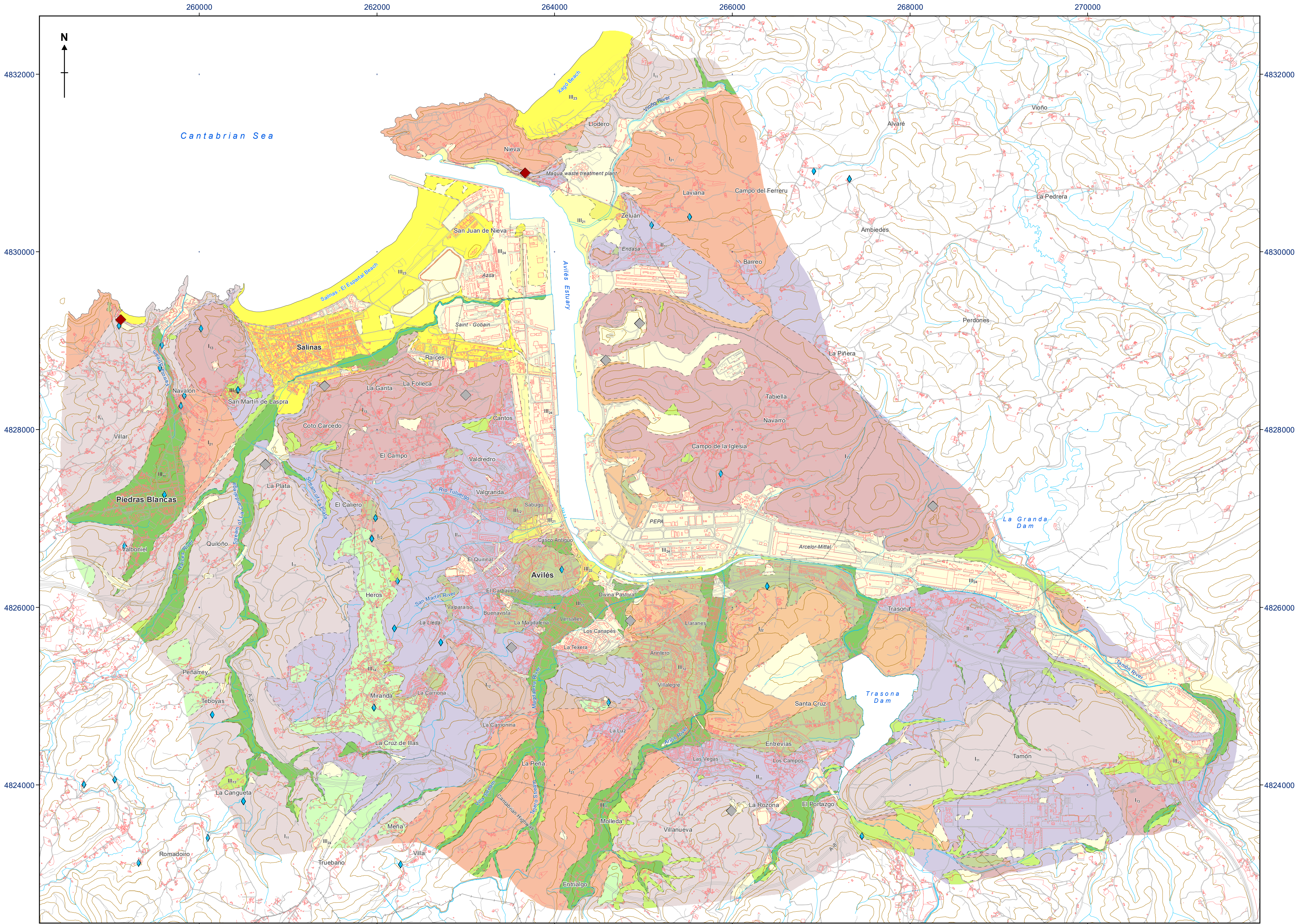


GEOTECHNICAL MAP OF AVILÉS AND SURROUNDINGS

1:25000



ZONE	SUBZONE	UNIT	DESCRIPTION	GEOLOGICAL EQUIVALENCE
I (rocks)	I ₁ (medium hard and hard rocks)	I ₁₁	Conglomerates, mudstones and sandstones	Paleozoic Units
		I ₁₂	Polygenic conglomerates and sandstones with clays interbedded	Lower Permo-Triassic Unit
		I ₁₃	Conglomerates with sandy matrix	Conglomeratic Jurassic Unit
	I ₂ (medium hard rocks with very soft rocks interbedded)	I ₂₁	Sandy limestones, limestones, breccia limestones, nodular limestones, sandstones, shales and siltstones	Rañeces Group
		I ₂₂	Dolomitic limestones, dolomites and clayey marls	Carbonated Jurassic Unit
II (mixture)	II ₁ (soft and very soft rocks with hard soils interbedded)	II ₁₁	Micaceous sandstones, marls, lutites, silts and low plasticity clays	Lower Permo-Triassic Unit
III (soils)	III ₁ (medium and soft soils)	III ₁₁	Clayey sands, silty sands, gravels and low plasticity clays	Alluvial deposits
		III ₁₂	Clayey sands and low/high plasticity clays	Eluvial deposits
		III ₁₃	Gravels, sands, silts and low plasticity clays	Colluvial deposits
		III ₁₄	Silty sands, clayey sands, silty gravels, low-fine content gravels and inorganic clays of low plasticity with silts or sands	Flat raised surface deposits
	III ₂ (soft and very soft soils)	III ₂₁	Low fine content sands, clayey sands, silty sands, gravels, inorganic clays of low plasticity and silty or sandy clays	Estuary deposits
		III ₂₂	Silty sands, gravels with clays, low plasticity inorganic clays and low plasticity organic silts	Marsh deposits
		III ₂₃	Low fine content sands and silty sands	Shore deposits
		III ₂₄	Heterogeneous mixtures	Man-made deposits

