Integrating Adaptive Environmental Management into Dredging Projects

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Definition - Adaptive Management

- decision framework facilitating flexible decision-making
- to be refined for future uncertainties, when understanding effect of current and future management actions.
- developing and implementing a management plan, defining project goals and periodically reviewing progress,
- in response to the outcomes of (environmental) monitoring, implementing corrective actions and refining of plan, as needed.

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Why this CEDA paper?

- Projects often permitted , after EIA, with conditions and thresholds based on best understanding.
- Yet uncertainties exist about effects and responses by nature – better or worse.
- Need for less rigid management structure recognised.
- Gives information on objectives, suggestions and recommendations how to apply adaptive processes.

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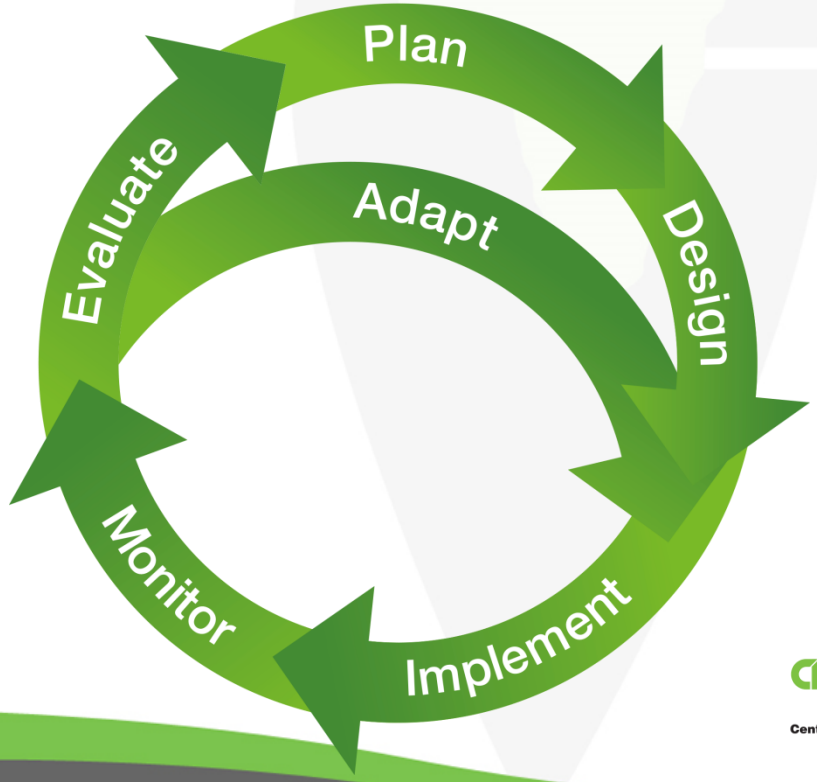
What is AM, and what can it deliver

- Decision framework for decision making in response to uncertainties, leading to AM plan, based on monitoring.
- Relatively formal process, towards high efficiency while aiming for good ecological state.
- 5 steps:



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What is AM, and what can it deliver

Project Consideration	Benefit	Disadvantage
Environmental	Enables a project with uncertainties to go ahead. Effective method of protection for the environment, especially when tiered management approach.	In rare instances, may be used as an "excuse" for poorly conceived design or project implementation. Dealing with uncertainties takes more time and effort.
Legal / Permitting	May allow projects to proceed with licence while still uncertainties on sensitive receivers.	May conflict with prevailing laws, when based on precautionary principle.
Effort and economics	Case-specific solution with initially more effort, but possibly lower total effort and cost. High attention level advantageous for overall result.	Uncertainty on effort complicates exact advance budgeting. Needs allowance for provisional funds. Might delay project.
Contractual	Allowance for flexibility reduces potential for conflicts.	Increased effort in contract management, for risk sharing
Social	Stakeholder trust may be improved by transparent process.	May be perceived to justify worse project outcomes. May be reluctance to reduce scope.

