

Phase 6 Climate Change Model Development

Gary Shenk and the CBPO modeling team

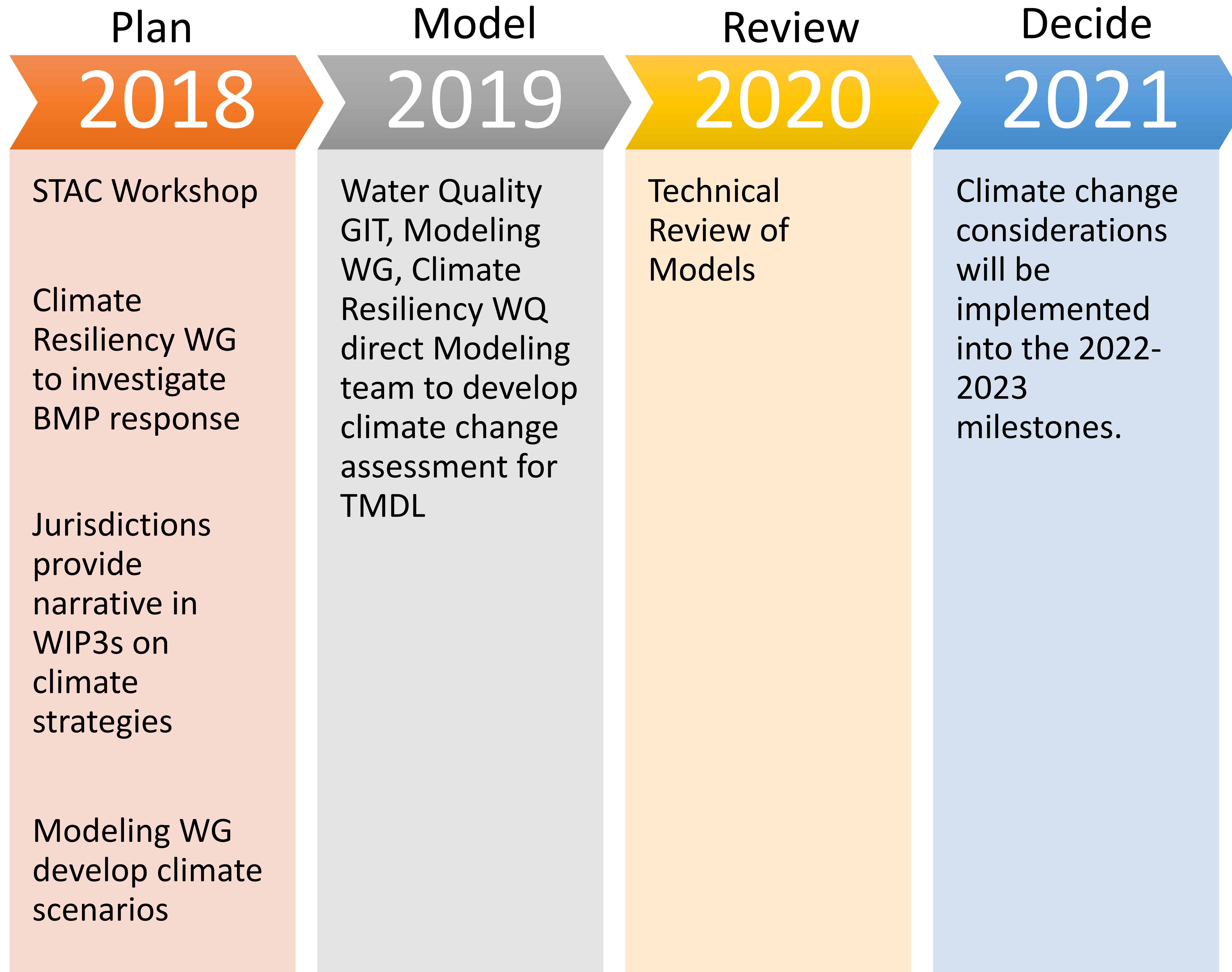
7/16/19

Presentation to MWG

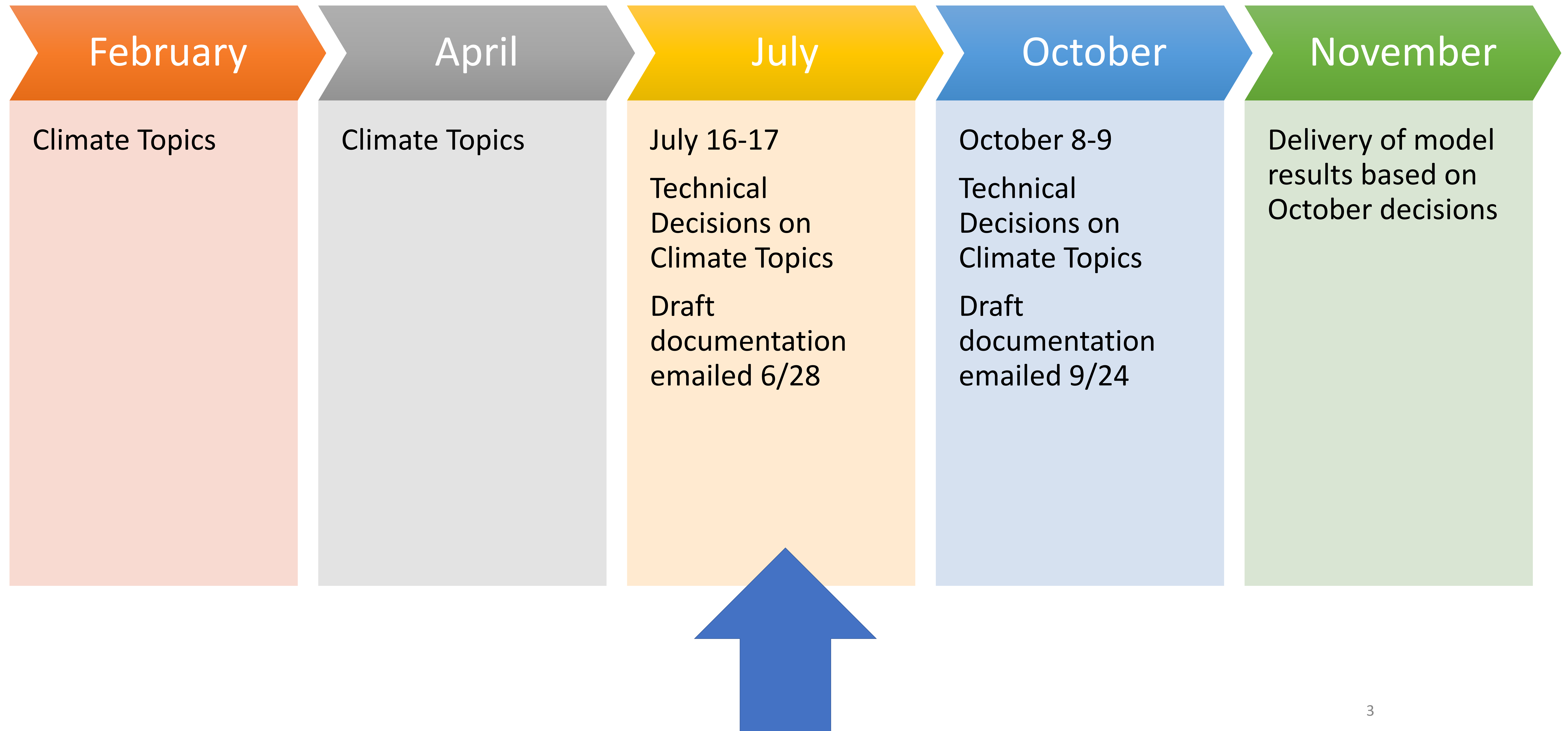
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Preliminary Information-Subject to Revision. Not for Citation or Distribution

