



Report Partner Document

ECOSEIS PHASE 2 SUMMARY REPORT

PTAC

This partner document has been created to provide a non-technical summary of information presented in EcoSeis Phase 2 Final Report (2024) referred to in this document as “The Report”, prepared by OptiSeis Solutions Ltd. for and with funding by Petroleum Technology Alliance Canada (PTAC). Additional background information is provided in this partner document to supplement the readers understanding of progress presented in The Report.

Introduction

The Report presents the results of the EcoSeis Phase 2 project led by OptiSeis Solutions Ltd., a Calgary-based geophysical technology company specializing in subsurface imaging and environmental footprint deduction. The project was conducted in collaboration with a number of funding and industry partners, including Alberta Innovates, Clean Resource Innovation Network (CRIN), National Research Council of Canada Industrial Research Assistance Program (NRC-IRAP), PTAC, and several major oil sands operators including Cenovus Energy, Canadian Natural Resources Ltd. (CNRL), ConocoPhillips, Imperial Oil Resources Ltd., and Suncor Energy.

OptiSeis is a pioneer in developing intelligent seismic design solutions that reduce the environmental and greenhouse gas (GHG) footprint of subsurface exploration. Their flagship product, EcoSeis, integrates advanced geophysical principles with ecological data analytics to enable resource operators to meet exploration goals while aligning with environmental, social, and governance (ESG) commitments. The central aim of the project was to validate and enhance the EcoSeis technology, OptiSeis’s proprietary seismic acquisition methodology, through rigorous field testing and environmental performance evaluation.

Background Information

Seismic exploration is a fundamental method used by the oil and gas industry to image the Earth’s subsurface and locate reservoirs of hydrocarbons. Traditionally, this process has involved cutting wide, linear clearings through forests, known as seismic lines, in order to deploy equipment for geophysical measurements. While effective for data collection, these practices have left a legacy of ecological disruption across Canada’s boreal regions, including forest fragmentation, delayed regrowth, and increased GHG emissions due to biomass removal and soil disturbance.

Recent technological advancements have focused on minimizing this environmental impact without compromising data quality. These include low-impact seismic (LIS) lines, miniaturized equipment, and improve spatial sampling algorithms. However, even with these improvements, the linear nature of seismic lines continues to pose challenges to ecosystem recovery and wildlife movement.

OptiSeis Solutions Ltd. has responded to this need for innovation by developing EcoSeis, a seismic survey design and analytics platform that applies proprietary algorithms to balance geophysical imaging requirements with environmental constraints. The software uses surface and subsurface datasets to guide seismic acquisition design, minimizing disturbance while maintaining or improving imaging quality.

Project Summary

The EcoSeis Phase 2 project set out to advance the EcoSeis technology by directly comparing a conventional 3D seismic program with an EcoSeis-designed survey in a real-world operational setting. Field trials were conducted in northern Alberta between 2022 and 2023, with detailed tracking of land disturbance, fuel usage, and emissions during the data acquisition phase.

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Three core studies were conducted as part of the project: a seismic line regrowth study, a line preparation test, and an emissions and footprint comparison between conventional and EcoSeis seismic programs. These studies collectively helped determine EcoSeis's environmental, technical, and operational viability.

SEISMIC LINE REGROWTH STUDY

This study assessed long-term vegetation recovery on seismic lines that were cut using LIS methods 18 to 20 years ago. The study compared these regrowth patterns with undisturbed forest plots and with areas that regenerated naturally following a 2002 House River wildfire. Researchers used standardized transect sampling across a range of ecosites including upland, transitional, and lowland to evaluate structural vegetation layers, tree height, stem density, ground cover, and visual obstruction.

The study found high vegetation recovery across most ecosystems on LIS lines, especially for lower strata ground cover, but differences remained in tree height and upper canopy structure in wetter ecosites. There was no significant difference between LIS and undisturbed reference plots for at least 10 of the 12 vegetation structural strata in all ecosites. Visual obstruction, a key indicator of wildlife habitat quality, was lower on LIS plots compared to reference plots, particularly at heights above one meter, which has implications for predator-prey dynamics and habitat fragmentation.

The study confirms that carefully planned LIS lines recover well over time, particularly in upland areas, and that EcoSeis could benefit from targeting reduced disturbance in ecosites with historically slower regrowth. These insights were used to refine EcoSeis algorithms to avoid or minimize line cutting in sensitive or slow-recovery ecosites, contributing to lower reclamation needs and enhanced environmental stewardship.

LINE PREPARATION AND CUTTING TEST

The goal of this study was to evaluate how different methods of seismic line preparation, such as mulching height and cutting methods, affect vegetation disturbance and subsequent recovery. The test was scheduled for winter 2024, but due to unseasonably warm temperatures and a lack of snow cover, the test could not be executed under standard operating conditions.

Despite the cancellation, detailed operational planning was completed, including safety assessments and equipment logistics. A new test is scheduled for the 2025 seismic season, with the objective of evaluating alternative cutting methods that further reduce surface damage, while maintaining operational efficiency. Preparatory work confirmed the technical feasibility and safety of alternative line-cutting strategies and informed ongoing software and procedural improvements.

This component remains a vital next step in understanding how line preparation choices influence environmental recovery and will contribute to best practice guidelines for future EcoSeis deployments.

LAND FOOTPRINT AND GHG EMISSIONS COMPARISON

The third and most impactful study compared the land disturbance and GHG emissions generated by a conventional seismic survey versus one designed with EcoSeis. Both surveys were conducted in the same area in northern Alberta, with tracked data for equipment movement, fuel consumption, and biomass disturbance.

The EcoSeis program achieved a 42% reduction in linear kilometers cut, and a 37% reduction in total disturbance area, compared to the conventional program. GHG emissions were reduced by 36%,

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accounting for both direct emissions from fuel use and indirect emissions from biomass decomposition following line clearing.

Modeling for new-cut scenarios suggests that EcoSeis can achieve reductions exceeding 50% in emissions and land impact, when not limited by pre-existing seismic infrastructure. The most significant source of emissions was found to be the loss of ecosystem carbon from clearing vegetation, emphasizing the value of EcoSeis's ability to reduce the number and width of seismic lines.

To support these findings, emissions calculations were developed using customized algorithms, which were then integrated into OptiSeis's osDesign software. This enables predictive modeling for future projects and allows operators to design seismic programs that meet both geophysical and environmental targets.

SUMMARY

Together, these three studies demonstrate that the EcoSeis methodology is not only viable, but superior to conventional seismic approaches in terms of environmental performance. This technology enables operators to meet regulatory and ESG demands while maintaining seismic data quality and reducing operational costs. The results of Phase 2 position EcoSeis for broader commercial adoption across sectors, including oil and gas exploration and emerging carbon capture and storage (CCS) monitoring applications.

Conclusion

The EcoSeis Phase 2 project provides compelling evidence that seismic exploration can be made significantly more sustainable without compromising data integrity or operational safety. The project not only validated the EcoSeis methodology in a commercial field environment but also demonstrated its scalability, integration potential, and regulatory alignment.

With support from Emissions Reduction Alberta (ERA), OptiSeis is now preparing to launch a \$16.2 million follow up project that will further test EcoSeis in diverse geological and operational contexts, including CCS monitoring. This initiative is expected to answer critical questions about the technology's broader applicability, safety, and cost-efficiency, paving the way for commercial-scale adoption.

EcoSeis represents a transformative shift in how seismic exploration can be conducted in harmony with environmental stewardship. As land access regulations tighten and ESG expectations grow, solutions like EcoSeis are not only viable, but increasingly necessary for the future of responsible resource development.