically at an appropriate interval in line with updated modelling and further information becoming available.

Stage 3 – A management plan for agreed remedial actions

Where Stage 2b identifies a material consequence which requires management intervention, it is proposed a mutually agreed management plan between the tenure holder and landholder would be required.

Principles

- Proactive management
- Landholder protections
- Evidence-based approach
- Productive capacity

The management planning process would be informed by the farm scale assessment and hinge on discussions between the parties about monitoring, predicted consequences to the farm, the strategy to manage or avoid those consequences and triggers for remedial management action and compensation.

Due to the variability of the modelling and predicted impacts, determining compensation upfront in advance of development and impact is difficult. It is proposed that the management plan would outline the agreed course of action to manage impacts and trigger points for compensation to be negotiated and agreed upon when impacts occur.

It is intended that the management plan be a legally binding agreement and part of the regulatory framework. The actions in the plan should be flexible enough to allow for factors such as seasonal variabilities, change in farming practices, and advances in technology and practices that offer improved remediation outcomes.

The intent of the agreed management plan is to provide confidence to landholders about how resource companies will manage any predicted material impacts to farming operations as a result of CSG-induced subsidence. It is therefore considered most appropriate to establish this plan upfront based on negotiations between the relevant landholders and resource companies.

The guidelines for assessing farm scale consequence would inform this process to increase clarity and transparency and provide appropriate guidance on the types of matters that should be considered in discussions around management. The agreed management plan is intended to be reviewed cyclically at an appropriate interval to remain contemporary should the regional assessment or farm scale assessment change.

The Commission is not recommending a prescribed format for the agreement and considers that this investigation would best sit with government as part of its detailed policy analysis. It would be appropriate that existing mechanisms under the MERC Act be examined.

Guidelines for assessing farm scale consequences

A key aspect of Stages 2b and 3 is that they require specific technical guidance to ensure a consistent and transparent assessment process is applied.

As part of the management framework, it is proposed that a set of statutory guidelines are prepared to inform the farm scale assessment and management planning process.

The guidelines should describe the key attributes and considerations for assessing consequence at a farm scale along with providing guidance on a methodology for assessing materiality of consequence. They are intended to also provide guidance on detailed on-farm monitoring processes. Any guidelines for assessing farm scale consequences that are adopted by government should be given statutory effect.

The Commission's consequence research project should inform the development of the guidelines for assessing farm scale consequences. As stated earlier, it is proposed that the guidelines be developed and endorsed by the relevant government agencies and OGIA.

Principles

- Landholder protection
- Evidence-based approach
- Productive capacity

2. Incorporate independent assessment and alternative dispute resolution processes

Independent impact assessment and alternative dispute resolution processes should be incorporated to ensure that if negotiations fail to produce an agreed outcome, there is a graduated process to assist determination prior to the Court. These processes are also important in instances where landholders may be outside of an 'area of interest' but believe that they have suffered a material impact due to CSG-induced subsidence.