LEGEND

- UNIT BOUNDARIES

Unit boundary
- RELIEF

Index contour
- HYDROGRAPHY

Springs

Hydrographic network
- MAN-MADE ELEMENTS

Administrative Boundary

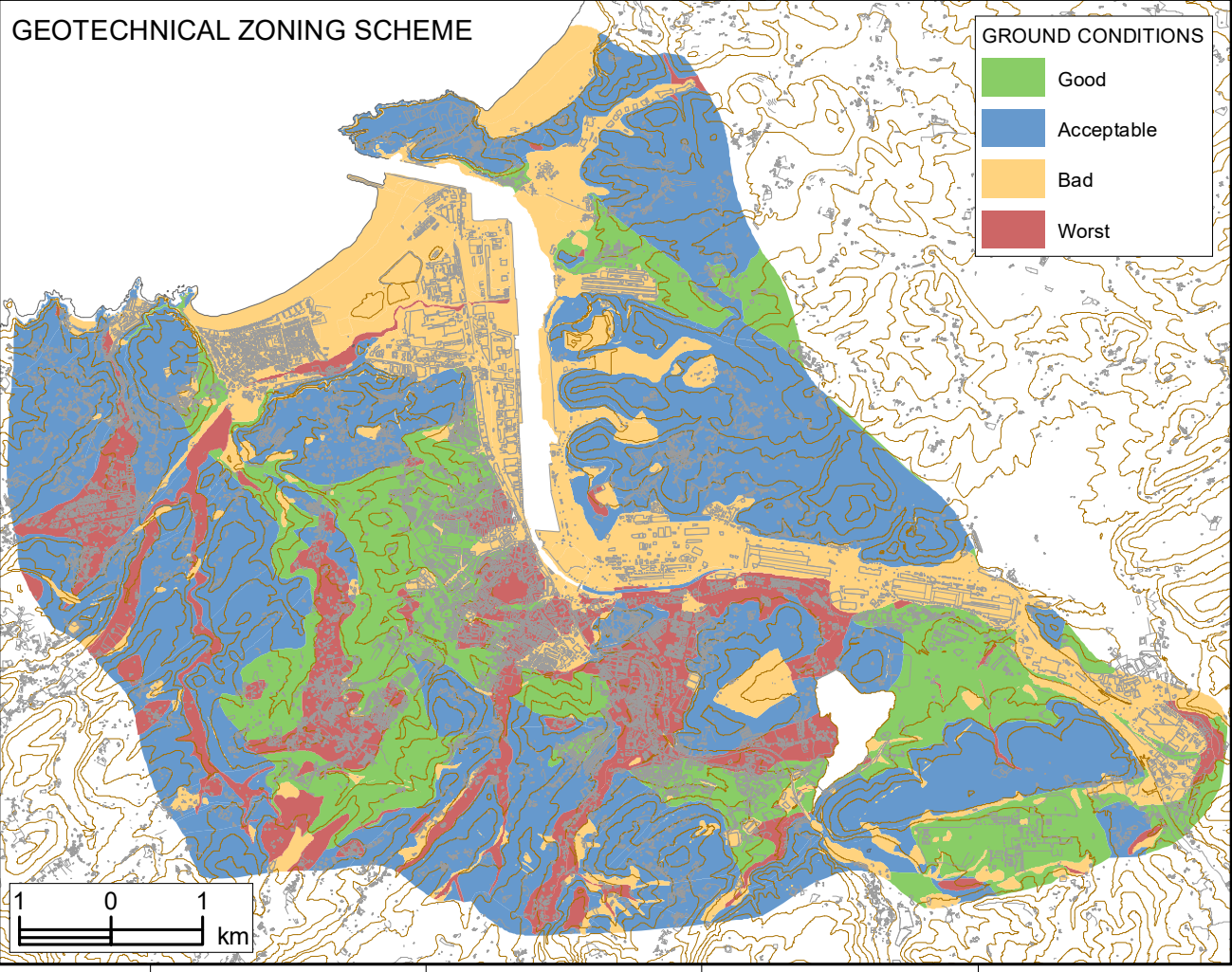
Highway

Conventional road

Building
- OPERATIONS

Quarry

Coal mine



NOTES ABOUT CONSTRUCTIVE CONDITIONS

- **Slope stability**, typical sections with heights of 6 m, without loads at the top and shallow water table. Slope stability was evaluated using finite element analysis with the shear strength reduction method and, empirical formulation limiting settlement, Mohr-Coulomb failure criterion.
- **Bearing capacity**, isolated footing of 1.5 m each side, under axial vertical load, installed at depth of 1.5 m, and ground water at least 2 m below the footing. Geotechnical calculations were performed using analytical polynomial formulation and, empirical formulation limiting settlement.
- **Settlement**, for allowable-load bearing capacity of shallow foundations not exceeding 0.2 MPa.



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Topographical Map 1:5,000, Government of the Principality of Asturias
Geodesic Datum ETRS89 - UTM ZONE 30T
Altitude above mean sea level at Alicante (Spain)

