



# TNFD PILOT PROGRAM

TCC started the trial of the TNFD framework in 2022. Also, it joined the TNFD Forum and the Pilot Program to offer feedbacks on the trial. In the meantime, TCC assessed the impacts of its business activities on biodiversity, identified and disclosed nature-related risks and opportunities, and adopted corresponding protection and restoration measures.

## 2.1 | Nature-related Risk and Opportunity Assessment Process

The pilot method for the analysis of nature-related risks and opportunities took reference with the LEAP approach recommended in the TNFD v0.4. We located the nature-related scope in the business activities of TCC, assessed and evaluated the dependencies and impacts on natural resources from our business activities, contemplated and deliberated over the existing strategies and future development directions, and disclosed the pilot results. Two biodiversity seminars and internal questionnaire survey were organized in the duration. Experts and scholars were consulted multiple times as well. With its operating sites in Taiwan as the priority pilot scope, TCC followed the recommended approach of Locate in LEAP, setting the Hoping Mine in Hualien, 3-in-1 Park of Port, Power, Cement Plant, Suao Taibaishan Mine, and Suao Plant as the locations for assessment.

### The LEAP Approach in the TNFD Pilot Program of TCC

## LOCATE

**1 Identify priority locations of business activities**  
 In line with the locations of TCC business activities, TCC tried to assess the nature conservation importance of the locations and the interaction of TCC with local natural environment to identify priority locations of key business activities for the pilot.

**PRINCIPLES FOR IDENTIFICATION**

Identify the interaction of key businesses with nature, such as an extensive use of natural resources or change to the local ecosystem	Identify the areas of high biodiversity importance or of water stress	Identify the business footprints and locations of key businesses
▲ Hoping Mine in Hualien ▲ Suao Taibaishan Mine	▲ Hoping Mine in Hualien ▲ Suao Plant	▲ 3-in-1 of Port, Power, Cement Plant at Hoping, Hualien ▲ Suao Taibaishan Mine ▲ Suao Plant

## EVALUATE

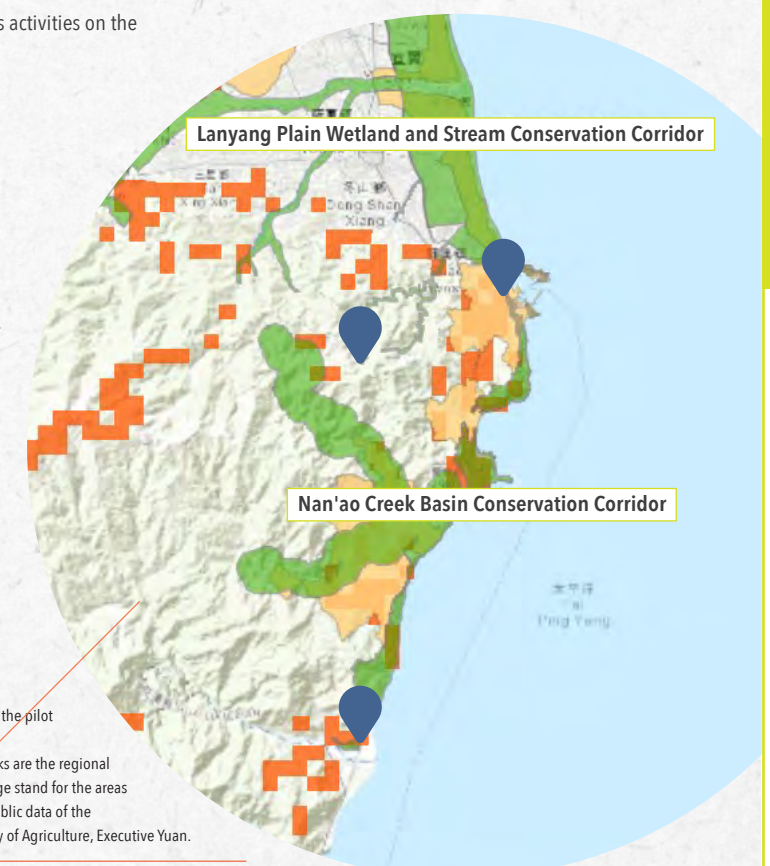
**2 Evaluate the dependencies and impacts of business activities**  
 Grounded on the content of priority business activities, TCC tried to evaluate its nature-related dependencies and impacts of its business activities on the natural environment or local residents.

