FORMAL OBJECTION TO THE FUENTE PICO WIND FARM PROJECT

EOL-43-2022 - Municipality of Voto, Cantabria

Submitted by: Juan Corrin (NIE Y5528443-Q) on behalf of the Matienzo Caves Project
Date: 12th February 2026
References:
FP-A: EOL-43-2022_EsIA(256.3.5).pdf , and associated documentation:
FP-B : EOL-43-2022_Proyecto(256.3.1.01_0).pdf
FP-C : EOL-43-2022_Proyecto_Infraestructuras(256.3.3.02_0).pdf
FP-D : EOL-43-2022_Cartografia(256.3.7) Maps shapefiles

Contents

Executive Summary ..... 2 - 5

Detailed Technical Analysis..... 6 - 19
1 Geological and Hydrogeological Context ..... 6 - 7
2 Impacts on Subterranean Ecosystems ..... 8 – 9
3 Construction Impacts and Mitigation Inadequacies ..... 9 – 12
4 Specific Contamination Pathways ..... 12 – 14
5 Inadequate Environmental Sensitivity Classification ..... 14 – 15
6 Documentation Deficiencies ..... 15 - 17
7 Restoration and Decommissioning Claims ..... 17 - 18
8 Regulatory and Procedural Failures ..... 18 - 19
9 Visual and Landscape Impacts 19

Key Conclusions and Recommendations ..... 20 - 22

References ..... 22 – 24

Annexes A – F ..... 25 - 55

A(i) Detailed Quote and Comment Compilation (Not included in English version) ..... 25 - 40
A(ii) Additional Impacts ..... 41 - 42
B Caves and springs (water supplys) at risk ..... 43 - 46
C Views down Llueva valley 47
D Cantabroniscus 48
E(i) Explosives – large scale use ..... 49 - 52
E(ii) Explosives for trench excavation ..... 53 – 56
F Matienzo Caves Project 57

EXECUTIVE SUMMARY

This objection addresses the proposed Fuente Pico wind farm project (EOL-43-2022), which proposes to install three Vestas 166-4.5 wind turbines each of 196 meters total height in the municipality of Voto, Cantabria.

The Fuente Pico wind farm project is exactly the type that is not allowed by Cantabria's Plan Regional de Ordenación Territorial (PROT). Under the technical directives, the PROT specifically identifies karst features as part of the exclusion zones for development (particularly for wind farm installations).

This project represents an unacceptable threat to a sensitive three-dimensional karst ecosystem and should be rejected outright.

Principal Grounds for Objection

1. Fundamental Incompatibility with Karst Terrain

The proposal seeks to industrialize a limestone karst landscape characterized by underground drainage systems, cave networks, subsurface rivers, and specialized subterranean biota. Building wind farm infrastructure on karst terrain is fundamentally different from construction on other geological substrates. The interconnected three-dimensional nature of karst systems means that surface disturbance inevitably propagates underground, with impacts extending far beyond the immediate construction footprint.

2. Absence of Site-Specific Hydrogeological Assessment

Most critically, the Environmental Impact Statement (EsIA) and accompanying technical documentation fail to provide adequate hydrogeological characterization of the karst system. The statement on page 17-18 of the Non-Technical Summary that "a geological and hydrogeological study of the geological context of the Karst in the Alto de Fuente Pico area" should be prepared acknowledges this deficiency, yet inexplicably suggests this fundamental assessment should occur *after* project approval rather than before. This represents a complete inversion of proper environmental assessment procedure.

Without understanding:

- The specific underground drainage pathways
- Connection points between surface disturbance and subsurface hydrological networks
- Locations and characteristics of springs and resurgences
- Residence times and flow velocities in the karst aquifer
- Baseline water chemistry and biological communities
- Vulnerability of specific karst features to construction impacts

...it is impossible to properly assess environmental impacts, design appropriate mitigation measures, or monitor construction effects.

3. Systematic Neglect of Subterranean Ecosystems

Throughout 2,430 pages of documentation, there is virtually no consideration of:

- Cave-adapted fauna (troglobitic and troglophilic species)
- Subterranean aquatic communities
- Groundwater-dependent surface ecosystems at springs
- Underground river systems and their biota
- Microbiological communities in karst waters

The monitoring plans focus exclusively on surface environments, with no provision for sampling resurgences, monitoring groundwater quality, or assessing impacts on hypogean fauna. This is a fundamental omission given that karst ecosystems are characterized by high levels of endemism and species adapted to stable underground conditions that are highly vulnerable to disturbance.

4. Inadequate Assessment of Construction Impacts

The construction phase will involve:

- Excavation of 105,728 m³ of material for roads and platforms
- Import of 63,703 m³ of fill material (approximately 4,250 lorry loads)
- Installation of copper grounding systems beneath each turbine foundation
- Use of explosives in fractured limestone (despite generic prohibitions)
- Creation of 7.8 km of underground cable trenches
- Extensive cut-and-fill operations on steep karst topography

Each of these activities poses specific risks to karst hydrology:

Sediment mobilization: Even with sediment control measures, the scale of earthworks will generate turbid runoff that will rapidly infiltrate through karst features, traveling through underground conduits to springs that may be kilometers distant. Suspended sediments will clog interstitial spaces in the epikarst, alter underground stream morphology, and smother benthic communities.

Chemical contamination: Fuels, oils, cement, bentonite (used in grounding rod installation), and other construction materials can infiltrate directly into karst voids. The copper grounding mesh (15 x 15 m, 90 mm² conductor) beneath each turbine will corrode over time, releasing copper ions that are toxic to aquatic invertebrates at very low concentrations. Leachate from embankment fill of unknown provenance may introduce additional contaminants.

Hydrological modification: The extensive drainage network proposed alongside roads will intercept surface runoff and concentrate discharge at specific points, fundamentally altering natural diffuse recharge patterns. The documents provide no plans showing drainage termination points or how outlets will be designed to mimic natural infiltration.

Physical destruction: Road construction, platform excavation, and cable trenching will directly destroy surface karst features including dolines, sinks, and cave entrances. The documents provide no inventory of such features or protocols for their protection.

5. Misclassification as "Low Environmental Sensitivity"

The project area is classified as having "Low Environmental Sensitivity" for wind farm development (p.19/316 EsIA). This classification is demonstrably incorrect and appears to result from application of a generic zoning tool that fails to adequately weight karst vulnerability. The classification of a karst landscape with active underground drainage as "low sensitivity" demonstrates either inadequate assessment methodology or willful disregard for hydrogeological reality.

Karst terrains are universally recognized in scientific literature as highly vulnerable to anthropogenic impacts due to:

- Direct hydraulic connection between surface and subsurface
- Rapid infiltration with minimal filtration
- Long residence times allowing contaminant accumulation
- Specialized, endemic fauna with limited adaptive capacity
- Irreversible modification of karst landforms

6. Generic and Misleading Documentation

The technical documentation is characterized by:

- Generic statements about renewable energy benefits with no site-specific analysis of local costs
- Repeated coordinate system errors (ERTS89 instead of ETRS89)
- Maps without scales or only partial
- Unsubstantiated claims about landscape restoration
- Contradiction regarding explosives use ("completely prohibited, except...")
- No information about whether trenches are shared with the adjacent Sierra de Sel project
- Absence of the word "karst" (or "kárstico") in the 753-page project description document

This generic approach obscures the specific and severe impacts that will occur at this particular location.

7. Inadequate Earthworks Balance

The excavation-embankment balance reveals a massive material deficit of 63,703 m^3, requiring importation of fill equivalent to 4,250 lorry loads. The documents provide:

- No information on source of this material
- No assessment of haulage impacts
- No analysis of fill material chemistry and leaching potential
- No explanation for why natural ground profiling requires such extensive supplementary fill

8. Cumulative Impact Disregard

The Fuente Pico project cannot be assessed in isolation. It forms part of a larger industrialization including:

- Sierra de Sel wind farm (10 generators) immediately adjacent
- Las Mazas wind farm (4 generators)
- Possibly shared electrical infrastructure (30kV and 55kV underground lines)

The cumulative impact of 17 turbines plus associated infrastructure across this contiguous karst landscape is dismissed in favor of piecemeal assessment of individual projects. The EsIA fails to address whether evacuation trenches are shared, whether construction timelines overlap, and what the additive impacts on karst hydrology will be.

9. Irreversible Transformation

Despite assurances about restoration and decommissioning, the reality is that:

- Karst landforms once destroyed cannot be restored
- Road cuts and embankments are permanent landscape modifications
- Underground hydrological patterns altered by construction will not revert
- Deep foundations (24.4 m diameter, up to 3.2 m thick) will remain indefinitely
- Access roads will remain as "industrial heritage"

The landscape will be permanently transformed from a relatively natural karst terrain to an industrial site, regardless of whether the generators eventually are removed.

Fundamental Conclusion

This project proposes to industrialize a sensitive karst landscape without adequate hydrogeological assessment, without consideration of subterranean ecosystems, without proper sediment and chemical management plans, and without honest acknowledgment of irreversible impacts. The Environmental Impact Statement fails to meet basic standards for karst environmental assessment and should be rejected.

The only environmentally appropriate alternative for wind farm development on Cantabrian karst is Alternative 0: do not build.

DETAILED TECHNICAL ANALYSIS

1. GEOLOGICAL AND HYDROGEOLOGICAL CONTEXT

1.1 The Nature of Karst Systems

Karst terrains develop through dissolution of soluble bedrock (primarily limestone) by slightly acidic meteoric water, creating a distinctive three-dimensional landscape characterized by:

- **Surface features**: Dolines (sinkholes), sinks, blind valleys, dry valleys, limestone pavements, and karren (lapiés)
- **Subsurface features**: Cave systems, underground rivers, conduits, fracture networks, and spring resurgences
- **Epikarst zone**: A highly weathered and permeable zone typically 5-15 m below the surface that stores and transmits water
- **Unique hydrology**: Rapid infiltration through solutionally enlarged fractures and conduits, with minimal filtration, creating direct connection between surface and deep groundwater

The three-dimensional interconnected nature of karst systems means that impacts at any point on the surface can propagate throughout the underground network. Unlike granular aquifers where flow is diffuse and slow, karst aquifer flow is often concentrated in conduits where water can travel kilometers per day. This creates unique vulnerabilities to contamination and ecosystem disruption.