Principles

- Clear pathway
- Evidence-based approach

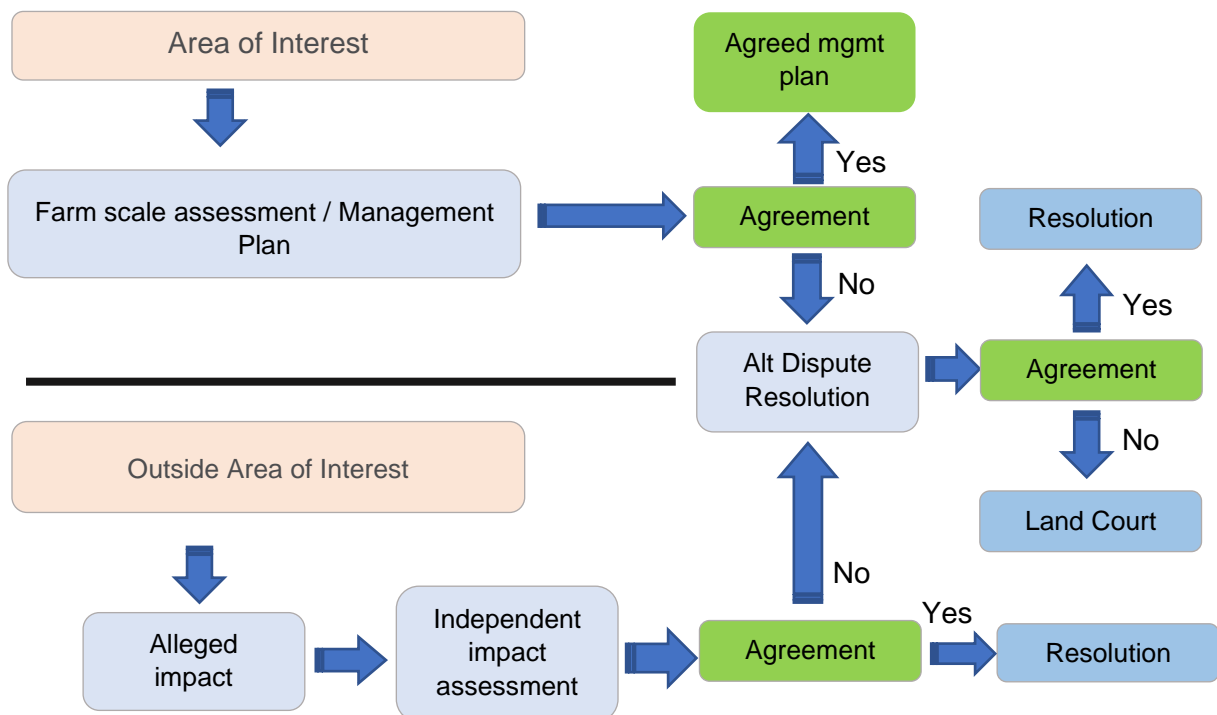


Figure 3 Proposed process for reaching agreement or resolution where CSG-induced subsidence impacts a property, including independent impact assessment and alternative dispute resolution.

In instances where a landholder is in an 'area of interest', and a farm scale assessment and/or management plan is required, if the landholder and tenure holder are not in agreement on the outcome of the farm scale assessment or management plan, they would have the option to refer the matter to the alternative dispute resolution process to seek to resolve the matter.

Where landholders outside of an 'area of interest' believe they are experiencing impacts as a result of subsidence, an independent impact assessment process should be made available to the parties. If the independent impact assessment process confirms material impact, the landholder and resource company would enter the subsidence management framework process. If agreement is unable to be reached, the landholder and resource company would enter the alternative dispute resolution process.

If an alternative dispute resolution process does not result in an agreed outcome, the Commission anticipates that the matter would escalate to the Land Court. The Commission considers that the Land Court is the most appropriate court as the framework is proposed to be enacted under the MERC Act, which utilises the Land Court for matters of dispute resolution.

Further work would be required to identify an appropriate entity or model for independent impact assessment.

3. Expand OGIA's functions in relation to technical assessment and advice to enable further determinations relating to CSG-induced subsidence

Fundamental to any reform to address CSG-induced subsidence is the expansion of OGIA's functions to include the ability for it to play a key role in provision of technical advice to relevant aspects of the CSG-induced subsidence management framework.

Principles

- Clear roles & responsibilities
- Evidence-based approach

OGIA was established under the *Water Act 2000* with the primary function of assessing and managing the impacts of groundwater extraction from resource operations in cumulative management areas (CMAs). CMAs are declared where impacts from resource development may overlap. The Surat CMA is currently the only CMA declared in Queensland.

OGIA's functions are listed under the *Water Act 2000* as:

- to advise the chief executive on matters relating to impacts on underground water caused by the exercise of underground water rights by resource tenure holders;
- to establish and maintain a database of information about underground water;
- to prepare underground water impact reports for cumulative management areas; and
- any other function given to the office under this Act or another Act.

Currently, OGIA plays a key role in terms of monitoring and modelling, however is limited in its capacity to provide technical input and advice in relation to making assessments on impacts relating to agricultural use of land associated with CSG-induced subsidence due to its remit being limited to '*impacts on underground water caused by... extraction from resource operations*'.

There is a close and integral relationship between the groundwater impacts and subsidence. This is because groundwater depressurisation is the cause for the subsidence. A prediction of subsidence, therefore, first involves predictions of groundwater depressurisation which

then feed into predictions of subsidence. The tools and techniques for predictions are also similar and closely integrated.