## ASSESS

**3 Analyze the nature-related risks and opportunities**  
 Based on the dependencies and impacts on nature, TCC tried to analyze the possible nature-related risks and potential development opportunities it might face.

## PREPARE

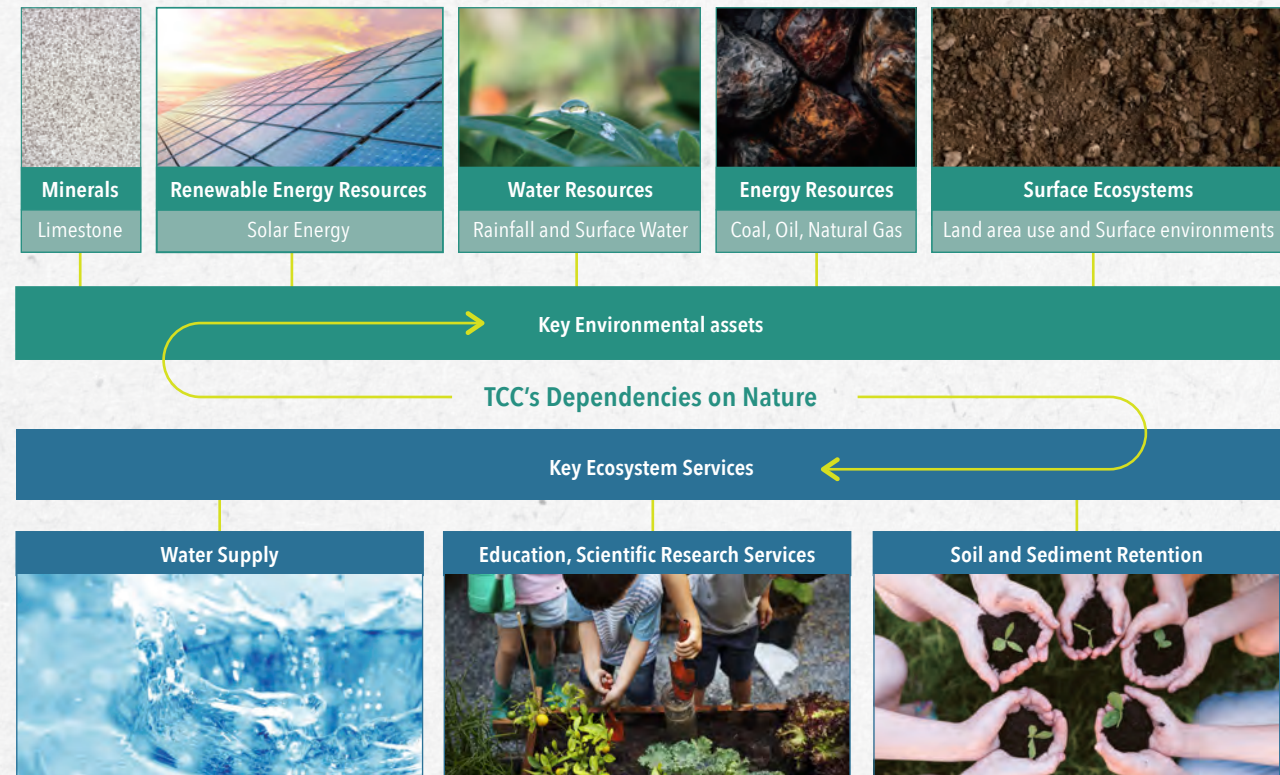
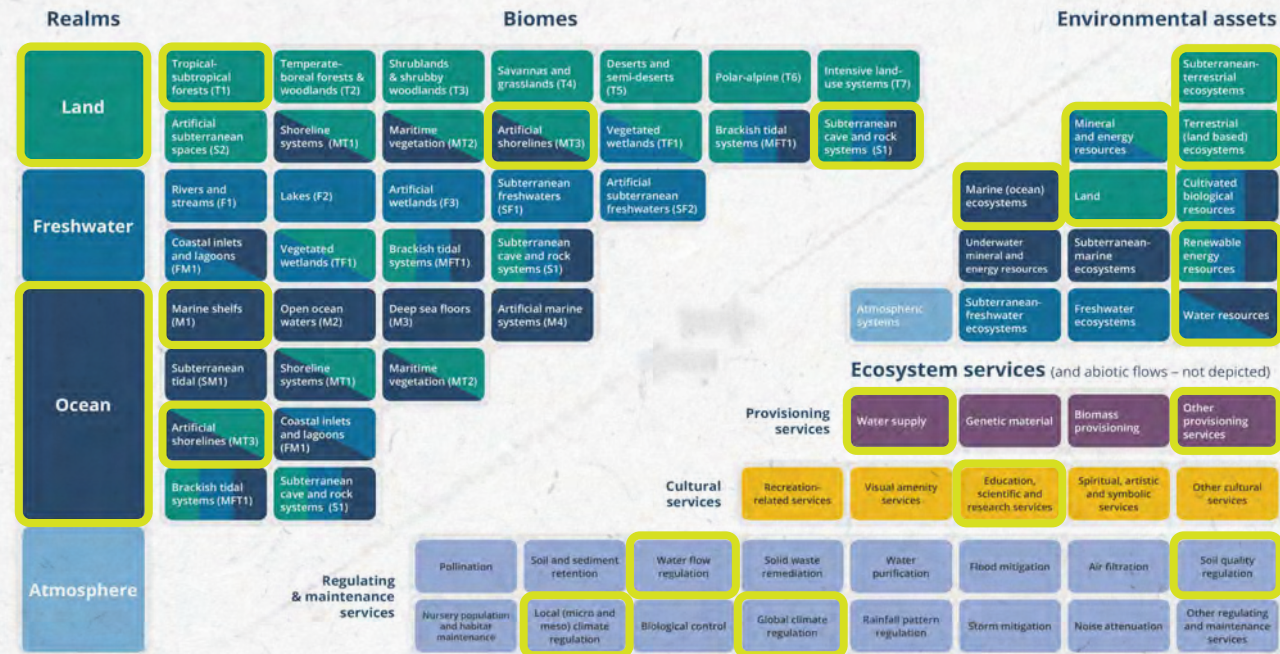
**4 Nature-related strategy thinking and disclosure reporting**  
 Based on the results of the nature-related risk and opportunity analysis, TCC mulled over its current actions and future strategic directions and disclosed the pilot results.