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UNIT	HYDROGEOLOGY		EXPLORATION					PROPERTIES				EXCAVATIONS				SLOPE STABILITY										FOUNDATION CONDITIONS									
	FLOW	k (m/s)	BH	TP	PM	Geophysics			Compressibility	Expansivity	Collapsibility	AV	Excavability	Method		Ratio H:V	Slope sanitation	Shotcrete	Metallic mesh	Drainage	Waterproofing	Structures				Bearing capacity (q _a)	Foundation				Settlements	Common problems			
						SM	ET	GPR						Mechanic	Blasting							Diaphragm wall	Pile wall	Micropile wall	Concrete wall		Direct	PP	In situ piles	Micropiles					
I ₁₁	Fissures, karst and/or porosity	10 ⁻⁵ -10 ⁻¹⁰	●	●			●	●	-	-	-	No	Partially ripable	●		1H:10V	●		●						>5 MPa	●				-	Karstic cavities and weathering soils				
I ₁₂	Fissures	<10 ⁻⁶	●	●			●	●	-	-	-	No	Not ripable	●		1H:10V	●		●						>5 MPa	●				-	-				
I ₁₃	Fissures and/or porosity	10 ⁻⁵ -10 ⁻⁷	●	●			●	●	-	-	-	No	Partially ripable	●		1H:10V	●		●						>1.5 MPa	●				-	-				
I ₂₁	Fissures and/or karst	10 ⁻⁵ -10 ⁻¹⁰	●	●			●	●	-	-	-	No	Partially ripable	●	●	1H:10V to 1H:5V		●					●	1 to 10 MPa	●				-	Karstic cavities and weathering soils					
I ₂₂	Fissures and/or karst	10 ⁻⁴ -10 ⁻⁸	●	●			●	●	-	-	-	No	Partially ripable	●	●	1H:10V to 1H:5V		●					●	1 to 10 MPa	●				-	Karstic cavities and weathering soils					
II ₁₁	Fissures and/or porosity	10 ⁻⁵ -10 ⁻¹⁰	●	●	●	●	●	●	Low to very high	Non-existent to low	No	Potential sulfate attack	Partially not ripable	●	●	1H:10V to 1H:2V						●	●	>0.2 MPa	●	●	●	●	●	High consolidation	lateral and in-depth strength variability				
III ₁₁	Porosity	10 ⁻⁵ -10 ⁻⁹	●	●	●	●	●	●	Low to medium	Non-existent to low	Potential	No	Normal ripping	●	●	1H:2V to 3H:2V				●	●	●	●	>50 kPa	●		●	●	Low potential	Differential settlements, potential uplift pressure, organic matter					
III ₁₂	Porosity	10 ⁻⁵ -10 ⁻⁸	●	●	●	●	●	●	Low to medium	Non-existent to very high (high plasticity)	Potential	No	Easy ripping	●	●	1H:1V to 3H:2V				●	●	●	●	>150 kPa	●		●	●	Low potential	Differential settlements					
III ₁₃	Porosity	10 ⁻⁵ -10 ⁻⁹	●	●	●	●	●	●	-	Non-existent to low	No	No	Normal ripping	●	●	1H:2V to 3H:2V				●	●	●	●	>100 kPa	●		●	●	-	-	High land slope				
III ₁₄	Porosity	10 ⁻⁴ -10 ⁻⁹	●	●	●	●	●	●	-	Non-existent to low	No	No	Easy ripping	●	●	1H:2V to 3H:2V				●	●	●	●	>100 kPa	●		●	●	-	-	-				
III ₂₁	Porosity	10 ⁻⁴ -10 ⁻⁸	●	●	●	●	●	●	Low to very high in high plastic. soils	Non-existent to low	Potential	No	Easy ripping	●	●	1H:1V to 3H:2V				●	●	●	●	<200 kPa	●	●	●	●	High consolidation	Organic matter, uplift pressure					
III ₂₂	Porosity	10 ⁻⁵ -10 ⁻⁸	●	●	●	●	●	●	Low to medium	Non-existent to low	Potential	No	Easy ripping	●	●	1H:1V to 3H:2V				●	●	●	●	<150 kPa	●	●	●	●	Low potential	Organic matter, uplift pressure					
III ₂₃	Porosity	10 ⁻⁴ -10 ⁻⁶	●	●	●	●	●	●	-	-	Potential	No	Easy ripping	●	●	1H:1V to 3H:2V				●	●	●	●	<200 kPa	●	●	●	●	-	-	Uplift pressure				
III ₂₄	Porosity	10 ⁻⁵ -10 ⁻⁷	●	●	●	●	●	●	Low to medium	Non-existent to very high	Potential	Potential sulfate attack	Easy ripping	●	●	1H:1V to 3H:2V				●	●	●	●	<150 kPa	●	●	●	●	High potential	Unsuitable as foundation level					

- BH Borehole
- TP Trial pit
- PM Penetrometer
- SM Seismic
- ET Electrical
- GPR Ground penetrating radar
- AV Aggressiveness
- PP Prefabricated pile