# Cumulative Assessment Model

*for Marine Renewables of Oregon*

A project commissioned by the Oregon Wave Energy Trust
For further information visit – www.oregonwave.org

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environmental services and products

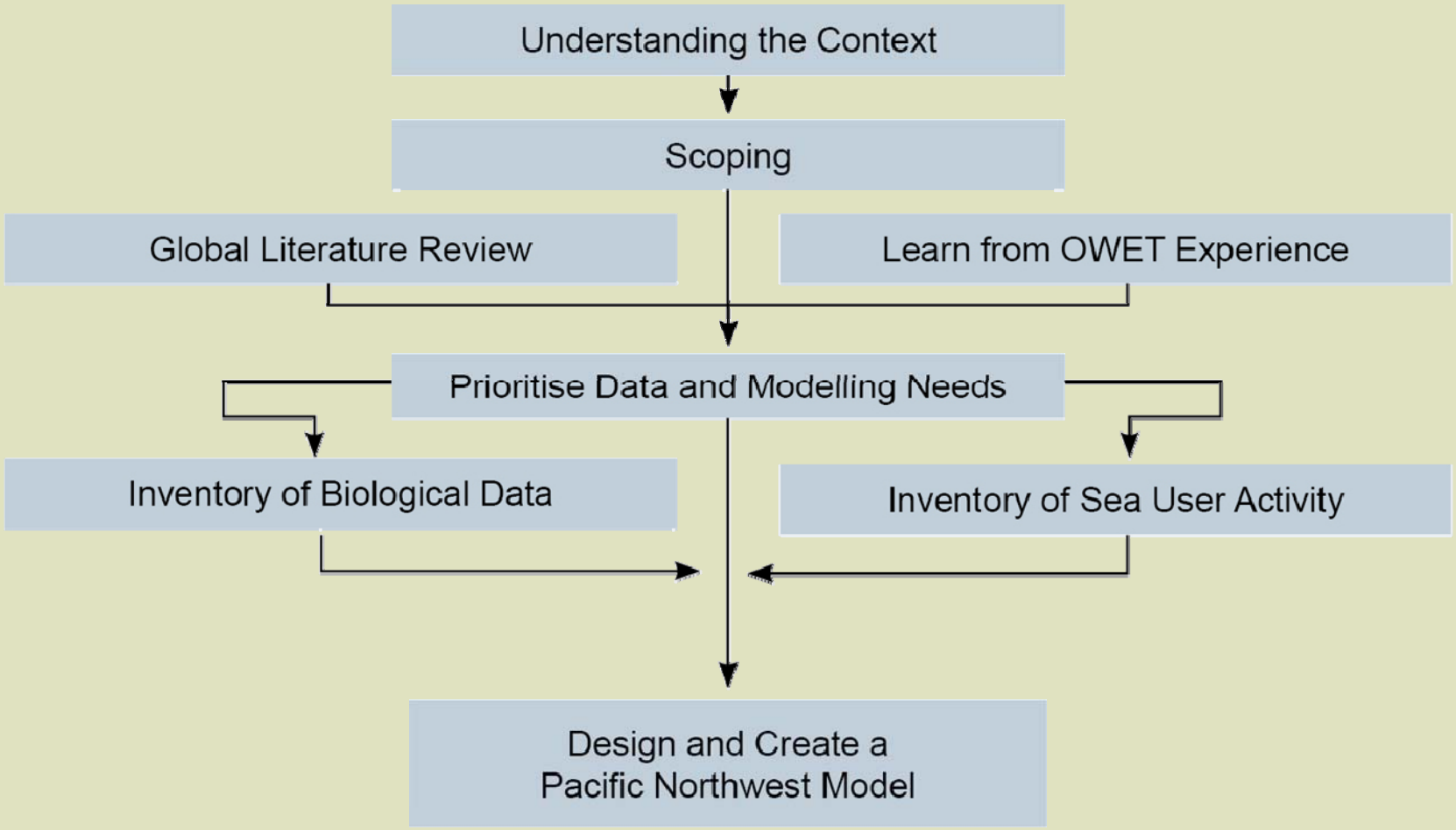
Parametrix

EMEC ORKNEY
The European Marine Energy Centre Ltd

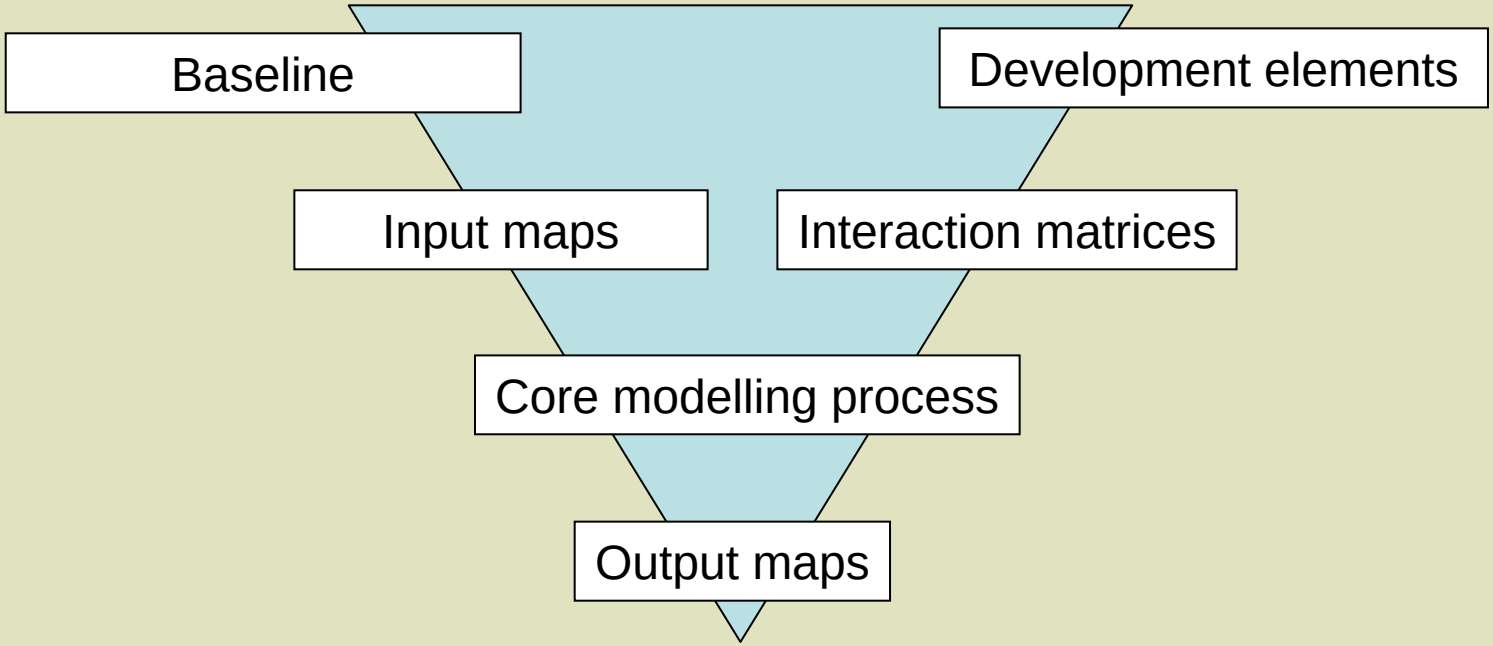
Powertech

# Proposed framework development

# Project plan



# Analytical framework structure



# Environmental baseline

- Environmental sensitivities
  - Physical
  - Ecological
  - Conservation
  - Socio-economic
  - Existing pressures and opportunities
  - Technical constraints
- Mapped in GIS

# Overall approach to the study

**Sensitivities**

**Physical**

**Ecological**

**Conservation**

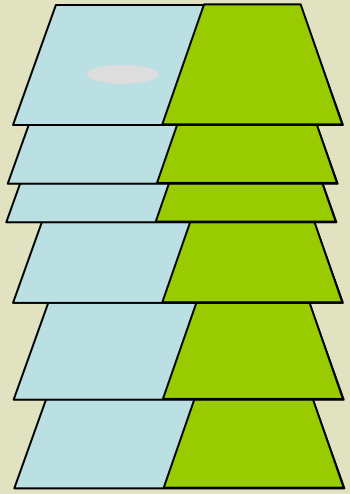
**Social**

**Economic**

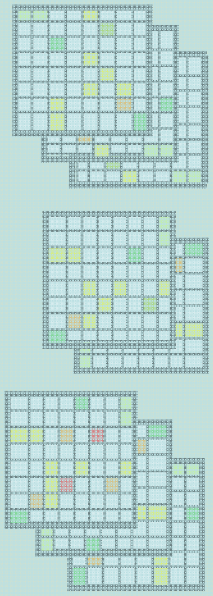
Environmental receptors & functions

Possible areas of cumulative effects

Sensitivity normalised in relation to level of impact, risk or ecosystem & society services



Impact levels for the relevant activity, specific to the sensitivities in the defined area are collated



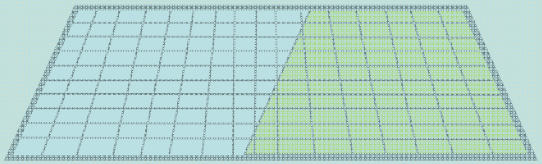
Environmental sensitivities & functions

Activities

Devices

Supporting technology

Associated operations



Scenarios that consider the distribution of sensitivities with appropriate impacts for a given set of activities

# Development activities

- Key development elements
  - Devices
  - Supporting technology and infrastructure
  - Supporting operations
  - Special areas
  - Integrated scenarios
- Matrices of interactions established

# Interaction matrices

| | Sensitivity | | | |
|---|---|---|---|---|
| Activity | ✓ | | ✓ | |
| | | ✓ | ✓ | ✓ |
| | ✓ | | | ✓ |
| | ✓ | ✓ | | |

Level of interaction also established

# Classification system – units of measure

- System which allows comparison of possible impacts across a wide range of factors
- Creates a common currency
- Deals with positive and negative outcomes
- All interactions will be classified on the basis of a recorded justification
- Common unit is level of positive or negative impact (could also be ecosystem function)

