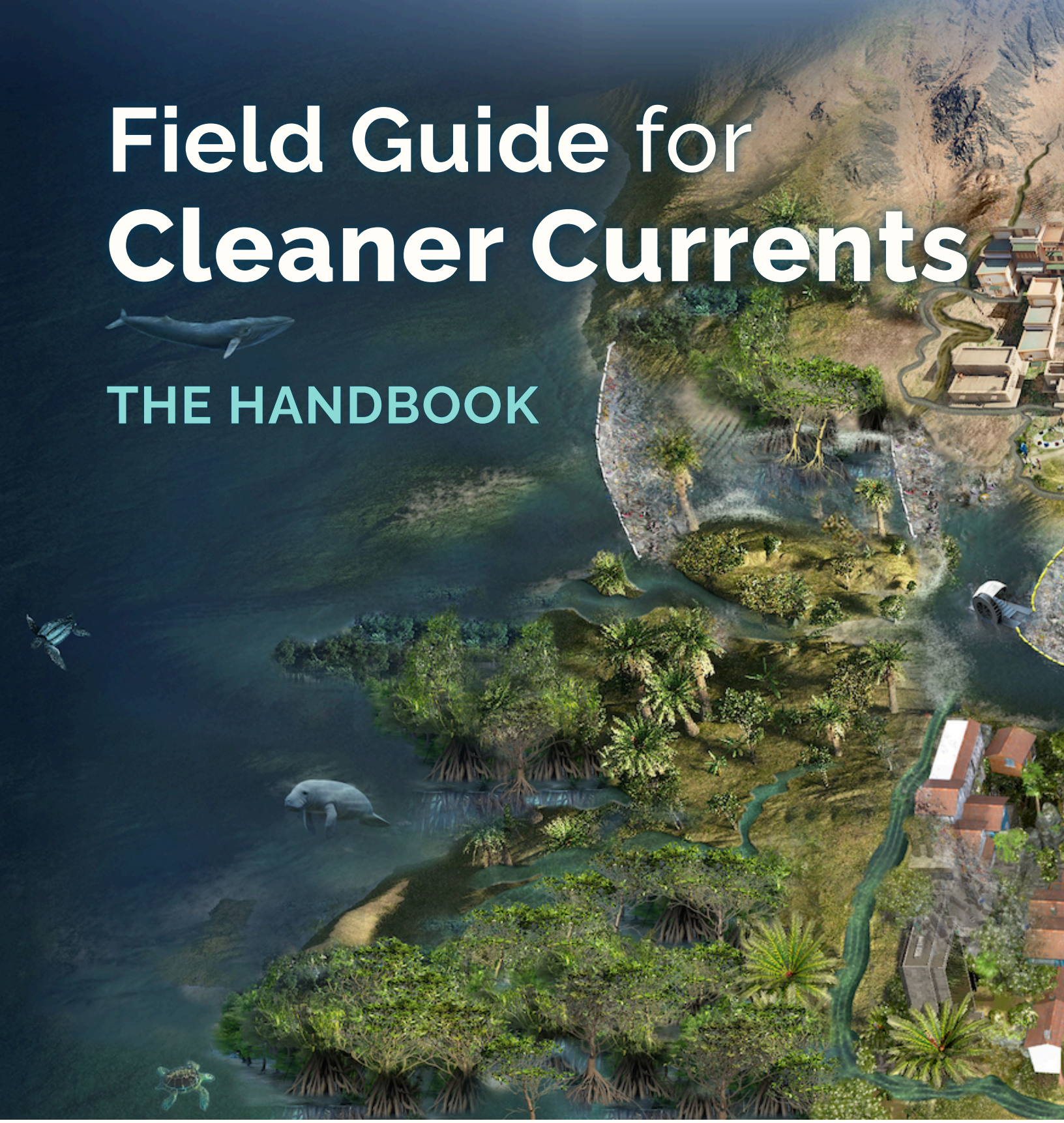
Field Guide for Cleaner Currents

THE HANDBOOK



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CLEAN CURRENTS COALITION

BENIOFF OCEAN SCIENCE LABORATORY

The Benioff Ocean Science Laboratory, based at the Marine Science Institute at the University of California, Santa Barbara, works to restore the health of the ocean by leveraging the power of science, technology, and collaboration to develop replicable and scalable solutions. The Benioff Ocean Science Laboratory is supported by the generosity of Marc and Lynne Benioff. Learn more at bosl.ucsb.edu.

The Clean Currents Coalition is a collaborative network of eight projects in eight countries across four continents working to combat plastic pollution through technology-based solutions that capture and remove plastic waste from rivers and prevent further transport from rivers to the ocean. The Coalition was created by the Benioff Ocean Science Laboratory in 2020. Learn more at cleancurrentscoalition.org.

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In Memory of Juan Andrés Silva—
who, above all else, valued friendship, community, & nature.

Contents

Introduction

Plastic pollution is a global threat to human health, economies, and ecosystems. One of the greatest planetary challenges in human history, plastic pollution is a complex problem that requires multiple solutions in many different forms. There is no panacea. And it is urgent—plastic pollution is predicted to double by 2050.[1]

In 2015, it was first estimated that 4.8 to 12.7 million metric tons of plastic pollution enter the ocean worldwide every year.[2] In 2017, we learned that only 9% of all plastic ever produced has been recycled.[3] Further research discovered that the majority of plastic pollution in the ocean originates on land, and that rivers are the primary transporter of land-to-ocean pollution.[4,5]

Based on this emerging scientific understanding, the Benioff Ocean Science Laboratory sought to develop solutions to marine plastic pollution by targeting rivers. In 2018, experts and leaders at the forefront of the fight against plastic pollution convened for a summit at the University of California, Santa Barbara to conceptualize interventions for plastic pollution in rivers*. An open call for river plastic capture project proposals revealed shared concern in communities around the world as well as passionate leaders ready to take action and solve this problem. From these proposals, eight unique projects from eight different countries across four continents were selected to form the Clean Currents Coalition ("Coalition").

*cleancurrentscoalition.org/get-involved/

Connected by a shared mission to clean up rivers in their own communities, the Coalition became a global network of projects collaborating to develop solutions to plastic pollution. Each project uses innovative technological designs and strategies to capture and remove plastic pollution from rivers to prevent it from reaching the ocean. The ultimate goal of these projects is to turn off the tap on plastic pollution so that plastic does not enter rivers in the first place. The Coalition projects have raised awareness of plastic pollution, compiled the world's largest public database on plastic in rivers, educated and empowered local communities, and engaged policymakers to enact stronger, more ambitious laws and regulations.

Together we can turn off the tap of plastic pollution, **one river at a time.**

On this journey, the Coalition amassed a wealth of knowledge and experience for the development, implementation, and operation of river plastic capture projects. The lessons learned, common challenges and solutions, and actionable advice emerging from the Coalition projects are documented and compiled in this Field Guide for Cleaner Currents—a comprehensive, open access, and sharable resource aimed at increasing the success and maximizing the impact of similar projects.

About the Field Guide for Cleaner Currents

The Field Guide for Cleaner Currents ("Field Guide") consists of two companion resources: The Tool (web-based interactive tool*) and The Handbook (this written document).

The Field Guide is organized into nine sections representing the different aspects, or "phases", of successful river plastic capture projects. Each phase is defined, summarized, and expounded upon through key insights, additional considerations and recommendations, and tangible examples and data from Coalition experience. The nine phases in the Field Guide are not necessarily sequential as presented, because each river plastic capture project is unique, and all phases may be relevant throughout different points in a project's timeline and may interact with one another.

*cleancurrentscoalition.org/field-guide/

The ten "Guiding Principles" found in the Field Guide represent the foundational values and philosophies for success that emerged from the experience of the Coalition. The Guiding Principles are universally applicable across projects and phases and are critical to maximize impact.

Additional comprehensive case studies from Coalition teams in Thailand and Panama illustrate the practical application of all phases for these two exemplary projects.

Using The Handbook

Guiding Principles are denoted by their numeric icons (1-10) throughout The Handbook.

- The complete list of **Guiding Principles** (and numeric icons) can be found on page 5 along with a ***shortened written description of each principle*** (which are used later as a reminder of the principle, in addition to the numeric icons).

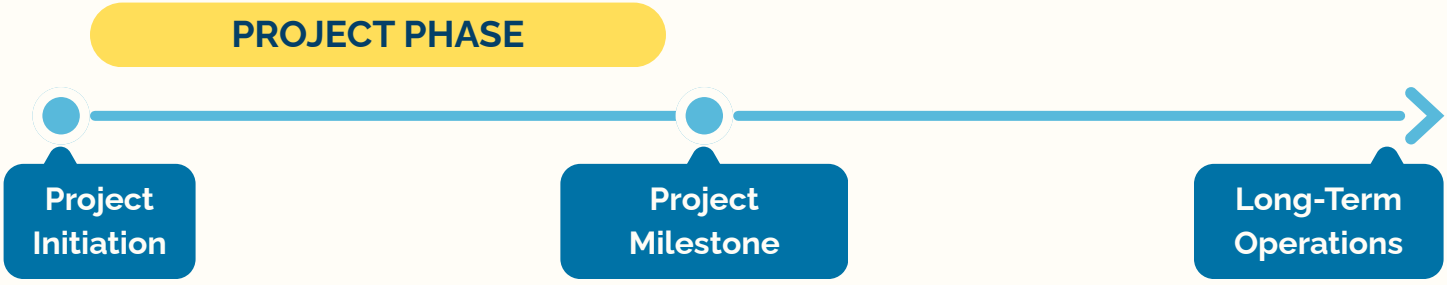
Project Phases headline each section of the Handbook and are denoted by their graphic icons.

- The complete list of **Project Phases** (and graphic icons) can be found on page 6 along with a ***shortened phase title*** (which are used later as a reminder of the phase, in addition to the graphic icons).