As OGIA's legislative functions include any other function given to it under another Act, OGIA could be given a statutory function under the MERC Act which deals with the land-related impact assessment and management associated with underground water extraction from resource development.

This would provide an appropriate statutory basis for OGIA's engagement with relevant aspects of the recommended management framework, including undertaking the regional subsidence assessment and provision of technical advice in determining areas of interest and risk assessments in relation to CSG-induced subsidence.

4. Ensure appropriate agronomy and irrigation specialist services to negotiation and preparation costs

The engagement between landholders and tenure holders around CSG-induced subsidence may be quite complex as it relates to precision farming systems and practices. This means that landholders may need access to specialist advice in relation to potential material impacts of CSG-induced subsidence in addition to the negotiation and preparation costs currently accessible under the MERC Act.

Principles

- Reasonable costs borne by tenure holders
- Evidence-based approach

Irrigation specialist and agronomy advice is considered a necessary input for assessing the consequence to farms as a result of CSG-induced subsidence given the complex and technical nature of subsidence impact assessment.

The Commission recommends that landholders are able to recover the costs of agronomy and irrigation specialist advice reasonably and necessarily required to facilitate negotiations under the proposed subsidence management framework.

5. Investigate mechanisms to ensure the protection of landholders affected by CSG-induced subsidence off-tenure

To address impacts of compensation liability for off-tenure landholders, consideration should be given to include off-tenure impacts for CSG-induced subsidence.

Principles

- Off-tenure impacts

The MERC Act currently restricts compensation to landholders who are located within the bounds of the resource authority. If landholders believe they are experiencing impact as a result of CSG-induced subsidence or the regional assessment identifies them as in an area of interest, there should be a mechanism for them to access impact assessment and potential recourse for impact regardless of whether they are on or off-tenure.

It is noted however that the risk-based approach to identifying areas of greatest impact may exclude off-tenure impacts, given that the extraction of gas and associated water is only authorised to occur within a resource authority.

6. Undertake analysis of potential changes to regional overland flow

A key concern raised during consultation was the potential impacts of changes to regional overland

Principles

- Evidence-based approach

flow as a consequence of CSG-induced subsidence and concerns that it may change a landholder's access to overland flow water.

Regional overland flow impact assessment and analysis is outside the scope of the body of work currently being led by the Commission and therefore has not been considered as part of the regulatory review.

The Commission recommends that the Queensland Government investigate potential implications for regional overland flow that may result from predicted CSG-induced subsidence. If it is determined that regional overland flow would be impacted by CSG-induced subsidence, relevant investigations into the adequacy of the regulatory framework should be undertaken.

7. Consider the potential for critical consequences

In implementing the recommended framework, Government should consider what the course of action would be in instances where CSG-induced subsidence is predicted to have a 'critical' impact to the land use occurring on a property and compensation for impacts would not be an appropriate resolution. This consideration is a key concern for the agricultural industry and landholders, and fundamental to the coexistence of CSG activities with regional communities.

Principles

- Landholder protection
- Risk-based approach
- Productive capacity

The Commission has utilised the word "critical" in line with the Macquarie dictionary definition of "relating to or with the quality of a crisis or turning point". Examples of such a scenario would need to be further investigated however could include situations such as where there is an inability to undertake irrigated farming activities permanently because of CSG-induced subsidence. These impacts would likely be determined during the farm scale assessment process.

Whilst current research to date does not indicate either way whether critical impact will occur, it is important that it is a consideration in the design of the framework, particularly as more information comes to hand regarding the science of materiality and consequence.

8. Provide additional information and support for landholders

The issue of the lack of clear information around CSG-induced subsidence and the stress and pressure being placed on landholders in this environment of uncertainty was raised as key issue, particularly by agricultural peak bodies, landholders and landholder representatives.

In particular, it has been identified that there is limited support or information available to landholders in the early stages of interactions with a resource authority holder and that this puts landholders at a significant disadvantage in terms of preparation for engagement with companies. Whilst the CSG-induced subsidence matter has highlighted this issue, the information and support issue is much broader and relates to broader landholder rights and regulatory requirements.