CBP Climate Work Plan



CBP 2019 MWG Climate Work Plan

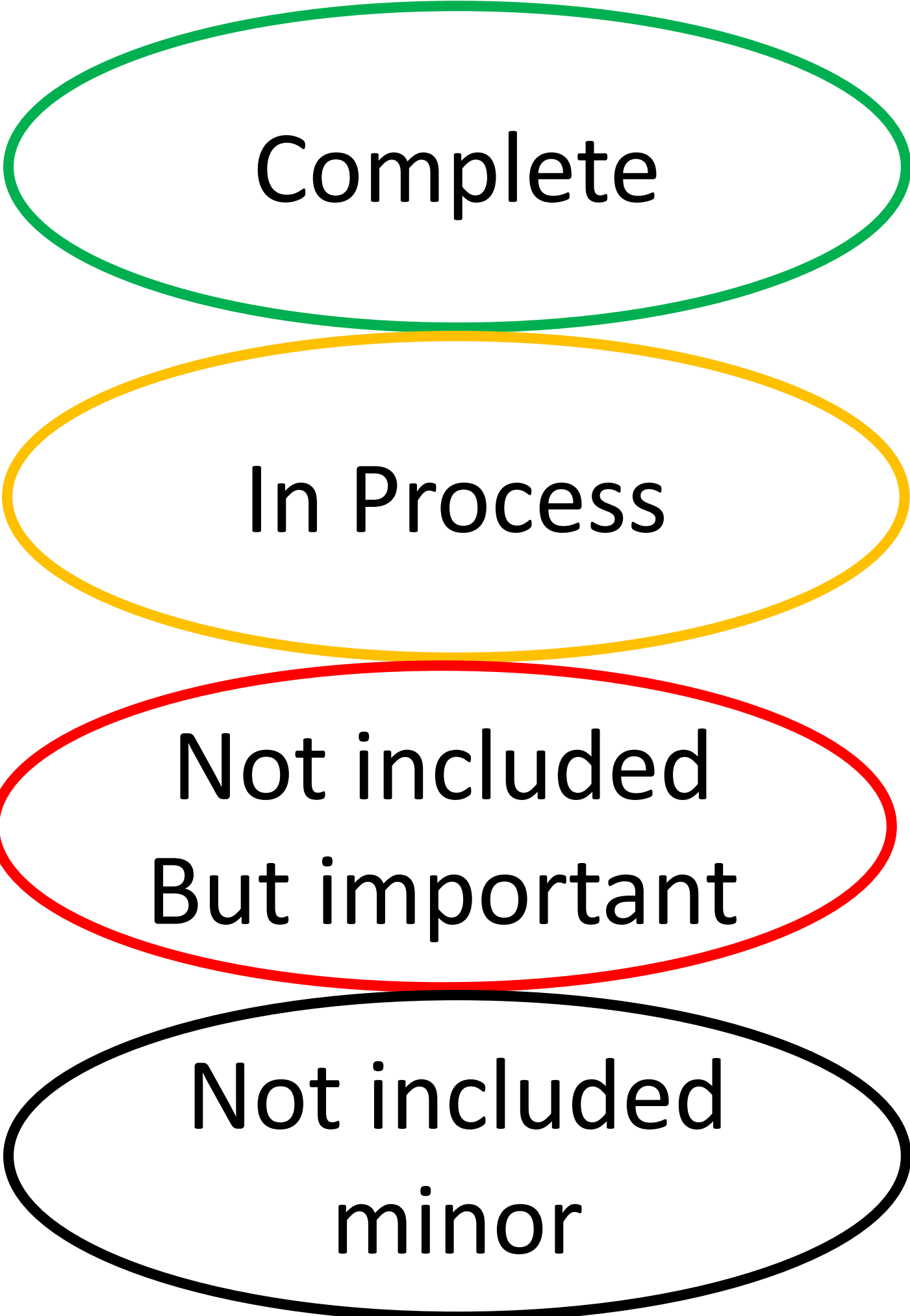


Approval Process

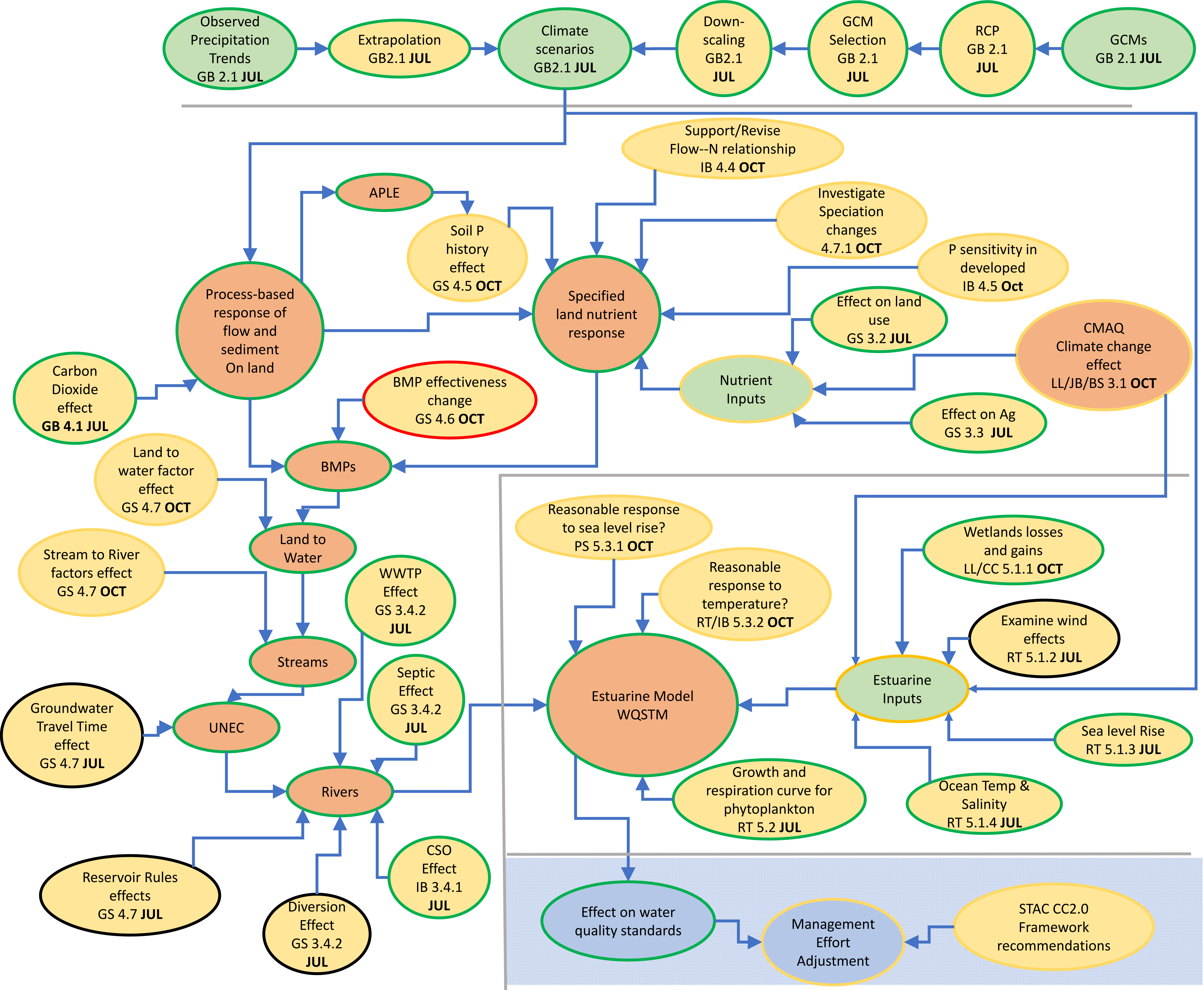
- Topics split into July and October quarterly meetings
- November delivery for final model results
- July topics
 - Documentation for July topics sent out to MWG, CRWG, and interested parties June 28th
 - Next three presentations – more in-depth presentation of July topics
 - Ask for approval from MWG today
- This presentation – Overview of all and brief description of October topics

Climate Change Processes and Dependencies

Model
Data Set
Endpoint
Project/Decision



Initials indicate the responsible person
Numbers indicate the section of the documentation



