The practicalities of managing EFlows assessments

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GOOD PRACTICE HANDBOOK

Environmental Flows for Hydropower Projects

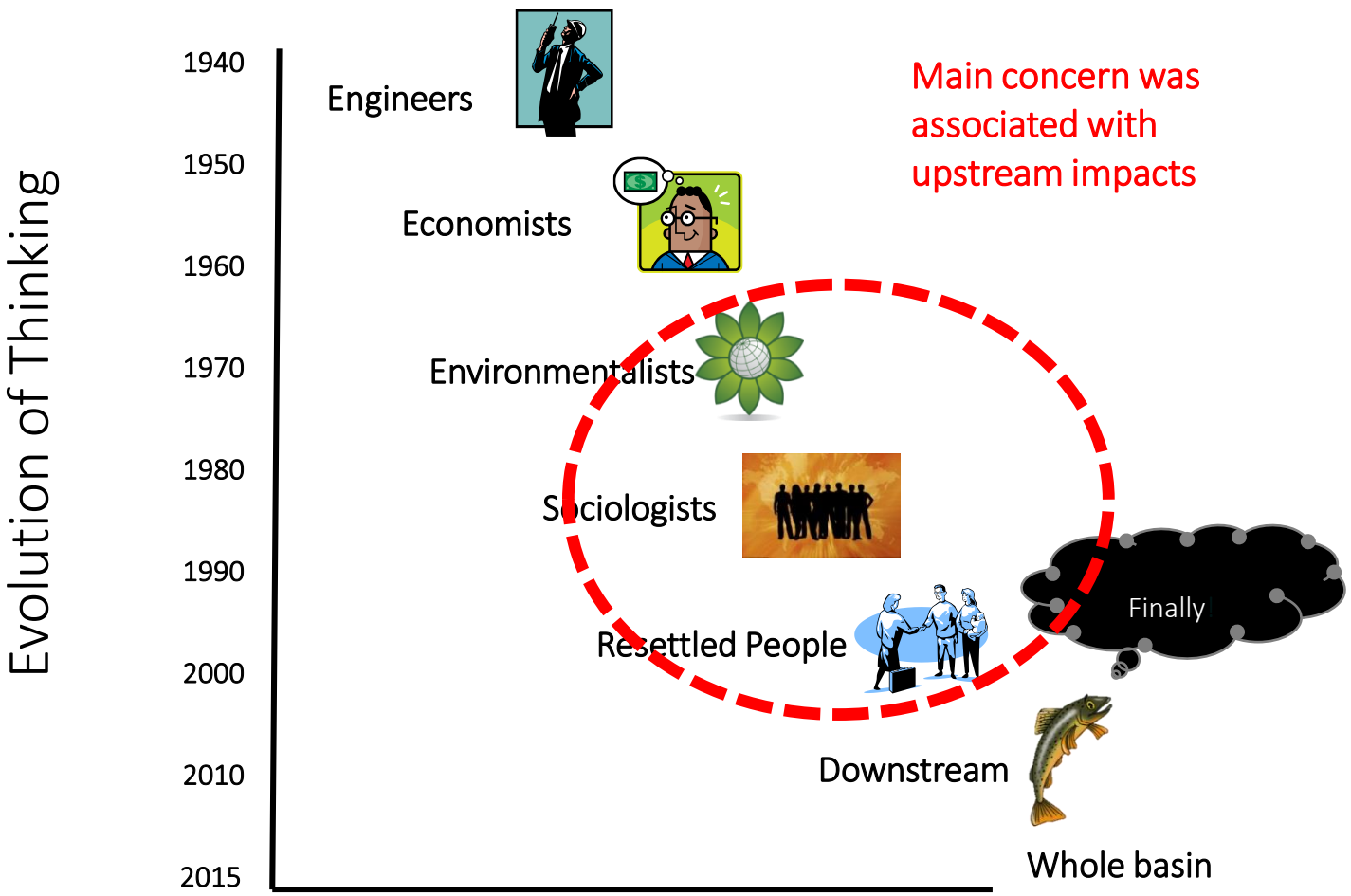
Guidance for the Private Sector in Emerging Markets

WORLD BANK GROUP
THE WORLD BANK IFC MIGA

Contents

- Introduction
  - Evolution of thinking about hydropower
  - Stakeholder engagement
  - Safeguards
  - Relationship with other assessment tools
- The EFlows assessment
  - Establish project context
  - Set-up EFlows assessment tool
  - Alternative analysis
  - EFlows Management Plan
  - Review
  - Implementation