Experience from the Field
Keep an eye out for Coalition advice and data in these boxes!

Each **Project Phase** detailed in The Handbook includes:

- **Intersectional Guiding Principles**
  - The principles of particular importance in context of each respective phase.
- **Related Project Phases**
  - The other project phases most connected to each respective phase.
- **Experience from the Field**
  - Advice compiled and shared by the Coalition, including:
    - Data points from the Coalition project survey pertinent to each respective phase.
    - Examples of real-world outcomes in the implementation of each respective phase.
    - Case studies that follow one project through all phases.
- **Timeline**
  - The portion of a project timeline most associated with each respective phase.



References

1. A.S. Pottinger. Pathways to reduce global plastic waste mismanagement and greenhouse gas emissions by 2050. Science, 386 (2024), p. 6726
2. J.R. Jambeck, et al. Plastic waste inputs from land into the ocean. Science, 347 (2015), pp. 768-771
3. R. Geyer, J.R. Jambeck, K.L. Law. Production, use, and fate of all plastics ever made. Sci. Adv. 3, e1700782 (2017)
4. L.C.M. Lebreton, et al. River plastic emissions to the world's oceans. Nat. Commun., 8 (2017), p. 15611
5. C. Schmidt, T. Krauth, S. Wagner. Export of plastic debris by Rivers into the Sea. Environ. Sci. Technol., 51 (2017), pp. 12246-12253

GUIDING PRINCIPLES

These ten guiding principles are the most fundamental recommendations for success gathered from the experience of the Clean Currents Coalition that are applicable throughout many phases of a river plastic capture project.

1. Leverage the project to turn off the upstream sources of plastic pollution

Turn off the tap

2. Anticipate and plan for unpredictable delays and expenses

Anticipate delays

3. Work with people that want to work with you

Work with willing partners

4. Maintain autonomy of local leadership and respect for community voices

Maintain local autonomy

5. Develop positive relationships with local, regional, and national governments

Develop positive relationships

6. Tailor the project to local environmental, social, economic, and cultural contexts

Tailor approach to local contexts

7. Prioritize long-term, sustainable operations in the project design and budget

Prioritize long-term operations

8. Involve, empower, and invest in local communities

Empower local communities

9. Remain flexible to adapt to challenges and changing circumstances

Adapt to new challenges

10. Collect data and use it to create positive change

Use data to create change

The project phases in which each guiding principle is of particular importance are denoted by their respective graphic icons

PROJECT PHASES

River plastic capture projects intersect many disciplines—engineering, environmental science, and policy and law, to name a few. The project phases organize these complex, interwoven components into themed categories.

Permits

1 2 5 7 10

Permits

Site Selection

1 3 6 9 10

Site Selection

Plastic Capture Technology Selection

1 2 6 9 10

Technology Selection

Infrastructure Installation, Operations, & Maintenance

1 2 3 7 9

Installation & Operations

Data Collection

1 4 5 8 10

Data Collection

Waste Management

1 2 5 8 10

Waste Management

Community Engagement, Investment, & Empowerment

1 3 4 6 8

Community Engagement

Communications, Education, & Media

1 3 4 8 10

Communications & Eduation

Finance & Budget

1 2 7 8 9

Finance & Budget

The guiding principles of particular importance to each project phase are denoted by their respective numeric icons

EXECUTIVE SUMMARY

Permits

1 2 5 7 10

The acquisition of permits is a necessary step in the implementation of all river plastic capture projects. The number and type of permits required, the application requirements, and the associated fees and costs will vary based on specific jurisdictions.

- Develop comprehensive knowledge of the local regulatory landscape and permit processes.
- Budget for permit application fees and costs with a buffer for unforeseen expenses.
- Build positive relationships and trust with permit agencies and stakeholders.

Site Selection

1 3 6 9 10

There are many factors to consider in site selection, and while there may not be a single perfect option, the chosen site should enable the achievement of the project priorities. Consider multiple options, retain backup options, and analyze the trade-offs between different potential sites based on the project goals.

- Observe prospective sites early in project development over multiple seasons and conditions.
- Collect hydrological, pollution load, debris composition, and other important data.
- Consider multiple sites and/or rivers and be prepared to be flexible and adaptable.

Plastic Capture Technology Selection

1 2 6 9 10

The selection of a plastic capture technology must be tailored to the unique local conditions of the target intervention site. It is important to remain flexible and expect to iteratively improve the technology and capture approach.

- Consider the future operation, maintenance, and repair requirements of capture technology.
- Ensure installation and operations are feasible—physically, financially, and practically.
- Select technology and processes tailored to withstand the unique challenges of a site.

Infrastructure Installation, Operations, & Maintenance

1 2 3 7 9

The installation and operation of physical infrastructure in harsh environments like rivers requires considerable experimentation and trial and error. Maintenance, repairs, and replacements to hardware are inevitable, and these expenses should be accounted for in the project budget. Adaptability and creativity are necessary throughout the life of the project as new problems arise.

- Create an equitable, respectful, and safe environment that prioritizes people and the planet.
- Design operations with adaptability and flexibility as project scope and resources allow.
- Commit to long-term operations and never abandon derelict infrastructure in a river.

Data Collection

1 4 5 8 10

River plastic capture projects provide a strategic opportunity to simultaneously clean rivers and collect detailed data on plastic pollution. The detailed characteristics of river plastic, such as the most prevalent item types (e.g., bottles) or plastic polymers (e.g., PET), can be used to inform more efficient upstream solutions that target the main sources of plastic pollution.

- Establish clear, consistent, and well-documented data collection protocols.
- Design data collection methods that are operationally feasible—start simple and expand.
- Consider metrics that include total and sorted plastic categories and end-of-life fates.

Waste Management

1 2 5 8 10

Once plastic is captured from a river, it is crucial that it is properly managed to avoid the cycle of leakage into the environment again. Available waste management infrastructure is highly variable depending on the location; disposal of captured plastic in a sanitary landfill may be the only available solution. Other available options may be to recycle, incinerate, or use for waste-to-energy, as well as non-traditional solutions including creative reuse or downcycle into new products.

- Identify all possible waste management solutions available in the site selection process.
- Budget for fees, expenses, and possible revenue associated with waste management.
- Understand local capacity to recycle, which is often limited or non-existent in some areas.

Community Engagement, Investment, & Empowerment

1 3 4 6 8

Every phase of a project hinges upon community support and is more impactful when there is local leadership and input. Invest in the community: offer local employment, build capacity through workshops and training, and provide tools that empower self-sustained, long-term solutions.

- Identify and connect with community leaders, figures that will differ by culture or location.
- Take a community-first approach that respects local input in project decisions, development, and implementation.
- Collaborate with diverse stakeholders: governments, the private sector, nonprofits, etc.

Communications, Education, & Media

1 3 4 8 10

River plastic capture projects are both visible (e.g., conspicuous physical infrastructure in prominent locations) and visual (e.g., vivid imagery of plastic pollution). Strategic, intentional communications can raise awareness of the problem and promote solutions. They can also build local support, encourage governments and stakeholders to take action, and serve as a powerful asset to cultivate financial sponsorship.

- Recognize the value of traditional and digital media engagement and youth education programs for creating systemic change.
- Leverage visual stories such as public art installations and diverse creative and programmatic approaches.
- Develop a consistent and recognizable style and brand that is tailored to the cultural context and audience.

Finance & Budget

1 2 7 8 9

Comprehensive and careful financial and budget management are essential to navigate the challenges and complexities of river plastic capture projects. An overly-stringent budget can limit impact, but irresponsible use of funds can bankrupt a project. In practice, multiple and creative approaches may be required to cultivate and maintain sufficient funds to support sustained project operations and future growth.

- Secure funds upfront for sustainable long-term operations and maintenance, when possible.
- Incorporate contingency funds into the budget for unexpected expenses.
- Pursue multiple financial support sources and strategies to build resiliency.

PERMITS

Intersectional Guiding Principles

1. Turn off the tap
2. Anticipate delays
5. Develop positive relationships
7. Prioritize long-term operations
10. Use data to create change

Permits

Related Project Phases: Site Selection | Technology Selection | Installation & Operations | Waste Management | Finance & Budget

Background

The acquisition of permits is a necessary step in the implementation of all river plastic capture projects. The construction and operation of physical infrastructure in rivers will invariably intersect with some level of environmental and civil regulation. The number and type of permits required, the application requirements, and the associated fees and costs will vary based on specific jurisdictions. To obtain all required permits will almost always take longer than anticipated and will likely be required before the start of any project operations. Begin the permit process as early as possible and allocate dedicated resources, time, and budget.

Key Insights

- Develop comprehensive knowledge of the local regulatory landscape and permit processes.
- Budget for permit application fees and costs with a buffer for unforeseen expenses.
- Build positive relationships and trust with permit agencies and stakeholders.

Range of Permit Fees & Costs:
$0-$1,500 USD

Range of Time to Acquire Permits:
3-24 Months

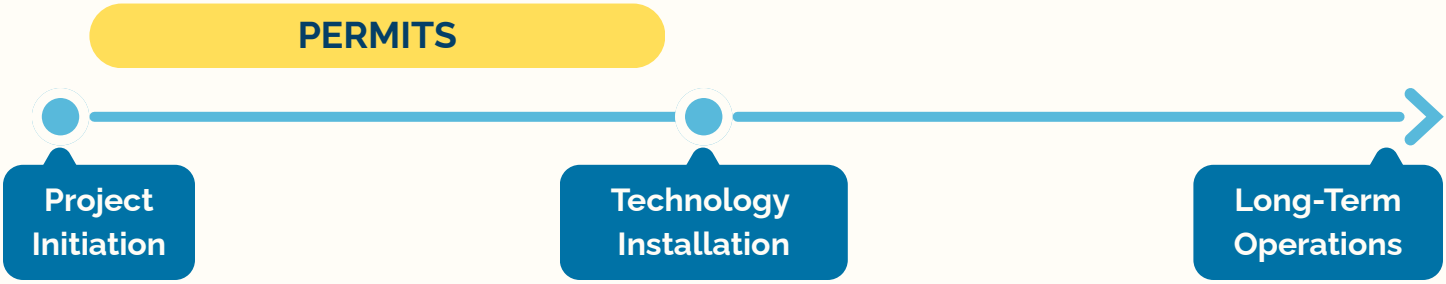
Additional Considerations and Recommendations

- **Expect unexpected delays—the permit process invariably takes longer than anticipated.**
  - Align resources, time, and budget with local permit requirements and costs, and be ready to adjust when those allocations are exceeded and change.
  - A river plastic capture project may be a first-of-its-kind for permitting officials and lack an established regulatory roadmap to guide the process. Provide comprehensive data in applications, detailed explanations to any questions that arise, and exercise patience with all stakeholders.
  - Prepare for the delays most likely to occur given the specific context of the project, such as government inefficiencies, emergencies and natural disasters affecting government staffing and priorities, or turnover of leadership.