Climate

Watershed

Estuary

Management

Climate Change Processes and Dependencies

Model

Data Set

Endpoint

Project/Decision

Complete

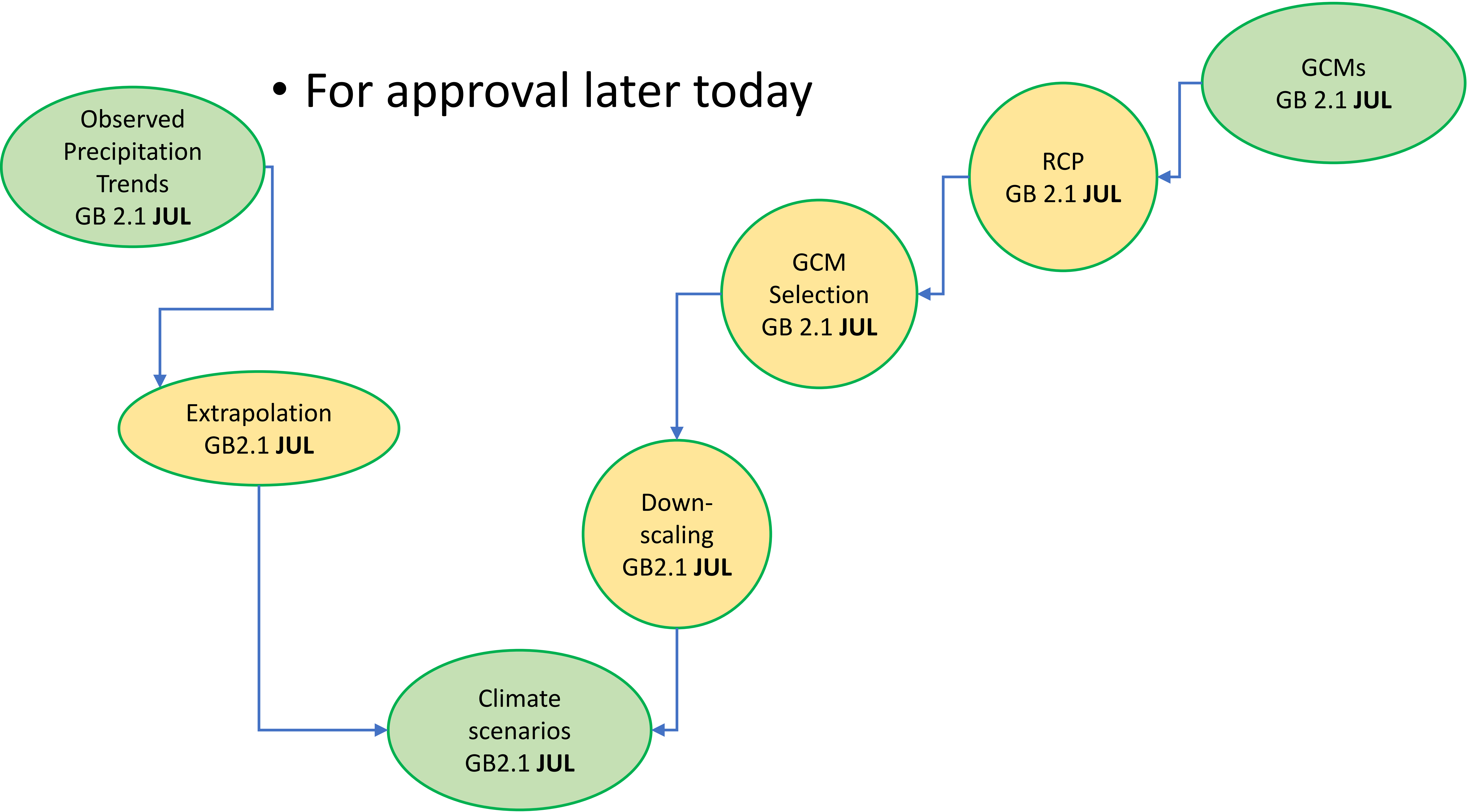
In Process

Not included
But important

Not included
minor

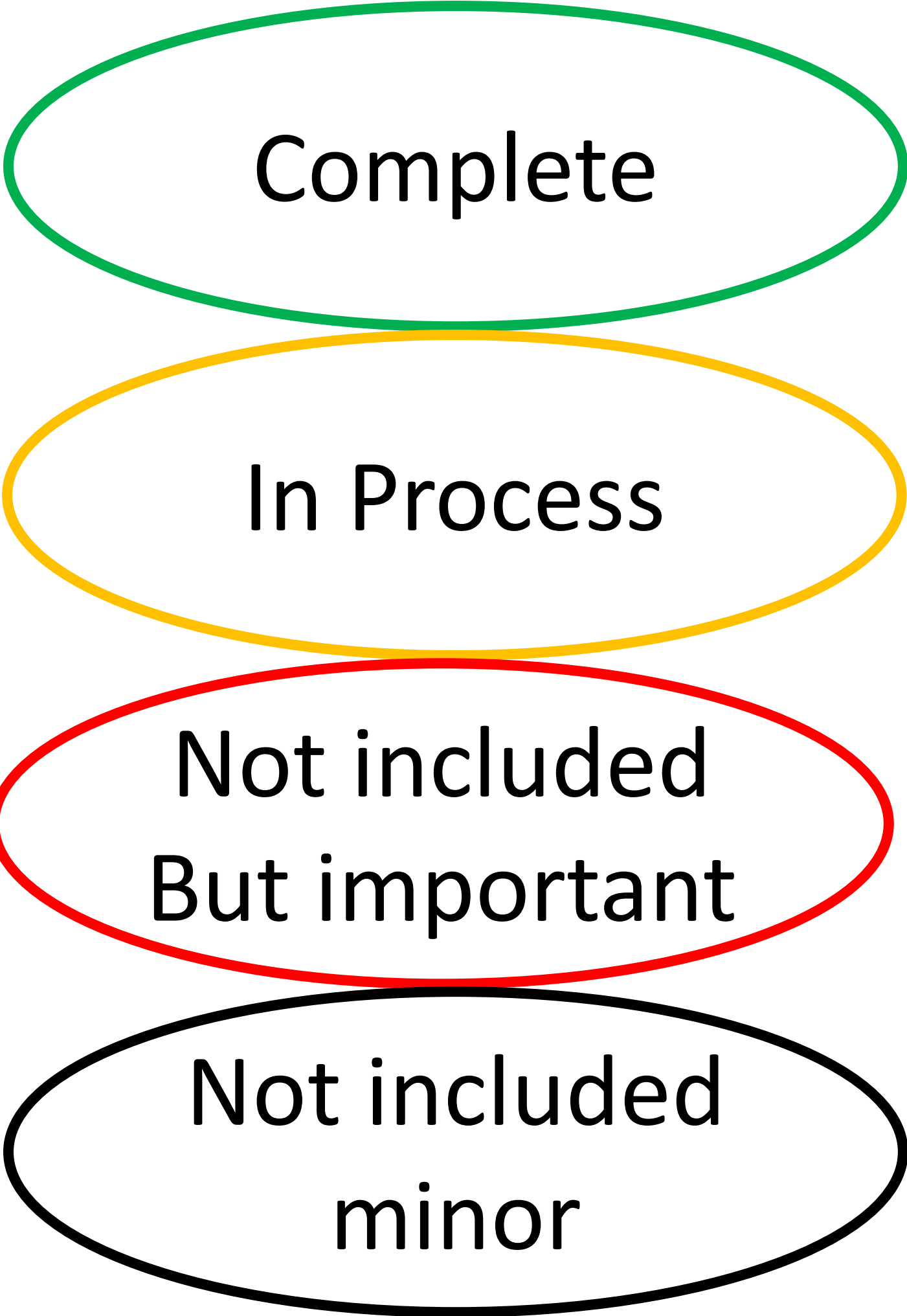
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• For approval later today