## Absolute evaluation Matrix

| Category | Health & Safety | Technical risk | Cost | Ecological | Economic | Social | Regulation | Reputation |
|---|---|---|---|---|---|---|---|---|
| -5 Extreme | >1F fatalities in life of project | Blue sky research, Design from scratch | > $100 million | Total change to ecosystem and no recovery | Loss of~business > $10 million | Massive social changes, affecting majority of population negatively | Fails to meet wide range of regulatory standards and policy requirements | International campaign with extensive direct action, civil disobedience with broad public support. |
| -4 Major | 1-10 fatalities in life of project | Novel technology unlested in the field | <$100 million | Major impact. High toxicity or poor recovery potential | Loss of~business <$10 million | Social changes, affecting major part of population | Does not meet current regulation or corporate policy | National campaign, with extensive direct action, civil disobedience with general public support. Extensive international media coverage |
| -3 Moderate | Fatality | Emerging technologies, with < 3 years experience | <$10 million | Change beyond natural variability but eventual recovery | Loss of~business <$1 million | Social changes affecting a minor section of the community | Obsolete with in 5 years | Widespread campaigning 5 concerns by single issue groups. Extensive local media coverage, some national. Occasional peaceful protest |
| -2 Minor | Increase overall risk, LTAs, chronic exposure | New technology with > 3 years field experience | <$1 million | Resilient to natural variability and good recovery potential | Loss of~business <$100,000 | Changes to localised community or limited organisational structures | Obsolete with in 10 years | Specific concerns or local concerns about specific development. Some local media coverage. |
| -1 Negligible | Poses additional hazard but low risk | Proven, well established technology | <$100,000 | Within scope of natural variability | Loss of~business <$10,000 | Changes affecting a few individuals negatively | May not meet future regulations | Air awareness and some concerns but no media coverage concerns |
| 0 | No change | No change | No change | Effects not detectable | None | Effects known but not detectable | Will meet current regulations | None |
| +1 Negligible | | | Savings <$100,000 | Marginal improvements to local ecosystems | Generates business <$10,000 | Positive changes affecting a few individuals | Generates goodwill | Awareness of possible value but no specific benefits |
| +2 Minor | | | Savings <$1 million | Measurable improvements to local ecosystems | Generates business <$100,000 | Changes to localised community or limited organisational structures | Seen as being proactive | Awareness of general value but no specific benefits. Limited support for specific projects. Benefits in a specific area of interest. |
| +3 Moderate | | | Savings <$10 million | Marked improvement to local ecosystems | Generates business <$1 million | Social changes affecting a minor section of the community | Meets all international guidelines – top quartile performer | Widespread agreement of benefits across number of issues and interests |
| +4 Major | | | Savings <$100 million | Permanent improvements to national ecosystems | Generates business <$10 million | Social changes, affecting major part of population | Exceeds all regulations, some future proofing | National recognition of benefits. Change of policy would result in national protest and extensive protest. |
| +5 Extreme | | | Savings >$100 million | Permanent improvements to regional ecosystems | Generates business >$10 million | Massive social changes, positively affecting majority of population | Best in class, future proofed concepts | International recognition. Change of policy would result in international diplomatic protest |

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# Base case – no mitigation/management

Levels of anticipated impact associated with each category of sensitivity and each element of wave development activity and each other pressure,

| Sensitivities | Category | Device 1 | Technology x | Operation y |
|---|---|---|---|---|
| Sensitivity/ function 1 | H | Impact level -2 | Impact level -3 | N/A |
| | M | Impact level -1 | Impact level -2 | N/A |
| | L | Impact level 0 | Impact level -1 | N/A |
| Sensitivity/ function 2 | HH | Impact level -5 | Impact level -5 | Impact level -5 |
| | H | Impact level -4 | Impact level -4 | Impact level -4 |
| | M | Impact level -3 | Impact level -3 | Impact level -3 |
| | L | Impact level -2 | Impact level -2 | Impact level -2 |
| | LL | Impact level -1 | Impact level -1 | Impact level -1 |
| Sensitivity 3 | H | Impact level +2 | Impact level 0 | Impact level 0 |
| | L | Impact level 0 | Impact level 0 | Impact level 0 |

# Alternate scenario - managed

Levels of anticipated impact associated with each category of sensitivity and each element of wave development activity and each other pressure,

| Sensitivities | Category | Device 1 | Technology x | Operation y |
|---|---|---|---|---|
| **Sensitivity 1** | **H** | Impact level -2 | Impact level -3 | N/A |
| | **M** | Impact level -0 | Impact level -2 | N/A |
| | **L** | Impact level 0 | Impact level -0 | N/A |
| **Sensitivity 2** | **HH** | Impact level -5 | Impact level -0 | Impact level -4 |
| | **H** | Impact level -4 | Impact level -0 | Impact level -3 |
| | **M** | Impact level -3 | Impact level -0 | Impact level -1 |
| | **L** | Impact level -2 | Impact level -0 | Impact level -1 |
| | **LL** | Impact level -1 | Impact level -0 | Impact level -1 |
| **Sensitivity 3** | **H** | Impact level +3 | Impact level 0 | Impact level 0 |
| | **L** | Impact level +2 | Impact level 0 | Impact level 0 |

