Project ACCESS (DE-FE0032447)

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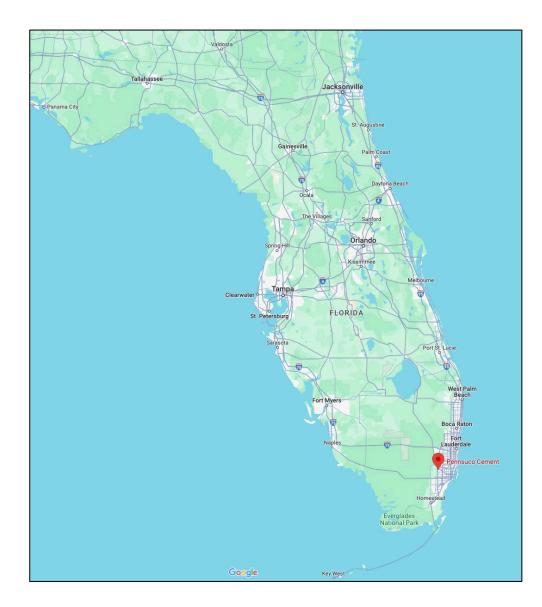






Background

- Engagement between **SSEB**, **Virginia Tech** and **Titan America** emerged through the SECARB-USA program.
- Initial efforts involved desk study to assess CCS potential at Titan America's Pennsuco Cement Plant, Miami, Florida.
- USGS CCS Framework reports favorable characteristics for CCS in region.
- VT Undergraduate and graduate student research built the pre-feasibility case for the Project Readiness effort.





Project Motivation

- Motivated commercial partner in Titan America
 - Ongoing decarbonization initiatives in Europe
 - Opportunity to de-risk early development stages in an area with little historical research
- Establish the foundation for a commercial-scale geologic storage complex for CO₂ captured from Titan America's Pennsuco Cement Plant

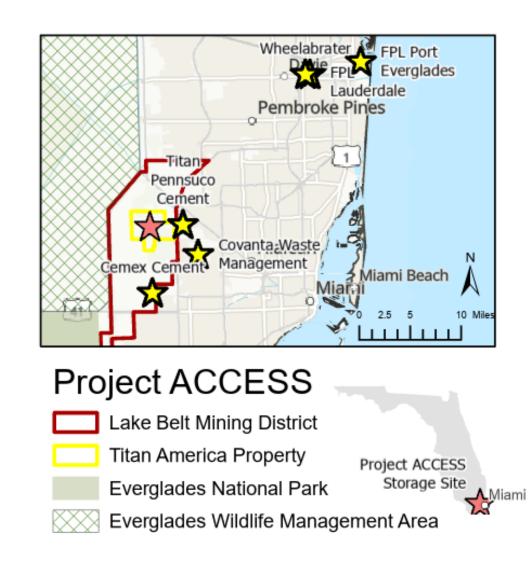
Project Duration: 24 months Period of Performance: July 19, 2024 to July 18, 2026 Funding: \$12,472,398 (\$3,472,398 cost-share)