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Implementing AM

Management considerations

- Not working from precautionary approach – worst case scenario
- Working on case-specific approach to less conservative scenario, focus on sensitivity of environmental receptors
- Management Organisation requires
  - temporary more intensive monitoring-evaluation-assessment
  - higher budget and resource requirements for MEA,
  - mechanism to deal with variable effort based on requirements,
  - mechanism to deal with changing total costs
  - cross-sectoral project management skills,
  - flexibility for a differing implementation timeframe

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Implementing AM (continued)

Management considerations

- Management structure to be communicated openly
  - Specific thresholds for effect
  - Tiered levels for action
  - Monitoring methodology (including frequency)
  - Review process for adjustments
  - Required response times
  - Decision making process
- Defined in Adaptive Management Plan
- Early Contractor Involvement advised

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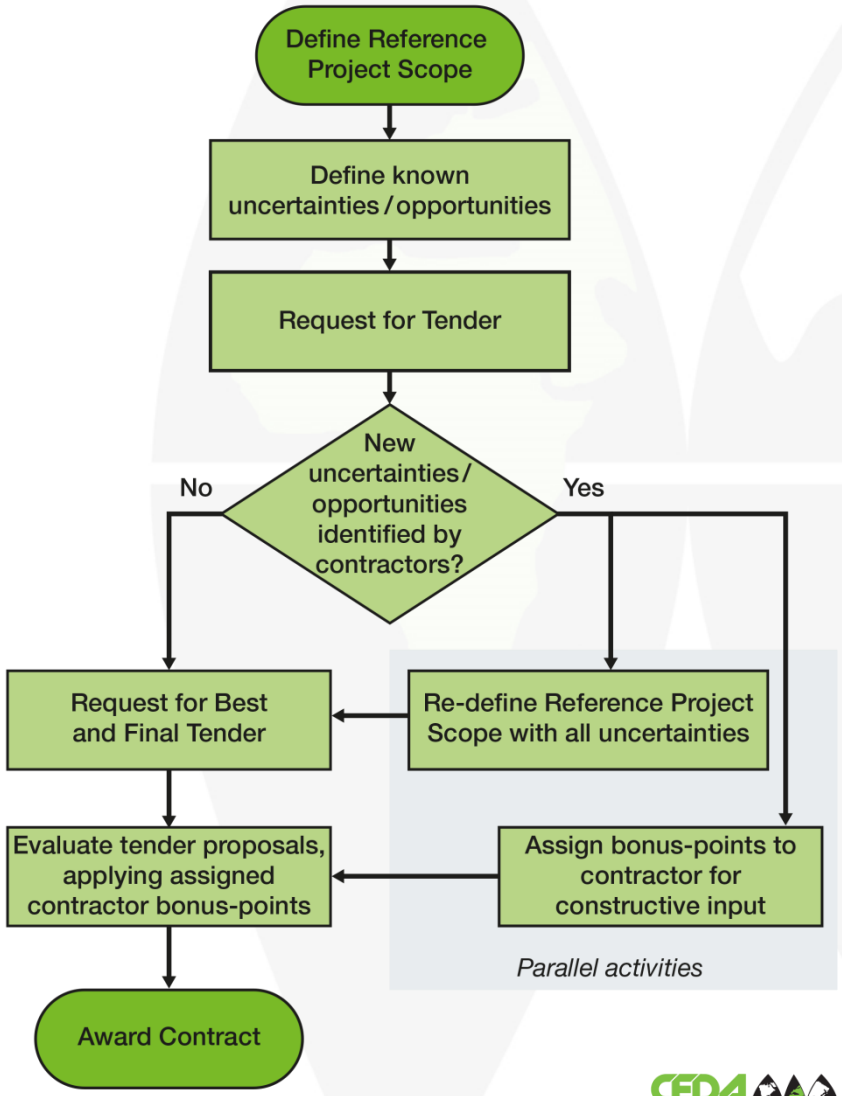
Implementing AM (continued)

Tendering Procedures

- How to objectively select Contractor for ECI when scope not clear.
- Example procedure



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Implementing AM (continued)