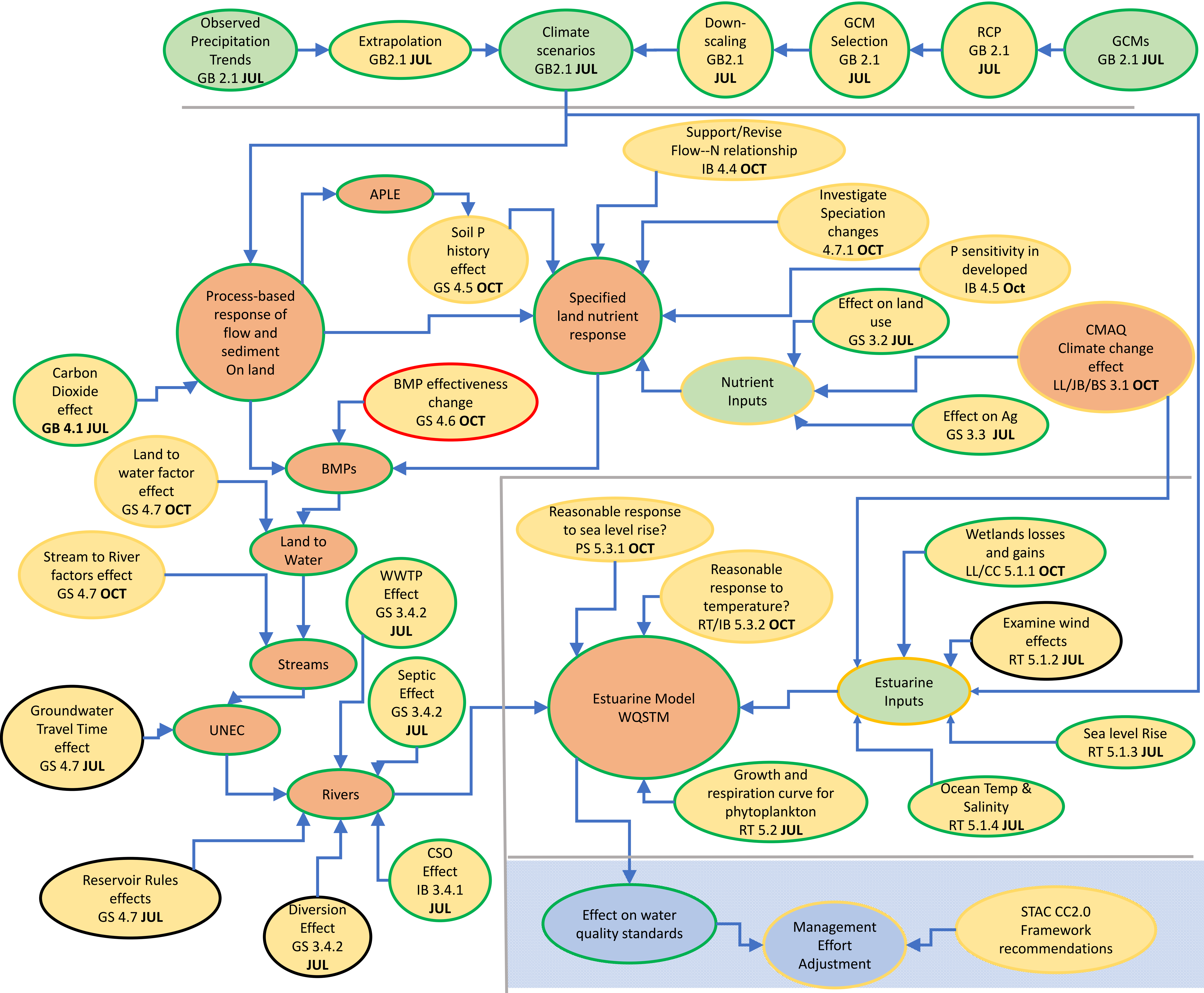


Climate Change Processes and Dependencies

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Climate

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Estuary

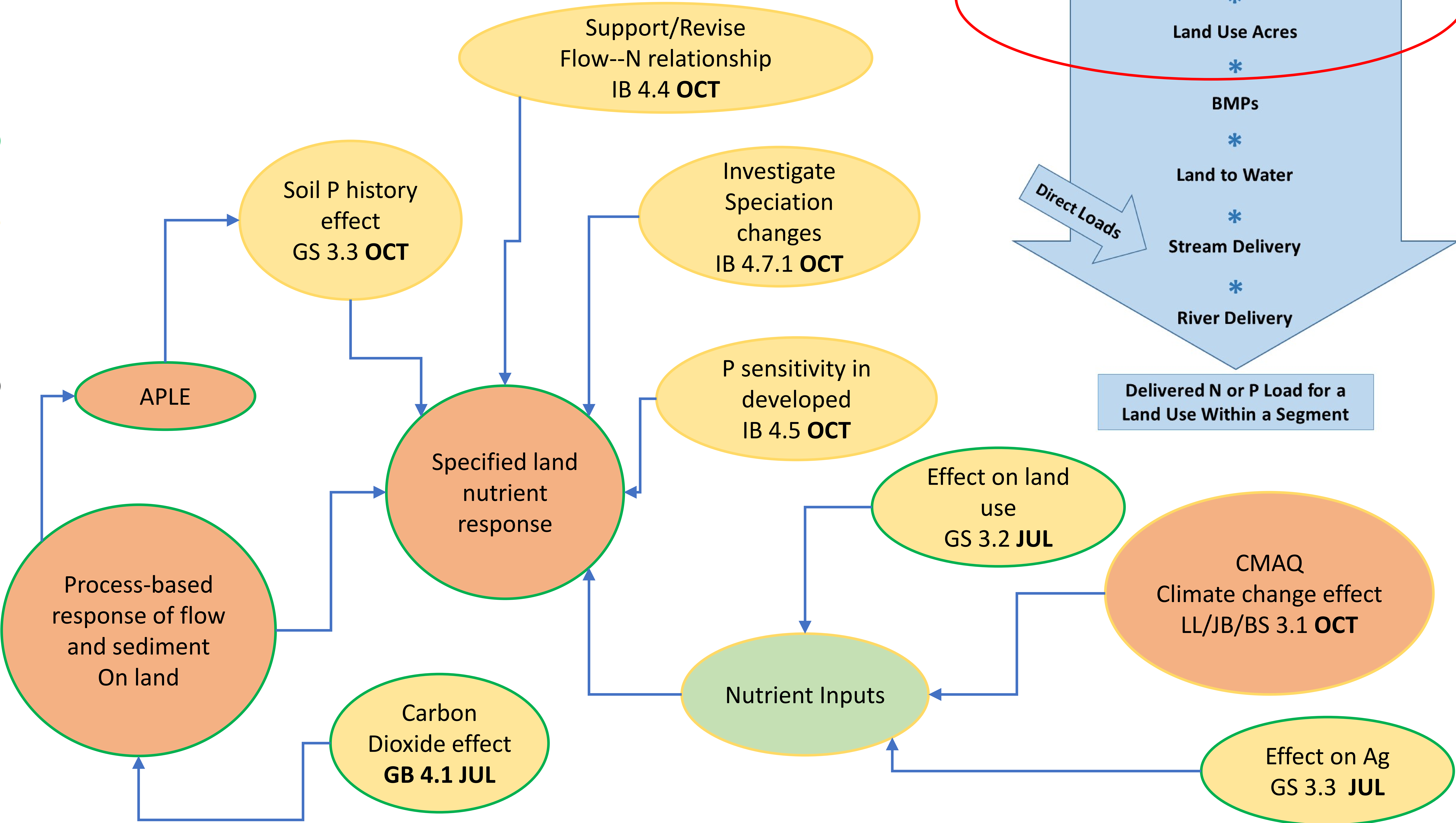
Management

Climate Change Processes and Dependencies

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Project/Decision

- Complete
- In Process
- Not included But important
- Not included minor

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Climate Change Processes and Dependencies