# Overall approach to the study

**Sensitivities**

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**Ecological**

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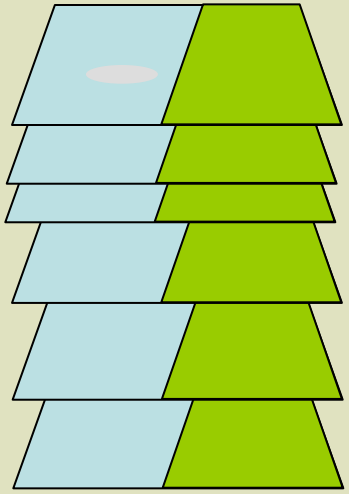
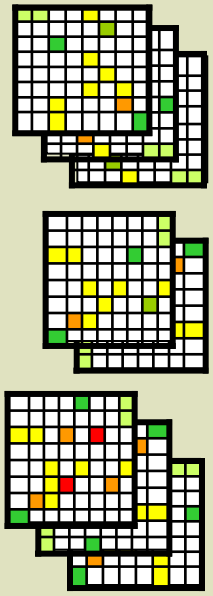
Possible areas of cumulative effects

Sensitivity normalised in relation to level of impact, risk or ecosystem & society services



Impact levels for the relevant activity, specific to the sensitivities



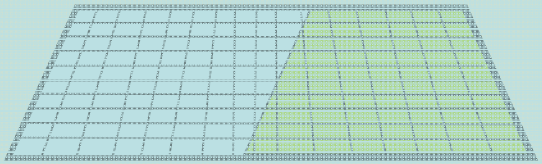
Environmental sensitivities & functions

**Activities**

**Devices**

**Supporting technology**

**Associated operations**



Scenarios that consider the distribution of sensitivities with appropriate impacts for a given set of activities

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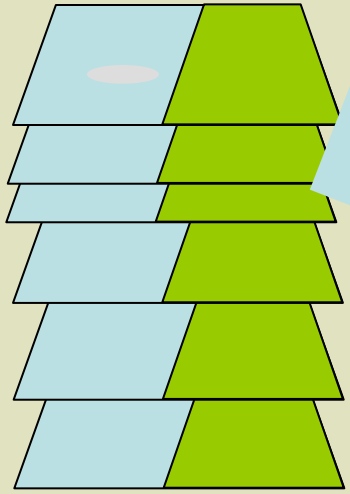

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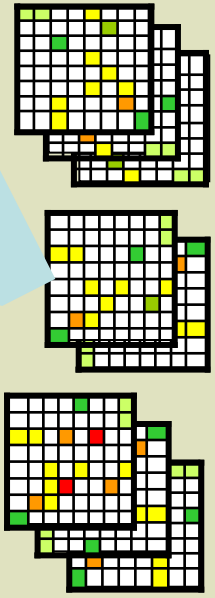
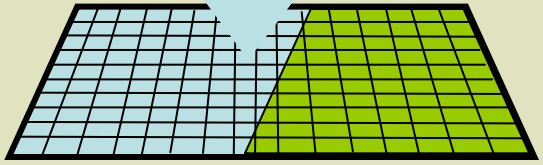


For each grid square based upon the level of sensitivity and the relevant impact vectors individual & "cumulative" effects are collated