- **Build collaborative relationships with stakeholders, focus on the benefits the project brings to government and community priorities, and avoid being perceived as adversarial or disruptive.**
  - Communicate that river plastic capture projects not only clean the environment, but also provide social and economic benefits like stable employment, education opportunities, and improved waste management services, to name a few.
  - Enlist the help and support of the local community to champion the project. Listen to their needs and support their autonomy with genuine leadership and opportunities to engage with input and feedback.
  - Emphasize to elected officials the ways in which the project benefits their constituents and offer them public recognition for their support. Elected officials can often direct agencies to expedite and prioritize certain permits. Allow them to capitalize on the good will created by the project if their support is critical to the success of the project. Permit approval is more likely when officials are excited about a project that is led by an organization and people they trust. Frequent and honest communication with regulators that highlights a sincere commitment to improving communities will establish this excitement and trust.

- **Keep long-term goals in mind when navigating the permit process.**
  - Explore the possibility of umbrella permits that encompass various activities across a whole city or province rather than a single installation to help streamline permits for anticipated future project expansions.
  - Ask for permits (if allowed) that automatically renew after the initial conditions expire, which can help prevent complications from changing circumstances (e.g., if a new political regime enters power that is less enthusiastic about the project or wants to differentiate itself from the priorities of the previous leadership).
    - For example, include a clause that specifies: "This permit will be automatically renewed unless terminated by either party six months before the end of the permitted period."

Timeline



Experience from the Field

Clean Currents Coalition, Global

Early and frequent communication with local/municipal, regional/sub-national, and national officials was critical across all eight Coalition projects, no matter the location or how stringent the regulatory landscape. In 2020, river plastic capture projects were often new to permitting officials, which resulted in delays to navigate bureaucracies and determine what permits were required, what information would be needed, and who should be involved. While every Coalition project required permits, the timeline, process, and approach to do so varied widely across regions. For projects located in countries with highly bureaucratic governments and strict regulations, it was critical for permit applications to be thorough, detailed, and accurate. In countries with less government oversight, it was often more important to develop strong personal relationships with decision makers whose support was more influential for project approval than the associated paperwork.

SITE SELECTION

Intersectional Guiding Principles

1. Turn off the tap
3. Work with willing partners
6. Talor approach to local contexts
9. Adapt to new challenges
10. Use data to create change

Site Selection

Related Project Phases: Permits | Technology Selection | Installation & Operations | Waste Management | Finance & Budget

Background

Nearly every aspect of a project will be affected by the selection of an optimal site (i.e., specific location in a river and the adjacent shoreline) on which to conduct the physical plastic capture. There are many factors to take into consideration in the selection of a site, and while there may not be a single perfect option, the chosen site should enable the achievement of the project priorities. Consider multiple options, retain backup options, and analyze the trade-offs between different potential sites based on the project goals.

Range of Prospective Sites Considered:
3-50

Range of Time to Select Site:
2-8 Months

Key Insights

- Observe prospective sites early in project development over multiple seasons and conditions.
- Collect hydrological, pollution load, debris composition, and other important data.
- Consider multiple sites and/or rivers and be prepared to be flexible and adaptable.

Additional Considerations and Recommendations

- **Keep the full scope of project operations in mind when assessing sites.**
  - Additional preparations may be required to make sites suitable for plastic capture operations (e.g., construction of access roads; erosion prevention measures). Think through the budget, timeline, and operational impacts of potential alterations.
  - Ensure there is sufficient shoreline space for post-collection processes such as sorting and storing. These locations should be easily accessible for waste management transportation and other operational needs.
  - Research the availability and accessibility of local waste management services and infrastructure for all prospective sites.
- **Engage and communicate with stakeholders from prospective sites to establish collaborative and inclusive relationships that are built on a foundation of trust.**
  - Make genuine attempts to connect with and involve adjacent communities, as they have

intimate knowledge of the river, are the most impacted by the project, and their support is critical to long-term success.

- Existing river uses, such as boat traffic, may impact or conflict with the project operations. Work in collaboration with other river users to find solutions that do not disrupt existing activities and do not create adversarial situations.
- Contact regulatory agencies in advance to inquire about the possibility of operating at the target site(s).
- River plastic capture projects face potential safety, theft, and vandalism risks because they require visible and valuable physical infrastructure; this risk may be mitigated with proactive community engagement.

- **Consider tradeoffs between prospective sites with the overall project's approach, context, and goals in mind.**
  - Rural areas may provide more space to operate, less resistance from stakeholders, and a simpler permitting process. Urban sites may have larger volumes of plastic pollution, be more visible as a tool for communications and influencing upstream change, and be closer to waste management facilities.
  - If using a predetermined capture technology, identify and prioritize the most important site characteristics required for that technology to be successful (e.g., depth; flow rates; organic content).
  - If selecting a site first and determining capture technology after, assess site characteristics to identify what technologies would be possible to use and analyze the options given the scope and resources of the project.
  - The public visibility of a site can be both an asset or a liability. Visible projects can be more effective communications tools, but can also experience resistance from permitting agencies, governments, or communities.

Timeline

SITE SELECTION

- Project Initiation
- Technology Operational
- Long-Term Operations

Experience from the Field

Marea Verde, Panama City, Panama

In Panama City, Panama, local non-profit Marea Verde was near-ready to install their trash wheel technology at their preferred river site. After over a year of project development, a few members from the adjacent community expressed antagonistic "not-in-my-backyard" (NIMBY) concerns about the project (e.g., trash piling up at the interception point, odor, attraction of animals, etc.). They became openly hostile and insisted on unrealistic demands, caused delays, and created difficult distractions for Marea Verde.

Marea Verde worked hard to address every concern, but these detractors proved unwilling to collaborate for a solution in good faith. Rather than appeasing these community members indefinitely with no return attempt to compromise, Marea Verde decided to relocate to a different river. They identified and engaged a community that was excited to work together, and from the outset they addressed any potential concerns of the community proactively and collaboratively.

While the decision to move the site caused a significant delay for the project at the time, it is clear now that it resulted in a much more successful and sustainable project. The additional, long-term positive impact made possible by the move far outweighed the time lost from the initial delay.

PLASTIC CAPTURE TECHNOLOGY SELECTION

Intersectional Guiding Principles

1. Turn off the tap
2. Anticipate delays
6. Tailor approach to local contexts
7. Prioritize long-term operations
9. Adapt to new challenges

Plastic Capture Technology Selection

Related Project Phases: Site Selection | Installation & Operations | Data Collection | Waste Management | Finance & Budget

Background

The selection of a plastic capture technology must be tailored to the unique local conditions of the target intervention site. There are a multitude of different technology options*, and trade-offs between options must be considered based on project priorities. The short-term manufacture and installation considerations of the capture technology must be feasible, and the long-term operations and maintenance should match the budget and capacity available to the project. It is important to remain flexible and expect to iteratively improve the technology and capture approach.

Key Insights

- Consider the future operation, maintenance, and repair requirements of capture technology.
- Ensure installation and operations are feasible—physically, financially, and practically.
- Select technology and processes tailored to withstand the unique challenges of a site.

Range of Technology Manufacture Costs:
$18,500-$1,000,000 USD

Range of Time to Select Technology:
4-24 Months

*cleancurrentscoalition.org/get-involved/

Additional Considerations and Recommendations

- **Align the selected capture technology with the project goals. Understand that compromises must be made between the pros and cons of technology options.**
  - Locally-sourced technology is often simpler to procure and repair and invests resources in the community. Imported technology can pose risks such as shipment delays, customs issues, higher costs, and hard-to-source replacement parts.
  - Increased technological complexity does not necessarily equate to increased plastic collection volumes; plastic collection volume is influenced by many other factors such as debris loads and patterns in the river and the alignment and efficiency of the technology design to the context of the specific river conditions.
  - Complex technology can be more expensive, difficult to scale, and harder to replicate than simpler options; however, it is often an effective tool to engage general audiences, which can generate more attention and incur benefits as a powerful communications asset.

- **Remain adaptive, creative, and iterative.**
  - Budget more resources and time than anticipated for the selection, design, and construction of technology and associated infrastructure—there invariably are unexpected costs and delays.
  - Accept that maintenance, repairs, and replacements will be necessary at some point. Take into account the budget, resources, and knowledge required to handle these challenges for each technology under consideration.
  - Be open to new or different solutions that can increase impact. Simple options (e.g., manually-serviced booms or traps) across multiple locations may result in more plastic captured than a single more complex technology (e.g., autonomous mechanical system). A coordinated series of capture devices may cover more river surface area, and a system targeting tributaries may facilitate simpler and more efficient operations.