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- For approval later today

- Land use
- Agricultural data
- Carbon Dioxide Effect

Complete

In Process

Not included
But important

Not included
minor

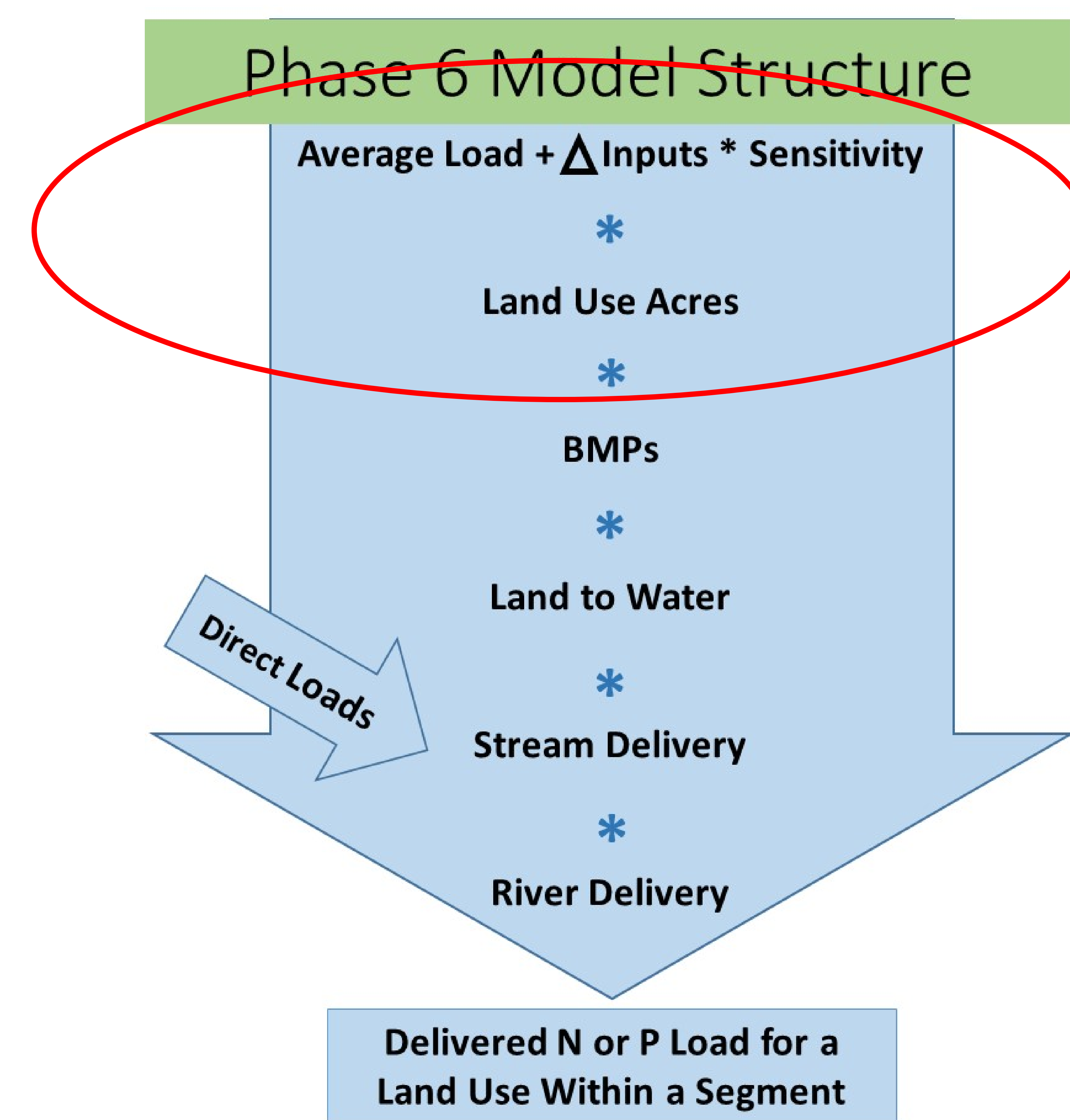
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Carbon Dioxide
effect
GB 4.1 JUL