Note 1: The blue flags on the map represent the priority business activities in the pilot program of TCC.  
 Note 2: The orange cubes represent the biodiversity hotspots; the green blocks are the regional conservation corridors of the National Green Network; the areas in light orange stand for the areas of concern of the National Green Network. The data was retrieved from the public data of the National Green Network, Forestry and Nature Conservation Agency of Ministry of Agriculture, Executive Yuan.

## 2.2 | Results of the Dependencies and Impacts on Nature Evaluation

### The Nature Elementary Concept of TNFD



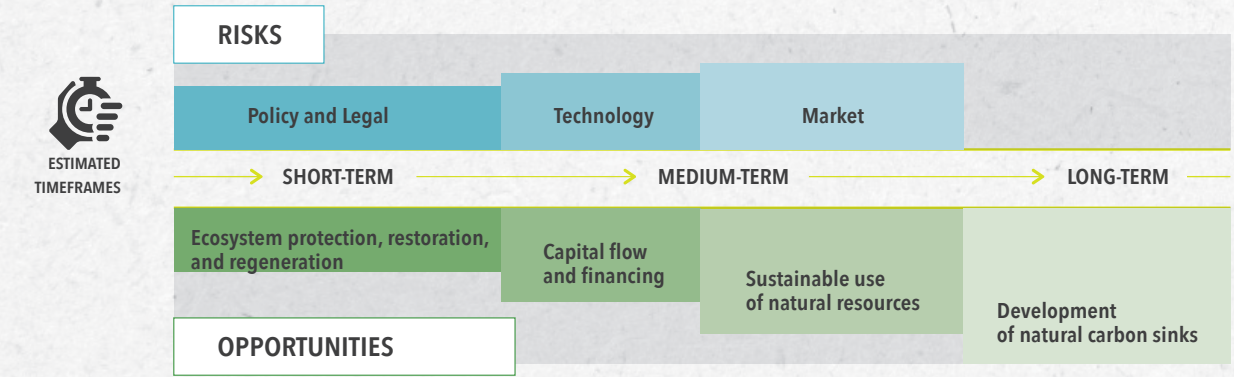
### TCC's Potential Impacts on Nature

IMPACT DRIVER	POTENTIAL IMPACTS AND IMPACTED SUBJECTS
 <p><b>Land use change</b></p>	<p><b>BUSINESSES OF THE ORGANIZATION</b> Minerals are vital raw materials. The mines are 100% approved after the government's environmental impact assessments (EIAs). The restoration of the mine vegetation constitutes the content of the EIA commitment, which requires relevant investments.</p> <p><b>LOCAL INDIGENOUS PEOPLES AND RELEVANT STAKEHOLDER GROUPS</b> The environmental changes stemmed from mining may lead to concerns of changes to the quality of life and risks of safety for residents.</p> <p><b>LOCAL ECOSYSTEM</b> The change of the original forest ecosystem due to mining may lead to destruction of habitats of the local animals and plants, resulting in failure of survival or displacement from their original habitats.</p>
 <p><b>GHG emissions</b></p>	<p><b>BUSINESSES OF THE ORGANIZATION</b> GHG emissions from business activities may increase the costs in carbon fee or tax.</p> <p><b>LOCAL INDIGENOUS PEOPLES AND RELEVANT STAKEHOLDER GROUPS</b> GHG emissions may cause the warming effect and extreme weather events in the long run, possibly rendering impacts of climate disasters on the local residents and stakeholders.</p> <p><b>LOCAL ECOSYSTEM</b> GHG emissions may cause extreme weather events in the long run, rendering impacts on the health of ecosystems and the survival of local flora and fauna.</p>
 <p><b>Pollutions of air, water, noise, etc.</b></p>	<p><b>BUSINESSES OF THE ORGANIZATION</b> Pollutions from business activities may lead to additional regulatory risks for the organization, which may require investment in new technologies or change the means of production, resulting in an increase in operating costs.</p> <p><b>LOCAL INDIGENOUS PEOPLES AND RELEVANT STAKEHOLDER GROUPS</b> Pollutions may lower the quality of life of local residents and stakeholders and threaten their health.</p> <p><b>LOCAL ECOSYSTEM</b> Pollutions may affect the health of local ecosystem, resulting in inability to survive and forced displacement for the local flora and fauna.</p>
 <p><b>Depletion of mineral/water resources</b></p>	<p><b>BUSINESSES OF THE ORGANIZATION</b> Depletion of mineral resources, for example, will render a mine unable to operate normally and the possible need in finding an alternative mining site and reconstruction of mine infrastructure.</p> <p><b>LOCAL INDIGENOUS PEOPLES AND RELEVANT STAKEHOLDER GROUPS</b> Water scarcity, for example, will lead to grave impact on the quality of life of local indigenous peoples, who may not be able to live anymore in the region.</p> <p><b>LOCAL ECOSYSTEM</b> Depletion of mineral or water resources, for example, will impact the foundation of local ecosystem, rendering inability of flora and fauna to survive.</p>
 <p><b>Invasive alien species</b></p>	<p><b>BUSINESSES OF THE ORGANIZATION</b> Due to the change in the mine vegetation from mining activities, the organization needs to protect the local environment from invasive alien species, which requires investments of relevant manpower and resources.</p> <p><b>LOCAL ECOSYSTEM</b> The removal of indigenous plants due to mining may increase the risk of alien species invasion and lead to extinction of certain rare indigenous species resulting from crowding out.</p>

### 2.3 | Results of Nature-related Risks and Opportunities and Coping Strategies

With NbS at the core, TCC manages risks and develop opportunities, committed to the solutions to the challenges of human society, including:

- Climate change mitigation and adaptation
- Disaster risk reduction
- Economic and social development
- Human health and wellbeing
- Food security
- Water security
- Environmental degradation and biodiversity loss