1.2 Project Site Karst Characteristics

The project is located in the Alto de Fuente Pico area within the Mesozoic Vasco-Cantabrian Basin. The EsIA (p.435/316, Annex XIV) acknowledges:

"The limestone massifs give rise to highlands with flat summits and blind valleys"

However, this brief mention fails to adequately characterize the karst landscape. The area exhibits typical karst topography with:

- Elevation range of the generators from 302m to 379 m (77 m relief)
- Elevation range of the hill: 50m - 379m (329 m relief)
- Limestone bedrock with surface karst features
- Underground drainage evidenced by blind valleys
- Surface water drainage to the Clarín River
- Multiple documented caves including Peñarrobra Cave, Trampascuevas Cave, and Cueva Otero IV (See Annex B)

1.3 Critical Absence of Hydrogeological Study

The most significant deficiency in the entire documentation is the absence of a proper hydrogeological study. The EsIA itself acknowledges this gap (pp.17-18/22, Non-Technical Summary):

"Preparation of a geological and hydrogeological study of the geological context of the Karst in the Alto de Fuente Pico area, which examines the hydrological connection between potential discharge points and the hydrological network of the area, determines the possible impacts of the project on the functioning of the karst, and includes a detailed topography of it."

This statement is presented as a *mitigation measure* rather than as a fundamental prerequisite for impact assessment. This reversal of proper procedure is unacceptable. A hydrogeological study should be conducted before project design, not after approval, to:

1. **Map underground drainage networks**: Determine where surface water infiltrates and where it resurges
2. **Identify vulnerable features**: Locate cave entrances, sinks, and dolines that could be damaged or serve as direct contamination pathways
3. **Characterize aquifer properties**: Determine flow velocities, residence times, and connectivity
4. **Establish baseline conditions**: Document current water chemistry, flow rates, and biological communities
5. **Assess vulnerability**: Determine which areas of the site have direct hydraulic connection to springs or cave systems
6. **Guide design and mitigation**: Ensure infrastructure is located to minimize impacts and that monitoring is properly positioned

Without this fundamental information, the entire impact assessment is speculative at best and negligent at worst.

The EsIA's hydrogeology section (p.7/22, Non-Technical Summary) states:

"Regarding the underground masses, the project is situated on the MASb Alisas-Ramales mass (016.210)."

This single sentence, referring only to the designated groundwater body, cannot substitute for site-specific hydrogeological characterization. There is no mention of:

- Underground drainage patterns from the high-altitude karst
- Locations of springs
- Connection between the construction area and downstream water resources
- Vulnerability assessment of the karst aquifer

There is no recognition that Los Boyones (shown as E.T.A.P. Alto de la Cruz on Google Maps), the main secure public water supply in Secadura, could be contaminated by the project. This critical spring is 1.6km from generator 2 and is connected to an extensive underground network including the 79.5 km-long Four Valleys System which brings water from Riaño, Matienzo and Llueva into Secadura. (See Annex B.)

2. IMPACTS ON SUBTERRANEAN ECOSYSTEMS

2.1 Systematic Omission of Cave Fauna

One of the most glaring deficiencies in the EsIA is the complete absence of any assessment of subterranean biological communities. The fauna section (pp.9-10/22, Non-Technical Summary) makes no mention of cave-dwelling organisms, and the monitoring plan (p.22/35, Annex XIII) for "amphibians, reptiles, and other groups" contains no provision for sampling underground environments.

This omission is scientifically indefensible. Karst systems support specialized biological communities including:

Troglobitic species: Organisms that complete their entire life cycle underground and cannot survive on the surface. These species typically exhibit adaptations including:

- Loss of eyes and pigmentation
- Enhanced non-visual sensory capabilities
- Reduced metabolic rates
- Extended lifespans and reduced reproductive rates
- High sensitivity to environmental changes
- High levels of endemism (found nowhere else)

Troglophilic species: Organisms that regularly use caves but can also survive on the surface

Stygobitic species: Aquatic organisms restricted to groundwater habitats

Groundwater-dependent surface fauna: Species that rely on stable spring flows and water quality

The Cantabrian karst is known to support important cave-adapted fauna. The complete absence of any survey or assessment of these communities represents a fundamental failure of the environmental impact assessment.

2.2 Vulnerability to Construction Impacts

Subterranean organisms are particularly vulnerable to disturbance because:

1. **Stable environment**: Cave and groundwater environments maintain relatively constant temperature, humidity, and chemical conditions. Surface disturbance can introduce temperature fluctuations, desiccation, and chemical changes that exceed adaptive capacity.
2. **Oligotrophic conditions**: Underground ecosystems are typically nutrient-poor, with food webs based on organic matter washed in from the surface. Introduction of sediment and associated organic matter can fundamentally alter these ecosystems.
3. **Small population sizes**: The low productivity of cave environments typically supports small populations of specialized species. Even localized impacts can threaten entire populations or species.
4. **Limited dispersal ability**: Many cave organisms have limited mobility and cannot recolonize disturbed areas from distant refugia.

5. **Slow recovery**: The low productivity and slow life cycles of cave organisms mean that disturbed communities may require decades to centuries to recover, if recovery is possible at all.

2.3 Specific Threats from Wind Farm Construction

The construction activities will threaten subterranean fauna through multiple pathways:

Sediment introduction: Excavation of 105,728 m³ of material will generate massive sediment loads. Even with surface sediment controls, fine particles will infiltrate through karst features and be transported through underground conduits. Sediment in underground streams can:

- Smother benthic invertebrate communities
- Clog interstitial spaces that provide habitat
- Reduce dissolved oxygen through organic matter decomposition
- Alter underground stream morphology

Chemical contamination: Construction will introduce numerous potential contaminants:

- Copper leaching from grounding systems (acute toxicity to invertebrates at µg/L concentrations)
- Petroleum hydrocarbons from machinery
- Cement and concrete leachate (highly alkaline)
- Bentonite from grounding rod installation
- Unknown chemical composition of imported fill material

Hydrological disruption: Altered surface drainage patterns can change recharge characteristics, potentially affecting:

- Seasonal flow patterns in underground streams
- Water levels in cave pools
- Dissolved oxygen concentrations
- Nutrient inputs

Physical destruction: Direct destruction of surface karst features that serve as habitat or are critical for underground community dynamics.

See Annex D for information about one such crustacean, *Cantabroniscus*.

3. CONSTRUCTION IMPACTS AND MITIGATION INADEQUACIES

3.1 Earthworks and Material Balance

The scale of proposed earthworks is massive and inadequately addressed in the documentation:

Roads:

- Excavation: 78,295 m³
- Embankments: 104,804 m³
- Material deficit: 26,509 m³

Platforms:

- Excavation: 27,433 m³
- Embankments: 64,627 m³
- Material deficit: 37,194 m³

Total material deficit: 63,703 m³ (equivalent to approximately 4,250 lorry loads of 15 m³)

This enormous deficit of excavated material relative to embankment requirements is not adequately explained. Questions that remain unanswered include:

1. Why is such extensive fill required? Does this indicate that natural landforms are being substantially modified beyond what is represented in the impact assessment?
2. Where will this material be sourced? No borrow pit locations are identified, and no assessment is provided of impacts from quarrying 63,703 m³ of material.
3. What is the chemical composition of fill material? Different rock types have different weathering characteristics and leaching potential. Fill material could introduce chemical changes to infiltrating water.
4. What are the haulage impacts? 4,250 lorry trips will generate dust, noise, diesel emissions, and road wear, yet these impacts are not quantified.
5. How will imported fill be placed on karst terrain where natural infiltration is high? Standard compaction procedures may not be effective where underlying voids exist.

The generic statements about earthworks in the Proyecto document (pp.85-91/157, FP-B) provide no site-specific assessment of these concerns.

3.2 Use of Explosives on Karst Terrain

The documentation contains contradictory and concerning statements about explosives use:

Page 57/157 (FP-B) states:

"The use of explosives is completely prohibited, except in those places where it is explicitly specified."

This is logically incoherent—explosives cannot be both "completely prohibited" and also allowed where "explicitly specified." The extensive technical specifications for blasting (pp.67-68/157, FP-B) make clear that explosives are expected to be used:

"In rock excavation areas, in cases where the removal can be carried out using explosives..."

The blasting specifications include detailed requirements for:

- Vibration studies and transmissibility laws

- Maximum fragment sizes (60 cm)
- Safety distances for buildings and buried conduits
- Monitoring of blast effects
- Blasting plan submissions one week before execution

These detailed specifications for explosives use are generic and fail to address the specific hazards of blasting in karst:

Fracture propagation: Karst limestone is typically already fractured. Blast-induced fracturing can create new pathways for rapid infiltration and contaminant transport.

Void communication: Blasting can open connections between previously isolated voids, fundamentally altering groundwater flow patterns.

Airblast effects: Pressure waves from blasting can propagate through air-filled voids in the subsurface, potentially affecting cave environments and fauna far from the blast site.

Vibration transmission: In fractured karst, vibration transmission is complex and unpredictable, with potential for focusing effects where geological structures converge.

Groundwater disruption: Blasting can temporarily increase hydraulic conductivity, allowing rapid drainage of perched water or temporary aquifers.

The complete absence of karst-specific blasting protocols indicates inadequate understanding of the geological setting.

3.3 Drainage System Deficiencies

Perhaps the most significant technical deficiency is the complete absence of a proper drainage plan. Despite 2,430 pages of documentation, there are:

- **No drainage plans**: No drawn plans showing the layout of the proposed drainage network
- **No outlet designs**: No specifications for how drainage will be discharged to mimic natural diffuse infiltration
- **No capacity calculations**: No hydrological modeling to determine peak flows or required drainage capacity
- **No water quality provisions**: No sedimentation basins, oil separators, or other treatment systems

The road specifications (pp.28-29/92, FP-B) describe only generic drainage features:

"Drainage: longitudinal drainage will be through earth ditches 1 m wide and 0.50 m deep (in areas of steep slope, the ditch will be concreted). In the relative low points of the platform, passage structures designed with a concrete pipe of 60 cm in diameter will be provided."

This describes conveyance infrastructure but not outlet strategy. On karst terrain, concentrated drainage discharges are particularly problematic because:

1. **Accelerated infiltration**: Concentrated flow from drainage pipes will create point-source infiltration, bypassing the natural epikarst storage and filtration.
2. **Erosion and sediment transport**: High-velocity discharge will erode soil and transport sediment into karst openings.
3. **Thermal impacts**: Road surfaces absorb heat; concentrated runoff will be warmer than natural diffuse rainfall, potentially affecting stable underground temperature regimes.
4. **Chemical loading**: Road runoff contains petroleum residues, tire wear particles (including zinc and other metals), and de-icing compounds (if used). Concentrated discharge delivers these contaminants directly to groundwater.