Evolution of thinking of hydropower



IFC Performance Standards

PS1: Assessment and Management of E&S Risks and Impacts

PS2: Labor and Working Conditions

PS3: Resource Efficiency and Pollution Prevention

PS4: Community Health, Safety and Security

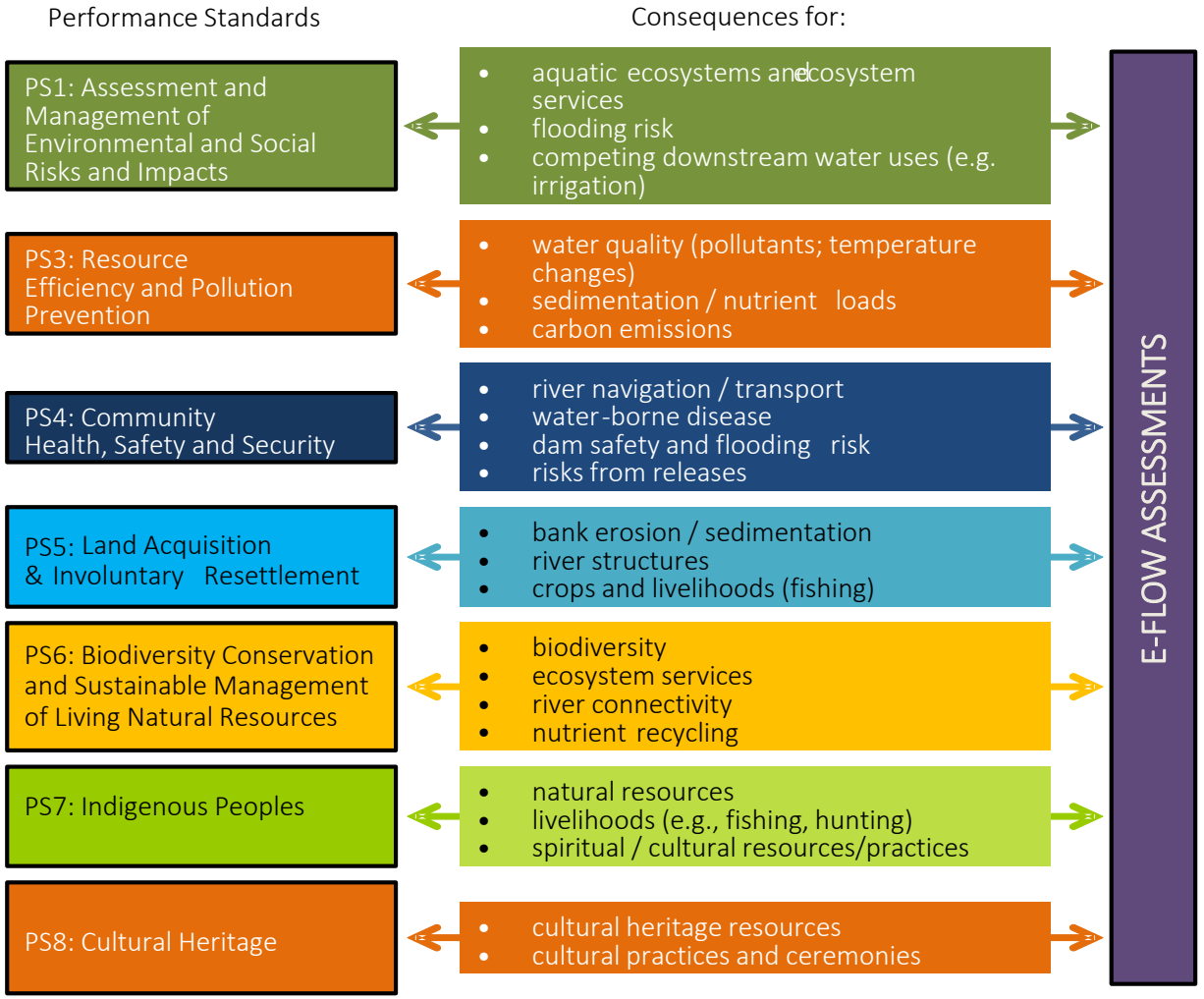
PS5: Land Acquisition and Involuntary Resettlement

PS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources

PS7: Indigenous Peoples

PS8: Cultural Heritage

E-Flows: Key cross-cutting component of PS compliance



Rise in consideration of EFlows

- International investors and financiers expect to have the GoM create a leveled playing field.

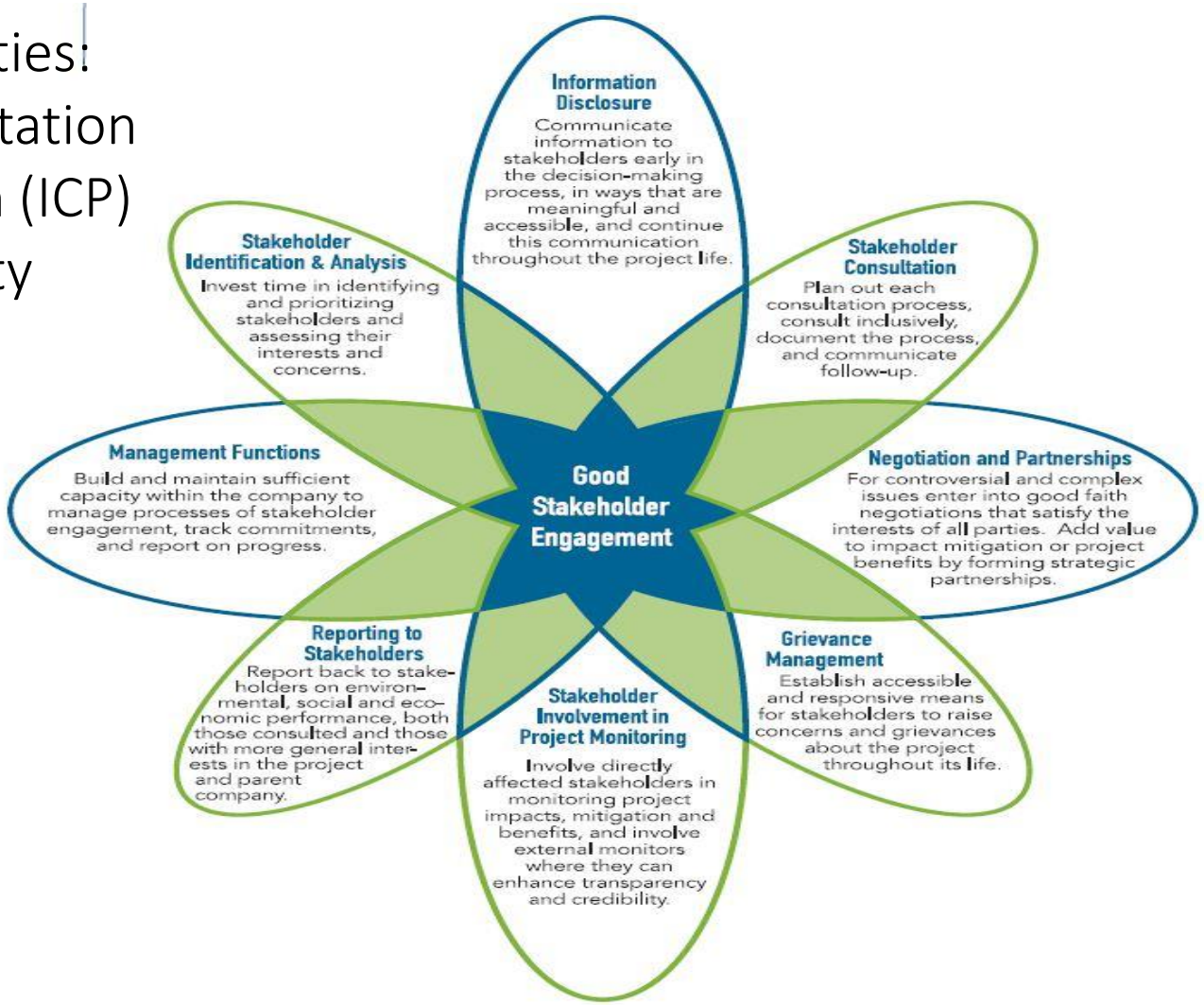
- IFC Performance Standards have become the benchmark for international financing; ADB and Equator Banks refer to IFC PS (http://www.equator-principles.com/).