#### Coping Strategies for Nature-related Risks and Opportunities

	!!! POSSIBLE IMPACTS	FINANCIAL IMPACTS	COPING STRATEGIES
<b>RISKS</b>			
<b>SHORT-TERM RISKS</b>	<p><b>Policy and Legal</b> Demands of more intensive environmental assessment and disclosure on biodiversity management from competent authorities or international organizations</p> <p><b>Products &amp; services</b> Higher EIA requirements result in impacts on the mining costs, production processes, and suppliers of TCC.</p> <p><b>Reputation, investment &amp; financing</b> Since mining is an irreversible action, there are impacts on the original ecosystem despite efforts in ecological restoration made, resulting in damage to the corporate image and reputation of TCC.</p>	<p>Increased Costs</p> <p>Decreased Income</p> <p>Reduced Access to Capital</p>	<p><b>Domestic/International collaboration and participation</b> ▲ Participate in GCCA, Business for Nature, and Taiwan Nature Positive Initiative of WBCSD-Taiwan to stay abreast with international trends and emerging ecological protection strategies. ▲ Sign up for the TNFD Pilot program to experiment with the introduction of the TNFD Framework to identify risks and plan for coping strategies in advance. ▲ Engage in industrial-academic cooperation with the relevant departments of domestic universities to conduct biodiversity research and analysis at mines and introduce good restoration technologies.</p> <p><b>High-level self-examination</b> Unceasingly conduct environmental and ecological monitoring superior to the EIA requirements to elevate the capacity of regulatory response.</p>
<b>SHORT-TERM RISKS</b>	<p><b>Technology</b> Requirements of a better efficiency of and less destruction to the environment from the mining or production technologies</p> <p><b>Production impacts</b> Limits of mining area and time result in a lower production capacity of mines and waste of efficiency in mineral resource utilization.</p>	<p>Increased Costs</p> <p>Decreased Income</p>	<p><b>Mining method optimization</b> Adopt joint mining to raise the efficiency in mining and quarry output available, delay the depletion of mine resources, and avoid ineffective waste.</p> <p><b>Raw material transportation optimization</b> The Hoping Mine employs a vertical shaft system to transport limestone, saving 1,600 truck trips per day. It is planned to introduce unmanned electric mining vehicles into the mines of the cement plants across the Taiwan Strait that meet the criteria in place of the traditional fuel-burning counterparts.</p>
<b>MEDIUM-TERM RISKS</b>	<p><b>Market</b> Preference of nature-friendly cement products from customers or investors</p> <p><b>Products &amp; services</b> Customers turning to buy nature-friendly products may lead to decreased sales of existing products.</p> <p><b>New R&amp;D and investment</b> Development of nature-friendly cement products may require an increased input of relevant resources like R&amp;D funding, equipment, and talents.</p>	<p>Increased Costs</p> <p>Decreased Income</p>	<p><b>Communication enhancement</b> Disclose carbon emissions on product delivery notes, set up a traceability system of products on a par with the food-grade counterpart, and incorporate sustainability topics in the Client Satisfaction Survey for client communication and education.</p> <p><b>Development of low-carbon products</b> <b>Low-carbon products R&amp;D</b> Actively employ methods like alternative raw materials, power generation by waste heat recovery, equipment &amp; process enhancements, and renewable energy for self-consumption to achieve low-carbon and circular production. Continue to innovate and develop eco-friendly products and increase carbon reduction benefits by optimizing the existing mix ratios or developing circular materials and concrete recycling.</p>