The monitoring provisions (p.22/35, Annex XIII) for drainage are limited to:

"A general analysis of the drainage network will be carried out, evaluating the incidence of waterlogging in the vicinity of the wind turbines..."

This focuses on surface flooding rather than groundwater impacts. There is no provision for monitoring resurgences for:

- Sediment load changes
- Chemical contamination
- Temperature fluctuations
- Flow regime alterations
- Biological community impacts

4. SPECIFIC CONTAMINATION PATHWAYS

4.1 Copper from Grounding Systems

Each wind turbine will have a copper grounding mesh (p.38/316, EsIA):

"...consisting of a copper mesh with outer dimensions of 15 x 15 m, arranged in a grid of 3.25 x 3.25 m, made of bare copper conductor with a cross-section of 90 mm^2..." "...four copper-coated steel rods of 14 mm in diameter and 5 m in length, with a copper thickness equal to or greater than 300 µm. A drilling machine will be used for the placement of these rods, and the hole in the ground will be filled with bentonite..."

Copper is toxic to aquatic invertebrates at very low concentrations (µg/L range). Leaching from buried copper will occur through:

1. **Electrochemical corrosion**: Copper oxidizes in the presence of moisture, releasing Cu^{2+} ions
2. **Galvanic corrosion**: Contact between dissimilar metals (copper and steel) accelerates corrosion
3. **Bentonite interaction**: Bentonite used to fill grounding rod holes is a clay that swells when wet, potentially creating pathways for water contact with copper surfaces

In a karst setting, copper ions leached from grounding systems will rapidly infiltrate to groundwater and be transported through conduits to resurgences, where they may accumulate in sediments and bioaccumulate in invertebrate populations.

4.2 Construction Chemical Risks

Construction will involve numerous materials that pose contamination risks:

Concrete and cement: Highly alkaline (pH >12), can substantially increase groundwater pH if leachate enters karst system. Many karst organisms are adapted to circumneutral pH and sensitive to alkaline conditions.

Diesel fuel and lubricants: Approximately 130,000 liters of diesel will be consumed during construction (assumption based on similar projects). Even small spills can contaminate large volumes of groundwater. Petroleum hydrocarbons are toxic to aquatic life and persistent in low-oxygen groundwater environments.

Hydraulic fluids: Heavy machinery uses hydraulic systems that can leak or rupture, releasing synthetic oils and additives.

Bentonite: Used for grounding rod installation. While relatively inert, bentonite can mobilize and clog karst conduits, and may contain chemical additives.

Unknown fill composition: The 63,703 m³ of imported fill could contain a wide range of chemical contaminants depending on source geology and history. No provision is made for chemical characterization of fill material.

On conventional geology, these materials would largely remain near the surface where impacts can be monitored and controlled. On karst, spills and leachate rapidly infiltrate and disperse underground, making containment and remediation extremely difficult or impossible.

4.3 Sediment Mobilization

The mobilization of 105,728 m³ of excavated material, plus the disturbance of existing surface layers across road corridors and platforms, will generate massive sediment loads. The generic sediment control measures described in the EsIA (silt fences, sediment traps, etc.) are designed for surface water protection and are largely ineffective on karst where infiltration is rapid and diffuse.

Sediment impacts include:

- **Physical smothering** of benthic invertebrate communities in underground streams
- **Light attenuation** in cave pools (affecting algae where light penetrates)
- **Clogging of interstitial spaces** in the epikarst and in alluvial deposits in cave streams
- **Organic matter loading** from topsoil mobilization, leading to deoxygenation
- **Persistent turbidity** in springs, affecting downstream ecosystems and potentially affecting domestic water supplies

The monitoring plan (p.12/35, Annex XIII) proposes sampling for:

"… turbidity, suspended solids, and basic physicochemical parameters (pH, conductivity, dissolved oxygen, and temperature)"

However, it specifies monitoring "those areas considered in the preliminary phase to assess the impact of the works on water quality" without identifying what these areas are. Critically, there is no mention of monitoring at springs, which is where impacts will be manifest.

5. INADEQUATE ENVIRONMENTAL SENSITIVITY CLASSIFICATION

5.1 "Low Environmental Sensitivity" Classification

The EsIA states (p.19/316):

"According to the environmental sensitivity map for the implementation of wind energy projects, the wind turbines of the 'Fuente Pico' wind farm are located within an area classified as Low Environmental Sensitivity."

This classification is fundamentally flawed. The EsIA itself acknowledges (p.20/316):

"It should be noted that this environmental zoning is a simplification of reality in order to understand the territory from a general perspective."

The classification of an active karst landscape as "low sensitivity" indicates either:

1. The classification methodology does not adequately weight karst vulnerability, or
2. The classification was misapplied, or
3. The classification was selectively used to justify the project

Karst terrains are universally recognized in environmental and hydrogeological literature as highly sensitive to disturbance due to their unique characteristics:

- **Direct surface-groundwater connection**: Minimal soil or sediment filtration
- **Rapid infiltration and transport**: Contaminants can travel kilometers in hours to days
- **Irreversible landform modification**: Destroyed karst features cannot be recreated
- **Endemic and specialized fauna**: High vulnerability to environmental changes
- **Critical groundwater resources**: Karst aquifers often provide drinking water and ecological base flows
- **Complex and poorly predictable flow patterns**: Difficult to model or manage impacts

The first consideration in siting any industrial development should be: "Is this area karst, and if so, is development compatible with protecting the three-dimensional karst ecosystem?" For wind farms involving extensive earthworks, hazardous materials, and permanent landscape modification, the answer for karst terrain should be "no."

5.2 Alternative Site Selection

The EsIA briefly describes four alternatives

- Alternative 0: Do not build
- Alternative 1: The proposed project (3 generators)
- Alternative 2: with pylons

- Alternative 3: with pylons

There is no meaningful analysis of alternative locations outside karst terrain. Spain has extensive areas of non-karst geology that would be far more appropriate for wind farm development. The focus on Cantabrian karst landscapes appears driven by wind resource quality and proximity to electrical infrastructure, not by environmental suitability.

The recommendation in this objection is unequivocal: **Alternative 0 (do not build) is the only appropriate choice for this karst landscape.**

6. DOCUMENTATION DEFICIENCIES

6.1 Systematic Errors and Omissions

The technical documentation contains numerous errors and omissions that undermine confidence in the assessment:

Coordinate System Errors: Multiple documents cite "ERTS89" as the coordinate system instead of the correct "ETRS89" (European Terrestrial Reference System 1989):

- p.3/35 in FP-C (Infrastructure document)
- p.21/92 in FP-B (Project document)
- p.59/316 in EsIA (Angle manholes table)

While this may seem like a minor typographical error, it indicates inadequate quality control and raises questions about accuracy of other technical data.

Missing Maps and Scales: Numerous figures lack essential information:

- p.50/316 EsIA: Figure 4 supposedly showing access road shows only a small part
- p.52/316 EsIA: Platform figure has no scale
- p.24/92 FP-B: Situation plan has no scale
- p.30/92 FP-B: Access road picture shows only small section
- p.32/92 FP-B: Platform plan has no scale

Missing GIS Data: The collection area mentioned in the documentation (p.53/316 EsIA, p.34/92 FP-B) was not provided as a shapefile with the mapping package, making it more difficult to verify the described locations.

Archaeological Report Format Issues: The cultural heritage annex (pp.1-42) contains figures without scales or north arrows (Figures 2, 3, 4), making proper assessment of archaeological site locations impossible.

Incorrect Cave Locations: Cueva Otero IV is positioned incorrectly in the documentation. The correct coordinates are 30T 457227 4800177 (ETRS89), and the cave is catalogued as #2788 in the Matienzo Caves Project database. The figure on page 33 of the archaeological report is therefore wrong, calling into question the accuracy of the entire archaeological assessment.

6.2 Generic vs. Site-Specific Analysis

A fundamental flaw throughout the documentation is the reliance on generic statements about renewable energy benefits and generic construction techniques, with minimal site-specific analysis of local conditions and impacts.

Examples of inappropriate generic statements:

Introduction (pp.15-16/316 EsIA):

"The use of renewable energies undoubtedly contributes to preserving the environment and ensuring sustainable development..."

This may be true globally, but it obscures the local reality that this specific wind farm will destroy a sensitive karst ecosystem and degrade viewsheds across a wide area.

Project description (pp.28-29/92 FP-B):

"The route generally runs through undulating terrain with gentle slopes..."

This characterization is misleading. The "undulating terrain" is karst topography characterized by bare limestone, broken limestone, lapiés, sinkholes, and dolines—specific features that should be identified and addressed, not glossed over with generic terrain descriptions.

The 753-page project description document (FP-B) contains not a single mention of "karst" or "kárstico." This is inconceivable for a project sited entirely on karst terrain. It suggests either:

1. The technical team preparing the documentation lacks basic geological knowledge of the site, or
2. The karst nature of the terrain was deliberately downplayed to avoid triggering appropriate levels of scrutiny

6.3 Failure to Address Sierra de Sel Relationship

The Fuente Pico project cannot be considered in isolation from the adjacent Sierra de Sel wind farm (10 turbines) and Las Mazas wind farm (4 turbines). Together, these represent a 17-turbine industrialization of a contiguous karst landscape.

Critical questions that remain unanswered:

1. **Shared evacuation infrastructure**: The 30 kV underground evacuation line from Fuente Pico appears to follow the same route as the 55 kV line from Sierra de Sel (noted in FP-A p.51/316 and FP-D). Are these cables in the same trench? If so, why is this not clearly stated, and how does it affect the impact assessment?
2. **Construction timing**: Will the projects be constructed simultaneously, requiring coordination of earthworks? Or sequentially, requiring reopening of trenches?
3. **Cumulative impacts**: What is the additive effect of 17 turbines plus associated infrastructure on:

    - Karst hydrology and underground ecosystems
    - Sediment and chemical loading to springs
    - Visual impacts across the landscape
    - Road traffic and associated impacts
4. **Coordinated assessment**: Why are these projects being assessed separately when they clearly function as components of a single integrated development?

The failure to properly assess cumulative impacts is a significant deficiency in the environmental assessment process.