- E-Flows assessment and management is a key and cross-cutting component to achieve compliance with IFC PS.

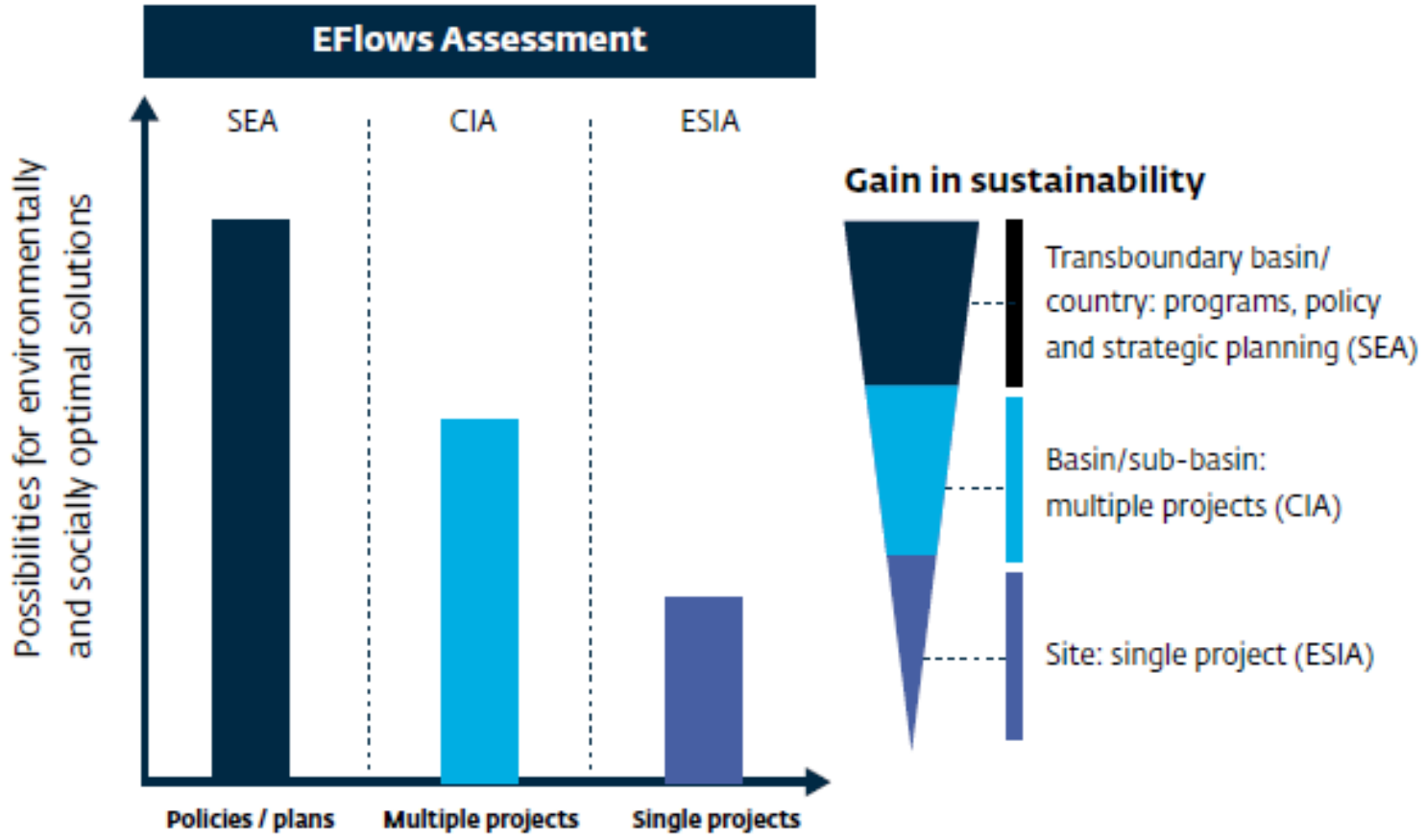
Stakeholder engagement

Affected Communities:

- Informed Consultation and Participation (ICP)
- Broad Community Support (BCS)



Relationship with Assessment Tools



Project-focused versus basin-wide

"Dam projects that do not emerge from a comprehensive basin assessment, and cumulative assessment, cannot claim to be sustainable"

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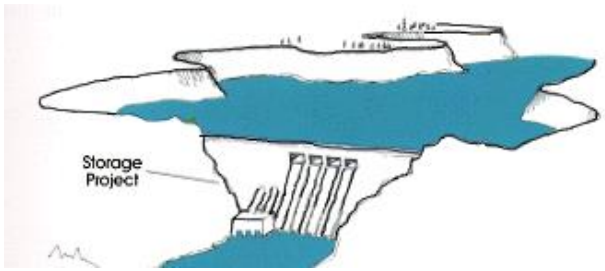
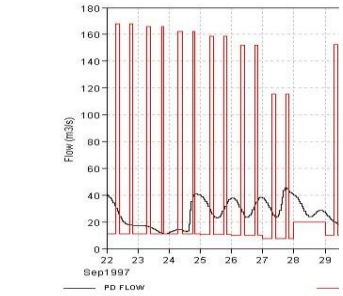
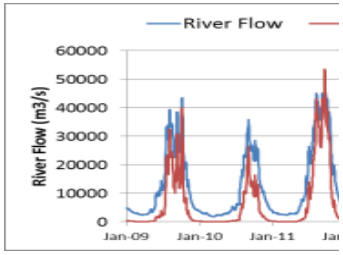
Location