Location

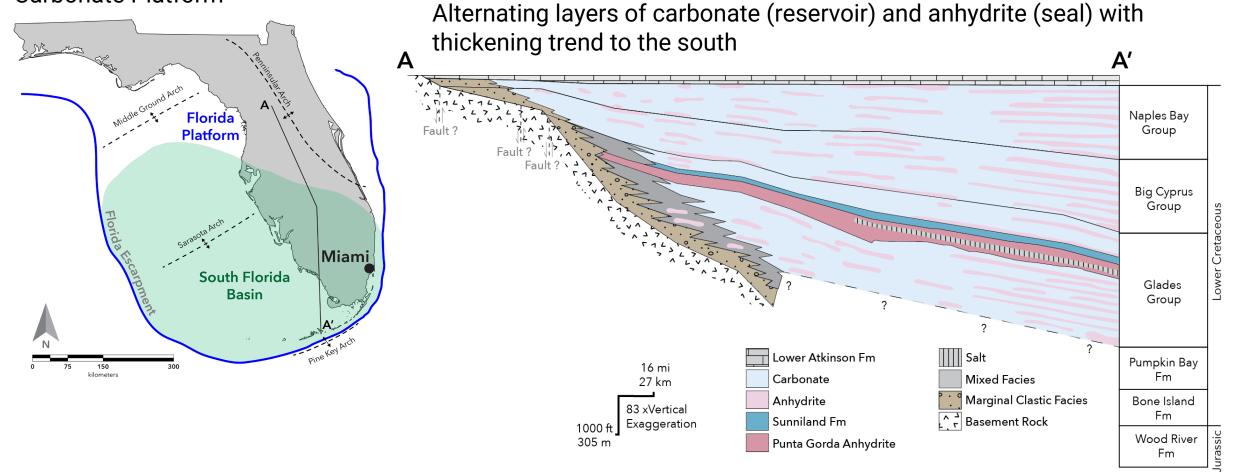
- Lake Belt Mining District is an industrial corridor in western Miami-Dade County
- Currently, no viable option for local industrial facilities looking to decarbonize in South FL Basin
- Initial scenario focused on the Titan Pennsuco facility and the neighboring Covanta Wase facility
 - 1.9 MMt CO₂ emitted annually
 - Opportunity to expand based on CarbonSAFE results





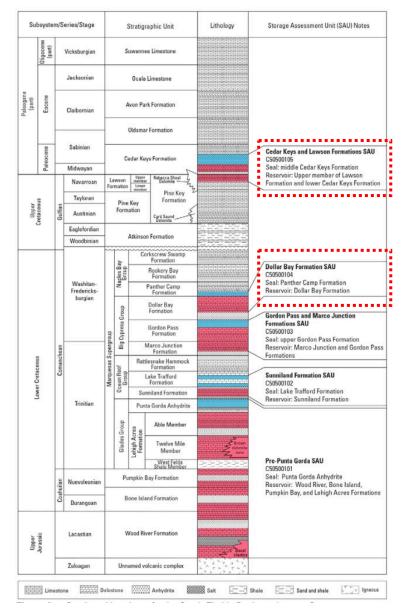
Geology: South Florida Basin

Carbonate Platform



Transcending Boundaries

Geology: Storage Assessment Units



USGS identifies five Storage Assessment Units comprising carbonate reservoirs with anhydrite seals

Target SAUs for Project ACCESS

- 1. Cedar Keys & Lawson SAU
 - Reservoir: Lower Cedar Keys Fm & Upper Lawson Fm
 - Diagenetically altered reef deposits & crystalline dolostone
 - Depth to top ~1,400 m (4,620 ft) bgs
 - Total thickness ~230 m (760 ft) at site
 - Porosity estimates: 0.14 0.23
 - Seal: Middle Cedar Keys Fm
 - Anhydrite rich-dolostone
 - Thickness ~200 400 m throughout South Florida Basin

2. Dollar Bay SAU

- o Reservoir: Dollar Bay Fm
 - Carbonate & dolostone
 - Depth to top ~2,600 m (8,580 ft) bgs
 - Total thickness ~200 m (6,600 ft)
- Seal: Panther Camp & Rookery Bay Fms
 - Anhydrite & gypsum deposits



USGS CCS Framework Chapter L, Roberts-Ashby (2015)