7. RESTORATION AND DECOMMISSIONING CLAIMS

7.1 False Promises of Landscape Restoration

The documentation contains repeated assurances about landscape restoration, including:

Page 16/22 (Non-Technical Summary):

"At the end of the works, a geomorphological and physiographic restoration of the temporarily altered areas...will be carried out."

Page 49-50/157 (FP-B, Vegetation and Revegetation section):

[Extensive text about hydroseeding slopes and establishing vegetation cover]

These assurances are misleading in a karst context because:

Karst landforms cannot be restored: Once a limestone ridge is excavated for a road cut, once a doline is filled with imported material, once a platform is cut into a karst slope, these features are permanently destroyed. Natural karst landforms develop over thousands to millions of years through dissolution processes that cannot be replicated through restoration efforts.

Subsurface alteration is permanent: Changes to underground drainage patterns caused by surface modification, compaction, and infrastructure installation cannot be reversed. The three-dimensional alteration of karst hydrology is irreversible.

Access roads are permanent features: The documentation acknowledges (p.16/22) that roads will be retained as "industrial heritage" after decommissioning. Road cuts, embankments, and drainage infrastructure will remain permanently, along with associated visual and environmental impacts.

Foundation impacts persist indefinitely: The turbine foundations (24.4 m diameter, up to 3.2 m thick concrete footings per p.53/316 EsIA) are not removed during decommissioning. They remain as massive underground structures that permanently alter infiltration patterns and represent potential sources of chemical leaching (alkaline concrete, rebar corrosion products).

7.2 The Perpetuity of Impact

The EsIA's discussion of restoration obscures a fundamental truth: this project represents permanent transformation of the landscape, not temporary use. Even if the aerogenerators are eventually removed, the site will never return to its pre-construction condition. The karst relief and landforms will never be restored and new roads will not disappear, no matter how much the promoters write that the landscape will be restored.

This is not a temporary industrial use that can be remediated—it is a permanent sacrifice of a natural karst landscape.

8. REGULATORY AND PROCEDURAL FAILURES

8.1 Inversion of Assessment Process

The most egregious procedural failure is the suggestion that a fundamental hydrogeological study should be conducted *after* project approval rather than before. As noted in Section 1.3, the EsIA lists preparation of "a geological and hydrogeological study of the geological context of the Karst in the Alto de Fuente Pico area" as a mitigation measure (pp.17-18/22, Non-Technical Summary).

This inverts proper environmental assessment procedure. The sequence should be:

1. **Baseline characterization**: Understand existing conditions (geology, hydrology, ecology)
2. **Impact prediction**: Assess how the project will alter those conditions
3. **Design modification**: Adjust project design to minimize impacts
4. **Mitigation planning**: Develop measures to address unavoidable impacts
5. **Monitoring**: Track actual impacts and adaptive management
6. **Assessment documentation**: Compile findings in EsIA

The Fuente Pico assessment has skipped steps 1-3 entirely, proceeding directly to steps 4-6 without the foundational knowledge necessary for meaningful analysis.

8.2 Inadequate Legal Compliance

The EsIA claims to fulfill requirements of Law 12/2013 (p.33/316), specifically:

Item 3: "Environmental inventory and description of key ecological or environmental processes and interactions."

The environmental inventory fails to include:

- Comprehensive karst feature mapping
- Cave entrance locations and protection zones
- Underground drainage network characterization
- Subterranean fauna surveys
- Spring locations and baseline monitoring

Item 4: "Identification, quantification, and assessment of the significant foreseeable effects...using measurable data..."

The impact assessment fails to quantify:

- Sediment loads to groundwater
- Chemical contamination concentrations and fate
- Copper leaching rates and ecosystem uptake
- Underground flow regime alterations
- Cumulative impacts of multiple wind farms

Item 5: "Establishment of preventive, corrective, and compensatory measures to reduce, eliminate, or compensate for significant environmental effects."

The mitigation measures are generic and unquantified:

- No sedimentation pond designs or capacity calculations
- No drainage outlet designs to mimic natural infiltration
- No chemical spill containment plans specific to karst
- No compensatory measures for destroyed karst features
- No plan for protecting identified cave entrances

The EsIA does not meet the legal requirements for adequate environmental impact assessment.

9. VISUAL AND LANDSCAPE IMPACTS

While this objection focuses primarily on hydrogeological and ecological concerns, it would be remiss not to mention the profound visual impacts of installing 196-meter-tall structures on karst ridgelines.

The project description (p.9/316 EsIA) specifies:

"...model Vestas 166-4.5, with a unit power of 4,500 kW, a hub height of 113 meters, and a diameter of 166 meters..."

Total structure height: 196 meters (hub height 113 m + rotor radius 83 m)

These are massive industrial structures that will be visible from great distances across the Cantabrian landscape. The proposal to site them on high points ("Monte Bajo" which forms the skyline in this area) will maximize visual impact.

The karst landscapes of Cantabria are internationally recognized for their scenic quality and have been enjoyed for millennia (Bronze Age artifacts found in nearby caves). The industrialization of these landscapes with 196-meter towers represents a fundamental and permanent alteration of landscape character.

When combined with the Sierra de Sel (10 turbines) and Las Mazas (4 turbines) developments, the cumulative visual impact will transform this section of the Cantabrian karst into an industrial zone rather than a natural landscape.

KEY CONCLUSIONS AND RECOMMENDATIONS

Principal Findings

1. **The Environmental Impact Statement is fundamentally deficient.** It fails to provide adequate hydrogeological characterization, ignores subterranean ecosystems, contains numerous technical errors, and relies on generic rather than site-specific analysis.
2. **The "Low Environmental Sensitivity" classification is incorrect.** Karst terrains are inherently highly sensitive to disturbance due to their three-dimensional interconnected nature and specialized ecosystems.
3. **No proper hydrogeological study has been conducted.** The absence of site-specific assessment of underground drainage patterns, spring connections, and karst aquifer vulnerability makes meaningful impact assessment impossible.
4. **Subterranean fauna and ecosystems are completely ignored.** No surveys, impact assessments, or monitoring provisions address cave-adapted organisms or groundwater-dependent ecosystems.
5. **Construction impacts are inadequately assessed and mitigated.** The scale of earthworks (105,728 m³ excavation, 63,703 m³ imported fill), use of explosives on fractured karst, and absence of proper drainage plans create unacceptable risks.
6. **Contamination pathways are not properly addressed.** Copper leaching, sediment mobilization, and construction chemical risks pose severe threats to karst water quality and biota.
7. **Cumulative impacts are ignored.** The Fuente Pico, Sierra de Sel, and Las Mazas projects represent a 17-turbine industrialization of contiguous karst but are assessed piecemeal.
8. **Restoration claims are false.** Destroyed karst landforms cannot be restored, and impacts on subsurface hydrology are permanent and irreversible.
9. **The assessment process is procedurally flawed.** Fundamental hydrogeological studies are proposed as post-approval "mitigation" rather than as prerequisites for impact assessment.
10. **Documentation quality is poor.** Coordinate system errors, missing scales, incorrect cave locations, and the complete absence of the word "karst" in the 753-page project description indicate inadequate technical rigor.
11. The **Impacts Table** (p205/316 EsIA) is wrong because of the inadequate assessments. Additional icons have been added and explained in Annex A(ii)

Specific Recommendations to Regulatory Authorities

The regulatory authorities responsible for reviewing this project should:

1. **Reject the project as proposed.** The Environmental Impact Statement does not meet minimum standards for assessing impacts on karst terrain and should not be accepted as adequate for decision-making.
2. **Require comprehensive hydrogeological assessment.** Before any wind farm can be considered for this area, a full hydrogeological study must be completed including:
    - Tracer testing to determine underground drainage connections
    - Spring and resurgence mapping with baseline water chemistry and flow monitoring

    - Vulnerability mapping showing direct connections between surface areas and critical springs
    - Cave entrance surveys and protection zone delineation
    - Epikarst characterization
    - Groundwater flow modeling
3. **Require subterranean biological surveys.** Cave-adapted fauna must be surveyed and assessed before impacts can be properly evaluated.
4. **Require integrated cumulative impact assessment.** The Fuente Pico, Sierra de Sel, and Las Mazas projects must be assessed together as components of a single development, not piecemeal.
5. **Re-evaluate environmental sensitivity classification.** The methodology that classified active karst terrain as "low sensitivity" should be reviewed and corrected.
6. **Enforce quality standards.** Documentation with coordinate system errors, missing maps, and incorrect cave locations should not be accepted.
7. **Consider Alternative 0.** The most environmentally appropriate decision for wind farm development on Cantabrian karst is to not build.

Broader Policy Implications

This case highlights a systemic problem with wind farm development in Cantabria.

Since most of Cantabria's mountains are karst limestone, high-elevation areas with good wind resources are almost inevitably karst. This seems like a fundamental conflict between renewable energy goals and protection of sensitive karst hydrogeology and ecosystems.

Cantabria faces a strategic choice: pursue renewable energy targets at the cost of destroying its internationally recognized karst landscapes, or recognize that some areas are inappropriate for industrial development regardless of renewable energy benefits.

The karst of Cantabria is world-renowned. The region's cave systems attract scientific research and tourism. The surface karst landscapes are distinctive features of Cantabrian scenery. The underground ecosystems harbor unique and endemic species found nowhere else.

If all proposed wind farms are erected, Cantabria risks becoming, the 'wind farm capital' of Spain and the autonomous community with the most destroyed surface and underground karst, the worst views and possibly the fewest tourists."

There is no shortage of land in Spain suitable for wind farm development. The focus on Cantabrian karst appears driven by wind resource quality and proximity to demand centers, not by environmental suitability. Other provinces have extensive areas of non-karst geology more appropriate for this type of development.

Final Statement

The Fuente Pico wind farm project represents an unacceptable threat to a sensitive three-dimensional ecosystem. The Environmental Impact Statement fails to adequately characterize the karst environment, assess impacts on subterranean ecosystems, or provide appropriate mitigation measures.

The only environmentally responsible decision is to reject this project and adopt Alternative 0: do not build.

Karst landscapes, once destroyed, cannot be restored. The decision made today will determine whether future generations inherit a functioning karst ecosystem or an industrial wasteland masquerading as a "green" energy site.

REFERENCES

The following peer-reviewed scientific publications and technical guidance documents support the position that wind farm development on karst terrain poses unacceptable environmental risks:

1. van Beynen, P., & Townsend, K. (2005). A disturbance index for karst environments. *Environmental Management*, 36(1), 101-116.