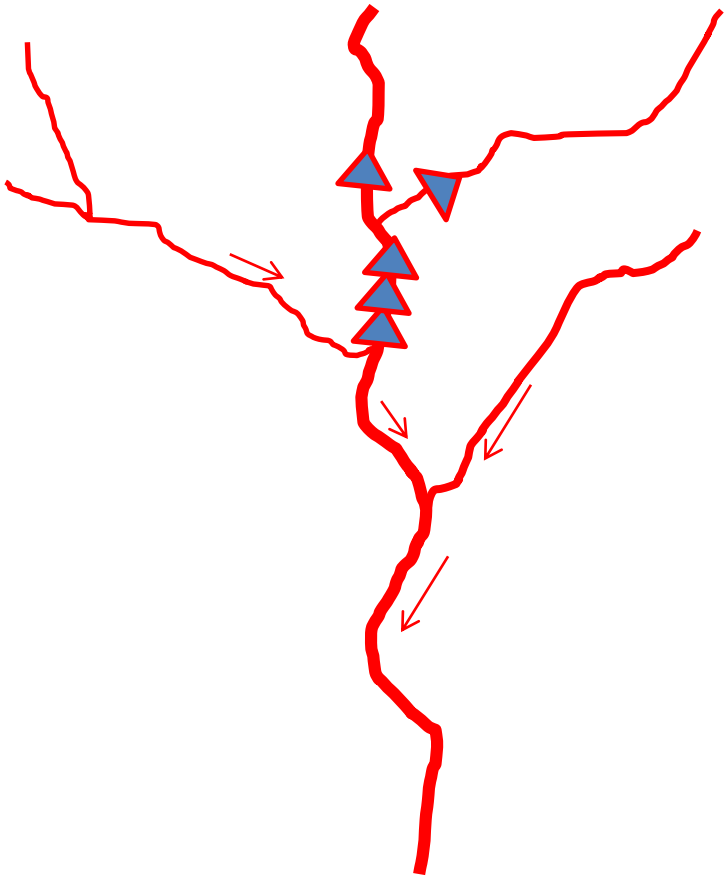
Design

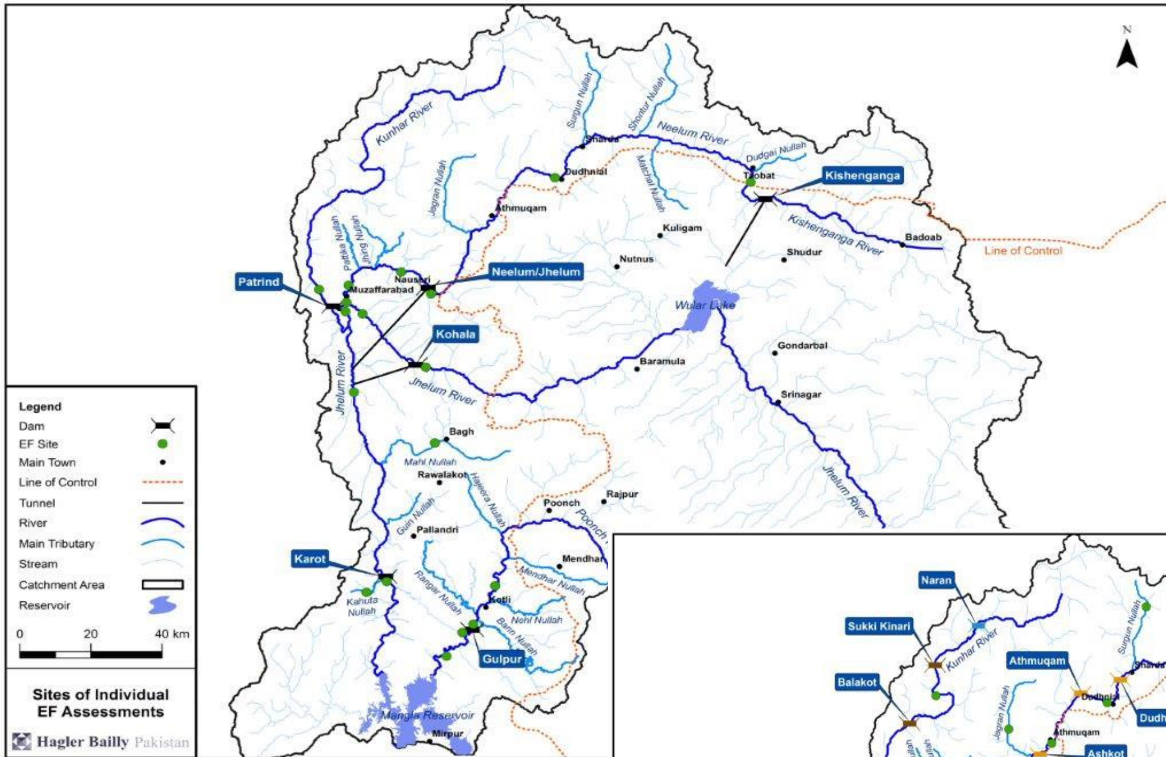
Operation (water, sediments and passage)