Coping Strategies for Nature-related Risks and Opportunities

OPPORTUNITIES

	POSSIBLE IMPACTS	FINANCIAL IMPACTS	COPING STRATEGIES
<b>Ecosystem Protection, Restoration, and Regeneration</b> <small>SHORT-/MEDIUM-TERM OPPORTUNITIES</small>	<b>Circular use of Resources</b> Reduce dependencies on the conventional energy and water resources, thereby lowering carbon emissions and water consumption.	Decreased Costs  Increased Access to Capital	<b>Renewable energy utilization</b> The first microirrigation system with the PV and energy storage combined in Taiwan is installed at the Suao Taibaishan Mine. The intermittency of renewable energy is solved via the energy storage system, sustaining the power for the microirrigation system throughout the year to irrigate and restore plants in a precise and stable manner.  <b>Circular use of water resources</b> ▲ Rainwater harvesting ponds are installed to the Suao Taibaishan Mine. ▲ A vertical shaft tunnel water reclamation system is installed to the Hoping Mine to recycle water resources for reuse. ▲ The membrane bioreactors (MBRs) are activated at the Hoping Plant to treat the domestic sewage on the plant for the purposes of sprinkling, plant irrigation, and tire washing, etc., achieving a 100% recycling of domestic sewage.
	<b>Restoration to the optimal or original ecosystem</b> Improve biodiversity and restore local ecosystems.	Return on investment in carbon sequestration technologies	<b>Restoration area expansion</b> Gradually expand the coverage of restoration upholding the principle of restoring while mining, continue afforestation for the remaining walls and undeveloped areas, and reserve a certain distance around the mine as a buffer zone, so as to avoid a direct impact of the developed area on the restoration results.  <b>Restoration system establishment</b> 100% implement biodiversity management plans and conduct education and training by KBCC or a professional restoration team to educate employees at the TCC mines for the restoration efforts, and transplant at least 20 suitable plant species (trees, shrubs, and ground cover) into the mines to ensure the indigenous species ratio above 60%.



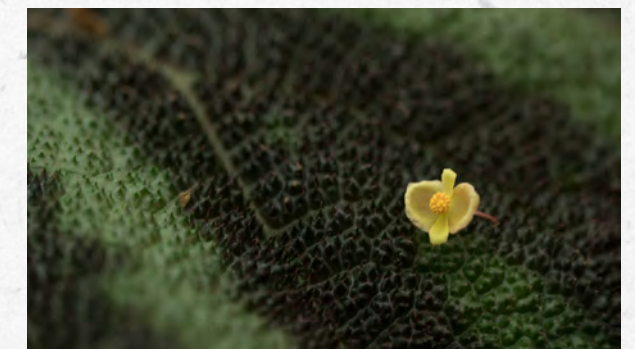
The Photovoltaic Energy Storage System at the Suao Taibaishan Mine



Drip irrigation system water outlet

OPPORTUNITIES

	POSSIBLE IMPACTS	FINANCIAL IMPACTS	COPING STRATEGIES
<b>Capital flow and financing</b> Access to nature-related green funds <small>SHORT-/MEDIUM-TERM OPPORTUNITIES</small>	<b>Investment in nature projects and actions</b> Protect and improve biodiversity, increase land use, and afforest to increase natural carbon sinks.  <b>Reputation, investment, and financing opportunities</b> The world will have a certain degree of recognition for the nature-friendly actions of TCC if TCC acquires nature-related green funds.	Decreased Costs  Increased Access to Capital	<b>Active nature-related information disclosure</b> Proactively disclose nature-related strategies and measures in the international ratings and sustainability reports and actively respond to questions from the rating entities to account for how to allocate the green funds obtained to the investments related to sustainable development and nature conservation.  <b>Active acquirement of green funding</b> TCC actively applies for green credits from financial institutions, including green loans and sustainability index-linked loans, and directs green funds into the green infrastructure construction. Meanwhile, TCC reduces its consumption and pollution of natural resources as well as lowers its carbon emissions and water consumption, so as to mitigate issues like climate change and water scarcity.