This paper presents a systematic framework for assessing human impacts on karst environments. It identifies key disturbance factors including:

- Surface alterations that modify infiltration patterns
- Introduction of sediment and contaminants to karst aquifers
- Impacts on endemic cave fauna
- Irreversibility of karst feature destruction

The disturbance index methodology directly contradicts the "low environmental sensitivity" classification applied to the Fuente Pico site and provides quantitative assessment tools that should have been employed in the EsIA.

Availability: Available through academic databases; DOI: 10.1007/s00267-004-0265-9

2. Goldscheider, N., & Drew, D. (Eds.). (2007). *Methods in Karst Hydrogeology*. Taylor & Francis.

This comprehensive textbook is the international standard reference for karst hydrogeological investigation. Chapter 3 (Vulnerability and Contamination Risk Mapping) is particularly relevant, establishing that:

- Karst aquifers are intrinsically vulnerable due to rapid flow with minimal filtration
- Construction activities pose severe risks through direct hydraulic connection between surface and groundwater
- Proper impact assessment requires tracer testing to determine connection times and pathways
- Generic mitigation measures designed for granular aquifers are ineffective in karst settings

The methods described in this volume represent minimum standards for hydrogeological assessment of development on karst—standards that the Fuente Pico EsIA fails to meet.

Availability: Available through libraries and academic publishers; ISBN: 978-0415428736

3. Culver, D.C., & Pipan, T. (2009). *The Biology of Caves and Other Subterranean Habitats*. Oxford University Press.

This authoritative text on subterranean biology demonstrates that:

- Cave and groundwater ecosystems support highly specialized fauna with extreme vulnerability to disturbance
- Many karst regions harbor endemic species found nowhere else
- Subterranean communities require decades to centuries for recovery from disturbance
- Standard surface ecological survey methods are inadequate for assessing subsurface impacts

The complete absence of cave fauna assessment in the Fuente Pico EsIA represents a fundamental failure when evaluated against the scientific standards established in this reference.

Availability: Oxford University Press; ISBN: 978-0199219926

4. Technical report on groundwater dependent terrestrial ecosystems, Technical report No. 6 (2012)

Published by: European Commission, Directorate-General for Environment
ISBN: 978-92-79-21692-3
DOI: 10.2779/93018

This report addresses groundwater-dependent terrestrial ecosystems in the context of EU water policy and protection requirements

Availability: Freely available online at https://op.europa.eu/en/publication-detail/-/publication/f7bd5cf8-c62c-41f6-8138-fe922a1f6410

5. Parise, M., Closson, D., Gutiérrez, F., & Stevanović, Z. (2015). Anticipating and managing engineering problems in the complex karst environment. *Environmental Earth Sciences*, 74(1), 7823-7835.

This paper specifically addresses engineering challenges in karst terrain, documenting:

- Unpredictable subsidence and stability problems due to hidden voids
- Contamination incidents from construction activities on karst
- Failure of standard drainage and foundation designs in karst settings
- Need for specialized site investigation methods including geophysical surveys and exploratory drilling

The generic construction specifications in the Fuente Pico project documentation fail to incorporate the specialized approaches this paper identifies as essential for karst environments.

Availability: Available through academic databases; DOI: 10.1007/s12665-015-4647-5

6. Hartmann, A., Goldscheider, N., Wagener, T., Lange, J., & Weiler, M. (2014). Karst water resources in a changing world: Review of hydrological modeling approaches. *Reviews of Geophysics*, 52(3), 218-242.

This comprehensive review demonstrates that:

- Karst aquifer behavior is fundamentally different from other aquifer types
- Prediction of impacts requires specialized modeling approaches
- Rapid flow velocities (up to km/day) mean contaminants can reach receptors quickly
- High spatial variability makes point predictions uncertain

The review establishes that the generic groundwater impact assessment in the Fuente Pico EsIA is inadequate for karst terrain, where specialized investigation and modeling approaches are required.

Availability: Open access through American Geophysical Union; DOI: 10.1002/2013RG000443

ANNEX A(i): DETAILED QUOTE AND COMMENT COMPILATION

This annex presents quotes from the Environmental Impact Statement and related documentation in the order they appear in the EsIA document (EOL-43-2022_EsIA(256.3.5).pdf), along with associated commentary. Material from other documents (Project Description, Infrastructure, Cartography) is integrated where it addresses the same issues. Page references use the format "p4/14" meaning page 4 of a 14-page document.

Not included in the English version

ANNEX A(ii): ADDITIONAL IMPACTS

-1 Impacto negativo teniendo en cuenta los ecosistemas kársticos superficiales y subterráneos

-1 Un posible impacto negativo, teniendo en cuenta los ecosistemas kársticos superficiales y subterráneos.

X Los resultados positivos propuestos no se producirán con los ecosistemas kársticos.

MATRIZ DE IDENTIFICACIÓN DE IMPACTOS		ATMÓSFERA Y AMBIENTE SONORO					CAMBIO CLIMÁTICO	GEOLOGÍA Y GEOMORFOLOGÍA		EDAFOLOGÍA		HIDROLOGÍA E HIDROGEOLOGÍA			FLORA Y VEGETACIÓN		FAUNA				FIGURAS DE PROTECCIÓN			FACTORES SOCIALES Y ECONÓMICOS			PATRIMONIO CULTURAL Y ARQUEOLÓGICO	PAISAJE	
(-1) Impactos negativos (+1) Impactos positivos		Calidad del aire	Contaminación lumínica	Contaminación electromagnética	Contaminación acústica	Olores	Huella de carbono	Características geológicas	Cambios en el relieve	Pérdida de suelo	Compactación, erosión y contaminación	Alteración de la calidad de las aguas superficiales	Alteración de la calidad de las aguas subterráneas	Alteración del drenaje, caudal y escorrentía superficial	Abundancia, densidad y diversidad	Afectación a especies protegidas e HICs	Aislamiento de poblaciones	Abundancia y diversidad	Mortalidad directa o indirecta	Afectación a especies protegidas o singulares	Red d Espacios Protegidos	Red Natura 2000	Otros espacios de interés	Variación modo de vida (cambios uso suelo, linfraestructuras, etc)	Economía local	Salud pública y seguridad	Afectación al patrimonio cultural y arqueológico	Alteración de la calidad paisajística	Visibilidad
FASE DE CONSTRUCCIÓN	Construcción y adecuación de viales	-1			-1			-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1			-1	-1			-1	-1	
	Montaje de instalaciones auxiliares y acopio de materiales								-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1				-1				-1	-1
	Tráfico de maquinaria y personal	-1			-1		-1	-1			-1	-1	-1		-1	-1			-1	-1				-1		-1			
	Despeje y desbroce	-1			-1		-1			-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1			-1					-1	
	Movimientos de tierra y apertura de zanjas	-1			-1			-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1			-1	-1		-1	-1	-1	
	Cimentaciones y montaje de elementos permanentes		-1					-1			-1	-1	-1	-1										-1				-1	-1
	Generación y gestión de residuos										-1	-1	-1					-1	-1							-1			
	Mano de obra y actividades económicas asociadas																								1				
FASE DE OPERACIÓN	Presencia del proyecto		-1	-1	-1						-1						-1	-1	-1	-1		-1				-1	-1	-1	-1
	Generación de energía	1					1																		1				
	Mantenimiento de la instalación				-1						-1							-1	-1										
	Generación y gestión de residuos										-1	-1	-1													-1			
	Mano de obra y actividades económicas asociadas																								1				
FASE DE DESMANTELAMIENTO	Desmantelamiento y retirada de los elementos del proyecto		-1				-1	-1				-1	-1	-1			X	X	X	X		1	1		-1	1		X	X
	Desmontaje de obra civil y restauración ambiental				-1				X			-1	-1	-1	1	1	-1	-1	-1	-1			1					X	1
	Tráfico de maquinaria y personal	-1			-1		-1	-1			-1	-1	-1		-1	-1			-1	-1				-1		-1			
	Generación y gestión de residuos										-1	-1	-1					-1	-1							-1			
	Mano de obra y actividades económicas asociadas																								1				