Effect on land use
GS 3.2 JUL

Effect on Ag
GS 3.3 JUL

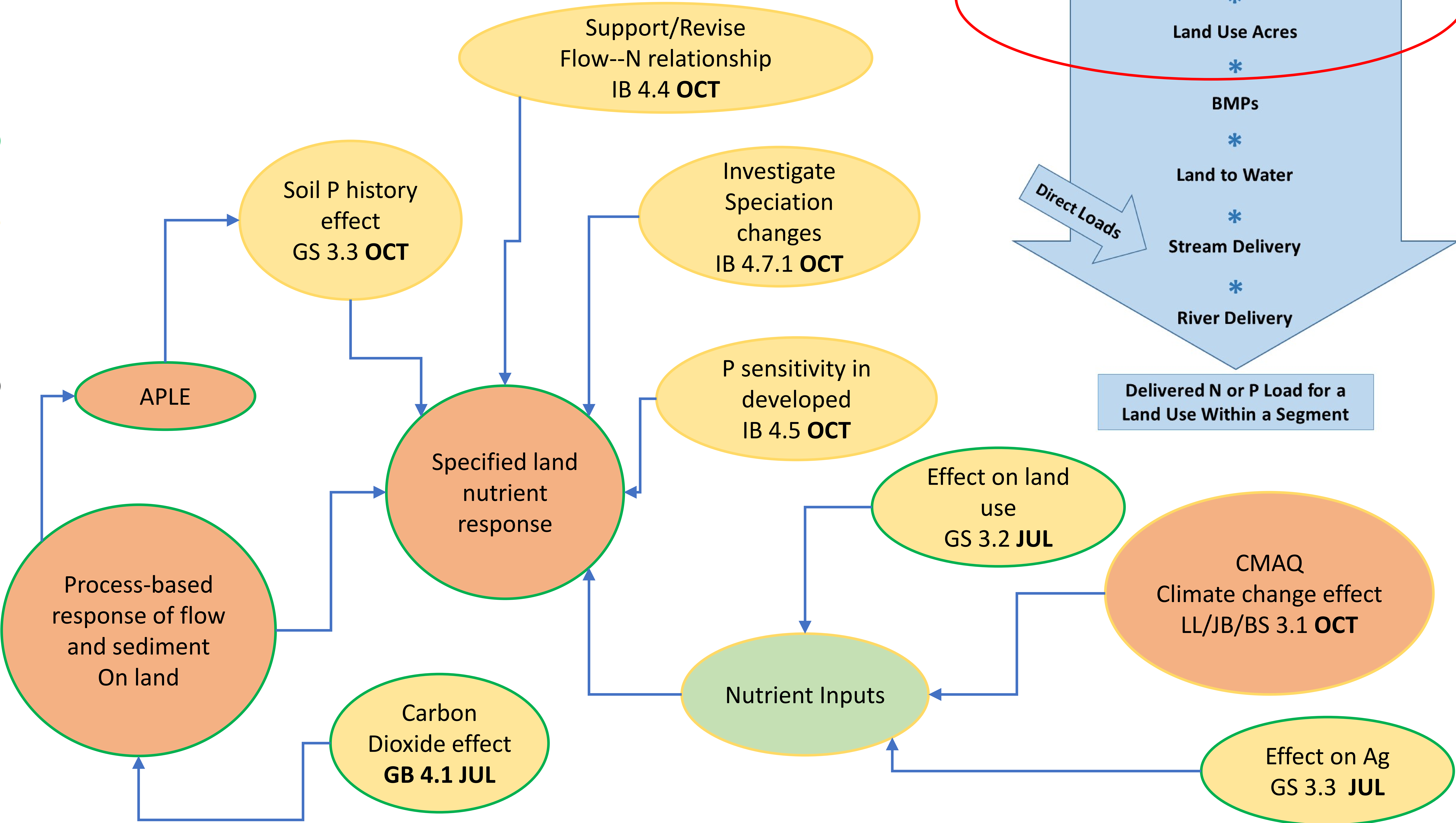


Climate Change Processes and Dependencies

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Climate Change Processes and Dependencies

Model

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Project/Decision