	<b>New technologies and well-being creation</b> Change the way of nature utilization and create new business opportunities.	Return on investment in carbon sequestration technologies  Business model development	<b>Launch of the Ho-Ping Ark Ecological Program</b> Launch the "Ho-Ping Ark Ecological Program," the only 10-year long-term soil species research program in the world, to carry out innovative ecosystem modeling, long-term soil monitoring and research, and talent training with a team of soil research experts.  <b>Deep ocean water application</b> Develop marine energy in the eastern Taiwan, apply the deep ocean water produced to high-economic-value fish product culture, care products R&D, and leisure facility establishment, etc., to provide various functional services such as safe fish products and healthy food.  <b>Resilient building materials</b> Use natural materials to develop basic building materials that are better fit for climate and urban development to meet the need for circular net-zero buildings.
<b>Sustainable use of natural resources</b> <small>MEDIUM-TERM OPPORTUNITIES</small>	<b>Reduced carbon fee/tax</b> Inventory and assess the carbon sink potential for an effectively application in the carbon reduction of the Company  <b>Climate resilience enhancement</b> Manage carbon sinks to reduce carbon while effectively protecting the natural environment and enhancing the resilience of Earth.	Decreased costs  Return on investment in carbon sequestration	<b>Carbon negative/removal</b> Develop carbon credit certification and offset in line with international standards to offset carbon emissions for competitiveness boost.  <b>Natural carbon sink strategies</b> TCC continues to develop strategies for mine afforestation (green carbon), soil research (yellow carbon), and creation of coral ecosystem or seaweed bed at the Hoping Port (blue carbon) to increase carbon sequestration efficiency and sinks as well as mitigate climate change.
<b>Development of natural carbon sinks</b> <small>SHORT-/MEDIUM-TERM OPPORTUNITIES</small>	<b>Climate resilience enhancement</b> Manage carbon sinks to reduce carbon while effectively protecting the natural environment and enhancing the resilience of Earth.	Decreased costs  Return on investment in carbon sequestration	<b>Carbon negative/removal</b> Develop carbon credit certification and offset in line with international standards to offset carbon emissions for competitiveness boost.  <b>Natural carbon sink strategies</b> TCC continues to develop strategies for mine afforestation (green carbon), soil research (yellow carbon), and creation of coral ecosystem or seaweed bed at the Hoping Port (blue carbon) to increase carbon sequestration efficiency and sinks as well as mitigate climate change.
<small>LONG-TERM OPPORTUNITIES</small>	<b>Climate resilience enhancement</b> Manage carbon sinks to reduce carbon while effectively protecting the natural environment and enhancing the resilience of Earth.	Decreased costs  Return on investment in carbon sequestration	<b>Carbon negative/removal</b> Develop carbon credit certification and offset in line with international standards to offset carbon emissions for competitiveness boost.  <b>Natural carbon sink strategies</b> TCC continues to develop strategies for mine afforestation (green carbon), soil research (yellow carbon), and creation of coral ecosystem or seaweed bed at the Hoping Port (blue carbon) to increase carbon sequestration efficiency and sinks as well as mitigate climate change.