Important Questions for Technology Selection

- **Are there tidal influences? Is the air salty or humid?**
  Moisture and salt increase the pace of corrosion and deterioration of materials. Certain materials better withstand humidity and salt.
- **At what frequency and magnitude do extreme weather events occur?**
  A replicable, lower-cost technology may be more effective if typhoons or hurricanes are common threats.
- **How intense are flood events and what technology can handle such conditions?**
  Plastic transport in rivers peaks during floods, making these events critical for effective operation.
- **What is the underlying geology of the site?**
  Some geologies are more prone to erosion, putting infrastructure at risk. Strong anchor points are needed to withstand debris loads on booms.
- **What types of wildlife are present and where within the site?**
  Infrastructure will have underwater components, but there are design options that can minimize the potential harm to wildlife. Often, there is minimal to no aquatic life in highly polluted rivers.
- **What materials will be used to construct the infrastructure?**
  Certain materials may be more or less expensive or accessible should repairs or replacements be required.
- **How much permanent infrastructure will be necessary?**
  Consider the invasiveness and negative legacy the abandoned infrastructure will have should the project be discontinued. Infrastructure that can be removed with minimal impact is preferable.
- **Is it feasible to install the required infrastructure at the site?**
  Ensure there is proper access for machinery, construction equipment, materials, etc.
- **What are local labor costs?**
  In some cases, it is cheaper to use manual, human-powered collection and removal. In others, increased automation lowers the cost compared to using more manual labor.
- **Is there sufficient space for the land-based operations of the plastic capture process?**
  Plan for how plastic will be moved from the river extraction point to the land infrastructure and design the technology to maximize efficiency.
- **What is the debris composition in the river at the site?**
  High organic debris loads can make the removal of plastic more difficult by entangling machinery components and increasing the weight and pressure put on barriers.
- **What is the composition of the plastic in the river?**
  Technology should suit the types of plastic being collected. Hard plastic bottles can pile up and escape over low-profile booms, while film plastics may clog conveyors and mechanical systems. If plastics travel below the surface, deeper grates beneath booms may be needed.
- **How much plastic is in the river?**
  Technology should match the river's trash loading patterns. Consistent flows may suit smaller, easily serviced traps, while highly variable rivers may require sturdier, high-capacity systems that can handle sporadic surges of trash.

Timeline

Experience from the Field

Ichthion Limited, Portoviejo River, Portoviejo, Ecuador

The technology-forward social enterprise Ichthion Limited deployed their Azure river plastic capture system in the Portoviejo River, Ecuador. This highly-engineered system consists of a floating curtain that moves with the tidal range of a river, a permeable barrier that allows fluvial fauna to pass under it, and a mechanical conveyor belt for autonomous extraction.

Once operational, the Azure system faced a series of unforeseen challenges that arose from the upstream and rural installation location such as extreme weather events, large organic debris flows, and site accessibility issues. To maximize its effectiveness and impact, Ichthion undertook an iterative process to adapt the system—which was originally designed for consistent flow rates and moderate debris volumes—to the local conditions that featured more sporadic debris influxes and a wide range of flow rates and water levels.

When Ichthion later expanded the project to more locations, the Azure system was complemented by more simple barrier and extraction systems sited where the river flows through the city of Portoviejo. These systems were well suited for the urban environment where less land area was available for shore-based infrastructure and existing human alterations to the river to mitigate flood and infrastructure damage made flow rates more predictable and consistent. These modifications allowed for simplified and more efficient operations at the new sites.

INFRASTRUCTURE INSTALLATION, OPERATIONS, & MAINTENANCE

Intersectional Guiding Principles

1. Turn off the tap
2. Anticipate delays
3. Work with willing partners
7. Prioritize long-term operations
9. Adapt to new challenges

Infrastructure Installation, Operations, & Maintenance

Related Project Phases: Technology Selection | Data Collection | Waste Management | Community Engagement | Finance & Budget

Background

The installation and operation of physical infrastructure in harsh environments like rivers requires considerable experimentation and trial and error. Maintenance, repairs, and replacements to hardware are inevitable, and those expenses should be accounted for in the project budget. Adaptability and creativity are necessary throughout the life of the project as new problems arise. Unlike some other aspects of these projects that can be difficult to change once established (e.g., site selection), plastic capture technology and day-to-day operational protocols can be designed to incorporate flexibility and modifications.

Range of Annual Maintenance Costs:
$1,500-$50,000 USD

Range of Time from Initiation to Operational:
6-36 Months

Key Insights

- Create an equitable, respectful, and safe environment that prioritizes people and the planet.
- Design operations with adaptability and flexibility as project scope and resources allow.
- Commit to long-term operations and never abandon derelict infrastructure in a river.

Additional Considerations and Recommendations

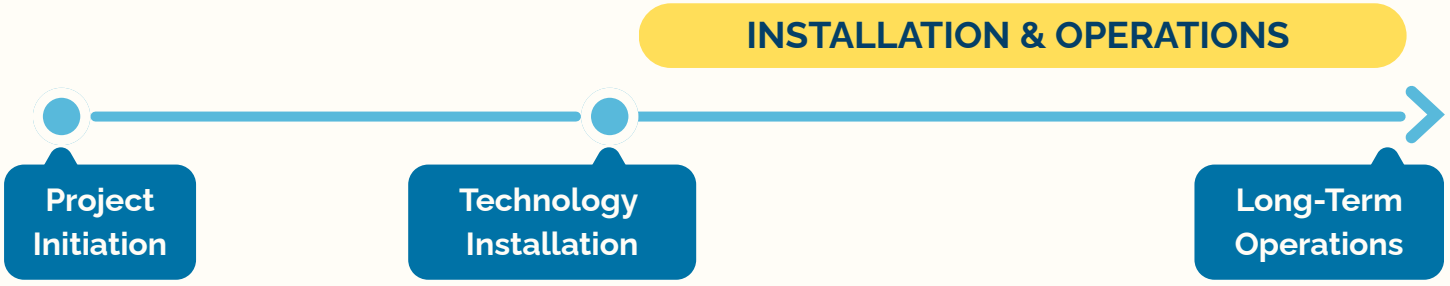
- **Document the technical details of technology installation, maintenance, repair, and operations—especially if a third party is involved in these processes.**
  - Develop a comprehensive understanding of the technology to build organizational capacity, empower the project team, and enable internal maintenance, repairs, and adjustments.
  - More capacity and knowledge provide greater control, which reduces reliance on outside assistance, avoiding delays and lowering costs.
  - Thorough records and knowledge transfer ensure that critical information and expertise is not lost in the event of staff and leadership turnover.
  - Manufacture and installation often require working with third-party services to provide specific expertise. Work only with trusted contractors, engineers, architects, and other service providers. Expect delays and cost changes when external partners are involved.

- **Create a detailed plan of the process and timeline for technology installation, and ensure it is feasible and sets realistic expectations.**
  - Take into account the order of operations for the work that must be done, as certain components may need to be completed before others can begin.
  - Build additional time and budget into the detailed technology installation plan for unforeseen problems (e.g., extreme environmental or political events) and delays.
  - It is sometimes more effective to install a minimum viable product on a shorter timeline (requiring more future investment), while at other times it may be more prudent to develop a more complete design on a longer timeline (requiring more initial investment).

- **Engage all project stakeholders in the installation, operations, and maintenance of infrastructure and technology to establish a sense of collective ownership and responsibility.**
  - Set expectations, communicate processes and timelines, and invest in the long-term growth and development of the local community.
  - Hire local workers to carry out project operations and create an equitable and respectful work environment. Prioritize safety by setting proper protocols and providing personal protective equipment.
  - Provide fair wages; benefits such as health insurance, vaccinations, and personal protective equipment; and training and career growth opportunities. Show appreciation and give well-deserved recognition for the difficult work carried out by project staff. Simple actions such as providing uniforms can make the staff feel more professional, valued, and prideful in their work.
  - Listen to and prioritize the needs of local leaders and community members. Incorporate their voices, expertise, and deep historical knowledge of the river in the project design. Highlight and credit their role in the success and impact of the project.

- **Design operations protocols that are feasible to implement given the context of the project, including the plastic capture technology in use, plastic volumes in the river, organizational capacity, and project budget.**
  - Minimize friction with the local community with proactive measures to mitigate potential conflict. If a nearby community may be concerned about the appearance and smell of trapped trash near their homes, daily debris removal can prevent prolonged trash build up and help prevent these concerns from materializing.
  - Be prepared to make changes as infrastructure is installed and operations are active. Small and large adjustments are a constant feature of river plastic projects given their complexity and unpredictable nature. Have contingency plans in place in case challenges arise such as extreme weather events, loss of funding, staff turnover, or changes in government regulations and laws.
  - Account for environmental factors that may affect operations, such as invasive species (e.g., water hyacinths), large organic debris deposits (e.g., trees), and extreme weather events (e.g., floods).