Environmental sensitivities & functions

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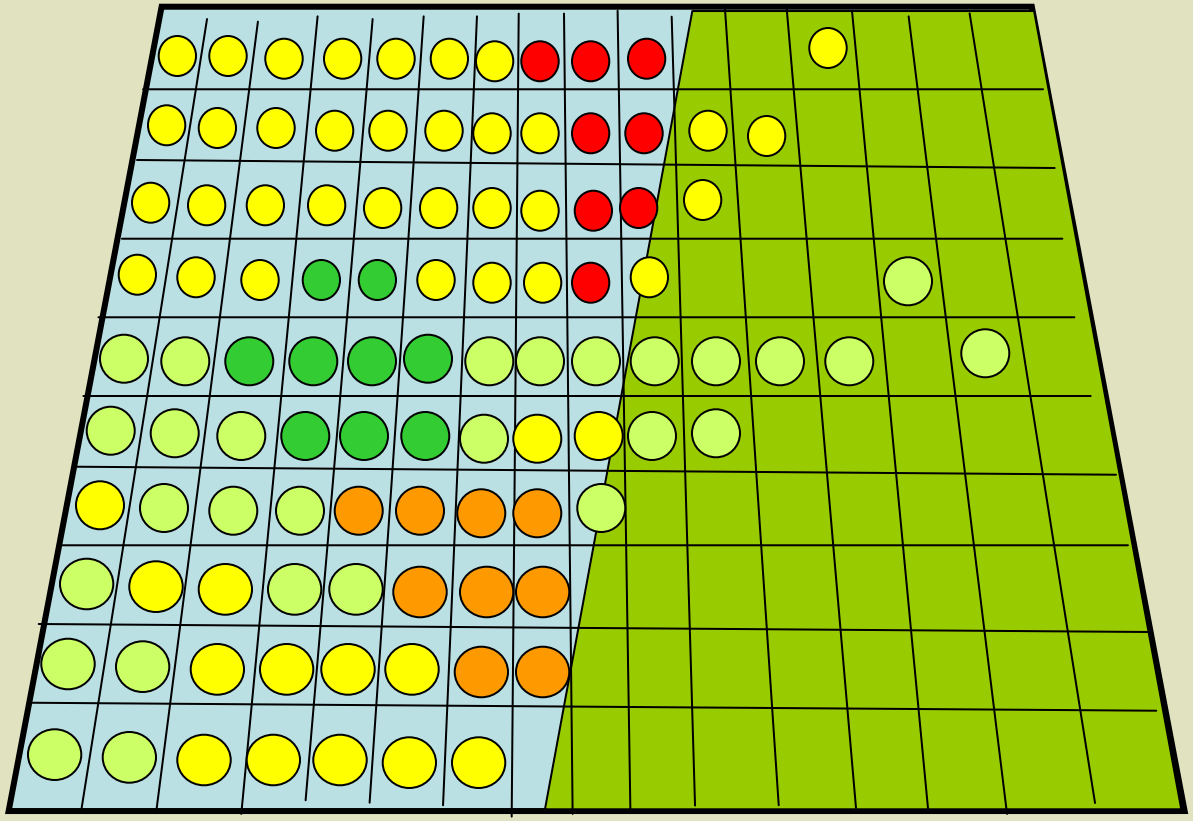
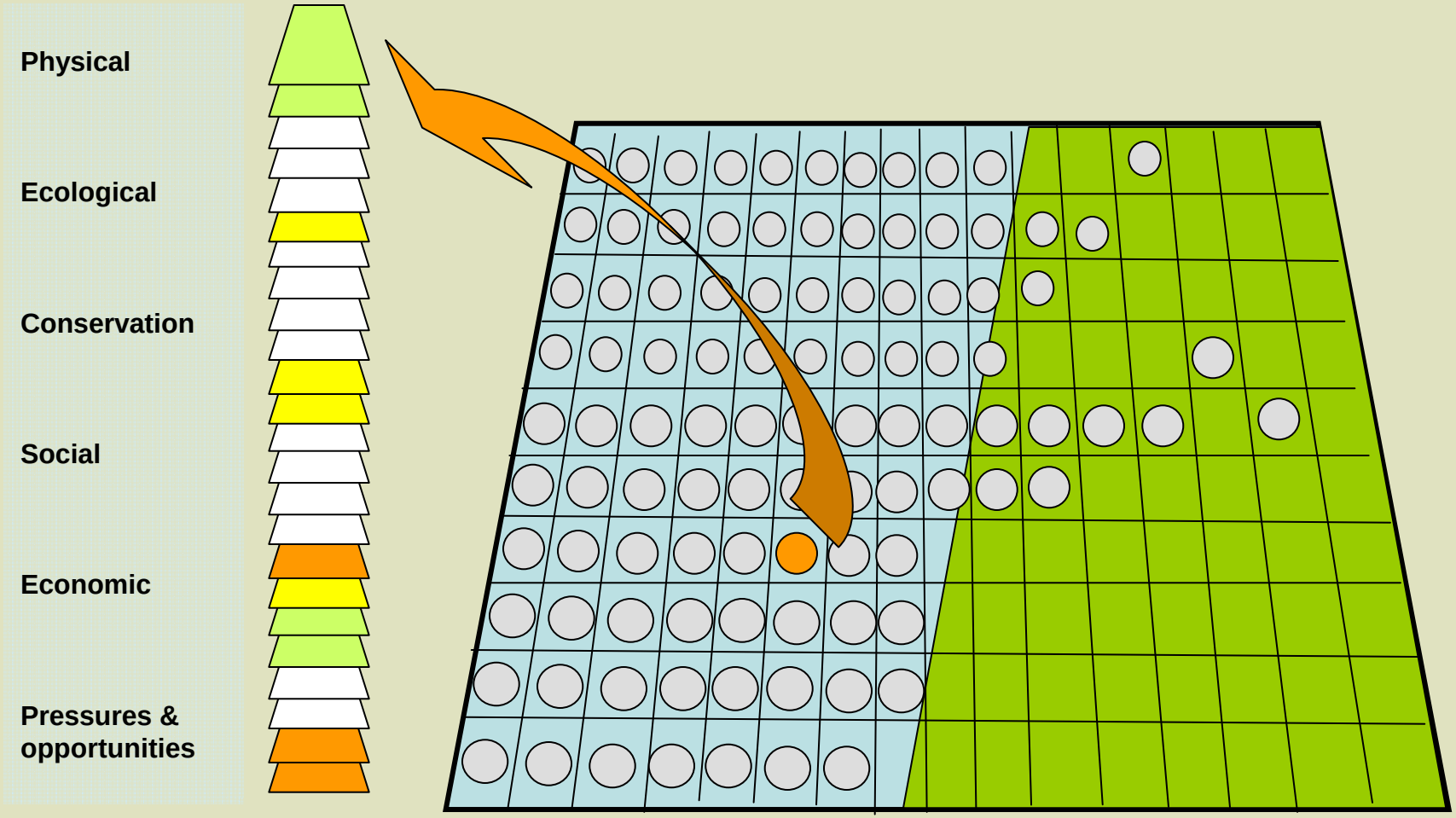
**Scenarios that consider the distribution of sensitivities with appropriate impacts for a given set of activities**

