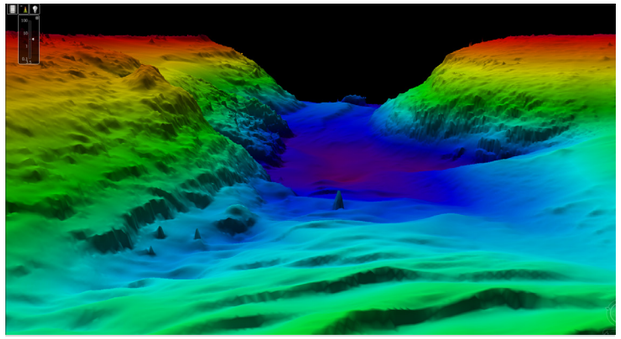
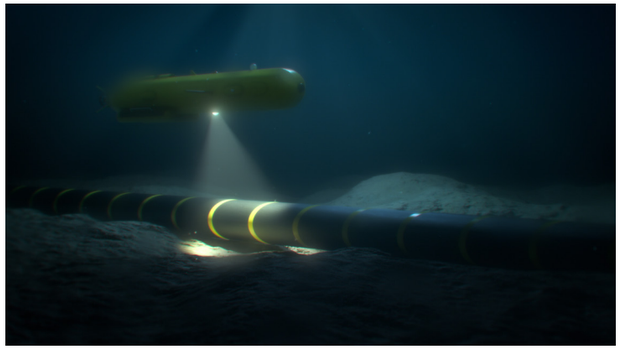
Marine Cable Routing: Subsea Fiber Optic & Power Cables



AECOM's investigative and interdisciplinary approach to conducting desktop studies helps clients minimize project risk through front-end analysis.

Key Reference Material

International Cable Protection Committee (ICPC) Recommendation No. 9, Issue 5B (Minimum Technical Requirements for a Desktop Study)



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Overview

Desktop study constraint analyses for planned marine cable infrastructure projects help to build a foundational baseline in which to design cost-efficient cable systems with minimal and/or controlled risk exposure. Desktop studies support marine routing analyses by:

- Identifying natural and anthropogenic characteristics of the system's marine footprint
- Tailoring assessments of temporal and spatial patterns of external aggression risks (e.g., anchoring, fishing gear) and permitting driven risks to balance the cost drivers for a cable system (i.e., cable length, burial plans, and armoring plans)
- Detecting constraints and opportunities to marine routing options and discovering re-routing options that mitigate risk exposures

Our Approach

AECOM's marine routing team builds marine route analyses that are tailored to clients' goals and engineering needs. Our team of experts, including scientists and engineers, combine an in-depth knowledge of the marine natural environment and human uses with engineering and permitting expertise to build detailed marine routing desktop assessments. The output of the desktop study assessment process includes blueprint marine routes to support downstream project milestones and a catalogue of identified risks with potential mitigation strategies for the planned project footprint. In addition, the analysis process produces recommendations for future research and/or assessment to help clients build viable and cost-effective marine routes. We implement our marine routing approach in accordance with the following process:

- **MARINE ROUTE FOOTPRINT IDENTIFICATION.** Establishment of the geographic target landing points for the marine routing assessment, which determines the overall study area footprint for the planned marine cable system.
- **TAILORED APPROACH TO CLIENT'S GOALS.** Identification of clients' goals regarding route design, landing points, engineering design considerations, and permitting drivers to tailor the analysis.
- **DATA AND INFORMATION COLLECTION.** Gather and compile data for the project footprint.
- **GIS-DRIVEN INTERDISCIPLINARY ASSESSMENT.** Combine and assess gathered data to identify risk environments and design a marine route to avoid identified risk areas and/or produce mitigation strategies for such routing. The marine routing design folds multiple considerations and characteristiscs into the process, including natural characteristiscs and human uses of the marine space, engineering inputs, marine operationality considerations, and permitting processes to build a layered approach to the analysis.
- **FINDINGS AND RECOMMENDATIONS.** Review of the analysis of the produced marine routes and desktop study with the client.
- **PATH FORWARD.** Support the client with post-desktop study project steps and acting upon a desktop study's recommendations, which could include specific studies, pre-survey preparation, permitting feasibility studies and pre-application regulator outreach, or augmented routing analyses.