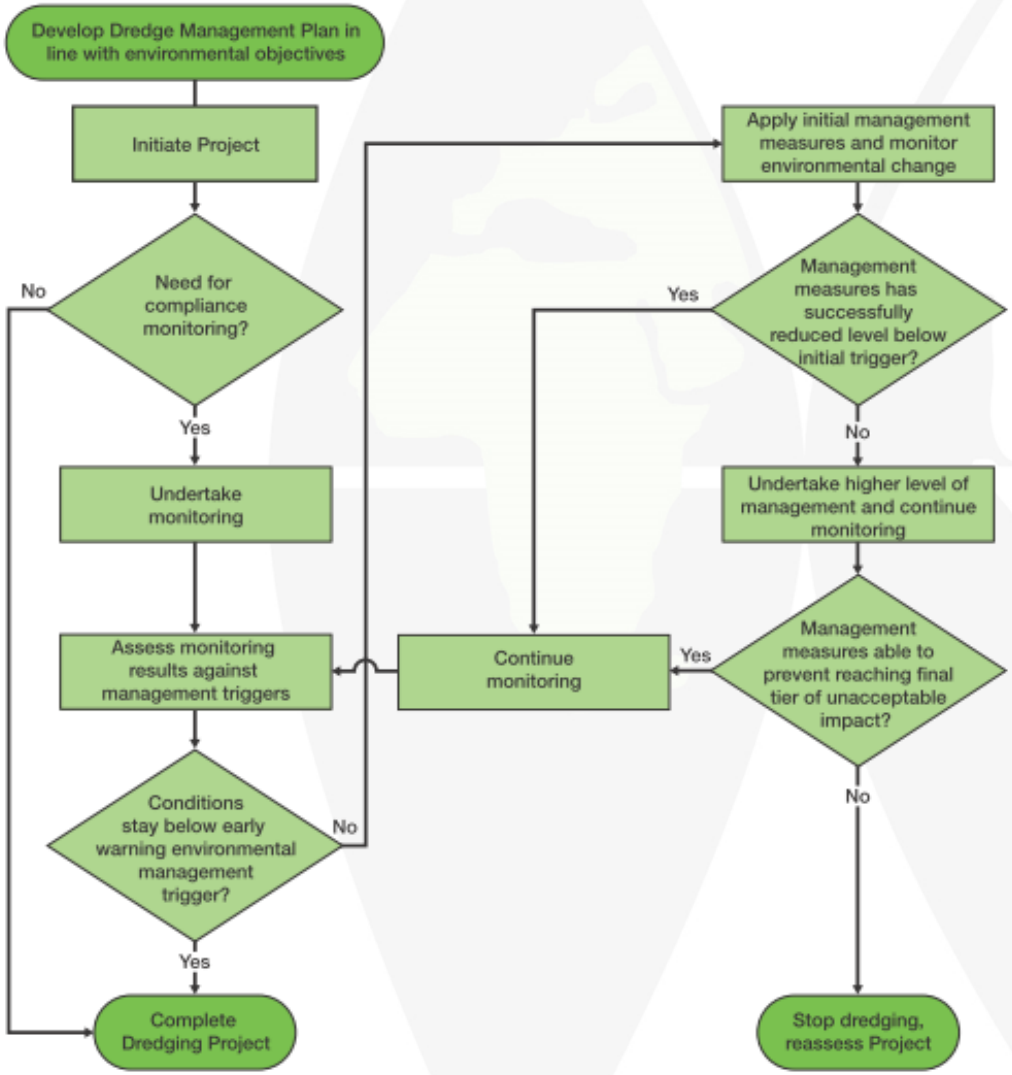
Legal aspects - Permits

- AM to comply with current law, possibly with combination of options.
- Uncertainty easily leads to precautionary conditions
- Role of Regulator to become more involved, if not pro-active
- Advisory Panel, with powers, could play important role in decision making, before and during implementation.

Critical success factors for AM

Adaptive Management Plan

- AMP with procedure for integrating AM during implementation phase
- Simplified example given.



Critical success factors for AM (continued)

Conditions

- Understanding baseline and natural variability
  - Essential (for any project)
  - For long term trends and variability
- Understanding sensitivity and setting triggers
  - Modeling to assist
  - Monitoring to inform
  - AM to adjust

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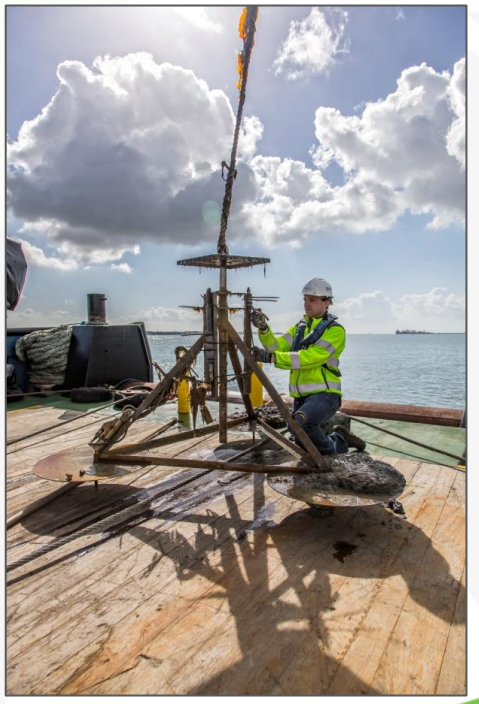
Critical success factors for AM (continued)