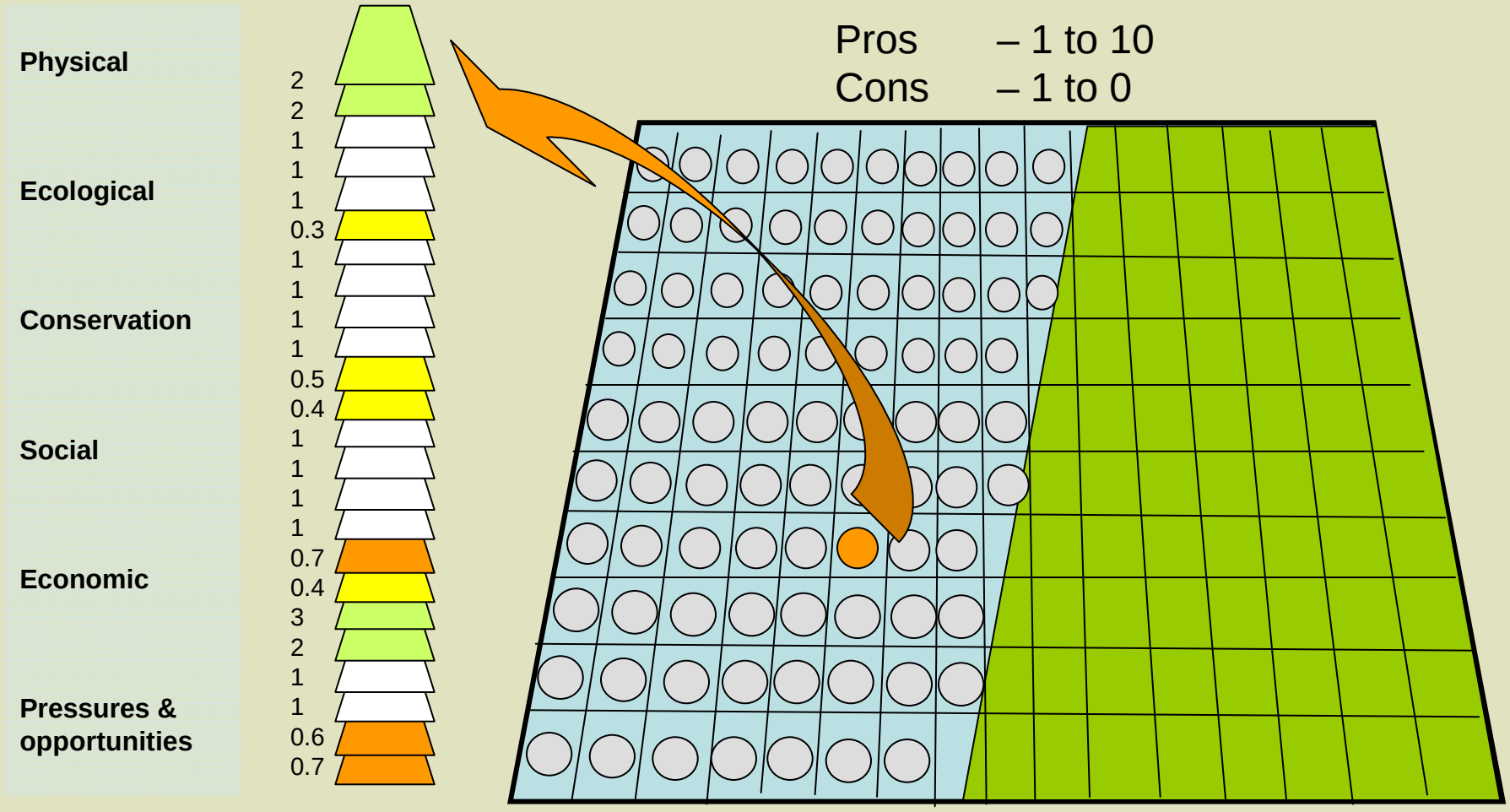
# Areas that are better or worse overall for development of wave energy