Ver página siguiente

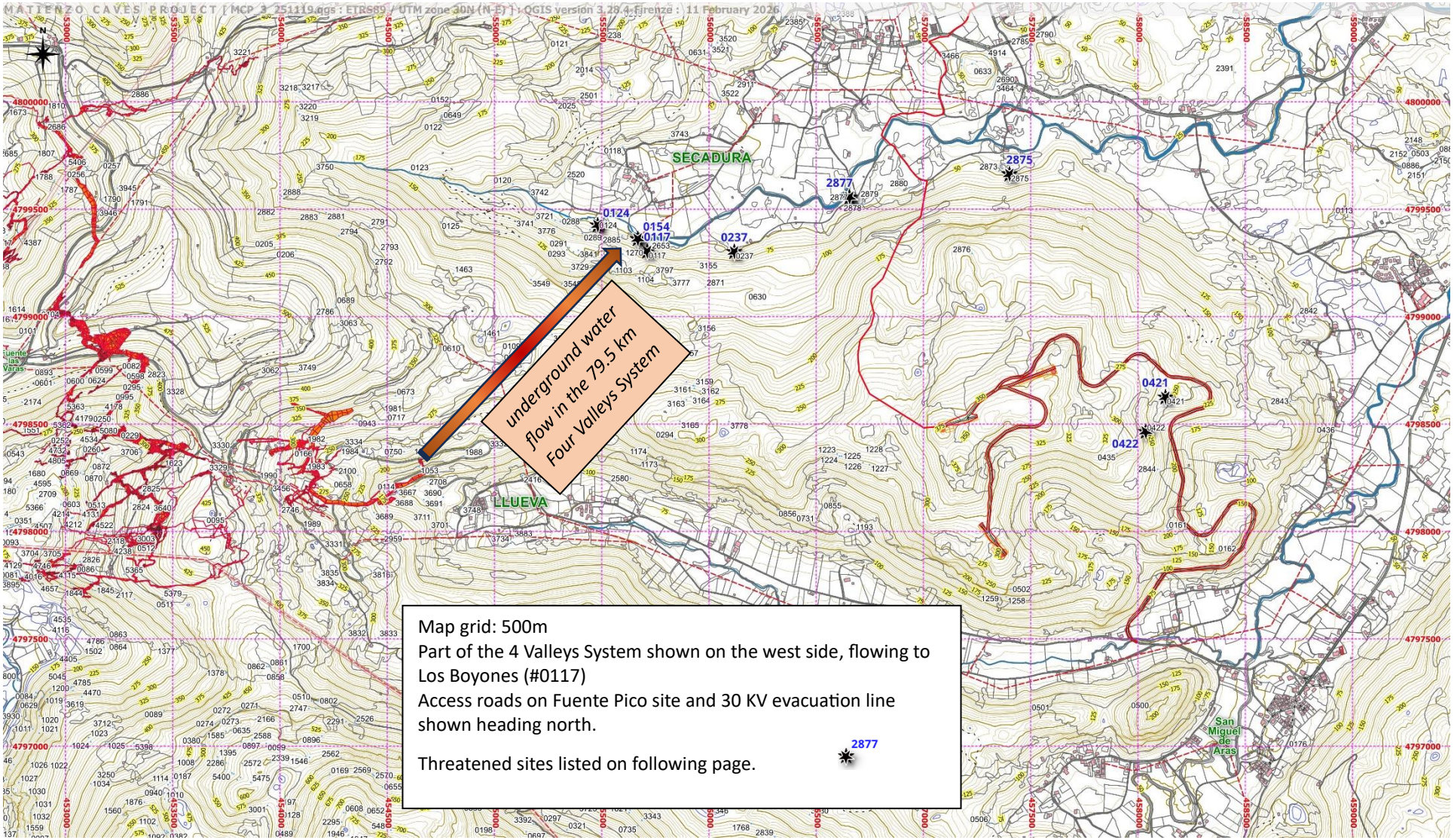
A B D G N O P Q

Notas sobre la matriz de Identificación de Impactos (EsIA página 205)

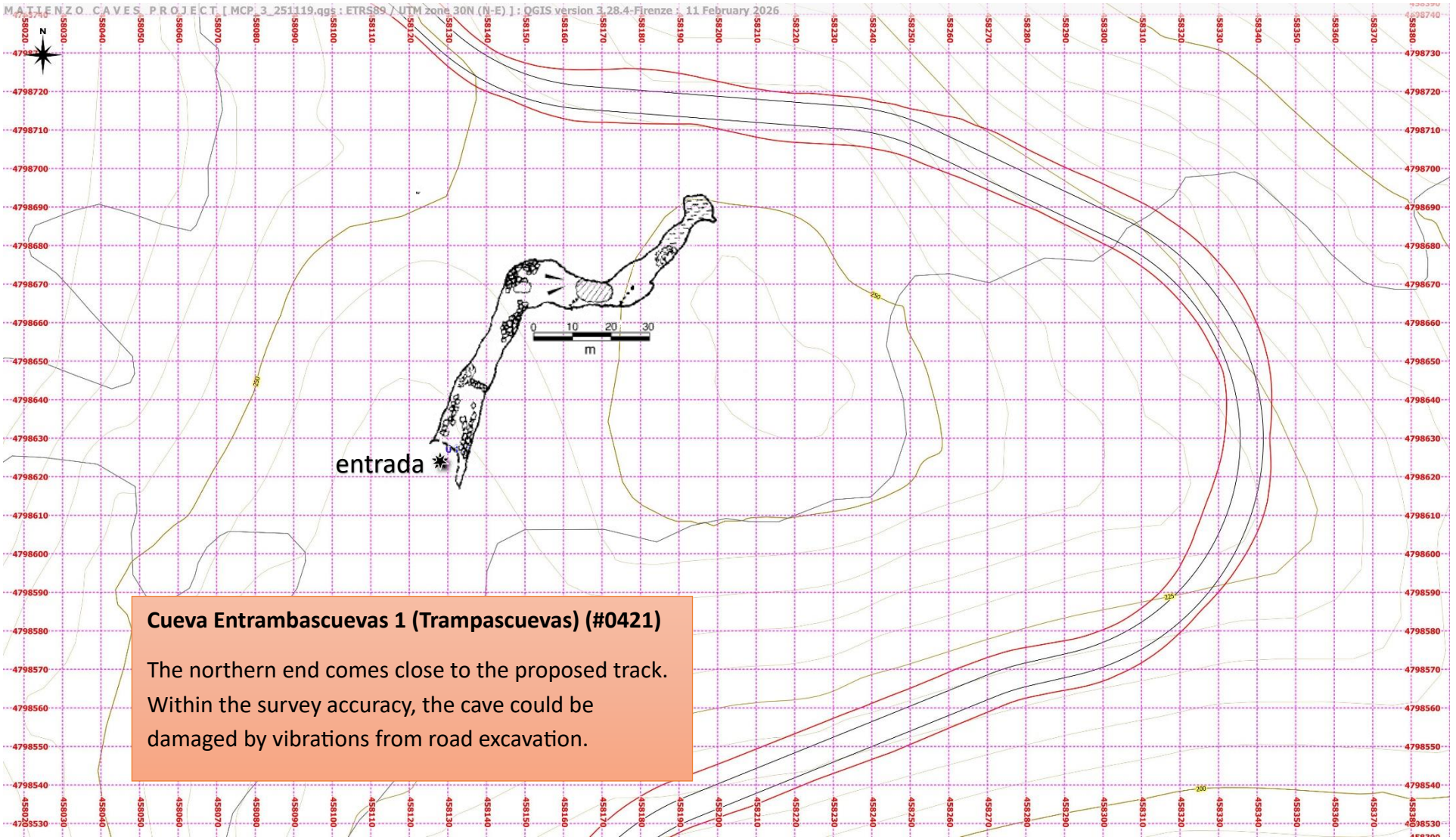
Notes regarding the Identification of Impacts matrix (EsIA page 205)

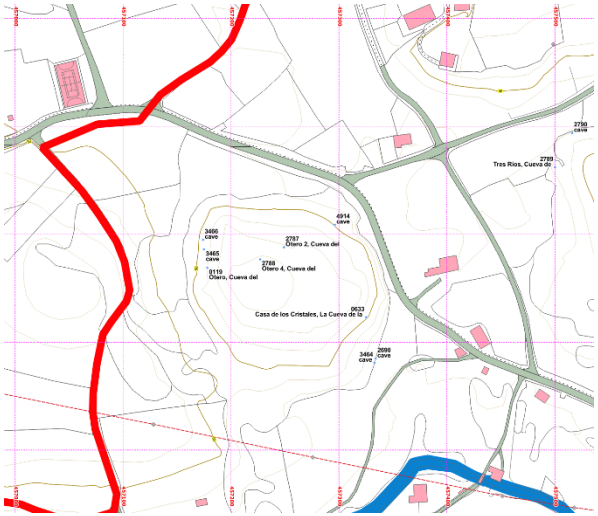
A	La construcción de carreteras generará barro, limo y otros desechos, algunos de los cuales se infiltrarán al ecosistema subterráneo.	The construction of roads will generate mud, silt and other debris, some of which will infiltrate to the underground ecosystem.
B	El área de recolección de 3390 m² es un terreno rectangular inclinado (65 x 52 m) con árboles y piedra caliza. ¿Es esta la zona correcta? ¿Se requieren caminos? Cualquier movimiento de tierra o piedra caliza tendrá un impacto negativo, como se muestra.	Collection area of 3390m² is a sloping, rectangular (65 x 52m) site in trees and limestone. Is this the correct area? Road(s) required? Any earth / limestone movement will have a negative impact as shown.
D	Habrá efectos subterráneos dependiendo de qué tan severa sea la limpieza.	There will be effects underground depending on how harsh the clearance is.
G	Cualquier escorrentía de desechos se infiltrará al subsuelo.	Any runoff from the waste will infiltrate to the underground.
N	La maquinaria pesada utilizada para el desmantelamiento alterará el drenaje y la escorrentía superficial. (-1) Desde el punto de vista de la fauna subterránea, no habrá un impacto positivo al eliminar elementos del proyecto. Las bases de hormigón aún serán visibles.	Heavy machinery used for dismantling will alter the drainage and surface runoff. (-1) From the point-of-view of underground fauna, there will not be a positive impact by removing project elements. The concrete bases will still be visible.
O	El desmantelamiento de las obras civiles y la restauración ambiental no funcionarán. Es imposible restaurar el accidentado paisaje kárstico. Si se intenta retirar las plataformas de hormigón y allanar la zona, esta tendrá un aspecto totalmente artificial. Cualquier restauración afectará los ecosistemas subterráneos con escorrentías, barro, etc. No habrá un impacto positivo en la calidad del campo, sólo un impacto negativo diferente.	The dismantling of civil works and environmental restoration will not work. There is no way in which the rugged karst landscape can be restored. If an attempt is made to remove the concrete platforms and smooth off the area it will look totally artificial. Any restoration will affect the underground ecosystems with runoff, mud, etc. There won't be a positive impact on the countryside quality, just a different negative impact.
P	Barro extra producido por el tráfico, contaminando cualquier escorrentía.	Extra mud produced by traffic. polluting any runoff.
Q	Cualquier escorrentía de desechos se infiltrará al subsuelo.	Any runoff from the waste will infiltrate to the underground.