Conditions

- Project-specific monitoring and analysis of data
  - In relation to aims of AM
  - Spatial / temporal / economic / environmental objectives
  - Transparency in data collection and processing
  - Distinguish natural events
  - Adjust program when appropriate
- Project-specific management responses
  - From simple (investigate) to extreme (stop)
  - Best in reaction to tiered trigger levels



Critical success factors for AM (continued)

Conditions

- Well defined roles and responsibilities
  - Project owner / developer responsible
  - Contractor to participate in monitoring
  - Contractor to sign-up to environmental objectives
  - (Moving towards Alliance)
- Effective review process
  - ‘slow’ monitoring to be followed by ‘quick’ decisions
  - No room for bureaucracy, pragmatism required
  - Assistance by Independent Review Panel

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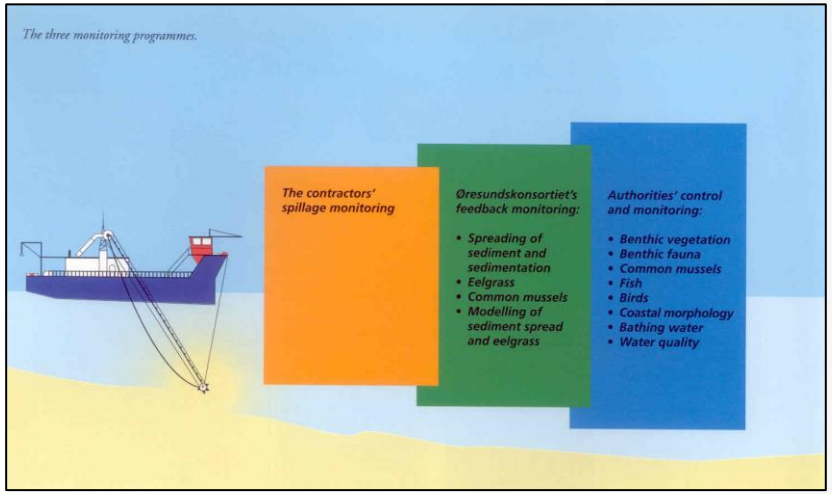
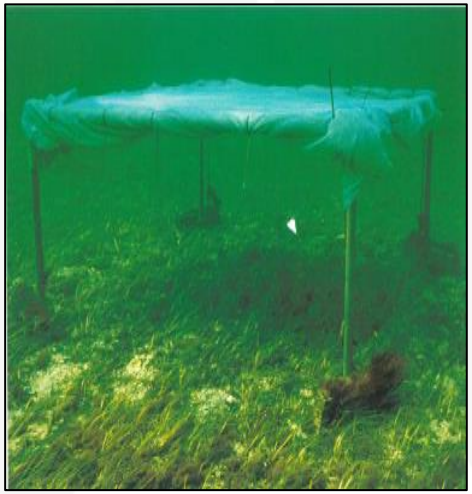
Case Study - Øresund Fixed Link (DK)

- Slow response on environmental receptors urged for management on spill budget.
- Contractor to monitor and responsible to manage project with SB
- Owner verifying response through feedback monitoring
- Within time / budget, no effects





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Case Study – Wheatstone (AUS)

- Dredging for LNG port and pipeline trench
- Strict water quality control
- Contractor to monitor turbidity, manage works against triggers, using forecast modeling
- Owner monitoring benthic communities, reviewing trigger values, using hindcast modeling

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Case Study – Poplar Island (US)

- Artificial Island in river used as storage area for dredged maintenance sediments
- Habitat restoration with AM: sequential filling and vegetation planting in cells.
- Monitoring of predicted effects, followed by adjustment of plans for next phase
- Facilitated environmental benefits with beneficial use of DM