# Analysis of factors associated with a particular grid square

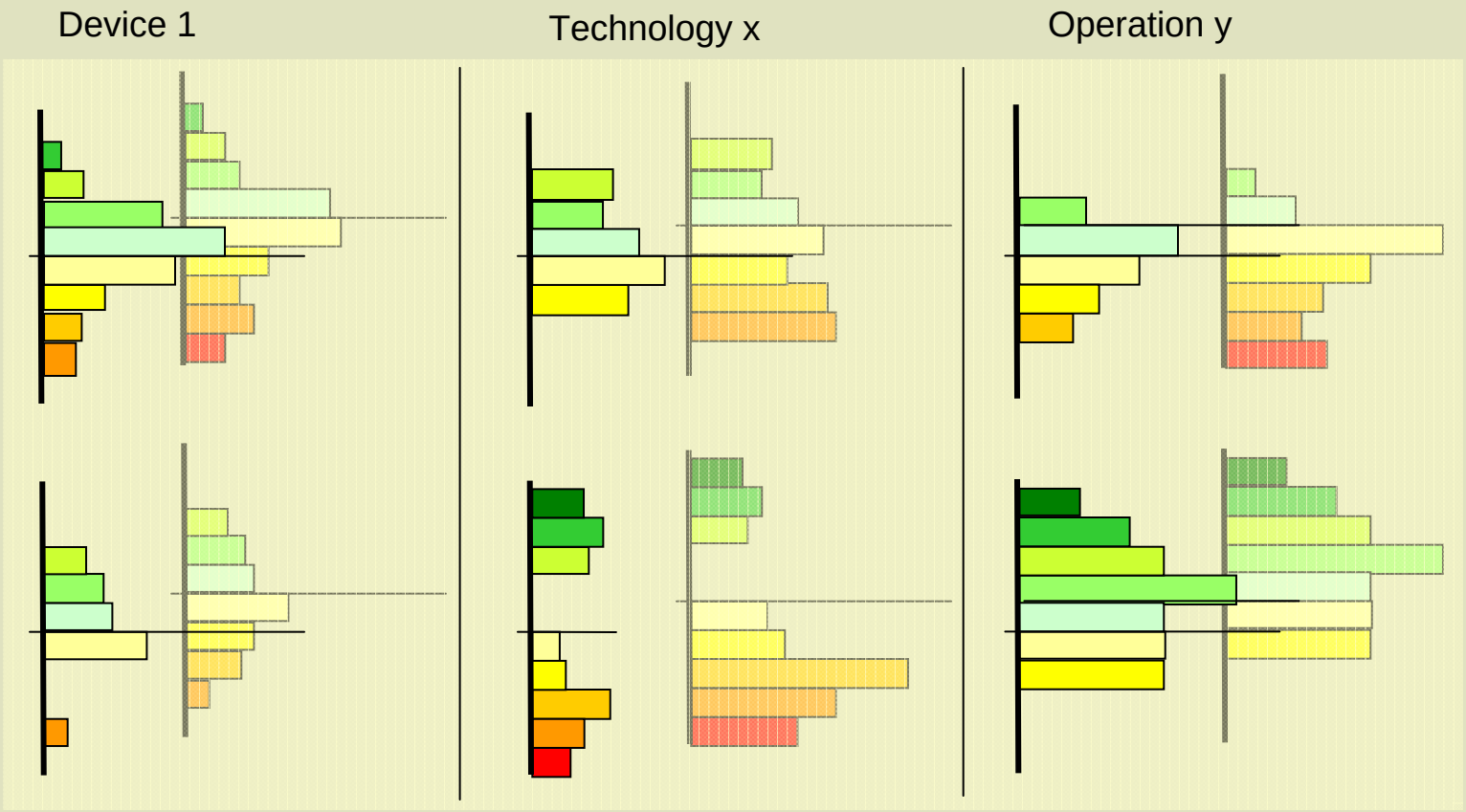


# Numerical units of classification




Product of pros and cons = relative suitability index (axbxcxd… = x)

# Scenario comparison




Performance is improved across many areas, need to note what is assumed to have been done

# Stakeholder engagement strategy and anticipated outcomes

# Stakeholder Involvement

## TIER 1

**Motivation to Participate**:
They will use the analytical framework.

**Project Benefit**:
They will use the analytical framework.

**Basic Outreach Approach**:
Regular, ongoing interaction.

**Potential Stakeholders**

- Marine Mineral Service
- NOAA–Fisheries
- US Fish and Wildlife Service
- Federal Energy Regulatory Commission
- USACE–404 permit
- EPA
- US Coast Guard
- ODSL
- DLCD
- ODEQ

## TIER 2

**Motivation to Participate**: Beneficiaries or parties affected by on-the-water impacts. Opportunity to provide a higher order of input/influence to project.

**Project Benefit**: Knowledge of on-the-water impacts. Opportunity for wider distribution of questionnaire through these stakeholders.

**Basic Outreach Approach**: Meeting(s) with OPAC/WEWG members, direct interviews, self-administered survey, focus group follow-up.