This matter sits within the Commission's jurisdiction in terms of information dissemination and providing resources to assist landholders in dealing with company interactions. As a result, the Commission sees this as a great opportunity to continue to refine and improve the information and services it provides. In the context of this review, the Commission will:

- develop appropriate information and fact sheet material on CSG-induced subsidence (in addition to the guidelines to inform farm assessments); and
- investigate the provision of 'one-on-one' information to landholders prior-to or during the early stages of engagement with resource authority holders.

The Commission will continue to engage with stakeholders around this matter, including via the Review of Coexistence Entities being conducted by the Department of Resources under the Queensland Resources Industry Development Plan.

Next steps

This report and recommendations will be provided to government for consideration.

The Commission has undertaken significant consultation in relation to CSG-induced subsidence and the recommendations contained in this Report. The recommendations have been made with balanced consideration of the feedback of various stakeholders.

It is likely that further consultation will be undertaken as appropriate during the implementation of the recommendations accepted by government.

Appendix: Consultation Undertaken

Dates	Forum	Description
Late 2021	UWIR	OGIA undertook consultation on the draft UWIR, which informed the subsidence work being led by the Commission.
June 2020 – Early 2022	Surat Stakeholder Advisory Group (SSAG)	Discussions with landholders in the Dalby district in relation to subsidence were held at the SSAG meetings.
Late 2021 – Early 2022	Stakeholder Advisory Group (SAG)	The SAG was utilised as a consultation mechanism to provide updates to a broad stakeholder group.
January 2022	Regulatory Review	The Commission consulted with government agencies to seek advice on the interpretation of the regulatory framework in the discussion paper. <ul style="list-style-type: none"> • Department of Resources • Department of Environment and Science • Department of Regional Development, Manufacturing and Water • Department of State Development, Infrastructure, Local Government and Planning • Department of Climate Change, Energy, the Environment and Water • Office of Groundwater Impact Assessment
20/05/22 – 30/06/22	Regulatory review of coal seam gas-induced subsidence Discussion paper	19 submissions received from key stakeholders to inform the Commission's review: <ul style="list-style-type: none"> • 8 landholder submissions • 4 agriculture industry submissions • 2 resource industry submissions • 2 legal profession submissions • 1 advocacy organisations' submission • 1 research institution submission • 1 state government submission
26/08/22 2/09/22 13/09/22 5/10/22	Targeted stakeholder briefings	In undertaking the review, the Commission developed a framework to set the direction for the recommendations and consulted on this at a high level. Briefings were held with: <ul style="list-style-type: none"> • Resources peak bodies and representatives • Agricultural peak bodies • State Government agencies (Department of Resources, DSDILGP, DAF) • Landholders • NGOs (Environmental Defenders Office, Lock the Gate)
10/10/2022	Regulatory review of coal seam gas-induced subsidence Draft Recommendation Report	The Commission undertook targeted stakeholder consultation and received submissions from agriculture and resources industry peak bodies and government agencies.

Themes	Agriculture Peak bodies & landholders	Resources industry	Advocacy organisation	Professional service provider	Research institution	Related recommendations and actions
Clear pathway to compensation	✓		✓	✓		1, 2
Off-tenure landholder rights	✓	✓		✓		5
Long term liability	✓	✓				1
Amending existing CCAs	✓			✓		1
Fit-for-purpose regulation & retrospectivity	✓	✓	✓	✓		1
Make good framework synergies	✓	✓				1
Approach in high risk areas (incl. no-go zones)	✓	✓	✓			1, 7
Defined roles & responsibilities	✓	✓	✓			3, 8
Compliance & enforcement	✓					Out of scope
RPI Act limitations	✓		✓			Out of scope
Production & drainage	✓		✓			1, 2, New principle
Overland flow	✓	✓	✓			6
Farm infrastructure	✓		✓			1, Consequence research
Dryland farming	✓					1, 2
Further clarity on deviated wells	✓		✓			Out of scope
Burden of proof on landholders	✓	✓	✓			1, 2
Health & wellbeing	✓		✓			1, 2, 8
Access to free independent legal & technical advice	✓		✓			4
Access to data & information	✓	✓				1, 8
Targeted workshops	✓			✓		8
Baseline surveys	✓		✓			OGIA research
Consultation on thresholds & government recommendations	✓	✓		✓		Targeted consultation undertaken
Risk assessment	✓	✓	✓			1, 7, Consequence research
Independent scientific research	✓	✓			✓	3, 6, OGIA research, Consequence research