## 2.4 | TNFD Pilot Process and Review

During the TNFD analysis process, TCC was deeply aware of the grave impact caused by ecosystem destruction and biodiversity loss. In addition to contemplation and investigation of the risks and opportunities faced, TCC also actively formulated strategies and targets and implemented corresponding measures to achieve the mutual benefits of ecological protection and business operation. TCC shall continue to conduct ecological protection and restoration plans. Aiming to protect the affected biodiversity hotspots and restore the potentially impacted ecosystems, the plans cover works such as mining operations, species protection, ecological restoration, and ecological value evaluation.

Discovery and Future Challenges for TCC	Plans and Practices of TCC
<p><b>Base Year of Ecological Restoration</b> Since the restoration of an ecosystem takes time and is subject to various factors, determining a clear benchmark makes the critical element for ecological restoration monitoring. Nonetheless, due to the difficulty in finding historical data and the lack of actual, specific data, it is challenging to determine the benchmark.</p>	<ul style="list-style-type: none"> <li>▲ Work with local experts to continuously and extensively collect and analyze historical data and monitoring data of local ecosystems, including biodiversity indicators, species richness, community structure, etc., understand the trend of ecosystem changes through a detailed data analysis, and find the appropriate base year via analysis.</li> <li>▲ Establishing a database demands a long-term continuous monitoring. Through regular data update and ongoing participation of local experts, TCC constantly revises and improves the mean to set the base year, so as to engage in and assess restoration efforts in an optimal manner.</li> </ul>
<p><b>Judgment of Restoration Results</b> Now that nature and ecosystems present regionality, there is no unified scientific method to follow for indigenous species restoration.</p>	<ul style="list-style-type: none"> <li>▲ Actively cooperate with local experts, including conducting ecological research with experts in the ecosystems in Taiwan and nature, and join the nature initiatives of Taiwan to capture the ecological issues related to Taiwan.</li> <li>▲ The undeveloped forest in proximity or the original landscape is used as the benchmark for comparison at this stage.</li> </ul> <p><b>Suao Mine:</b> Understand the local indigenous species with the undeveloped forest in proximity as the reference.</p> <p><b>Hoping Mine:</b> Plant the tree species recommended by Forestry and Nature Conservation Agency in line with the EIA and work with KBCC, with the indigenous species in the region at core, to replant trees at different altitudes to the mine successively, restoring the limestone habitat to its original landscape systematically. Meanwhile, plant the tree species recommended by the Forestry Bureau in line with the EIA.</p>
<p><b>Global Scenario Analyses</b> At present, without a unified international guidance for reference, there is only qualitative scenario analysis available.</p>	<p>TCC shall stay abreast of international initiative organizations, such as the contents of the SBTN and the Final Framework (v1.0) of TNFD.</p>