**Potential Stakeholders**

- Ocean Policy Advisory Council
- US Fish and Wildlife Service– owner of all Oregon's coastal rocks
- Oregon Economic Development Department
- Marine Reserves NGO Coalition
- Hatfield Marine Science Center Staff
- Fishing Associations
- Coastal Counties
- Non–fisheries Ocean/Beach Recreational User Groups
- Oregon Public Ports Association
- Oregon Public Power Association
- Coastal Tribes
- Coast-wide Business Industry Association(s)

## TIER 3

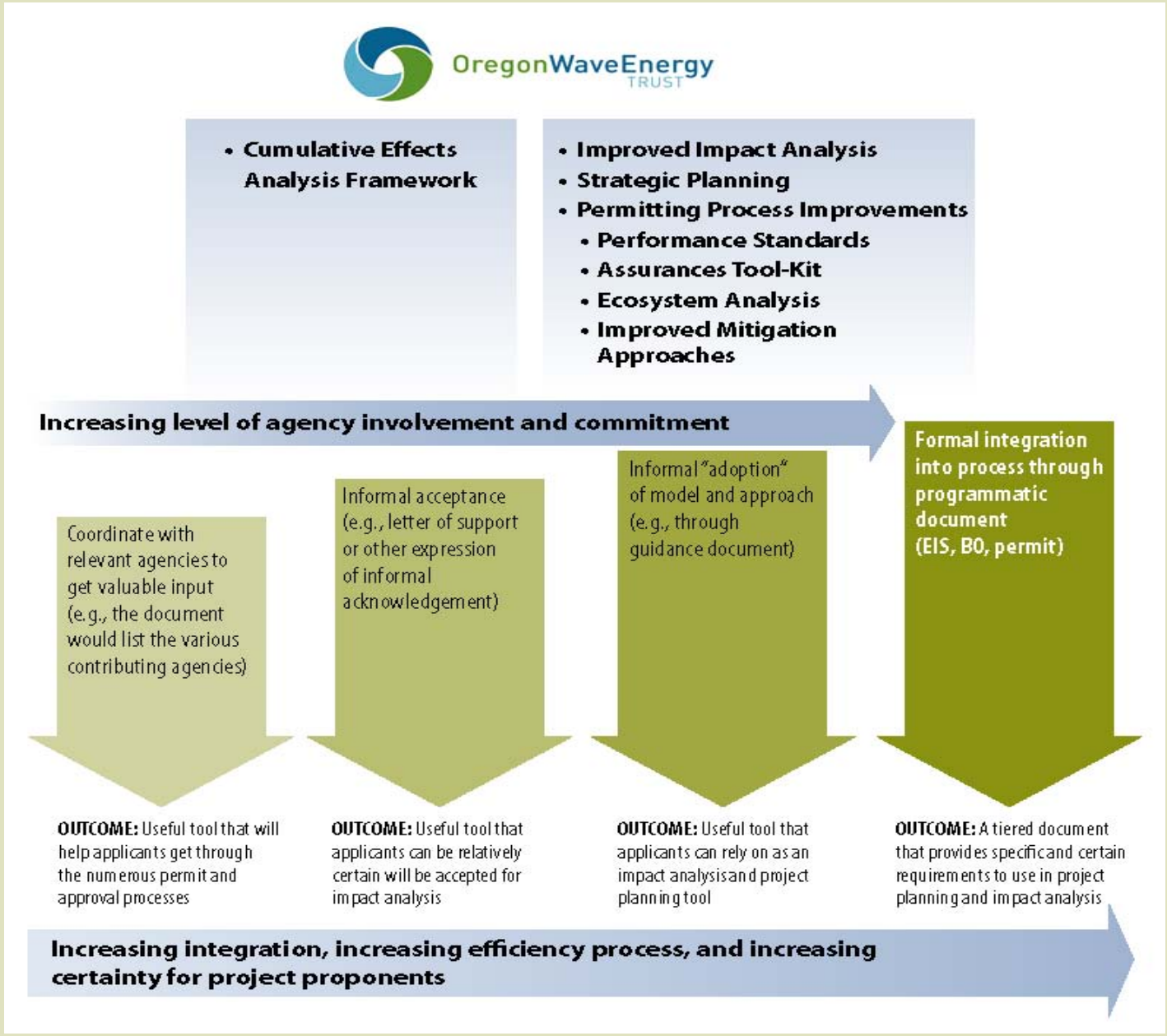
**Motivation to Participate**:
Self-interest.

**Project Benefit**: Keeps a wide audience informed.

**Basic Outreach Approach**: Project notifications, reports, updates, will offer to accept individual input from such stakeholders (e-mails, letters, etc.).

**Potential Stakeholders**

- SDAO/AOC/LOC, etc.
- Coastal cities and counties without any off-shore wave energy proposals
- Local Chambers of Commerce and business groups


OregonWaveEnergy
TRUST
• Cumulative Effects Analysis Framework
• Improved Impact Analysis
• Strategic Planning
• Permitting Process Improvements
• Performance Standards
• Assurances Tool-Kit
• Ecosystem Analysis
• Improved Mitigation Approaches
Increasing level of agency involvement and commitment
Coordinate with relevant agencies to get valuable input (e.g., the document would list the various contributing agencies)
Informal acceptance (e.g., letter of support or other expression of informal acknowledgement)
Informal "adoption" of model and approach (e.g., through guidance document)
Formal integration into process through programmatic document (EIS, BO, permit)
OUTCOME: Useful tool that will help applicants get through the numerous permit and approval processes
OUTCOME: Useful tool that applicants can be relatively certain will be accepted for impact analysis
OUTCOME: Useful tool that applicants can rely on as an impact analysis and project planning tool
OUTCOME: A tiered document that provides specific and certain requirements to use in project planning and impact analysis
Increasing integration, increasing efficiency process, and increasing certainty for project proponents