CO₂ Storage Scenarios

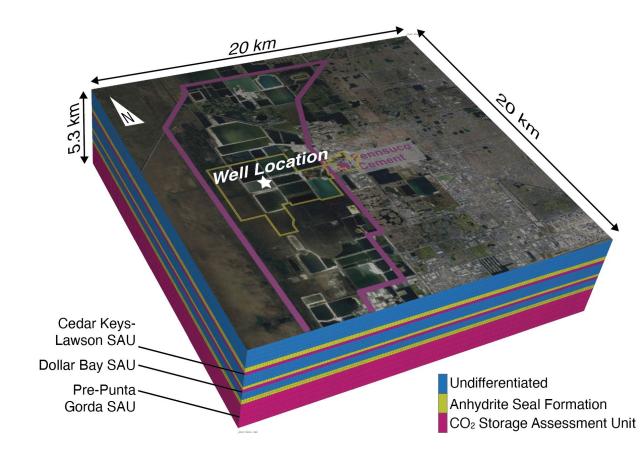
Volumetric Storage Estimates

	P ₁₀ (MMt CO ₂ per km ²)	P ₅₀ (MMt CO ₂ per km ²)	P ₉₀ (MMt CO ₂ per km ²)
Cedar Keys-Lawson SAU	1.7	2.6	4.0
Dollar Bay SAU	1.0	1.6	2.4
TOTAL	2.7	4.2	6.4

Additional CO_2 storage potential in deeper Pre-Punta Gorda Fm: 7.3M Mt CO_2/km^2 (P₁₀) to 13.6M CO_2/km^2 (P₉₀)

Dynamic CO₂ Storage Simulations

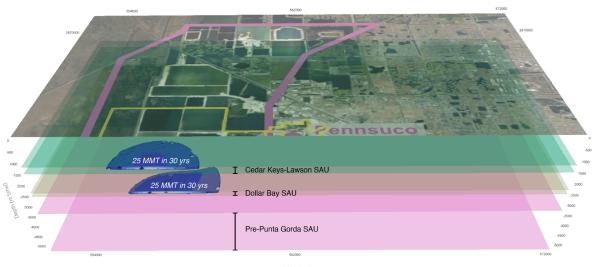
- 50M metric tons CO₂ in 30 years (1.7M Mt/yr)
 - \circ 25M Mt CO₂ into Cedar Keys-Lawson SAU (850k Mt/yr)
 - \circ 25M Mt CO₂ into Dollar Bay SAU (850k Mt/yr)
 - Pre-Punta Gorda not included in dynamic scenario

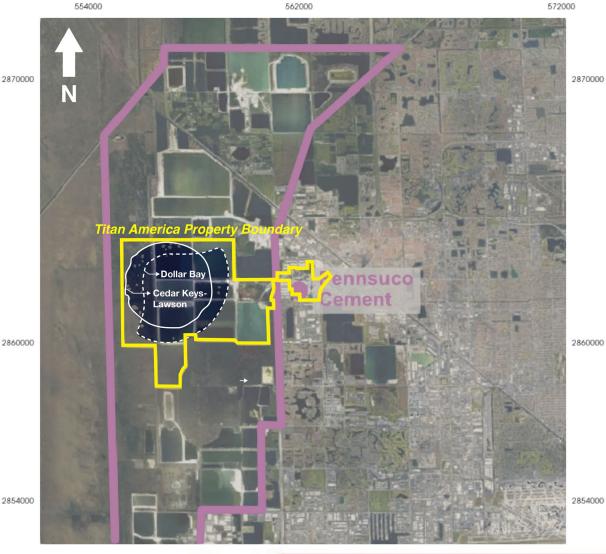




Dynamic Modeling Results after 30 yrs

- Stacked configuration may allow CO₂ plume to remain within Titan Americal property boundary (yellow outline)
- Critical pressure front (330 kPa) within Cedar Keys-Lawson SAU migrates beyond property boundary, but remains within Lake Belt Mining District (pink outline)