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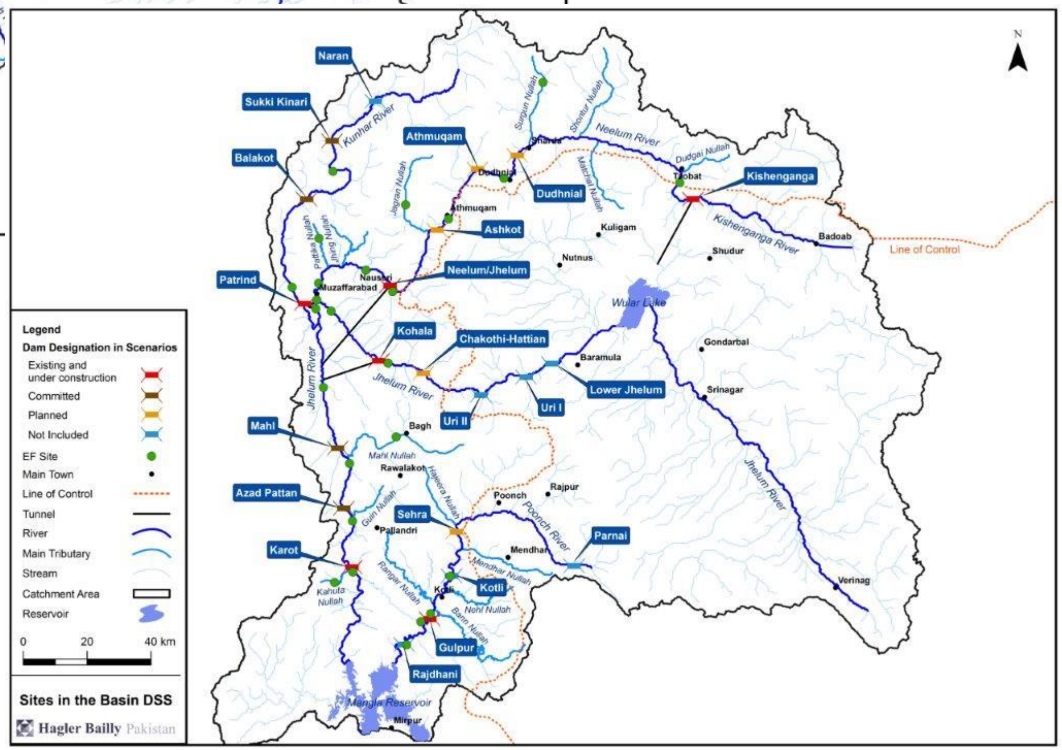
Kunhar River
Surgun Nullah
Shontur Nullah
Neelum River
Sharda
Dudgai Nullah
Dudhnial
Taobat
Kishenganga
Jagran Nullah
Matchal Nullah
Athmuqam
Kuligam
Kishenganga River
Badoab
Line of Control
Pattika Nullah
Jhing Nullah
Patrind
Nauseri
Muzaffarabad
Neelum/Jhelum
Nutnus
Shudur
Wular Lake
Kohala
Gondarbal
Baramula
Jhelum River
Srinagar
Bagh
Mahl Nullah
Rawalakot
Haveera Nullah
Poonch
Rajpur
Gulin Nullah
Pallandri
Poonch River
Karot
Mendhar
Mendhar Nullah
Kahuta Nullah
Rangar Nullah
Kotli
Nohl Nullah
Banh Nullah
Gulpur
Mangla Reservoir
Mirpur
Legend
Dam
EF Site
Main Town
Line of Control
Tunnel
River
Main Tributary
Stream
Catchment Area
Reservoir
0 20 40 km
Sites of Individual EF Assessments
Hagler Bailly Pakistan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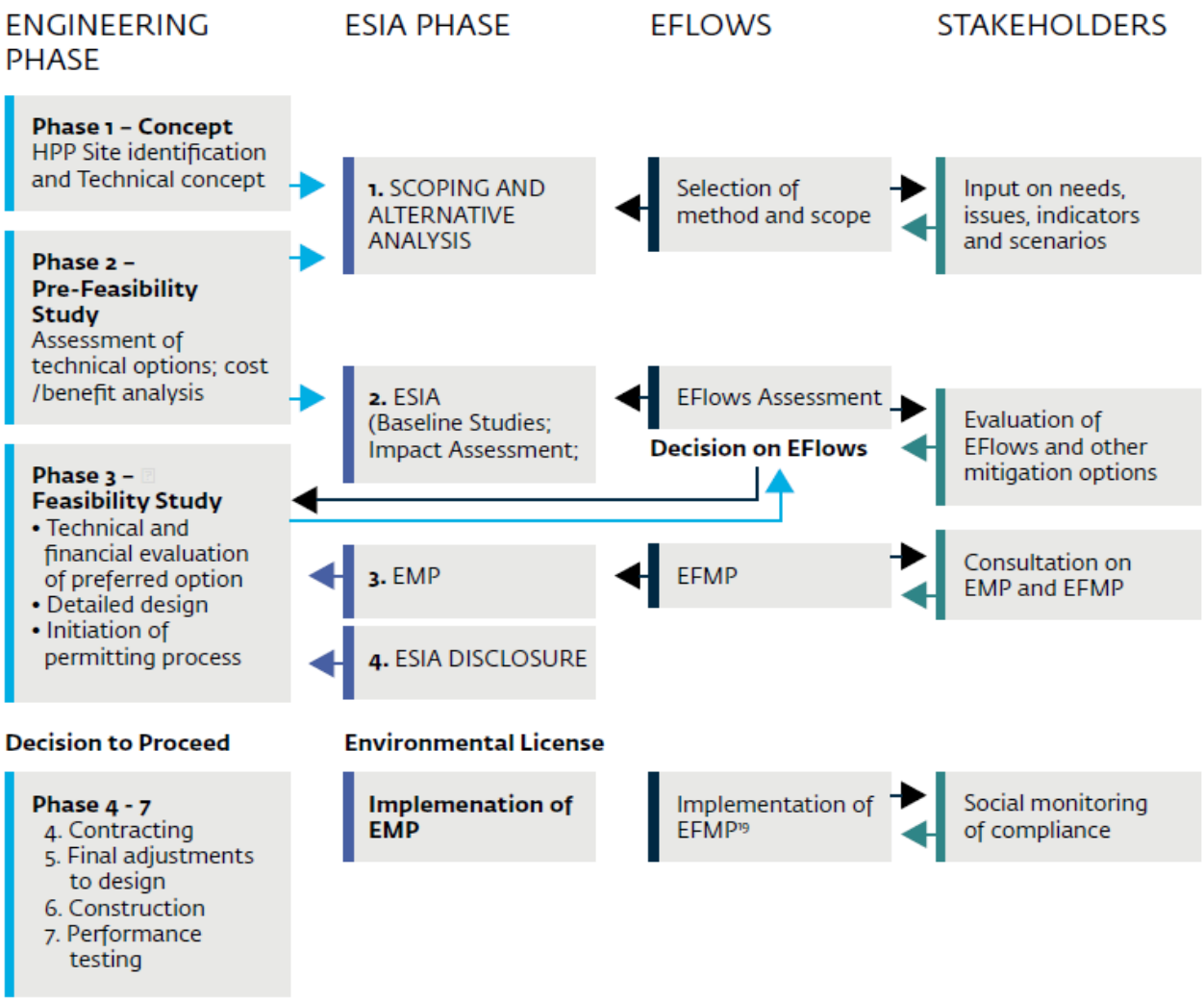
Kotli
Nohl Nullah
Banh Nullah
Gulpur
Rajdhani
Verinag
Mangla Reservoir
Mirpur
Legend
Dam Designation in Scenarios
Existing and under construction
Committed
Planned
Not Included
EF Site
Main Town
Line of Control
Tunnel
River
Main Tributary
Stream
Catchment Area
Reservoir
0 20 40 km
Sites in the Basin DSS
Hagler Bailly Pakistan

Alignment with ESHIA



Logframe for EFlows assessment

Establish project context

Identification of Values/ Uses / Function:

Environmental Values: (Ecological, Cultural, Landscape or Recreational)

Set up of EFlows assessment tool

Engagement with Stakeholders - what are the important Environmental Values?