Timeline



Experience from the Field

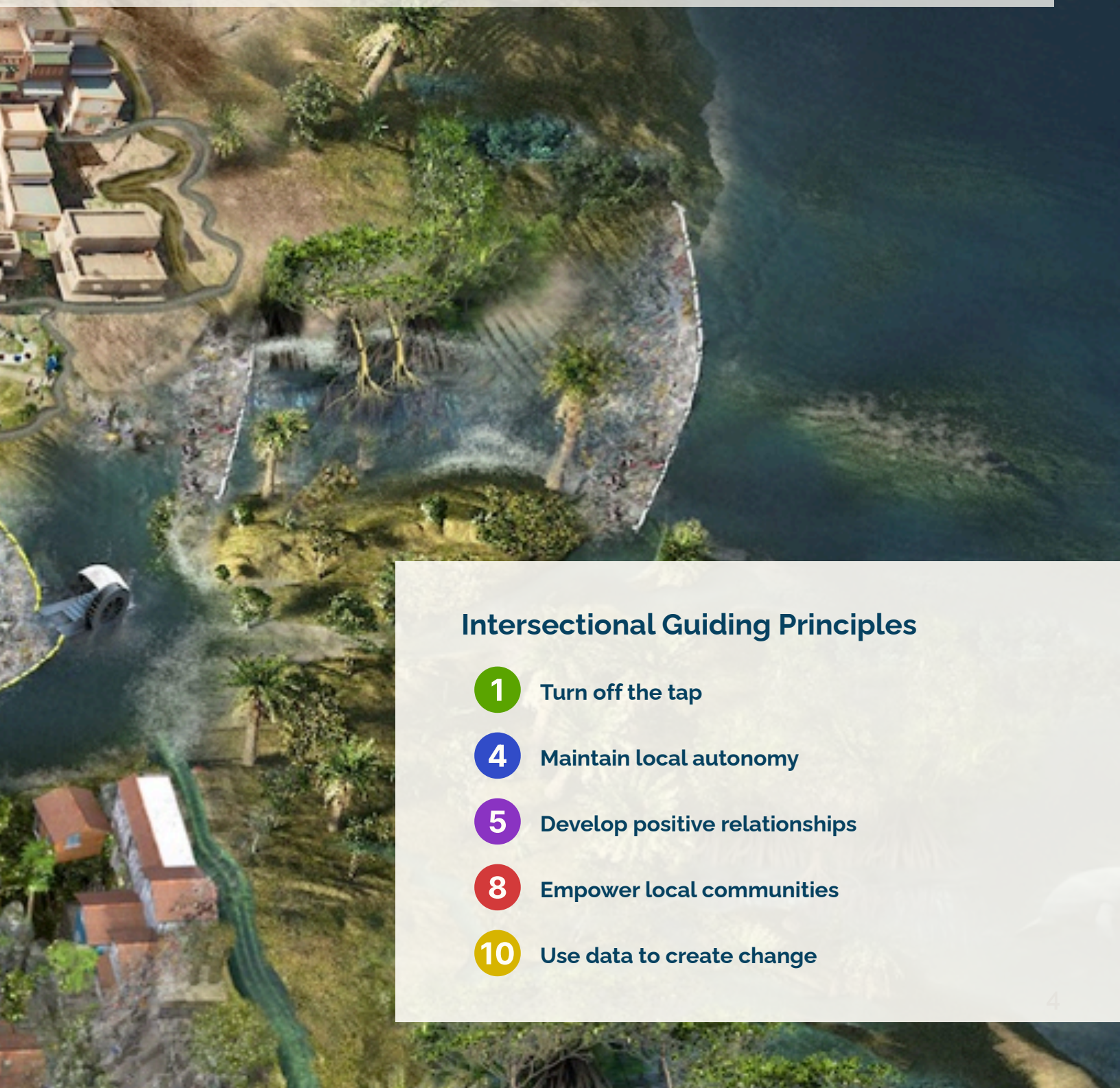
Greeneration Foundation, RiverRecycle, & Waste4Change, Citarum River, Bandung, Indonesia

The Citarum Repair project in Bandung, Indonesia set out to install a custom river plastic capture system that featured an advanced boom design and conveyor extraction unit that was designed and built in Europe. When the technology was shipped to Indonesia, a number of unforeseen challenges occurred, including delays in shipping (during the COVID-19 pandemic) as well as issues clearing imports through Indonesian customs.

The project pivoted to a simpler, locally-fabricated boom and conveyor system that enabled immediate installation and operations. However, the dynamic environment posed additional challenges: the local geology made it difficult to find suitable anchor points for the boom; large magnitude shifts in water levels and flow rates threatened infrastructure; and massive seasonal outbreaks of water hyacinth plants jammed the conveyor unit, adding considerable time to extraction and sorting.

The Citarum Repair team responded by creatively adapting and iterating the plastic capture technology design and operations. Adjustments were made to better handle the local environment (e.g., favoring manual extraction over conveyor operations during water hyacinth season), and increased collection efforts through partnerships with local informal waste pickers helped to sustain impact when the plastic capture technology was out of operation.

DATA COLLECTION



Intersectional Guiding Principles

1. Turn off the tap
4. Maintain local autonomy
5. Develop positive relationships
8. Empower local communities
10. Use data to create change

Data Collection

Related Project Phases: Permits | Site Selection | Technology Selection | Installation & Operations | Waste Management

Background

Range of Resources Used for Data Collection: 5%-30% (Time & Budget)

Data collection enables the implementation and operation of river plastic capture projects (e.g., for permits, site selection, etc.) and is invaluable for measuring project impact (e.g., total plastic diverted). Although it is clear that massive amounts of plastic enter our rivers, we still lack sufficient data to fully understand and solve the problem. River plastic capture projects provide a strategic opportunity to simultaneously clean rivers and collect detailed data on plastic pollution to help fill this knowledge gap. The detailed characteristics of river plastic, such as the most prevalent item types (e.g., bottles) or plastic polymers (e.g., PET), can be used to inform more efficient upstream solutions that target the main sources of plastic pollution.

Key Insights

- Establish clear, consistent, and well-documented data collection protocols.
- Design data collection methods that are operationally feasible—start simple and expand.
- Consider metrics that include total and sorted plastic categories and end-of-life fates.

Additional Considerations and Recommendations

- **Recognize that data is a powerful tool that can be used to increase project impact and spark systemic, upstream change to solve the plastic pollution problem. Data collection of any form is useful in the global effort to fight plastic pollution.**
  - Plan ahead to collect data that will be most useful for your objectives. Data collected before and after the intervention can quantify the effectiveness and impact of the project to communities, governments, and potential funders.
  - Use data-driven insights to target efficient solutions. For example, it may not be a priority to lobby for a plastic bag ban if plastic bags are not common in the river. Or, a high volume of plastic water bottles could suggest the value of high-impact campaigns to provide reusable bottles and free filtered water refill stations in the community.
  - Submit data to larger efforts that aggregate plastic clean up efforts, such as the International Trash Trappers Network. Real, accurate data about the fate of waste is difficult

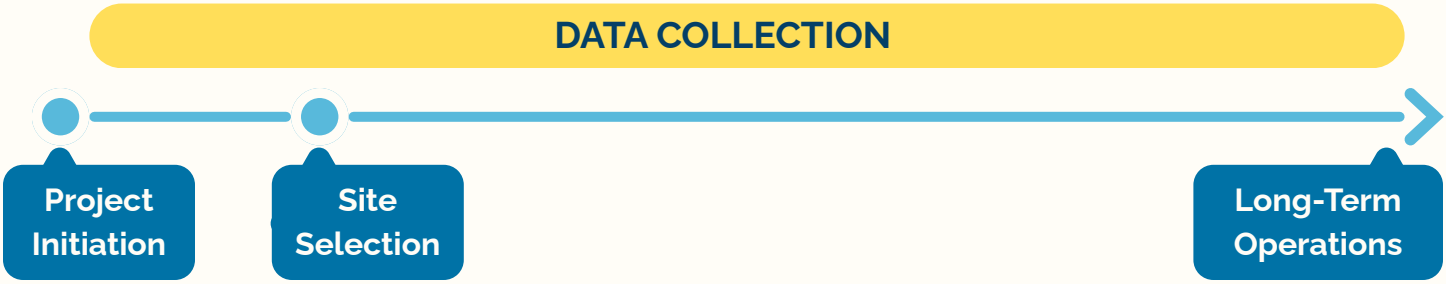
to find, and the more centralized data that documents this reality, the more evidence there is to unlock large scale investments and action.
- Share and visualize collected data in a way that is understandable, useful, and tailored to the project goals and the target audience.

- **Provide the project team with tools that make data collection as simple and efficient as possible with standardized protocols that reduce confusion, error, and inconsistencies.**
  - There will be different levels of experience and comfort with the process of data collection. Clearly define each category of data, document them, and train workers to accurately sort plastics. Consider providing printed identification guides with picture examples of the plastic types and items for which data is collected and how to sort them.
  - Invest in tools required for data collection, such as scales, personal protective equipment, and sorting bins and tables.
  - Maintain clear records of data collection protocols and collected data in an organized database. Well documented protocols will reduce inconsistencies caused by staff turnover. Frequent database upkeep will help identify inconsistencies, errors, and anomalies that are inevitable in the process of transcription of field data logs.
  - There are certain capabilities and limitations of data collection in the field. Consider different data entry methods—such as handwritten sheets or digital app-based tools —and which may be more advantageous in specific situations.
  - Be aware that classifications of plastic types and items often vary across regions. For example, thin single-use plastic bags may be marketed as HDPE in one country, while in most other countries they are considered LDPE. These discrepancies can be managed if clear methods and protocols are developed, documented, and applied consistently.

Best Practices for Data Collection

- Commit to simple summary metrics such as total debris captured and total plastic collected.
- Beyond summary metrics, sort plastics by polymer type (e.g., PET, HDPE, LDPE), item type (e.g., bottles, bags, foam containers), or producer/brand.
- For polymer type, adhere to the standardized American Society for Testing Materials (ASTM) International Resin Identification Coding System (RIC) (numbers 1-7: PET, HDPE, LDPE, PP, PVC, PS, Other) for identification and broad comparability.
- Utilize sub-sample data collection methods when resources are limited or restricted for comprehensive data collection. Random samples of waste are set aside for periodic sorting (monthly, quarterly) and the relative compositions are extrapolated to total capture numbers. The more samples taken over time, the more robust the extrapolation results.
- Data may be reported by weight (e.g., 60 kg plastic bottles) and/or by counts (e.g., 120 plastic bottles). Align the units to the project goals and remain consistent. There are methods to convert between weights and counts, but they will be inexact estimates.
- Artificial intelligence systems using computer vision are in early development stagesand in limited use, but have the potential to dramatically reduce the time and effort associated with data collection by automating data collection using computer-powered cameras. However, these systems are in their infancy, require a considerable amount of initial start-up investment in time and capacity building, are highly individualized to a location and technology, require alterations based on the composition of plastic in a certain location or region, and are not yet highly precise.