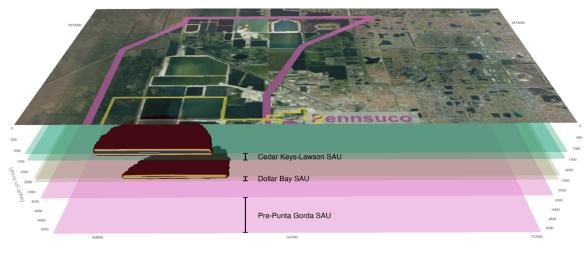


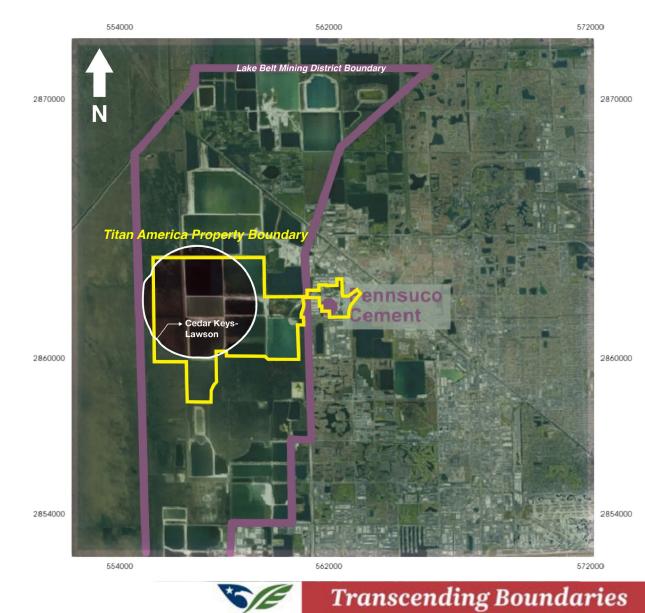
Transcending Boundaries

CO2 8aturation 0.1 0.15 0.2 0.25 0.3 0.35 0.4 0.45 0.5 0.55 0.6 0.65 0.7 0.75 0.8 0.85 0.9 0.95 1

Dynamic Modeling Results

- Stacked configuration may allow CO₂ plume to remain within Titan Americal property boundary (yellow outline)
- Critical pressure front (330 kPa) within Cedar Keys-Lawson SAU migrates beyond property boundary, but remains within Lake Belt Mining District (pink outline)





Community Dynamics

- Site host Titan has a long history of working in the area and engaging with community groups
- Community support all levels
 - Expand as part of CarbonSAFE Phase II
 - Utilize Titan's network and local partner Florida International University
- Extensive ground water monitoring program in place, with data reported on a regular basis

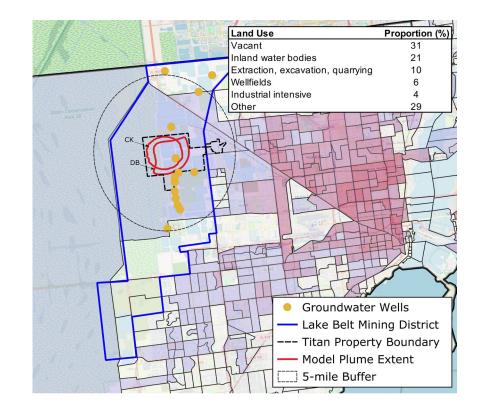
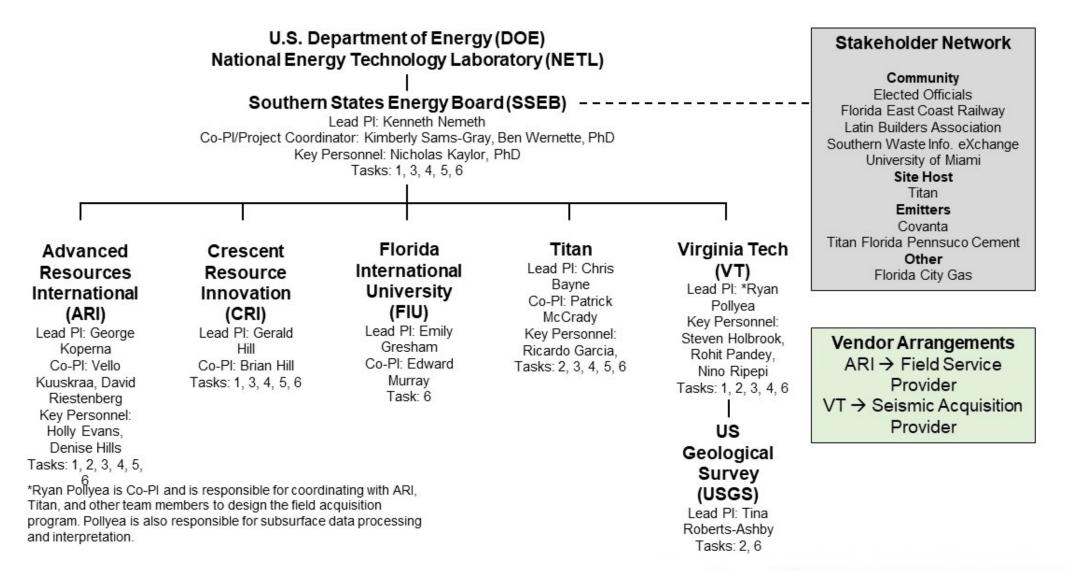