ANNEX B: Caves and springs (water supplys) at risk



all phases	0117	Boyones, Los	Secadura	455712	4799303	49	Cave with deep water. Resurgence for the 4 Valleys System (78km).	This is a major, secure regional resurgence. Behind the entrance pool and abstraction point there is a complex network of cave passages bringing water from Riaño, Llueva, Secadura (north) and Matienzo. Some of the Matienzo feeder water comes from Cueva Vallina at Arredondo, a straight line distance of 8.4km. See also other sites related to this complex resurgence and drinking water supply: #0154, #0124	**Altered water flows + pollution**	https://matienzocaves.org.uk/descrip/0117.htm
all phases	0124	Crecidas, Surgencia de las	Secadura	455481	4799425	52	Resurgence with cave passage.	Length 200m; Depth 5m See also other sites related to this complex resurgence and drinking water supply: #0117, #0154	**Altered water flows + pollution**	https://matienzocaves.org.uk/descrip/0124.htm
all phases	0154	77A, Cueva	Secadura	455668	4799361	48	Cave with deep water. probably connected to #0117, the cave behind the main resurgence.	Length 466m; Depth 5m - See also other sites related to this complex resurgence and drinking water supply: #0117, #0124	**Altered water flows + pollution**	https://matienzocaves.org.uk/descrip/0154.htm
all phases	0237	Bodegon, El	Secadura	456118	4799301	53	Cave with deep water.	Length 347m; Depth 15m	**Altered water flows + pollution**	https://matienzocaves.org.uk/descrip/0237.htm
all phases	0421	Entrambascuevas 1	San Pantaleón de Aras	458128	4798624	237	Archaeological cave	Length 103m The survey of this archaeologically important cave shows the passage heading northeast from the entrance towards the track. The cave appears to be little distance below the surface and would be easily damaged.	**Collapse of end of cave; traffic vibrations damaging formations and disturbing bats. See map on the following page.**	https://matienzocaves.org.uk/descrip/0421.htm
all phases	0422	Entrambascuevas 2	San Pantaleón de Aras	458036	4798464	263	Cave with delicate formations.	Length 205m Easily damaged with vibration.	**Damage to formations caused by vibrations.**	https://matienzocaves.org.uk/descrip/0422.htm
all phases	2875	resurgence	Secadura	457401	4799662	43	Resurgences.	A set of small springs.	**Altered water flows + pollution**	https://matienzocaves.org.uk/descrip/2875.htm
all phases	2877	resurgence	Secadura	456655	4799555	40	Resurgence with cave passage.	Small spring.	**Altered water flows + pollution**	https://matienzocaves.org.uk/descrip/2877.htm


M A T I E N Z O C A V E S P R O J E C T [MCP_3_251119.qgs : ETRS89 / UTM zone 30N (N-E)] : QGIS version 3.28.4-Firenze : 11 February 2026
N
0 10 20 30
m
entrada
Cueva Entrambascuevas 1 (Trampascuevas) (#0421)
The northern end comes close to the proposed track. Within the survey accuracy, the cave could be damaged by vibrations from road excavation.



Map grid: 100m

The red line is the proposed trench carrying the 30 kV evacuation line from Fuente Pico (and the 55 kV line from the Sierra de Sel wind farm proposal?)

Caves here possibly threatened by vibrations:

code	Name & link to description
0119	Cueva del Otero
0633	La Cueva de la Casa de los Cristales
2690	Cave
2787	Cueva del Otero 2
2788	Cueva del Otero 4
3464	Cave
3465	Cave
3466	Cave
4914	cave

Correcting a position error, Cueva del Otero IV (#2788) is found near the top of the small hill.

Other cave(s):
Peñarrobra Cave (#0502) is at approximately 457408 4797731 (Datum: ETRS89), about 166m map distance and about 75m below generator 3.

ANNEX C: Views down Llueva valley

	The view from the west end of the Llueva valley, just before the road from Fuente las Varas levels out. The arrow points to the area where it is proposed to install 3 193m-high generators. The top of the hill is about 225m above valley bottom. *Photo: Harry Long*
	The fine view looking down the Llueva valley, from the road that winds down from Fuenta las Varas. The arrow points to the area where it is proposed to install 3 193m-high generators. The top of the hill is about 225m above valley bottom. These are huge generators, completely out of proportion to the landscape. *Photo: Harry Long*

ANNEX D: Cantabroniscus

A request for information to AI Claude about this crustacean came back with the information below

Cantabroniscus primitivus is a fascinating cave-dwelling isopod crustacean endemic to the Cantabrian Mountains in northern Spain.

Biology and Classification

- It belongs to the family Trichoniscidae within the suborder Oniscidea (terrestrial isopods or woodlice)
- It's considered a relict species with primitive characteristics, reflected in its species name "primitivus"
- It's the only species in its genus (Cantabroniscus)

Habitat and Distribution

- Found exclusively in limestone caves of the Cantabrian Mountains in northern Spain
- Inhabits subterranean aquatic environments, particularly in karst systems
- Restricted to a very limited geographical range, making it extremely endemic

Adaptations

- Like many cave organisms, it displays troglomorphic adaptations including:
    - Lack of pigmentation (typically appearing whitish or translucent)
    - Reduced or absent eyes
    - Elongated appendages for sensing its environment
    - Slow metabolism adapted to the resource-limited cave environment

Conservation Status

- Due to its extremely limited range and specialized habitat requirements, it's considered vulnerable to environmental changes
- Threats include groundwater pollution, disturbance of cave systems, and climate change impacts on the karst hydrology

This species represents an important example of specialized evolution in subterranean environments and is of significant interest to biospeleologists.

Cantabroniscus has been photographed at least 6 times in different caves in and around Matienzo.



Above: Cantabroniscus in Orillonzuco (#1162) Photo: Juan Corrin

Below: Cantabroniscus in Cueva de Fresnedo 2 (#0841)
Photo: Simon Cornhill



ANNEX E(i): Explosives – large scale use

Concerned with the use of explosives in a karst area, the following prompt was put to Claude AI (Sonnet 4.5):
"Please critique this extract [1.5.10.2 USE OF EXPLOSIVES from "DOCUMENT No. 3 – SPECIFIC TECHNICAL REQUIREMENTS in EOL-44-2022_Proyecto(289.3.1.01_0).pdf"] and give me a proper method of working within a limestone karst area, including recommendations as to whether explosives should be used - and possible alternatives."

Critique of Generic Explosives Specification for Limestone Karst Terrain

Critical Deficiencies

You're absolutely correct—this specification is **dangerously generic** for limestone karst terrain. It reads like a standard highway construction document and completely fails to address the unique geological hazards of karst environments.

Major Omissions:

1. **No karst-specific geological investigation requirements**
    - No cavity detection surveys (Ground Penetrating Radar, electrical resistivity, seismic refraction)
    - No groundwater tracing or dye studies
    - No speleological assessment
    - No evaluation of rock mass discontinuities and solution-enlarged fractures
2. **Complete ignorance of groundwater vulnerability**
    - Karst aquifers are among the most vulnerable to contamination
    - Explosives residues (nitrates, ammonia, fuel oils) can rapidly contaminate entire watershed systems
    - No consideration of protected springs, wells, or underground water supplies
    - No mention of Environmental Protection Zone designations common in karst areas
3. **Generic vibration criteria are inadequate**
    - DIN 4150 addresses building damage, not cave roof stability
    - Underground voids can collapse at much lower vibration thresholds
    - No consideration of thin rock bridges, natural arches, or delicate geological features
    - Slope stability in fractured karst limestone is highly sensitive to vibration
4. **No recognition of blast-induced fracturing risks**
    - New fractures can interconnect existing voids, causing catastrophic collapse
    - Blast damage zones in fractured karst can extend 10-20x farther than in competent rock
    - Progressive failure can occur days/weeks after blasting
5. **Assumes blasting is acceptable** rather than evaluating whether it should be avoided entirely

---

Proper Method for Working in Limestone Karst

Phase 1: Comprehensive Pre-Construction Investigation

Geological & Hydrogeological Studies:

- Multi-method cavity detection (GPR, ERT, microgravity, seismic)
- Core drilling with downhole camera inspection (NOT percussion drilling)
- Identify all caves, voids, solution features within 100m of each turbine
- Groundwater tracing to map subsurface drainage
- Rock Quality Designation (RQD) and rock mass classification
- Identify "no-go" zones where caves/voids preclude development

Environmental Baseline:

- Inventory springs, wells, and surface water sinking points within 2km
- Baseline water quality monitoring
- Cave fauna surveys (many karst species are endangered)
- Establish vibration monitoring points in sensitive areas

Phase 2: Foundation Design Adapted to Karst

For 196m turbines on sloping karst:

- Consider drilled pier foundations extending through weathered zone to competent rock
- Cavity grouting may be required before foundation construction
- Each turbine location may require unique foundation design
- Pad foundations are typically unsuitable in karst—too sensitive to differential settlement

Phase 3: Excavation Strategy (Minimize or Eliminate Blasting)

RECOMMENDATION: AVOID EXPLOSIVES ENTIRELY

Primary Alternative Methods:

1. **Mechanical Excavation with Rock Breakers**
    - Hydraulic hammer attachments on excavators
    - Controlled, low-vibration removal
    - Allows inspection during excavation to detect voids
    - **Best option for karst environments**
2. **Non-Explosive Demolition Agents (NEDA)**
    - Expansive grouts (e.g., Dexpan, Betonamit)
    - Drill holes, fill with expanding agent, wait 24-48 hours
    - Zero vibration, zero flyrock, silent
    - Slower but much safer in karst
    - Ideal for rock with RQD < 50%
3. **Diamond Wire Sawing**
    - For creating precise cuts in competent rock
    - Vibration-free
    - Expensive but appropriate for sensitive locations
4. **Hydraulic Rock Splitters**
    - Wedge-type splitting systems
    - Controlled fracturing along predetermined planes
    - Low vibration
5. **Roadheader or Tunnel Boring**
    - For access road cuts in very difficult terrain
    - Continuous mechanical cutting
    - Allows immediate support installation

IF Explosives Must Be Used (Last Resort):

Restricted Blasting Protocol for Karst

Pre-Blast Requirements:

- 3D mapping of all voids within 200m
- Trial blast monitoring at each new location
- Peak Particle Velocity limits: **< 50 mm/s near voids**, < 25 mm/s for delicate features
- Frequency analysis (low-frequency waves travel farther in karst)

Controlled Blasting Techniques:

- **Microblasting only**: Maximum 5-10 kg per delay
- Pre-splitting or smooth blasting to create damage control boundaries
- Electronic detonators for precise timing
- Deck charges (small charges separated by stemming)
- Never use ANFO in fractured rock (coupling is poor, energy dissipation excessive)
- Use emulsion explosives with lower detonation velocity

Specific Karst Restrictions:

- No blasting within 50m of known voids
- No blasting within 100m of cave entrances
- Drilling pattern must avoid intersecting solution channels
- All blast holes inspected with downhole camera before charging
- If void intersected, hole abandoned and grouted
- Continuous seismic monitoring during blasting operations

Phase 4: Access Road Construction in Karst

Critical Considerations:

- Roads on sloping karst are especially problematic (drainage, stability)
- Minimize cut-and-fill (use elevated viaduct sections where necessary)
- Never route drainage into sinkholes without engineered treatment
- Road drainage must be managed to prevent sinkhole formation
- Expect significant variation in excavation depth to reach competent rock
- Retaining walls may require rock anchors drilled into competent limestone

Construction Sequence:

1. Clear vegetation minimally (roots stabilize epikarst)
2. Map all surface karst features along alignment
3. Excavate in short sections with continuous geological supervision
4. If cavity encountered, stop, assess, grout or reroute
5. Never backfill over ungrouted voids

Phase 5: Monitoring & Contingency

Real-Time Monitoring:

- Seismographs at sensitive locations during any blasting

- Water quality monitoring before, during, and after construction
- Settlement monitoring if working near known voids
- Cave atmosphere monitoring if working near cave systems

Contingency Plans:

- Emergency void grouting materials on-site
- Alternative foundation designs prepared
- Sinkhole collapse response protocol
- Groundwater contamination response plan

Summary Recommendation

For a wind farm on **rugged, sloping limestone karst** with **196m turbines**, I strongly recommend:

1. ✅ **AVOID EXPLOSIVES** - Use mechanical methods (rock breakers, NEDA)
2. ✅ **Invest heavily in pre-construction investigation** - 3-5% of project cost
3. ✅ **Expect site-specific solutions** - No two turbine locations will be identical
4. ✅ **Engage karst specialist geotechnical engineer** and hydrogeologist
5. ✅ **Plan for 20-30% longer construction time** compared to non-karst sites
6. ✅ **Budget for cavity grouting** - likely needed at multiple locations

The current specification should be rejected and replaced with one written specifically for karst conditions, preferably by someone with experience in karst geotechnical engineering.