Timeline



Experience from the Field

Ocean Conservancy & the Centre for Marinelife Conservation and Community Development (SPLASH Project), Red River, Nam Dinh, Vietnam

In Nam Dinh, Vietnam, the Strategic Plastic Litter Abatement in the Song Hong (SPLASH) Project placed a particular emphasis on data collection. Captured plastic was meticulously sorted and weighed into granular categories including polymer types (e.g., bottles). The project utilized existing data collection protocols established by the United States National Oceanographic and Atmospheric Administration (NOAA) and provided thorough training of those protocols to the project team. This approach allowed for consistent, well-documented data collection across six different capture sites.

Local community members were also surveyed before, during, and after the project to measure the impact of education and outreach campaigns. Survey questions measured the understanding and awareness awareness of the plastic pollution problem, waste management options and sustainability, and attitudes towards the environment. Both the plastic data and social data collected by SPLASH project enabled the opportunity to analyze the effectiveness of local upstream plastic pollution policies and evaluate the social influence of education and communication efforts.

WASTE MANAGEMENT

Intersectional Guiding Principles

1. Turn off the tap
2. Anticipate delays
5. Develop positive relationships
8. Empower local communities
10. Use data to create change

Waste Management

Related Project Phases: Permits | Site Selection | Installation & Operations | Data Collection | Finance & Budget

Background

Mismanaged waste is a primary driver of plastic pollution in rivers, and it is often a dearth of waste management infrastructure and services that cause the need for river plastic capture projects in the first place. Once plastic is captured from a river, it is crucial that it is properly managed to avoid the cycle of leakage into the environment again. Available waste management infrastructure is highly variable depending on the location; disposal of captured plastic in a sanitary landfill may be the only available solution. Other available options may be to recycle, incinerate, or use for waste-to-energy, as well as non-traditional solutions including creative reuse or downcycle into new products. Understand the local supply chain and life cycle impacts of the waste management options available, as there are many contextual intricacies and nuances to general umbrella terms (e.g., "incineration") in which specific processes vary by location.

Range of Annual Waste Management Budgets: $12,000-$35,000 USD

Key Insights

- Identify all possible waste management solutions available in the site selection process.
- Budget for fees, expenses, and possible revenue associated with waste management.
- Understand local capacity to recycle, which is often limited or non-existent in some areas.

Additional Considerations and Recommendations

- Be aware of waste management needs from the earliest stages of planning.

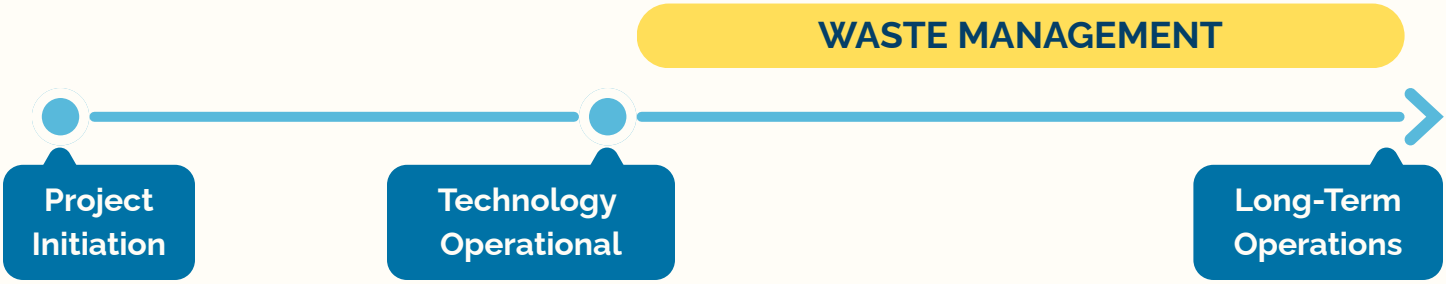
- Ensure feasible waste management options are available as early as permit acquisition and site selection. In many locations, infrastructure and services are severely lacking or nonexistent.
- Identify all possible waste management solutions given local infrastructure and research the supply chain of waste to understand the overall impact of the options.

- **Set sanitary landfill as the minimum goal for waste management and think creatively to increase waste management options.**
  - Wash and dry collected plastic, if feasible, to increase acceptance rates at recycling facilities.
  - Consider non-traditional options such as downcycling—a process that transforms low-value plastic (non-recyclables) into other products or goods. Profits from downcycled products can be reinvested into the project to provide a stable funding source.
  - Successful examples of downcycled solutions include the use of collected plastic as feedstock to transform into paving bricks to build walkways and to make plastic plywood boards for furniture or walls in construction.

Important Research for Waste Management

- Are there any waste management options available in the region? Is the nearest landfill sanitary, or is there leakage?
- Where is the nearest recycling facility and how might transporting materials there incur environmental impacts such as carbon emissions that reduce the overall environmental benefits of recycling?
- Which types of plastic can (or cannot) be recycled locally? Are there additional limitations to recycling capabilities such as requirements for clean and non-degraded materials?
- If utilizing waste-to-energy, is the facility well-designed and does it follow proper regulations to avoid producing additional air pollution?
- If delivering recyclables to a third party aggregator, what is the ultimate fate of those materials? Are they resold, or shipped long distances across oceans and continents?
- How much will waste management cost? Is there a dumping fee at the landfill? Are there costs associated with recycling?

Timeline



Experience from the Field

TerraCycle Global Foundation, Lat Phrao Canal, Bangkok, Thailand

Because landfills in Thailand have high rates of leakage into the environment, the TerraCycle Global Foundation project in Bangkok, Thailand established a “no waste to landfill” policy. This high and admirable waste management standard required considerable investments of time and resources in the project operations to accomplish.

Recycling was made the first priority for collected materials. To maximize recyclable materials, a meticulous washing, drying, and sorting process was established, for which additional physical space and infrastructure was dedicated onsite. Even with this maximum effort and commitment, only 11% of the collected materials were recyclable.

The remaining materials were delivered as feedstock to a local waste-to-energy facility that met international standards for safety, pollution control, and other important considerations. Before final selection of the waste-to-energy plant (that adhered to strict European standards), dozens were toured and thoroughly vetted due to inconsistent quality and sustainability in the industry.

COMMUNITY ENGAGEMENT, INVESTMENT, & EMPOWERMENT

Intersectional Guiding Principles

1. Turn off the tap
3. Work with willing partners
4. Maintain local autonomy
6. Tailor approach to local contexts
8. Empower local communities

Community Engagement, Investment, & Empowerment

Related Project Phases: Permits | Site Selection | Installation & Operations | Waste Management | Communications & Education

Background

A universal characteristic of every successful river plastic capture project is a commitment to sincere community engagement, investment, and empowerment. Every phase of a project hinges upon community support and is more impactful when there is local leadership and input. Ask for and be responsive to community needs, value their perspectives, and be inclusive in decisions, development, and implementation of a project. Invest in the community: offer local employment, build capacity through workshops and training, and provide tools that empower self-sustained, long-term solutions.

Range of Resources Used for Community Engagement:
10%-50% (Time & Budget)

Key Insights

- Identify and connect with community leaders, figures that will differ by culture or location.
- Take a community-first approach that respects local input in project decisions, development, and implementation.
- Collaborate with diverse stakeholders: governments, the private sector, nonprofits, etc.

Additional Considerations and Recommendations

- **Co-develop the project with community input and leadership—value their perspectives in a project that directly impacts them by listening first and practicing inclusive decision making, development, and implementation.**
  - Engage the community early in the project. A foundation based on communication and trust will help to gain support from the outset and mitigate potential future conflict. There will always be antagonistic viewpoints to manage, but concerns may be overcome with enough community support.
  - No one will know the problem more intimately than the local community. Tap into that resource for a more strategic and effective approach that targets the root causes of the problem.
  - Enable a sense of ownership and pride over the project and avoid pushback by involving the community in the project development and leadership.

- **Include community investment into the budget and as a key component of project operations.**
  - Employ local community members and provide uniforms to provide reliable income and uplift the often underserved waste picker niche.
  - Ensure that project resources are funneled directly to support the community and prioritize building local capacity by providing training and tools.

Successful Community Engagement Strategies

- **Focus Groups**
  - Host small group discussions at periodic intervals that foster trust and buy-in by providing a two-way channel of communication and an open platform to offer feedback. Targeting community leaders (e.g., cultural and/or religious figures, elders, local business owners, etc.) can increase participation.
- **Workshops and Trainings**
  - This format tends to center on imparting information as opposed to receiving information as in focus groups.
  - Provide learning opportunities on subjects such as health, safety, and environmental threats of plastic pollution and teach transferable skills such as creating valuable products and handicrafts out of repurposed plastic.
  - Tailor content to the specific cultural context and local needs.
  - Workshops and training signal a commitment to the community which creates allies and instills trust.
  - Incentivize participation by providing:
    - Relevant and useful content
    - Free food and entertainment
    - Game-structured content to encourage fun participation
- **Public Art and Beautification**
  - Improve the conditions of public spaces through investments in public art and green spaces. Hire local artists to paint murals and build sculptures or clean informal dump sites and replace them with community parks or gardens.
  - Allow the community to take the lead in the selection of the project, location, medium, design, and artist. Public art projects are for all to enjoy, so the impact is usually high with a relatively low financial investment.
- **Community Events**
  - Bring people together to foster community and instill responsibility for the project through clean-ups, site visits, and corporate volunteer programs.
  - Make volunteer events fun by providing food, giveaways, music, and cameos from influential people. Gamify the experience to make educational components more engaging or frame them as challenges or competitions with prizes and incentives.
  - In addition to bringing the community together, events provide opportunities to build partnerships, find additional funding sources, advertise, and spread awareness and education about the problem and solutions.

Timeline

Experience from the Field

WILDCOAST (COSTASALVAJE), Los Laureles Canyon, Tijuana, Mexico

In Los Laureles Canyon, Mexico, WILDCOAST prioritized the engagement and involvement of the community from the inception of the project. They identified local leaders (respected elders, in this cultural context) and listened to their needs rather than pushing predetermined solutions. This genuine approach built trust, and led to endorsements from these leaders that garnered support from the broader community to co-design and co-manage the project informed by their lived experience.

