ENVIRONMENTAL MONITORING INITIATIVES

1. OVERVIEW AND SDG 14 RELEVANCE

The Applied Research Center for Environment and Marine Studies (ARCEMS) at KFUPM supports Saudi Arabia's commitment to sustainable development and the protection of marine resources through applied environmental monitoring, scientific research and industry partnerships. Its current environmental monitoring program directly supports Sustainable Development Goal 14 (Life Below Water) by improving the protection, restoration and sustainable management of coastal and marine ecosystems.

During 2025–2026, ARCEMS is implementing three environmental monitoring projects covering the Zuluf, Marjan, Tanajib and Juaymah areas. The projects are being conducted in association with McDermott, Saipem and DMDC. The work provides independent environmental evidence during and after major construction activities and helps project owners identify, control and verify potential impacts on marine and terrestrial environments.

2. MONITORING AS A PREVENTIVE ENVIRONMENTAL ACTION

ARCEMS applies a layered monitoring approach. Monthly compliance visits provide regular field verification of environmental conditions and project controls. These visits include in-situ water-quality measurements and turbidity monitoring, together with inspection of environmental management and HSE requirements. More detailed monitoring phases are conducted semiannually to evaluate changes in water and sediment quality, habitats, biodiversity and environmental pressures.

This approach supports SDG 14 by generating timely information for preventing pollution, reducing habitat disturbance and protecting marine ecological functions. It also allows monitoring results to be compared over time, so that unusual conditions can be investigated and mitigation measures can be improved.

3. INSTITUTIONAL AND NATIONAL CONTRIBUTION

As a KFUPM-led initiative, ARCEMS connects university expertise with national development activities. The program integrates marine science, environmental chemistry, ecology, engineering, field monitoring, laboratory analysis, geospatial assessment and environmental reporting. This provides a practical mechanism for supporting responsible

offshore and coastal development while maintaining environmental accountability.

4. SCOPE OF ENVIRONMENTAL MONITORING ACTIVITIES

The ARCEMS program covers multiple environmental components (Table 1) so that potential project effects are assessed at both the physical and ecological levels. Monitoring is conducted during compliance visits and through major semiannual surveys, with the scope adapted to the requirements and environmental sensitivities of each project location. The monitoring surveys confirms a healthy and stable ecosystem (Figure 1 to 3) without any major impacts from the development activities.

Table 1. Major monitoring components, sampling frequency and contribution to SDG 14.

Monitoring component	Main activities	Contribution to SDG 14
Water quality and turbidity	Monthly in-situ measurements, turbidity monitoring and semiannual water-quality surveys	Early detection and control of pollution and suspended sediment
Sediment quality	Semiannual sediment sampling and laboratory assessment	Identifies contamination and seabed disturbance risks
Macrobenthos	Semiannual benthic-community surveys	Tracks ecological condition and seabed biological response
Seagrass and coral	Habitat surveys and assessment of coral and seagrass condition	Protects sensitive habitats and ecosystem services
Underwater noise	Underwater noise surveys during project activities	Assesses disturbance to marine fauna and supports mitigation
Waste management	Site inspections, waste tracking and compliance verification	Prevents marine litter and improper disposal
Terrestrial environment	Terrestrial ecological and environmental surveys	Controls land-based pressures affecting coastal waters
Air quality and noise	Routine and periodic air-quality and ambient-noise monitoring	Controls project emissions and indirect environmental pressures