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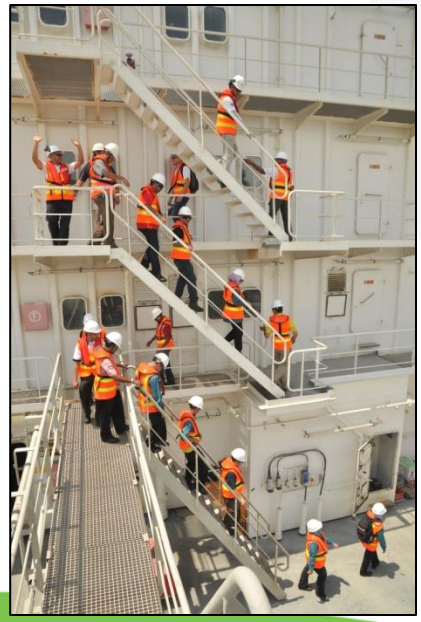
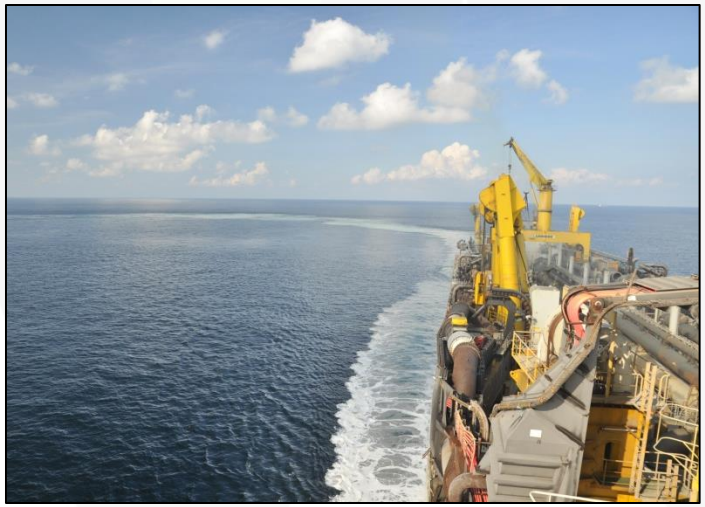
Case Study – Lumut (Malaysia)

- Dredging with 14 km silt curtain at 25 m water with 3m waves as per conservative EIA
- Execution by large TSHD and extensive plume monitoring, no silt screen; good information of stakeholders
- For reduced budget, within time, monitoring and modeling demonstrated compliance to thresholds





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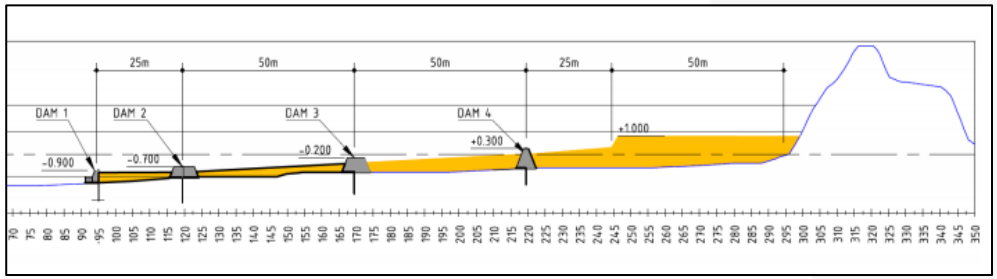
Case Study – Schelphoek (NL)

- Sand nourishment while keeping ‘area alive’: pilot
- Intensive monitoring for pilot, and for compliance to strict execution triggers.
- AM used in preparation to get all stakeholders in line
- AM used in adjusting replenishment design following monitored effects



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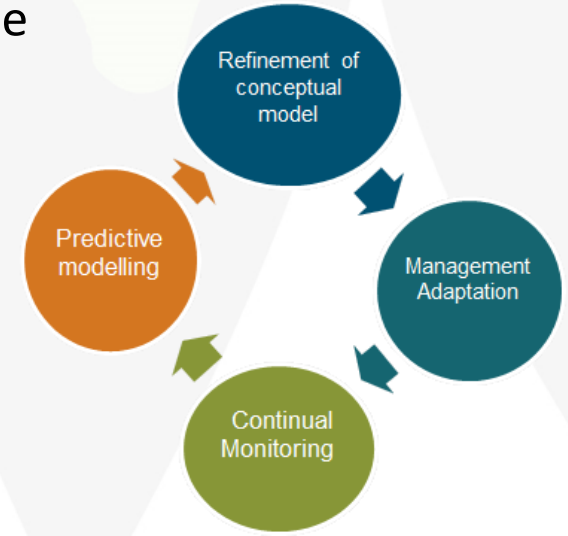
Other Case studies – London Gateway

- Dredging & reclamation with DO & TSS levels as safety net to sensitive receiver sites
- Monitoring showed impact of natural variability on threshold management, requiring modifications
- Baseline & thorough data analysis paramount
- Thresholds, with action plan, to avoid unnecessary control actions and to guarantee required environmental control
- Work approvals allowed for adaptive monitoring