WILDCOAST further proved their commitment by providing the community with tools (shovels, saws, gloves, etc.) to develop locally-led, sustainable solutions under their own initiative after broader institutional systems failed them. With these tools, the community came together to clean up neighborhood streets, improve public spaces, and repair homes and reinforce building foundations. The project also used the hundreds of waste car tires collected from the riverbed and adjacent areas to build a riverside public park complete with tire swings and an enclosed fútbol (soccer) field. And with the help of local artists, beautiful murals depicting a healthy, plastic-free ocean are found throughout the neighborhood.

COMMUNICATIONS, EDUCATION, & MEDIA

Intersectional Guiding Principles

1. Turn off the tap
3. Work with willing partners
4. Maintain local autonomy
8. Empower local communities
10. Use data to create change

Communications, Education, & Media

Related Project Phases: Installation & Operations; Data Collection; Waste Management; Community Engagement; Finance & Budget

Background

River plastic capture projects are both visible (e.g., conspicuous physical infrastructure in prominent locations) and visual (e.g., vivid imagery of plastic pollution). These characteristics offer inherent stories of impact centered around people, communities, and nature that capture attention and invoke thoughtfulness and stewardship. Strategic, intentional communications can raise awareness of the problem and promote solutions. They can also build local support, encourage governments and stakeholders to take action, and serve as a powerful asset to cultivate financial sponsorship. These intrinsic communications opportunities, combined with project data and strong community connections, create an excellent foundation for education—the key driver of permanent, upstream change that prevents plastic pollution in the first place.

Range of Resources Used for Communications & Education:
5%-25% (Time & Budget)

Key Insights

- Recognize the value of traditional and digital media engagement and youth education programs for creating systemic change.
- Leverage visual stories such as public art installations and diverse creative and programmatic approaches.
- Develop a consistent and recognizable style and brand that is tailored to the cultural context and audience.

Additional Considerations and Recommendations

- **Dedicate time, budget, and resources to developing a tailored communications and public relations strategy.**
  - Take advantage of the charisma and visibility of river plastic capture technologies to raise awareness of plastic pollution, build local support, encourage government action, and strengthen fundraising efforts.
  - Cater to the intended audience—tailor messages and content to align with values and motivations of those audiences and communicate through platforms and channels that are relevant to them.

- Use insights from data to inform communications strategies that target upstream and systemic change. For example, focus advocacy efforts on the most prevalent types of waste found in the river rather than less common items.
- Leverage visual media to tell compelling stories about the people, community, technology, and impact of the project. Build and maintain a robust library of photo and video assets.
- Include a call to action in all communications. Examples may include an ask for donations or support, a push to register for a public cleanup event, or a challenge to reduce plastic consumption.
- Approach negative tones in communications, such as brand shaming, with caution. This tactic can invoke powerful and impactful emotional responses, but should always be strategic and well considered given the risk of losing allies and creating enemies.

- **Capitalize on events, milestones, achievements, and moments to engage with media and create communications and education opportunities.**
  - Harness the momentum of strategic moments, like the completed installation of technology and start of operations, to host events, pitch stories to the media, and catch public attention.
  - Think beyond social media and consider additional creative communication methods that are culturally appropriate. Examples include physical media like flyers and public art in community centers, features on the local TV and radio stations, and creative collaborations with non-traditional partners like professional sports teams.

Successful Education Programs and Initiatives

- **Door-to-Door Household Visits**
  - Build personal relationships with the community through genuine, face-to-face interactions. Household visits facilitate reciprocative communication pathways to answer questions, alleviate concerns, promote the project, and customize education and awareness messaging. This approach can be time and resource intensive, and it may not be appropriate in certain cultures.
- **Before and After Surveys**
  - Conduct surveys in adjacent communities before the project to establish a baseline of the understanding, awareness, attitudes, and behaviors of the local public towards the environment and plastic pollution. Use the survey results to identify priority topics and knowledge gaps for education programs. Repeat surveys later in the project to assess the impact on public understanding, awareness, and behavior.
  - Surveys are typically deployed to a random selection of community members who are likely to be beneficiaries of the intervention. Administer surveys in-person and consider partnerships with local organizations already established and trusted in the community.

- **School Programming**
  - Partner with local schools to teach sustainability classes, establish student-run recycling systems, host clean-up days, or provide teachers with materials and lesson plans on environmental stewardship topics. Young audiences tend to be more receptive to new information, and often there is a transfer of knowledge from child to parent that is more effective than direct adult outreach.
  - Ensure that programs support teachers and schools rather than burden them with more work. Pair programs with services and investments such as school clean-ups, improved waste management infrastructure and tools, or plantings of trees, flowers, and gardens.

Timeline

Experience from the Field

The Ocean Cleanup, GraceKennedy Foundation, & Clean Harbours Jamaica, Kingston Harbour, Kingston, Jamaica

The Kingston Harbour Cleanup Project recognized the value of communications, storytelling, and media as powerful tools to spread awareness, educate communities and policy makers, and inspire meaningful upstream action to solve the plastic pollution crisis. A comprehensive communications strategy was developed that included a commitment to create and disseminate consistent communications, collect high-quality media assets, and host frequent events such as beach clean-ups.

The project offloading site (where the plastic collected by boat in the harbor was delivered, sorted, and stored) was transformed into an education and visitor center, complete with informational displays, painted ocean murals, and art installations made from collected bottlecaps and other debris. This provided a welcoming space for visiting student groups from local schools to experience the project site, tour the facility, and learn about their local marine environment and how to protect it.

The investment in communications, media, and education programs drove awareness of the project and problem to over 1 million people on average per month on social media, showing the value of river plastic capture projects as powerful communication and education tools.

FINANCE & BUDGET

Intersectional Guiding Principles

1. Turn off the tap
2. Anticipate delays
7. Prioritize long-term operations
8. Empower local communities
9. Adapt to new challenges

Finance & Budget

Related Project Phases: Permits | Technology Selection | Installation & Operations | Waste Management | Finance & Budget

Background

Comprehensive and careful financial and budget management are essential to navigate the challenges and complexities of river plastic capture projects. In addition to upstart costs, ensure long-term operations and maintenance considerations are built into the financial strategy to prevent the abandonment of infrastructure and community programs. Include buffers and contingency in the budget for unexpected costs and focus on project goals to inform resource allocation prioritizations necessitated by limited funds. An overly-stringent budget can limit impact, but irresponsible use of funds can bankrupt a project. In practice, multiple and creative approaches may be required to cultivate and maintain sufficient funds to support sustained project operations and future growth.

Key Insights

- Secure funds upfront for sustainable long-term operations and maintenance, when possible.
- Incorporate contingency funds into the budget for unexpected expenses.
- Pursue multiple financial support sources and strategies to build resiliency.

Range of Monthly Operations Costs
$5,000-$100,000 USD

Additional Considerations and Recommendations

- **Establish concrete plans to ensure the long-term financial sustainability of the project. Leverage multiple sources (some suggestions below), maintain contingency funds, and employ creative strategies for acquiring funding, reducing the risk that the loss of any single source will significantly disrupt operations.**
  - Create opportunities for businesses to place their logo or advertisements on the technology to generate revenue.
  - Engage small local businesses—they can become unexpected donors.
  - Leverage connections through friendraising, or peer-to-peer fundraising. Set clear targets and provide supporters with fundraising tools such as websites.

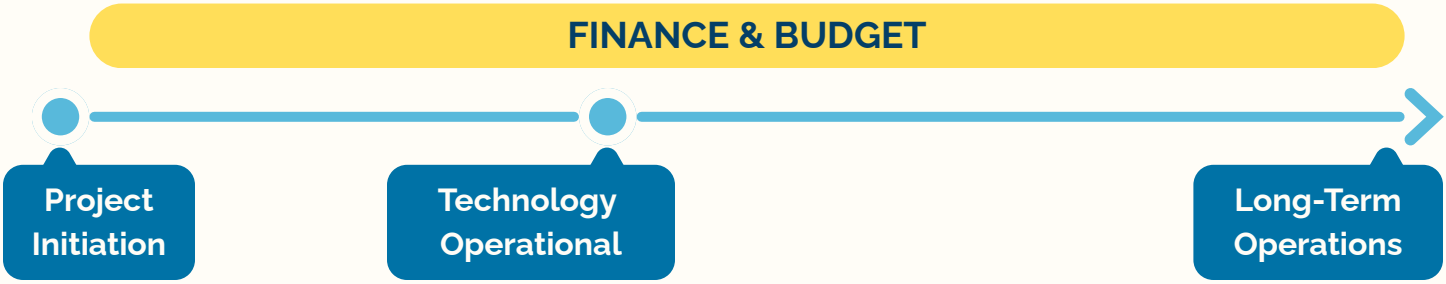
- Crowdfunding at events can have lower returns because of the upfront investment of hosting. If used, make it known in advance that attendees will have opportuninties to donate, and seed early contributions to spark momentum.
- Approach high reliance on monetization of recovered plastic waste with caution. Markets for repurposed plastic and plastic credits are emerging, but pricing is unstable, and viability depends heavily on achieving high collection efficiency. Partnering with plastic repurposing organizations can help establish pathways to market, however scaling these efforts can be challenging due to high upfront costs and slow returns on investment.
- Invest time in building relationships with the local creative community (public relations companies, ad agencies, etc.), as many may be willing to offer pro bono work to support meaningful causes.