Alternative Analysis, and Cumulative Impact Assessment

Supervision and Control

Set the Targets for Ecological Flows regime

(e.g. </= 10% reduction of fish habitat; maintain reach used for a traditional ritual)

Set EFlows for the full flow regime, and design operating rules

Agree on policy, procedure, institutional arrangements and financing for implementation of EFlows

Compile EFlows Management Plan

Implementation, monitoring and QA

Institutional /political

Technical

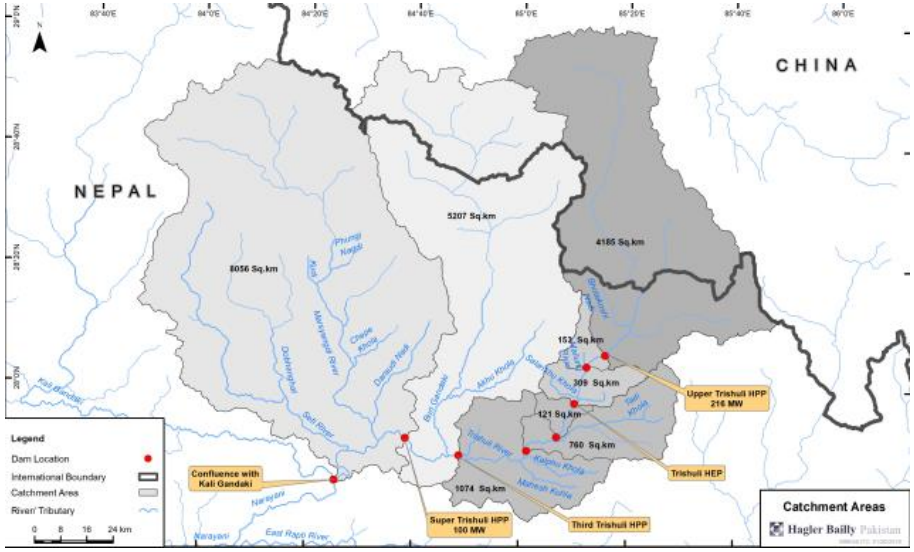
ESTABLISH PROJECT CONTEXT

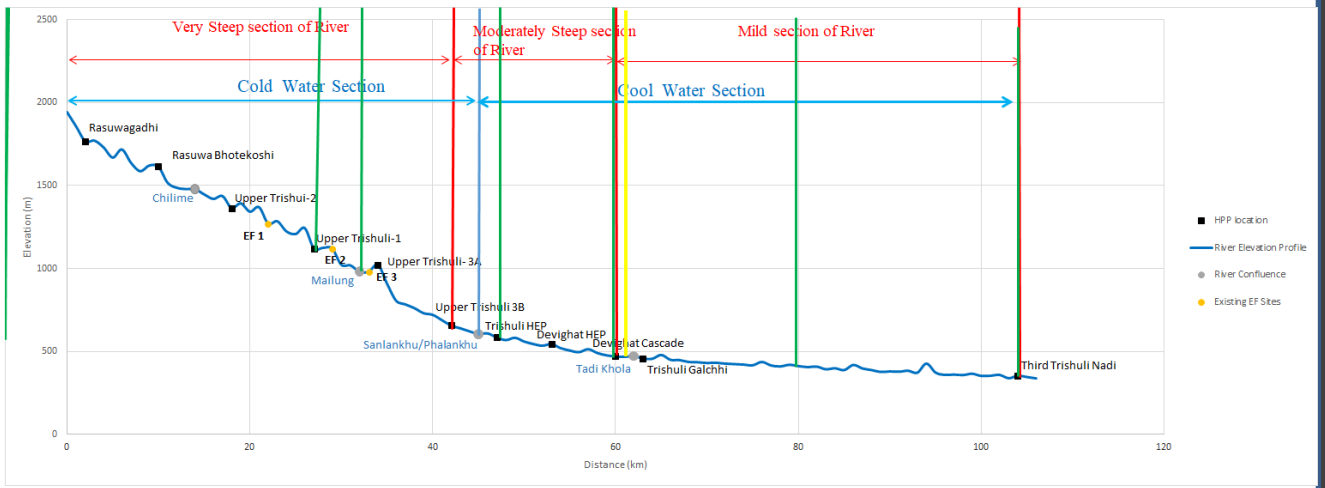
Establish project context

- Delineate basin/sub-basin (geomorphological and development context):
  - Identify main issues:
    - Ecosystems
    - River uses
  - Select EFlows sites/reaches
- Select appropriate level of resolution for the EFlows Assessment
- Select EFlows Assessment team

Delineate basin/sub-basin

- Main types of aquatic ecosystems
- Settlements and socioeconomic uses
- Ecologically uniform zones:
  - Hydrology
  - Sediment
  - Slope
  - Habitats
  - Biota.