Illustration of the Lake Belt Mining District of north central Miami-Dade County, Florida, and Disadvantaged Communities as reported by the Climate and Economic Justice Screening Tool. Disadvantaged Communities are shaded according to number of criteria in 90th percentile nationally (cool colors equal fewer criteria; warm colors equal more criteria). Also shown is Titan's property boundary, the modeled extent of the CO₂ plume for the Cedar Keys Lawson (CK) and Dollar Bay (DB) storage assessment units, and existing groundwater monitoring wells. Inset shows land use classification (as a percentage) of all land within 5 miles of the storage area of interest.



Project ACCESS Team



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Project Objectives

Demonstrate that the subsurface saline formations at the storage complex can store commercial volumes of CO_2 safely and permanently

Develop a comprehensive Community Benefits Plan

Develop the infrastructure framework for a CO₂ storage hub

Establish a rigorous risk registry and conduct a comprehensive risk assessment

Create a monitoring plan

Execute a comprehensive site characterization plan to support the Underground Injection Control (UIC) Class VI Permit in Phase III

Evaluate project commerciality.



Tasks

Task 1 – Project Management and Planning

Task 2 – Site Specific Characterization & Assessment of the CO₂ Storage Complex

Task 3 – Preliminary Project Risk Assessment with Mitigation & Management Plan

Task 4 – Plan for Subsequent Detailed Site Characterization & UIC Class VI Permitting

Task 5 – Project Technical & Economic Feasibility Assessment, Including Conceptual-Level Design Study for CO₂ Transport

Task 6 – Community Benefits Plan



Deliverables

Task/ Subtask Number	Deliverable Title	Due Date
1.0	Project Management Plan	Update due 30 days after award. Revisions to the PMP shall be submitted as requested by the NETL Project Manager.
2.2	Geophysical (Seismic) Characterization Plan	60 Days After Site Selection.
2.5	Stratigraphic Test Well Drilling Design Plan	120 Days After Site Selection.
2.8	Geologic Analysis Report – Core Analysis, Refined Geologic Model, and Reservoir Modeling	30 Days Prior to End of Performance Period.
3.1	Initial Risk Assessment with Mitigation and Management Plan	90 Days Following Initial Risk Assessment Meeting.
3.2	Final Risk Assessment Focused on Class VI and Commercialization	90 Days Prior to End of Performance Period.
4.1	Class VI Readiness Assessment and Plan for Subsequent Detailed Site Characterization	30 Days Prior to End of Performance Period.
5.4	Infrastructure Assessment Report	30 Days Prior to End of Performance Period.



