Addressing Uncertainty in EIA Practice

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THE WIZARD OF ID
by Brant Parker and Johnny Hart
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I'M GOING TO BUILD A GIANT MALL RIGHT HERE
WHAT ABOUT THE ENVIRONMENTAL IMPACT, SIRE?
WE'LL BUILD IT TO WITHSTAND ANYTHING!
PARKER

Uncertainty

- Technical-rational model of EIA:
  - Informed decision-making
    - Comprehensive information
    - Accurate predictions
  - Positivist paradigm
  - Uncertainty is

What is uncertainty

- ‘A partial or total lack of understanding or knowledge of an event, its consequence, or its likelihood’ (IESC January 2015)
- ‘The state, even partial, of deficiency of information related to understanding or knowledge of an event, its consequence, or likelihood’ (AS/NZS ISO 31000:2009)

- Uncertainty ≠ probability

Outline

- Sources and causes of uncertainty
- Dealing with uncertainty

Parameter Uncertainty

- Lack of survey effort, spatial, temporal
- Inappropriate survey techniques
- Shifting baselines
- System complexity
- Determining the value/importance/sensitivity
- Practical and epistemological limitations to how much we can know (post-positivism)

Model uncertainty

- Two types of models are used in IA:
  - Conceptual models
    - Describe the interactions in the social and environmental systems under study
  - Predictive models
    - Predict changes in systems when certain pressures are introduced
    - Quantitative, numerical/mathematical
    - Qualitative, descriptive

Model uncertainty

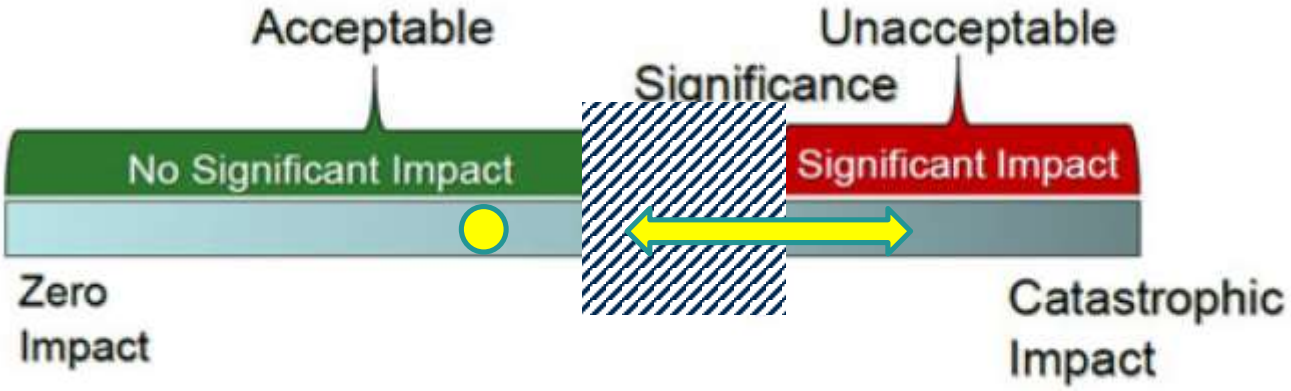
- Incorrect inputs and assumptions (conceptual and predictive models)
- Understanding of cause and effect relationships
- Insufficient knowledge of the proposed activity
  - Magnitude of changes
- Modeller bias (conscious and unconscious)
  - Assumptions
  - Interpretation of results

Systemic uncertainty

- Cumulative, synergistic, simultaneous and interactive impacts
- Natural disasters
- Recovery rate and success
- Particularly significant in large scale and/or long-term analyses