EFlows site/reach selection

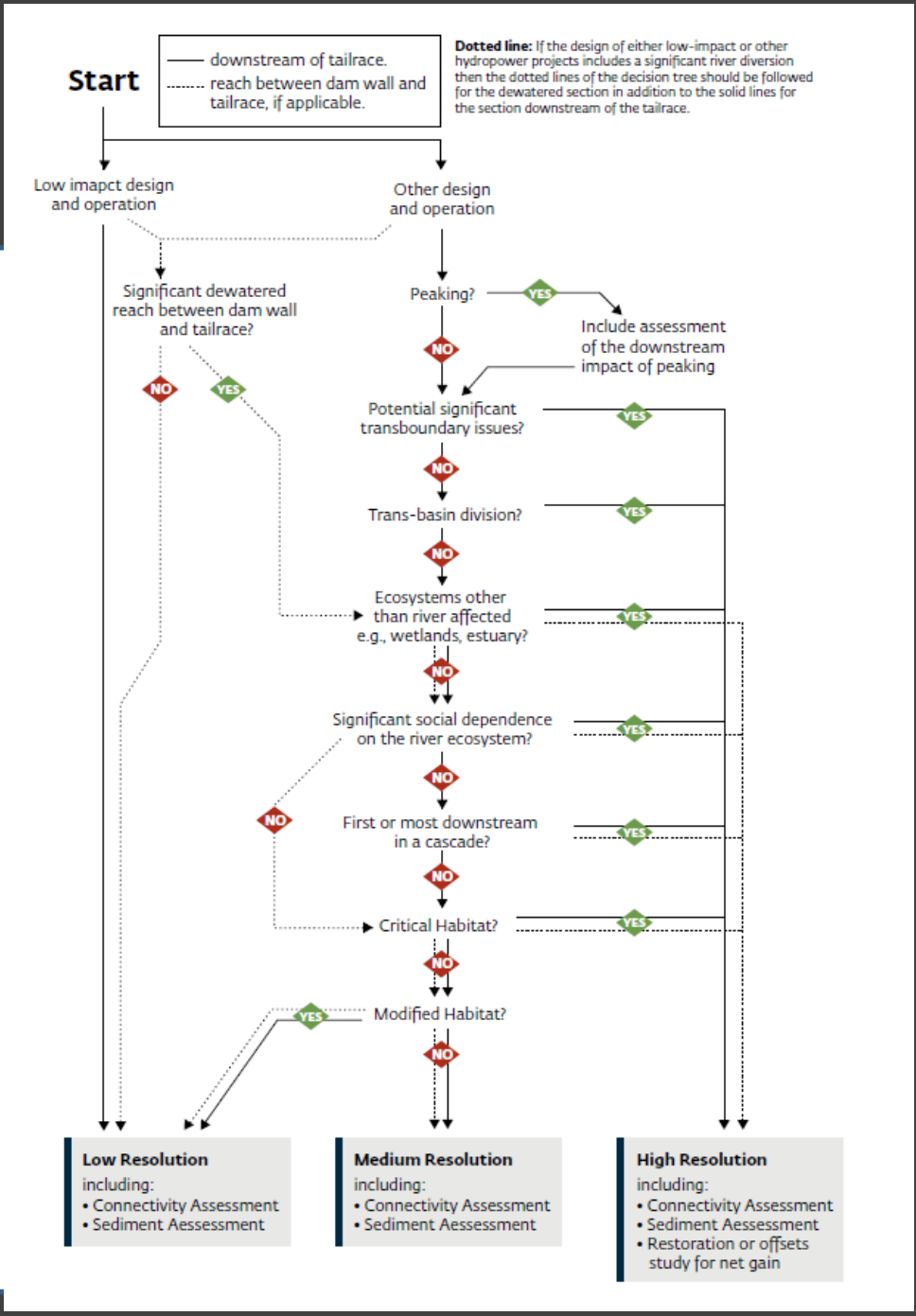
- Representative
  - Ecosystems
  - River type
  - Hydrological and sediment changes
- Keep in mind the future
- Other criteria:
  - Hydrology
  - Access
  - Safety
  - Sensitivity to flow/sediment change
  - Part of life history of key species

Select resolution of EFlows Assessment

- Low-resolution
  - Not affect on Natural, Critical Habitat; rare, endangered or threatened species;
  - No social reliance on the riverine ecosystem
  - Baseload plants with no substantial influence on the flow regime, i.e., months outside of the dry season are relatively unimpacted
- Medium-resolution
  - Not affect on Critical Habitat; rare, endangered or threatened species;
  - No significant social reliance on the riverine ecosystem
  - Near other existing HPPs (e.g., cascade of dams) as long as they are not the most downstream
- High-resolution holistic
  - Will affect Critical Habitat;
  - Will affect rare, endangered or threatened species;
  - May significantly degrade or convert Natural Habitat
  - Affect aquatic ecosystems other than rivers, such as an estuary or a floodplain
  - Significant social reliance on the riverine ecosystem
  - Transboundary or trans-basin effects

Decision tree

- Location
- Design
- Operation



EFlows assessment team

- Team may comprise one or more of:
  - EFlows practitioner-team leader
  - Hydrologist
    - Ecohydraulic modeller
    - Water quality specialist
  - Geomorphologist/sedimentologist
  - Botanical ecologist
  - Macroinvertebrate ecologist
  - Fish ecologists

Rough cost comparisons

Level of resolution	Units	Low Resolution	Medium Resolution	High Resolution
Team and effort				
No. of EFlows practitioners	People	1	1-2	1-2
No. of specialists	People	1-2	2-6	6-10
No. of site visits	Trips	1	1-2	2-3
No. of scenarios	Number	1-4	3-4	4+
Duration	Months	1-2	6-12	6-24
Time and cost estimates				
Preparation	Person days	1-2	10-30	20-50
Data collection	Person days	2-4	10-40	40-80
Assessment	Person days	1-3	10-40	40-110
Write-up	Person days	1-3	10-30	30-50
Total	Person days	5-12	40-140	130-290
Cost	US$ (x1000)	4 – 10	30 – 110	100– 400
Additional time and level of effort				
Flow routing for peaking	Person days	n/a	10-20	15-30
Restoration and offset measures	Person days	n/a	10-20	20-60
Social /Stakeholder engagement	Person days	n/a	20-40	30-60
Additional specialist	Person days	n/a	15-25	20-40
Additional scenario	Person days	n/a	2-10	2-10