Schedule

- Awarded on July 19, 2024
- Updated the PMP on July 30, 2024
- Initial discussion held with Florida DEP focused on permitting regime for boreholes
 - 62-528.603 Exploratory Well Construction and Testing Permit Guidelines within FL DEP UIC program (Class V)
 - Working through permit application expectations
- Establishing sub awards
- Project kickoff meeting planned for late August 2024

Task Description	Start Date	End/Due Date	Ju		Q3 Nug Sej	рO	Q4 Ict Nov	v Dec	Jan	Q1 Feb	Mar	Q: Apr Ma		Jul /	Q3 Nug Sep	Oct	Q4 Nov	Dec	Jan	Q1 Feb Ma	ar Apr	Q2 May	Jun	Q3 Jul Aug Sep
Period of Performance	07/19/24	07/18/26	ſ																					POP
Year 1	07/19/24	07/18/25	J											,Y1										
Year 2	07/19/25	07/18/26												÷										_Y2
Task 1.0 - Project Management and Planning	07/19/24	07/18/26		Æ												-	-			1				1-PM&P
Subtask 1.1 - Project Management Plan	07/19/24	07/18/26																						1.1
D1.1: Project Management Plan	08/18/24	08/18/24	-	-	♦D1.1	-										-								
M1.1: Participate in NETL Project Kick-Off Meeting	10/17/24	10/17/24	1	++-			M1.1									+								
Subtask 1.2 - Project Coordination & Technical Interaction	07/19/24	07/18/26	+																					1.2
Subtask 1.3 - NEPA Compliance	07/19/24	07/18/26	+																		1			1.3
Bil Metrics	07/19/24	07/18/26	+																		1			BIL
Task 2.0 - Site Specific Characterization & Assessment of the CO2 Storage Complex	07/19/24	07/18/26	+-					1		-		-		1 1	-	1				-				2-Characterizatio
	07/19/24			Œ										2.1										2.Characterizatio
Subtask 2.1 - Site Selection and Resistivity Survey		07/21/25		Œ		-	1		21					L										
Subtask 2.1.1 - Site Selection	07/19/24	01/18/25	_ _ _						- P				_											
M2.1.1: Site Access Agreements and Permits Acquired for Resistivity and 2D Seismic Surveys	01/18/25	01/18/25	<u> </u>			_			€M2.	1.1			_			_								
Subtask 2.1.2 - Resistivity Survey	01/19/25	07/21/25				_								2.1.2										
M2.1.2: Resistivity Surveys Complete	07/21/25	07/21/25												.∲M2.1	.2									
Subtask 2.2 - 2D Seismic Acquisition	01/19/25	04/19/25										2.2												
D2.2: Geophysical (Seismic) Characterization Plan	03/20/25	03/20/25	Ŷ								∳D2	2												
M2.2: 2D Seismic Surveys Complete	04/19/25	04/19/25	\$									€М2.2												
Subtask 2.3 - 2D Seismic Interpretation	02/18/25	06/20/25								1				2.3										
M2.3: Report and Presentation to NETL Detailing Regulator and Community Interactions and Seismic Work to De-Risk Drilling	06/20/25	06/20/25											1	M2.3										
Subtask 2.4 - Stratigraphic Test Well Permitting	06/21/25	12/21/25												1		1		,2	.4					
M2.4: Site Access Terms and Permits Acquired for Stratigraphic Well Drilling	12/21/25	12/21/25	\rightarrow	++-		-				-			-			-		∳M	2.4					
Subtask 2.5 - Stratigraphic Test Well Drilling Plan	10/19/24	06/20/25	Ť	-		-	1							25		-								
D2.5: Stratigraphic Test Well Drilling Plan	06/20/25	06/20/25	\pm	+	-	-	-							D2.5	_	+				_				
M2.5: Complete Well Design and Drilling Plan	06/20/25	06/20/25	<u> </u>	++-		-							_	M2.5							_			
			<u> </u>	++-		_							- '	1 2.5										
Subtask 2.6 - Well Drilling and Geologic Data Collection	06/21/25	10/18/25	+			_										- P.								
M2.6: Stratigraphic Well Drilling Complete	10/18/25	10/18/25	4			_							_			•	A2.6							
Subtask 2.7 - Core Analysis	08/19/25	02/17/26													_	-	-			2.7				
Subtask 2.8 - Geologic and Numerical Modelling	11/18/25	07/18/26															_			_	_	-		2.8