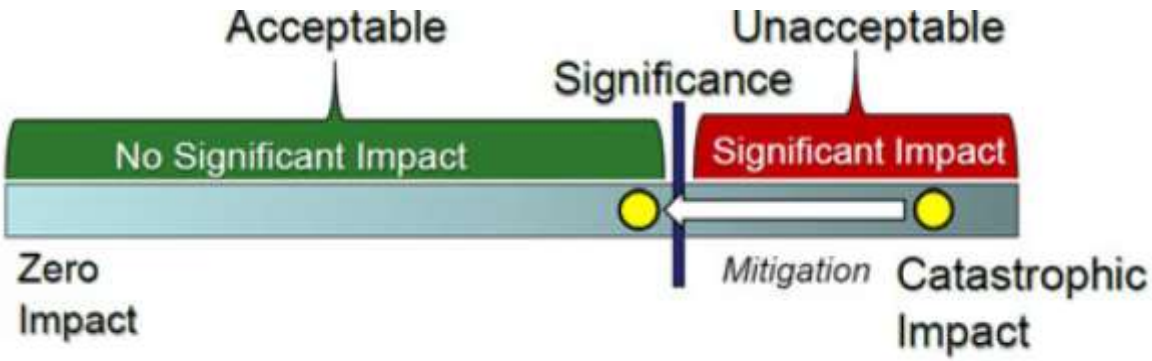
How Uncertainty is Compounded

- Acceptability of impacts
  - Determine threshold of significance for each environmental or social component
  - Decide which side of the threshold the predicted adverse impact falls on (Ehrlich & Ross, 2015)



Compounding uncertainty

- Mitigation of impacts
  - For unacceptable impacts, decide if mitigation measures can make the residual impact acceptable



Dealing with Uncertainty

- Precautionary principle – in some legislation
- South Australia - Ministerial determinations
  - Uncertainty description
  - Uncertainty assessment

Dealing with Uncertainty

- Limited guidance available for technical studies:
  - IESC – groundwater modelling, water-related ecological responses
  - WA/GBRMPA – dredge plume modelling guidelines
  - NSW SIA guidelines
    - Sensitivity analysis, justification of assumptions

Dealing with Uncertainty

- Approaches – examine a range of possible outcomes:
  - Model realistic and (reasonable) worst case scenarios
  - Bayesian networks
  - NSW SIA guidelines:
    - Impacts are ‘significant’ if two or more significance criteria (duration, extent, severity, sensitivity) are **unknown**

Dealing with Uncertainty

- Responses
  - Adaptive management
    - Limited guidance on how to do this
    - Significant issues with post-approval enforcement of compliance – checking, also validation
  - EPBC Act offsets policy - higher offset ratios if higher uncertainty
  - Almost no follow up or validation

Dealing with Uncertainty

- The need to deal with uncertainty is recognised in Terms of Reference/Guidelines:
  - "provide all available baseline information relevant to the environmental risks of the project … and any **uncertainties** in the information." (Queensland Generic ToR)
  - "characterise, quantify and address **uncertainties** that may affect the effectiveness of management measures and therefore on the confidence that biodiversity values would be maintained …" (EPBC Act guidelines)

Reporting Uncertainty

- Patchily addressed in specialist (modelling) reports
  - IESC highly critical of many water/groundwater assessments
- Poorly addressed in EISs
  - SA – Central Eyre Iron Project – good example
- Rarely addressed in Regulator's assessment report

Reporting Uncertainty

- Avoidance behaviour (Leung et al 2015)
  - Proponents hate to appear uncertain
  - Scientists are taught to be certain or silent
  - Engineers are taught to reject uncertainty
  - Decision-makers demand certainty

Decisions

- Very rare for uncertainty to be a factor
- Refusals based on uncertainty
  - WA - Shark nets on Perth beaches (2015)
  - Qld - Traveston Dam (2009)
  - NZ – undersea mining (2013) (approved 2017 – but appeals lodged)

Conference theme

- Uncertainty contributes to wicked problems
  - Uncertain about values
  - Science is not providing us with complete, accurate information
- Wicked solutions require us to find ways to move forward in the face of uncertainty

Recommendations

- EIA practice could be improved:
  - Reduce uncertainty as far as practicable
  - Be clear what we don't know
  - IA-SIS to produce guidelines
- We need to recognise inherent and intractable uncertainty
  - Make decisions anyway
  - Be able to move forward

Recommendation

- Enable environmental practitioners to give good advice in the face of inherent and intractable uncertainty in environmental and social science