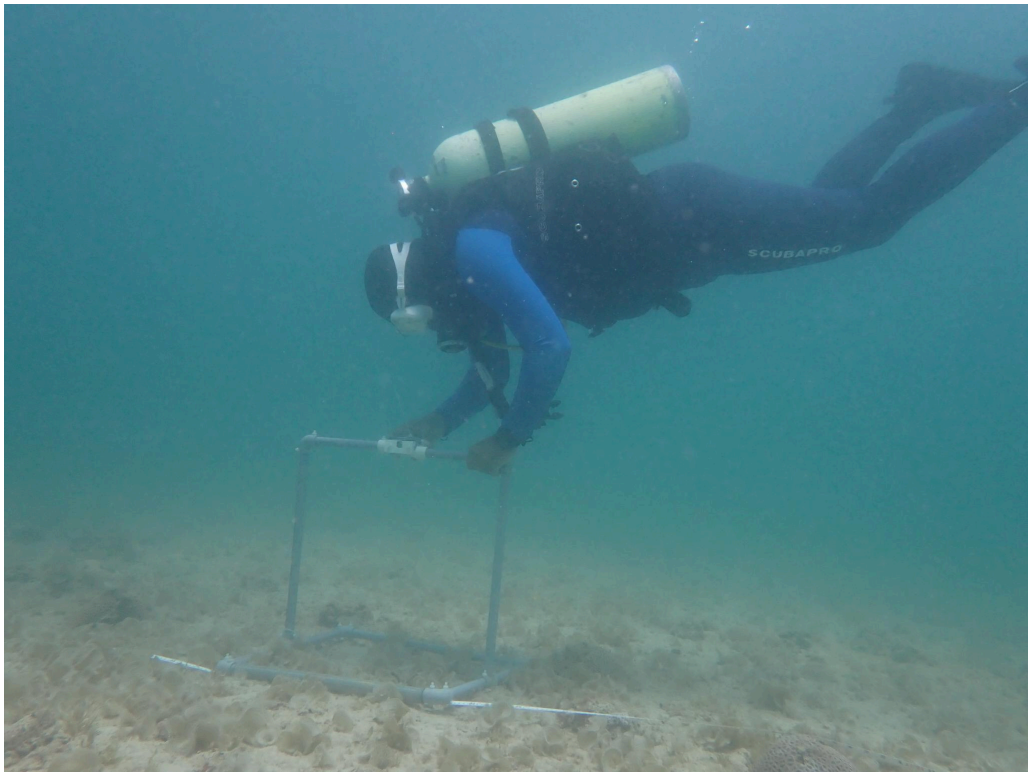


Figure 1. Seagrass and coral monitoring in Juaymah.



Figure 2. Seagrass species *Halophila Ovalis* in Tanajib.



Figure 3. Seagrass associated fishes in Tanajib

5. REPORTING, COMPLIANCE AND ADAPTIVE MANAGEMENT

ARCEMS converts field observations and specialist surveys into a structured reporting system for each project. Weekly HSE reports communicate immediate observations, compliance issues and required actions. Monthly progress reports consolidate monitoring activities, findings, incidents, corrective actions and implementation status. Annual reports provide a longer-term assessment of environmental performance, trends and the effectiveness of mitigation measures.

6. OUTCOMES AND CONTRIBUTION TO SDG 14

Pollution prevention

Regular in-situ, turbidity, water and sediment monitoring helps identify potential pollution and sediment related impacts before they become more severe.

Protection of sensitive habitats

Coral, seagrass and macrobenthos surveys provide evidence for protecting habitats that support fisheries, biodiversity and coastal ecosystem functions.

Reduction of disturbance

Underwater-noise monitoring and waste-management inspections address less visible but important pressures on marine organisms and habitats.

Evidence based compliance

The combination of field visits, semiannual surveys and periodic reporting provides traceable evidence for environmental compliance and project decision making.

Longterm environmental stewardship

Continuous monitoring builds datasets that can support trend analysis, cumulative impact assessment and improved environmental management in Saudi coastal waters.

7. CONCLUSION

ARCEMS, led by KFUPM, is translating SDG 14 into practical action through sustained environmental monitoring at Zuluf, Marjan, Tanajib and Juaymah. In partnership with McDermott, Saipem and DMDC, the program combines monthly compliance monitoring, semiannual specialist surveys, weekly HSE reporting, monthly progress reporting and annual environmental assessment. This integrated system helps prevent pollution, protect marine habitats and support sustainable development in Saudi Arabia.