The cheapest approach initially (blasting everything) will likely be the most expensive ultimately (foundation failures, sinkholes, litigation, environmental damage).

ANNEX E(ii): Explosives for trench excavation

Concerned with the use of explosives in a karst area, the following prompt was put to Claude AI (Sonnet 4.5):
"Building a 13.4km trench to take a 55kV 3 phase line from a wind farm to a distribution substation. The trench dimensions are 1.6m deep and 0.65m wide. Along the length there are to be 8 prefabricated splicing chambers built (each 7.9m x 2.4m x 3.15m depth). This trench is going to run through limestone karst (with some interleaved sandstone beds). The working methods could involve jack hammer and explosives.
Please give a full analysis of this situation, especially the possible damage to nearby cave chamber roofs. Is there any other methods to sensibly remove limestone in a trench?"

Comprehensive Analysis: Trenching Through Limestone Karst

Primary Concerns with Cave Chamber Damage

Critical Risks:

1. **Unknown cavity locations** - Karst topography features unpredictable void spaces ranging from small cavities to large chambers
2. **Roof collapse potential** - Disturbance from above can destabilize naturally-formed chamber roofs, especially if:
    - Roof thickness is minimal (< 2-3m above cavity)
    - Rock is weathered or fractured
    - Natural support pillars are compromised
3. **Cascading failures** - One collapse can trigger adjacent failures in interconnected systems

Working Method Analysis

Jack Hammers/Pneumatic Breakers:

- **Vibration level:** Moderate (localized)
- **Risk:** Medium - Can cause progressive fracturing of roof rock, especially in thin or weathered zones
- **Concern:** Repeated impact stress may propagate cracks into cave roofs

Explosives:

- **Vibration level:** HIGH (far-reaching)
- **Risk:** VERY HIGH in karst
- **Specific dangers:**
    - Ground shock waves travel efficiently through limestone
    - Can destabilize chambers 50-100m+ from blast site
    - May trigger delayed collapses (hours to weeks later)
    - Difficult to control in fractured/bedded limestone
    - **NOT RECOMMENDED in known/suspected cave areas**

Safer Alternative Excavation Methods

1. Rock Trenchers/Chain Trenchers:

- Continuous cutting action with minimal vibration
- Can handle medium-strength limestone
- More predictable than impact methods
- Better for maintaining trench stability

2. Hydraulic Rock Breakers with Damping:

- Lower frequency, less ground transmission than pneumatic
- Can be fitted with vibration-dampening mounts
- More controlled energy application

3. Controlled Rock Sawing:

- Diamond wire or chain saws
- Minimal vibration
- Very precise cutting
- Expensive but safest for sensitive areas
- Good for sandstone beds

4. Hydraulic Splitting/Bursting:

- Near-zero vibration
- Uses hydraulic expansion in drilled holes
- Slow but extremely cave-friendly
- Ideal for confirmed sensitive zones

5. Chemical Rock Splitting (Expansive Agents):

- Zero vibration/shock
- Drill holes, insert expanding cement/compound
- Slow (12-48 hours per cycle)
- Very expensive but safest option
- Examples: Dexpan, Bristar

Essential Pre-Construction Investigations

1. Geophysical Surveys:

- Ground Penetrating Radar (GPR) - limited depth but good for shallow voids
- Electrical Resistivity Tomography (ERT) - detects air/water-filled cavities
- Seismic refraction - identifies velocity contrasts (rock vs void)
- Microgravity - can detect larger voids

2. Borehole Investigation:

- Rotary drilling with careful logging
- Downhole camera/CCTV inspection
- Acoustic televiewer logging
- Note: Boreholes can themselves break into chambers - requires experienced drillers

3. Cave Registry Research:

- Check with local caving organizations (you mentioned Matienzo caves - is this in Cantabria region?)
- Survey records may show known cave passages near route
- Speleological societies often have invaluable data

4. Desktop Study:

- Geological maps for limestone types/bedding
- Sinkhole/depression mapping
- Spring locations (indicate active flow systems)
- Historical records of subsidence

Risk Mitigation Strategies

Design Phase:

1. **Route optimization** - Avoid known cave areas even if longer
2. **Depth reduction** - Consider shallower trench where ground investigation permits
3. **Trench width** - Your 0.65m is relatively narrow (good)
4. **Splicing chamber locations** - These deeper excavations (3.15m) are highest risk

Construction Phase:

1. **Continuous monitoring:**
    - Vibration sensors (geophones) at intervals along route
    - Set trigger thresholds (typically <10 mm/s PPV for sensitive structures)
    - Visual inspection ahead and behind excavation face
2. **Adaptive methodology:**
    - Have equipment for multiple excavation methods on standby
    - Switch to lower-impact methods when anomalies detected
    - Geologist/karst specialist on-site during excavation
3. **Grouting program:**
    - Pre-treat detected voids with controlled low-strength grout
    - Stabilize loose roof rock before excavation
    - Create temporary support for chamber roofs
4. **Support installation:**
    - Immediate trench support system (sheeting, hydraulic shores)
    - Don't leave excavations open longer than necessary
    - Rock bolting if roof rock exposed
5. **Excavation sequence:**
    - Work in shorter sections (50-100m)
    - Allow rock mass to "relax" between sections
    - Monitor for ground movement/settlement

Specific Concerns for Your Project

Splicing Chambers (7.9m x 2.4m x 3.15m deep):

- These represent **significant risk** - much larger excavation
- Depth increase from 1.6m to 3.15m nearly doubles rock stress redistribution
- Consider:
    - Pre-excavation ground treatment
    - Alternative designs (shaft access with horizontal gallery?)
    - Prefabricated caissons that minimize excavation volume
    - Spacing away from highest-risk karst zones

Sandstone Interbeds:

- Often more competent than limestone
- May act as natural roof protection for caves below

- But can also create perched water tables
- Excavate carefully - can be load-bearing layer

Environmental/Legal Considerations

1. **Cave protection legislation** - Many jurisdictions protect caves as natural heritage
2. **Water resource protection** - Karst aquifers are vulnerable
3. **Bat habitat** - Caves may have protected species
4. **Archaeological sites** - Caves often contain artifacts
5. **Insurance** - Notify insurers of karst ground conditions

Recommended Approach

Minimum Standard:

1. **Comprehensive geophysical survey** of entire route
2. **Trial excavations** in representative geology (5-10 locations)
3. **Exclusion zones** around any detected significant voids (minimum 10m radius)
4. **Primary method:** Rock trencher with hydraulic breaker backup
5. **AVOID explosives entirely** unless route can be confirmed cave-free
6. **Grouting program** for any voids intersected
7. **Real-time monitoring** during all excavation

Gold Standard:

1. All of the above PLUS:
2. **Speleological survey** of known cave systems near route
3. **3D ground model** integrating all survey data
4. **Karst specialist** on project team throughout
5. **Contingency budget** for dealing with unexpected voids (20-30% of excavation cost)

Final Recommendation

Do NOT use explosives for this project. The risk to cave systems is too high and the potential consequences (catastrophic roof collapse, injury, environmental damage, project delays, legal liability) far outweigh any cost savings.

Invest in proper ground investigation and use mechanical excavation with vibration monitoring. The upfront cost is higher but the risk reduction is substantial.

ANNEX F: Matienzo Caves Project

El Proyecto de Cuevas de Matienzo

El Proyecto de Cuevas de Matienzo es una iniciativa de larga trayectoria dedicada a explorar, documentar y preservar los extensos sistemas de cuevas en y alrededor de la depresión de Matienzo en el norte de España desde la década de 1960. Operando con permisos oficiales del Gobierno de Cantabria, el proyecto realiza expediciones sistemáticas que han documentado miles de cuevas, creando un archivo digital y físico integral de topografías, fotografías, descripciones de cuevas y datos geológicos.

El proyecto sirve como un centro de colaboración internacional donde espeleólogos experimentados y novatos trabajan juntos para ampliar el conocimiento de estas formaciones kársticas únicas, promoviendo la conservación de cuevas y apoyando la investigación científica en campos como la arqueología, hidrología, biología y cambio climático.

A través de su sitio web interactivo, el Proyecto de Cuevas de Matienzo hace sus hallazgos accesibles al público, permitiendo a investigadores y entusiastas de todo el mundo beneficiarse de sus sesenta y cinco años de exploración espeleológica, mientras crea conciencia sobre la importancia de proteger estos frágiles ecosistemas subterráneos.

The Matienzo Caves Project

The Matienzo Caves Project is a long-standing initiative dedicated to exploring, documenting, and preserving the extensive cave systems in and around the Matienzo depression of northern Spain since the 1960s. Operating with official permits from the Cantabrian Government, the project conducts systematic expeditions that have documented thousands of caves, creating a comprehensive digital and physical archive of surveys, photographs, cave descriptions and geological data.

The project serves as an international collaborative hub where experienced and novice cavers work together to expand knowledge of these unique karst formations while promoting cave conservation and supporting scientific research in fields such as archaeology, hydrology, biology and climate change.

Through its interactive website, the Matienzo Caves Project makes its findings publicly accessible, allowing researchers and enthusiasts worldwide to benefit from its sixty-five years of speleological exploration while raising awareness about the importance of protecting these fragile underground ecosystems.

END OF OBJECTION DOCUMENT

Submitted by:

Juan Corrin
(NIE Y5528443-Q)
[juancorrin@matienzo.org.uk]

On behalf of Matienzo Caves Project

Signature

12th February 2026