D2.8: Geologic Analysis Report – Core Analysis, Refined Geologic Model, and Reservoir Modeling	06/18/26	06/18/26	\$																				- i	D2.8
Task 3.0 - Preliminary Project Risk Assessment with Mitigation & Management Plans	07/19/24	07/18/26	1	÷												-								3-Risk
Subtask 3.1 - Initial Risk Assessment and Development of Mitigation and Management Plans	07/19/24	01/14/25							3.1															
D3.1: Initial Risk Assessment with Mitigation and Management Plan	01/15/25	01/15/25	\$						♦ D3.1															
Subtask 3.2 - Final Risk Assessment and Development of Mitigation and Management Plans	01/15/25	07/18/26																						3.2
D3.2: Final Risk Assessment Focused on Class VI and Commercialization	05/19/26	05/19/26	-	-		-							_			-							3.2	
Task 4.0 - Plan for Subsequent Detailed Site Characterization & UIC Class VI	11/18/25	07/18/26	+													-								4 UIC
Subtask 4.1 - Class VI Readiness	11/18/25	07/18/26		-		-	_						-			-	1							4.1
D4.1: Class VI Readiness Assessment and Plan for Subsequent Detailed Site Characterization	06/20/26	06/20/26	\pm	++-	-	-	_	_					-			-								D4.1
Subtask 4.2 - Injection Well Design, and Initial MVA Plan	02/18/26	07/18/26	-¥-'	++-												-								4.2
Task 5.0 - Project Technical & Economic Feasibility Assessment, Including Conceptual-Level Design Study	02/18/26	07/18/26		+		-				-		-	-		_	-			_	1			1	4.2 5-Feasibility
for CO2 Transport	_		+	\vdash		_	_																	
Subtask 5.1 - Potential CO2 Source Screening and Selection	04/20/25	07/18/26	\perp	\square										1 1										5.1
Subtask 5.2 - Conceptual-Level Design Study for CO2 Transportation	11/18/25	07/18/26																						5.2
Subtask 5.3 - Pore/Surface Rights and Right of Way Requirments	11/18/25	07/18/26																						5.3
Subtask 5.4 - Technical and Economic Feasibility Assessment	02/18/26	07/18/26																		i de la compañía de la				5.4
D5.4: Infrastructure Assessment Report	06/18/26	06/18/26	\$																					D5.4
Task 6.0 - Community Benefits	07/19/24	07/18/26		ŧ		-				-						1			,					6-Community
Subtask 6.1 - Community and Labor Engagement	07/19/24	07/18/26																					1	6.1
M6.1: Host a community and stakeholder engagement event to include a public presentation on CBOO work within 9 months of project award and before stratigraphic well drilling (CBOO Commitment B2)	04/19/26	04/19/26																			•	M6.1		
Subtask 6.2 - Investing in Job Quality and a Skilled Workforce	07/19/24	07/18/26																						6.2
Subtask 6.3 - Diversity, Equity, Inclusion and Accessibility (DEIA)	07/19/24	07/18/26	+																					6.3
M6.3.a.: Identify at least one point of contact and hold at least one introductory meeting with faculty representing at least two Florida Historically Black College and Universities (HBCUs) not represented on the Project Team within enotins of project award (GBOC Comminent C2)	01/18/25	01/18/25							∲М6.:	3.a														
M6 3.5: Host at least one event to communicate STEM-related CCUS job opportunities to underrepresented groups and students at a Florida minority-serving campus 60 days prior to the end of the performance parior (GEP Commitment D3)	05/20/26	05/20/26																				• 1	V16.3.b	
			_													1							-	
Subtask 6.4 - Justice40 (J40)	07/19/24	07/18/26		÷																				6.4



Thanks!

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