## Key Actions Taken by TCC

**Ecofriendly Low-carbon Mining Hilltop Platform Mode & Vertical Shaft Transport Method**

Hoping Cement Special Zone tackled common transportation issues associated with open-pit mining in cement production, caused by dust, mud, and smoke from large trucks.

The circular economy model was taken into account right at the beginning of plant establishment, and the 3-in-1 of port, power, cement plant business model was adopted to optimize the efficiency of resource use. Beginning in 1987, TCC invested NT\$3.75 billion to establish the only open-pit mining with a vertical shaft transport system at the Hoping Mine, which significantly reduced environmental impact and landscape disruption. Limestone is mined progressively from mountaintop to plant using this vertical shaft system. After crushing, the raw materials are conveyed to silos and the plant via underground, enclosed conveyor belts, ensuring automation and eliminating noise and dust pollution. This pioneering approach received recognition, including a Technical Medal from the Chinese Institute of Mining and Metallurgical Engineers and the Excellence Award for Safety and Health Practices from the Council of Labor Affairs.

## KBCC Assistance in Restoring the Indigenous Species of Mines from Greenhouse to the Wild

To restore mine ecosystems effectively, TCC focuses on preserving the indigenous plant provenance and partners with KBCC for their expertise. KBCC helps conserve and propagate indigenous plants like Taiwan urn orchids and Oriental chain ferns, planting them back in their natural habitats. This effort aims to transition greenhouse-grown seedlings to the wild. KBCC shall continue to provide ongoing support by offering expert advice and selecting appropriate species for afforestation plans, aligning with natural forest evolution. TCC will continue growing seedlings, expanding indigenous species in the mines, and restoring the mines original ecological landscapes.



## Quantitative Report of the Mine - The First Case of ESV Evaluation for the Hoping Mine

In 2020, the Hoping Plant of TCC worked with Professor Chyi-Rong Chiou, Director of Biodiversity Center, National Taiwan University, to perform evaluation of the ecosystem service value (ESV) for the Jinchang Mine in Xiulin Township, Hualien County. The value of natural regulation services was estimated, including carbon sequestration, water conservation, air purification, and support services and encompassing items like soil and sand loss prevention and biodiversity. Based on the relevant measurements and reference prices of ecosystem services, such as international carbon trade prices, municipal water prices, costs for reduction of different pollution sources, and costs for dredging of streams and reservoirs, the ESV in the scope of the Jinchang Mine was estimated at NT\$108,371,802.

For the full text of the report on the ESV estimation for the mining area at the Jinchang Quarry, please refer to:



**The Hoping Mine:** In 2020, TCC collaborated with KBCC to restore the rare and endemic Taiwan urn orchid (*Bletilla formosana*), which is an indigenous plant in the in Hualien's Hoping Mine. KBCC employed aseptic seeding to cultivate around 2,000 seedlings, which were then transferred to the Hoping Mine's nursery for a minimum of 6 months to acclimate to the local climate. In October 2020, 300 Yunnan *Bletilla* seedlings were manually planted, with one planted for every 5 meters of mining. In 2022, KBCC continued the restoration efforts by propagating over 3,000 oriental chain ferns (*Woodwardia prolifera*) and brush pot trees (*Sphaeropteris lepifera*) using bulbil and seedling methods, preserving them in their greenhouse.

**The Suao Taibaishan Mine:** Starting from 2018, KBCC has been regularly collecting the provenances of the indigenous brush pot tree and oriental chain fern from the Suao Taibaishan Mine each year for cultivation back at KBCC. After the provenances become saplings, they are restored to the Taibaishan. Also, certain saplings are provided to the National Ilan University (NIU) for academic cooperation so as to continue cultivating and propagating the plants at the restoration greenhouse of NIU.