SET UP OF EFLOWS ASSESSMENT TOOL

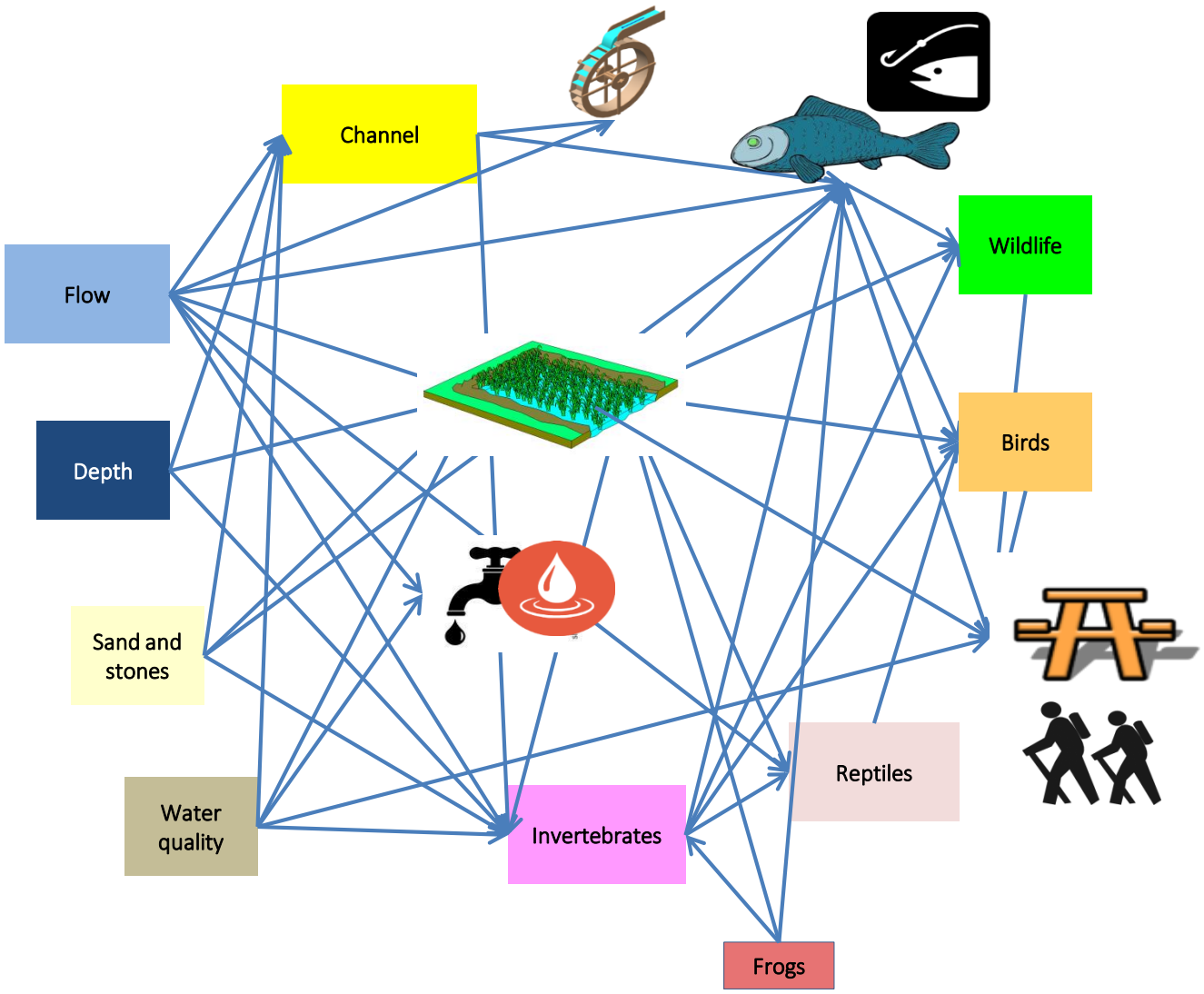
Prepare input data/timeseries

- Hydrology
  - monthly
  - daily
  - length
- Sediment
  - suspended sediments
- Water quality
  - Temperature
  - Nutrients
  - Toxins

Select indicators and status

- Select indicators
  - relate to the issue being addressed
  - have links to flow/sediment
  - encompass the relevant factors affecting the ecosystem
  - amenable to quantification in some form
  - reflect stakeholder concerns
- Assess status and trends
- Derive relationships
  - Extrapolation
  - Review literature
  - Expert opinion
- Screen for off-sets
  - Alternative locations
  - Management interventions
  - Restoration

Indicators


Channel
Flow
Depth
Sand and stones
Water quality
Invertebrates
Frogs
Reptiles
Wildlife
Birds

Collect field data

- The power of seeing
- ‘Essential’ data
  - Ecohydraulic
  - Physical
  - Biological
    - Life history
- Seasonality
- Constructing baseline:
  - absolute rarely possible
  - relative

ALTERNATIVE ANALYSIS

Alternatives analysis

- Location
- Design
  - Size
  - Turbine selection
    - Minimum operating flows
    - Generation on EFlows releases
  - Mitigations
    - Fish passage
- Operation and management
  - Flow and sediment scenarios
  - Peaking versus baseload power generation
  - Catchment management
- Power purchasing agreements

Cumulative Impact Analysis

"Dam projects that do not emerge from a comprehensive basin assessment, and cumulative assessment, cannot claim to be sustainable"

Stockholm Water Week 2018

EFLOWS MANAGEMENT PLAN (EFMP) AND IMPLEMENTATION

The EFMP

- Details:
  - HPP; affected river reach(es); scope and objectives; dates and duration of agreements
- Policy statement:
  - Regulations and agreements targeted; responsibilities assigned; objectives
- Record of decision
  - EFlows assessment method; stakeholder engagement; target values for protection; operation and design of HPP; power generation targets; PPA
- Monitoring program
  - Sampling points, baseline data, methods and schedules; data analysis; reporting and QA
- Implementation framework
  - Institutional responsibility, capacity and competency requirements
- Reporting and QA/auditing arrangements
- Adaptive management frameworks
- Budgets, source of funds and financial management

Review

- Were stakeholders adequately engaged?
- Is there a review of existing knowledge?
- Is there a delineation?
- Is assessment resolution adequate / justified?
- Is the method used published in scientific literature?
- Are sediments and biotic migration considered?
- Are EFlows assessment sites appropriate?
- Is the time-step of assessment appropriate?
- Is an implementable EFMP in place?

Implementation

- Scale
- Capacity
- Funding
- Political will
- Audits and review

Thank you