Acknowledge: DEME / DP World London Gateway

Other Case studies – Stour/Orwell Estuary

- To offset anticipated effects of the deepening on estuary habitat, sediment recycling as mitigation: maintaining fine sediment budget, combining port development and support of local ecosystem.
- Following consent, concern about whether the recycling would be effective led to a Regulator decision to increase the recharge.
- Monitoring over the next few years showed muddy accretion in several areas, caused by recharging too much sediment in a less than ideal way.
- Further refinements of the mitigation have been effective and have not only mitigated for dredge but also greatly reduced background estuary erosion
- Developer, harbour authority and regulator were able to agree on the principle of flexibility in the management approach.
- Process of mitigation and monitoring and learning and adaptation hard to pre-determine; if you pre-determine too much you end up being over cautious.



Acknowledge: HR Wallingford / HHA

Main Messages

- AM efficient and cost-effective management process when objectives clear, yet local environmental effects uncertain, and management actions implemented to address uncertainties as project progresses.
- AM to desired goals by addressing uncertainty, incorporating flexibility and robustness, with new information for decision-making as the project develops.
- AM “modern” approach, potential to become good practice; underlines commitment for process optimisation. Not likely AM to become good practice for all projects, but advantages mainly for larger and multi-year projects.

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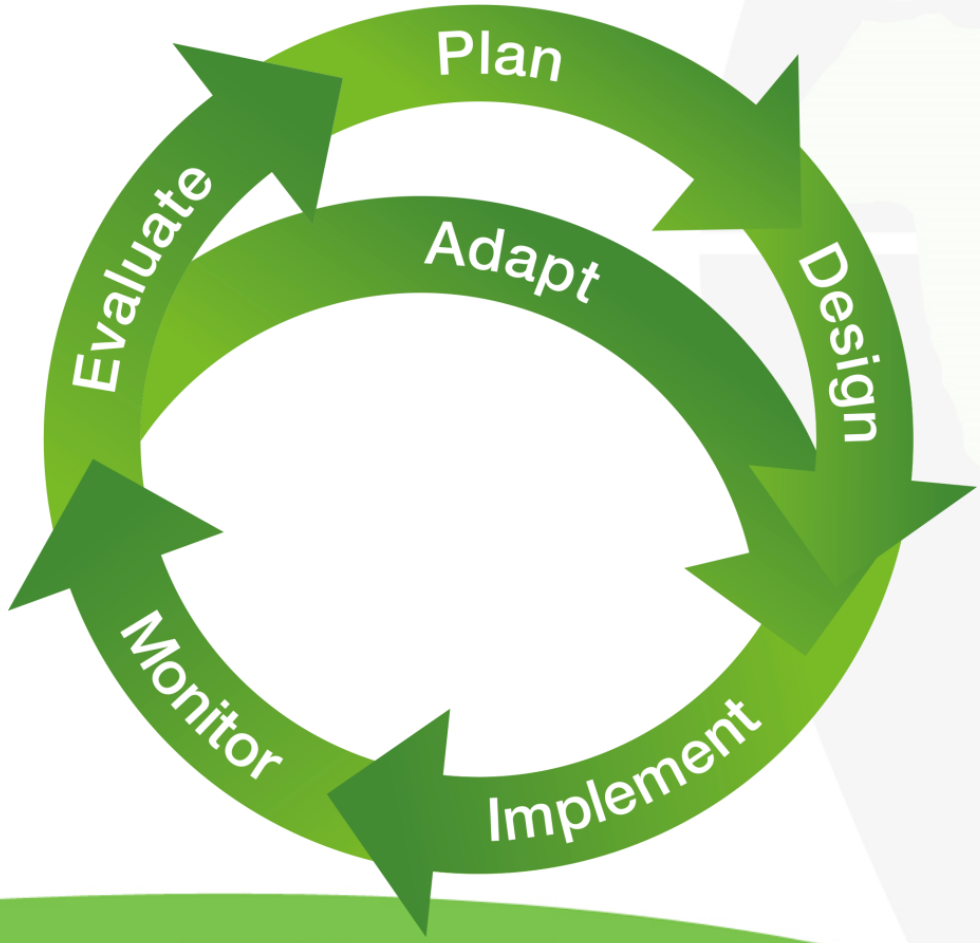

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