- **Develop a compelling donor/investor pitch that focuses on the impact a donation or gift will have and clearly communicates your needs and how the money will be spent. Tailor the pitch to each specific audience.**
  - Learn what motivates donors. Know your competition and clearly articulate what sets your work apart.
  - Share bold, compelling ideas that inspire donors and encourage ambitious visions. Many funders are motivated by opportunities for investing alongside catalytic capital investors that provide protection for other investors by carrying risk. Catalytic capital includes equity investments, debt financing, loan guarantee, and recoverable grants.
  - Targeted strategies such as presenting a giving range, matching gifts to build momentum, and inviting donors to support a specific aspect of the project are often more persuasive. Large donors want to give—but want to be asked.
  - Begin with small asks (e.g., advertisement placements) to build relationships with donors that may become major future supporters.
  - Act with integrity and uphold project goals and values, even if that means declining support from donors whose visions are not aligned.

- **Build trust and promote a sense of connection and investment with donors/investors through consistent communication, appreciation, and engagement.**

  - Maintain consistent communication through scheduled updates every few months. Be open and transparent about progress and challenges.
  - Express gratitude through gestures such as handwritten or verbal thank-yous.
  - Invite donors to engage with the organization, such as by organizing site visits, to strengthen their connection and commitment to the work.

Timeline



Experience from the Field

Chemolex Company Limited & Smart Villages Research Group, Athi River, Nairobi, Kenya

A for-profit social enterprise startup company, Chemolex Company Limited uses expertise in chemistry and engineering to develop marketable products that promote sustainability, circularity, and environmental stewardship. In Nairobi, Kenya, the dearth of waste management services and the lack of value for any recyclable materials inspired Chemolex to not only clean up the polluted local rivers, but also to create value for the collected plastic and avoid adding to the already over capacity landfill.

The project designed and built a manufacturing facility with equipment to process and reform plastic waste as a raw material. Here, the captured river plastic was cleaned, melted, molded, and pressed into paving bricks, which were then sold in bulk to customers such as construction supply retailers. The profits from the paving brick sales provided a consistent and reliable income source to sustain the project operations, which also reduced the reliance on volatile funding sources like grants, individual donations, and awards.

CASE STUDIES

Lat Phrao Canal, Bangkok, Thailand
Project Lead: TerraCycle Global Foundation

Permits

Strong relationships with stakeholders proved more valuable in the acquisition of permits relative to the minutiae of bureaucratic paperwork. The necessary approvals ranged from hyperlocal (e.g., neighborhood district) to national (e.g., Ministry of Environment). A memorandum of understanding (MOU) allowed indefinite operations within a defined scope and circumvented the need for multiple permits and annual renewals.

Site Selection

Fifty prospective sites with diverse characteristics—from large rivers and urban areas to small tributaries and rural land—were considered before the Lat Phrao Canal was ultimately chosen. Site evaluation criteria included high pollution levels, operational accessibility, room for future expansion, and most importantly, an eager and welcoming community that wanted to participate.

Case Study: Thailand

Plastic Capture Technology Selection

Plastic capture technologies were considered only after the Lat Phrao Canal site was selected to allow for a context-tailored design. Options were evaluated on two baseline conditions: the technology must be manufactured locally with durable materials and feature a modular design to enable simple repairs and improvements. A series of metal trash traps serviced by boat met the baseline requirements and emerged as the best fit for the urban channelized environment of Lat Phrao Canal.

Infrastructure Installation, Operations, & Maintenance

Maintenance costs exceeded initial budget allocations as repairs were more frequent than expected and raw materials experienced steep price increases over time. Significant investments to empower local project staff including training, education, durable tools, and respectable wages led to very efficient trash trap operations, high employee satisfaction, and low staff turnover.

Data Collection

Considerable time and space were dedicated to implement detailed data collection protocols. Plastic was separated from the captured debris, all recyclables were sorted into polymer and item type classes, and random sub-samples of the non-recyclable fraction of collected plastic were sorted. This level of detail is not always feasible, but in this case proved to be worth the effort when these data were critical in the process to receive plastic credit certification.

Case Study: Thailand

Waste Management

High leakage rates in Thai landfills inspired a "No Waste to Landfill" policy where all captured plastic was either recycled or sent to a waste-to-energy plant. Before final selection of the waste-to-energy plant (that adhered to strict European standards), dozens were toured and thoroughly vetted. This high and admirable waste management standard required considerable allotments of time and resources in the project budget.

Community Engagement, Investment, & Empowerment

Community engagement included activities such as the empowerment of local voices with leadership responsibilities, tours for local school groups, and assistance to nearby neighborhoods during emergencies like floods and fires. Operations team members — all local residents with difficult pasts — were provided with reliable employment, fair wages, official uniforms, and safety equipment, which helped them to feel pride, gain community respect, and build a better life.

Communications, Education, & Media

The project prioritized education programs in partnership with schools, which were so successful that they became the fastest expanding component of the project. The visibility of the project in the community—with uniformed staff and branded boats at work on the canals every day—raised awareness of the positive impact on the shared waterways. The project was also featured in documentaries, influencer campaigns, news coverage, and conferences.

Finance & Budget

The majority of project funds were provided by international sources (mainly from the United States) including family foundations, individual donors, grants, and corporate gifts, in part because philanthropic giving at any level is not common in the local Thai culture. A reliable source of income was developed through paid corporate social responsibility (CSR) events sponsored by companies whose employees visit the site and participate in hands-on, gamified project operations.

Juan Díaz River, Panama City, Panama
Project Lead: Marea Verde

Permits

Four permits were required from three different institutions of government, a process that took around six months. This river plastic capture project was a first-of-its-kind in Panama City, which led to timeline delays but helped establish a new regulatory roadmap with permit agencies to streamline the process for future similar projects.

Site Selection

Environmental and social conditions were observed for two prospective sites, such as river conditions (e.g., seasonal flow patterns) and surrounding area (e.g., sufficient space for waste sorting). The selection process prioritized the critical characteristics required for the already selected trash wheel technology. Due to a few vocal detractors and a "not in my backyard" (NIMBY) sentiment, the project was relocated to a different site with more enthusiastic adjacent communities.

Plastic Capture Technology Selection

The highly-engineered, large-scale trash wheel technology was selected because the associated education, awareness, and communications benefits justified the added cost and complexity. Adaptations were made to the trash wheel technology and process design in consideration of local conditions including tidal influences, brackish water, and local recycling capacities.

Infrastructure Installation, Operations, & Maintenance

Adaptability and creativity were critical in response to infrastructure challenges that included: construction of access roads to accommodate heavy machinery for installation; more robust riverbank stabilization due to the local geology and topography; frequent maintenance to minimize rapid corrosion caused by the tropical, humid, salt-laden air; and the inclusion of a secondary boom to lessen excessive stress applied by heavy debris loads.

Data Collection

Data collection efforts included captured river plastic metrics as well as environmental condition and social behavior data. Simple, streamlined, and sustainable protocols were instituted after the initial plan to collect data on 30+ categories of debris proved to be infeasible. Data were collected on total captured trash, plastic, and recycled plastic, supplemented with occasional random sample sorting exercises to extrapolate more detailed metrics.

Waste Management

Sanitary landfills and traditional mechanical recycling were the sole local waste management options available. Only certain plastic polymers (PET and HDPE) could be recycled. Some items made of these polymers, such as bottles filled with liquid, were deemed too dirty or degraded to be recycled and were therefore landfilled. To address upstream sources of debris, a door-to-door recycling program via bicycle was developed to provide waste management access in previously underserved communities.

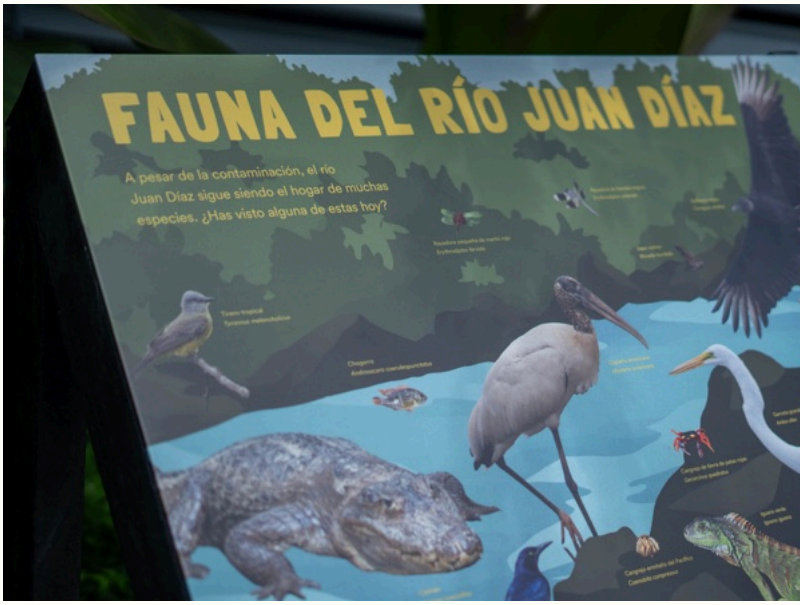
Case Study: Panama

Community Engagement, Investment, & Empowerment

Genuine commitments and investments to engage and empower the local community included job creation, training, and public artwork which fostered support, a sense of collective ownership, and pride for the project. Trash wheel operational staff were hired in partnership with a local organization that offered rehabilitation and transitional services for people in difficult situations.

Communications, Education, & Media

Proactive media outreach capitalized on the charismatic qualities of the trash wheel technology to draw the attention of local, national, and international news outlets and collaborations with social media influencers helped reach new audiences. An interactive education center at the trash wheel site offered school and visitor tours, and a sustainability training course for teachers targeted long-term systemic change by inspiring the next generation of environmental stewards.



Finance & Budget

A carefully planned long-term operations budget was necessary to justify the large capital investment required for the trash wheel installation. Grants, individual donor stewardship, corporate giving, and visitor center fees, among other fundraising strategies, were all used to establish a diverse and resilient portfolio of financial support. Campaigns that targeted a specific goal (e.g., to construct the education center) were particularly successful, especially when “matching” gifts were pledged to catalyze additional contributions.

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