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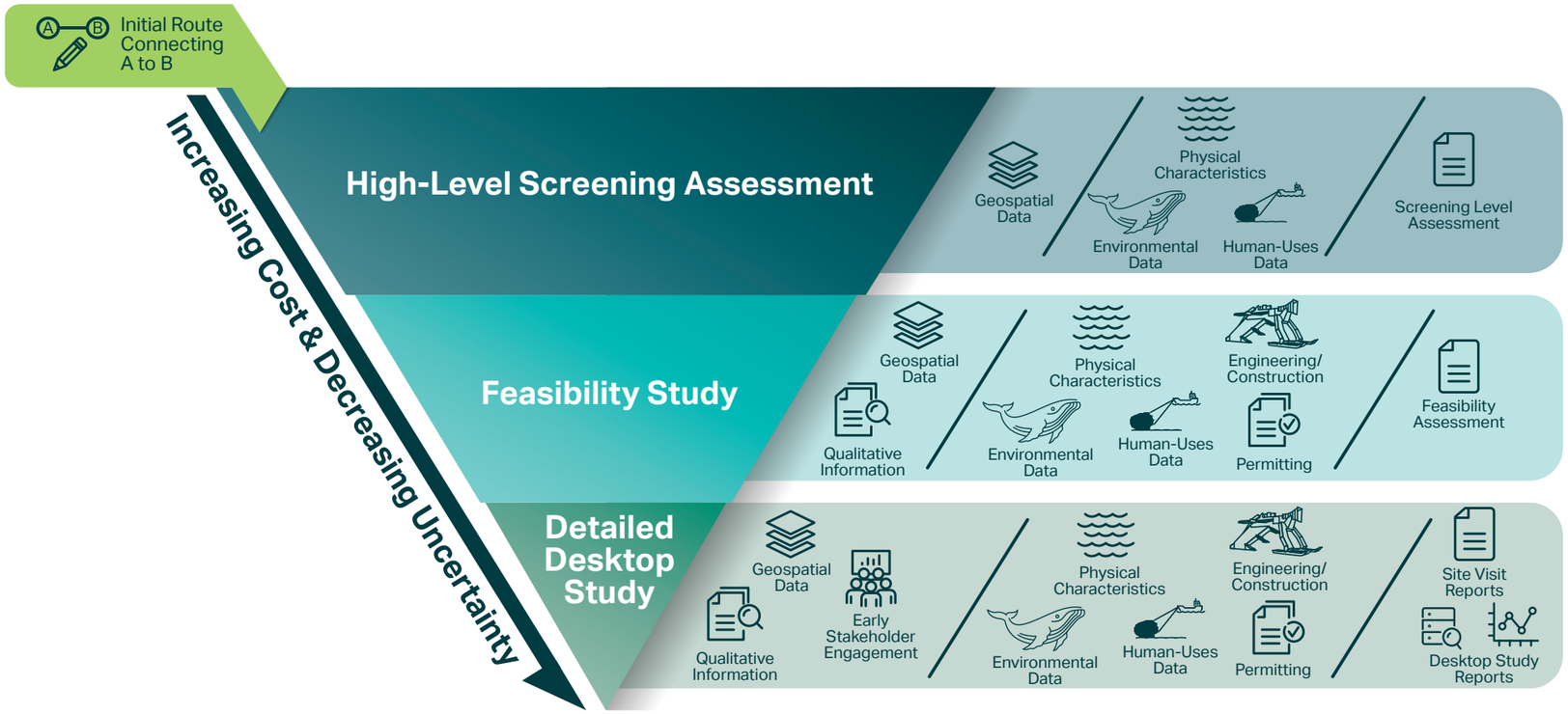
Areas of Expertise

- **SCALABLE DESKTOP STUDIES** that fit client needs. AECOM has an agile desktop study methodology framework that can be adapted to meet clients wherever they are at within their project planning.
- **GEOSPATIALLY-DRIVEN MARINE DESKTOP STUDY ANALYSES** focus on gathering and analyzing marine geospatial data to understand the natural characteristics and human uses associated with planned submarine cable footprints to assess compounded risk environments, marine operationability, and long-term risk exposure for a system.
- **MARINE GEOLOGIC ASSESSMENTS** build an understanding of the marine geologic and bathymetric setting to inform routing choices and needs, HDD or direct landing options, burial, and armoring.
- **PERMITTING-DRIVEN RISK AND CONSIDERATIONS** can serve as an input to marine routing assessments and/or be a bundeled service with marine routing desktop studies (i.e., a Permit Feasbility Study)
- **ENGINEERING ASSESSMENTS** inform viable solutions for marine routes, including landing point needs such as HDDs or open trench landings

Key AECOM Attributes

- **EXPERIENCED TEAM OF MARINE SCIENTISTS.** AECOM's team of marine scientists translate scientific data and information for application to marine infrastructure projects, identifying how natural or man-made conditions could impact a marine asset. Such a tailored approach identifies constraints, opportunities and risks to inform marine technical route design.
- **SPECIALIZED INTERDISCIPLINARY MARINE CAPABILITIES.** AECOM has a unique team of geospatial scientists with strong backgrounds in marine science that allow them to apply specialized and tailored GIS techniques to projects to analyze and communicate a marine cable project's geospatial risks, opportunities, and findings.
- **REGULATORY/PERMITTING SPECIALISTS.** AECOM's team of permitting experts are well-versed in support of a variety of marine cable projects worldwide. Our permitting team has global experience and actively supports our desktop study analyses so the permitting perspective can be incorporated into the interdisciplinary analysis, tracking and analyzing any constraints to a project that could create permitting risk and/or extend permitting timelines. By incorporating our subsea permitting team expertise into desktop study projects, we help to de-risk permitting processes from project start.



- **HDD ENGINEERING AND CONSTRUCTION EXPERTISE.** AECOM's experienced HDD Engineering & Construction team has supported a variety of marine projects with HDD, microtunneling, conventional boring, and trenched solutions. The team has also conducted operational stress analyses, borehole stability analyses, permitting support and documentation for sites/easements as well as construction inspection, monitoring and as-built documentation. Our team has conducted over 2,500 trenchless designs to date and has the expertise to not only support desktop studies and early risk landing identification, but also is able to support projects as they move beyond the desktop study phase into project implementation.
- **FISHING ASSESSMENT EXPERIENCE.** Our team at AECOM is seasoned in conducting fishing assessments, understanding target catches, fishing gear types, and spatial and temporal patterns to fishing activity. Incorporating such fishing pattern assessments into desktop studies are critical to identifying marine cable routes for projects. Such assessments also serve as an important factor to a project downstream as burial plans are prepared. AECOM's team not only recognizes the importance of assessing fishing risk within a desktop study but is prepared to support clients after the desktop study phase as a project transitions into burial plans and permitting processes.

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