Complete

In Process

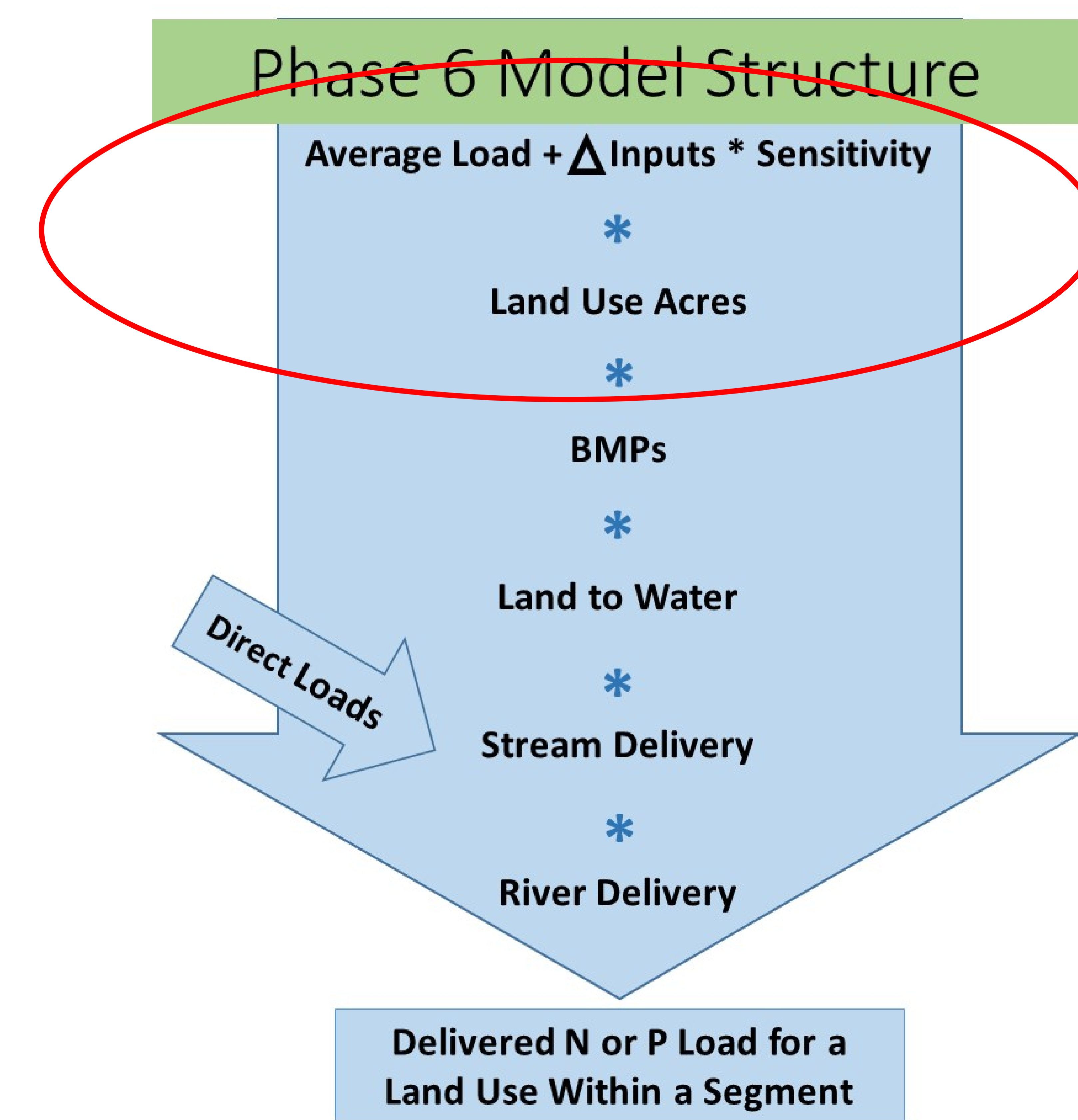
Not included
But important

Not included
minor

- Atmospheric Deposition
 - No change in dry deposition
 - Change in wet related to rainfall

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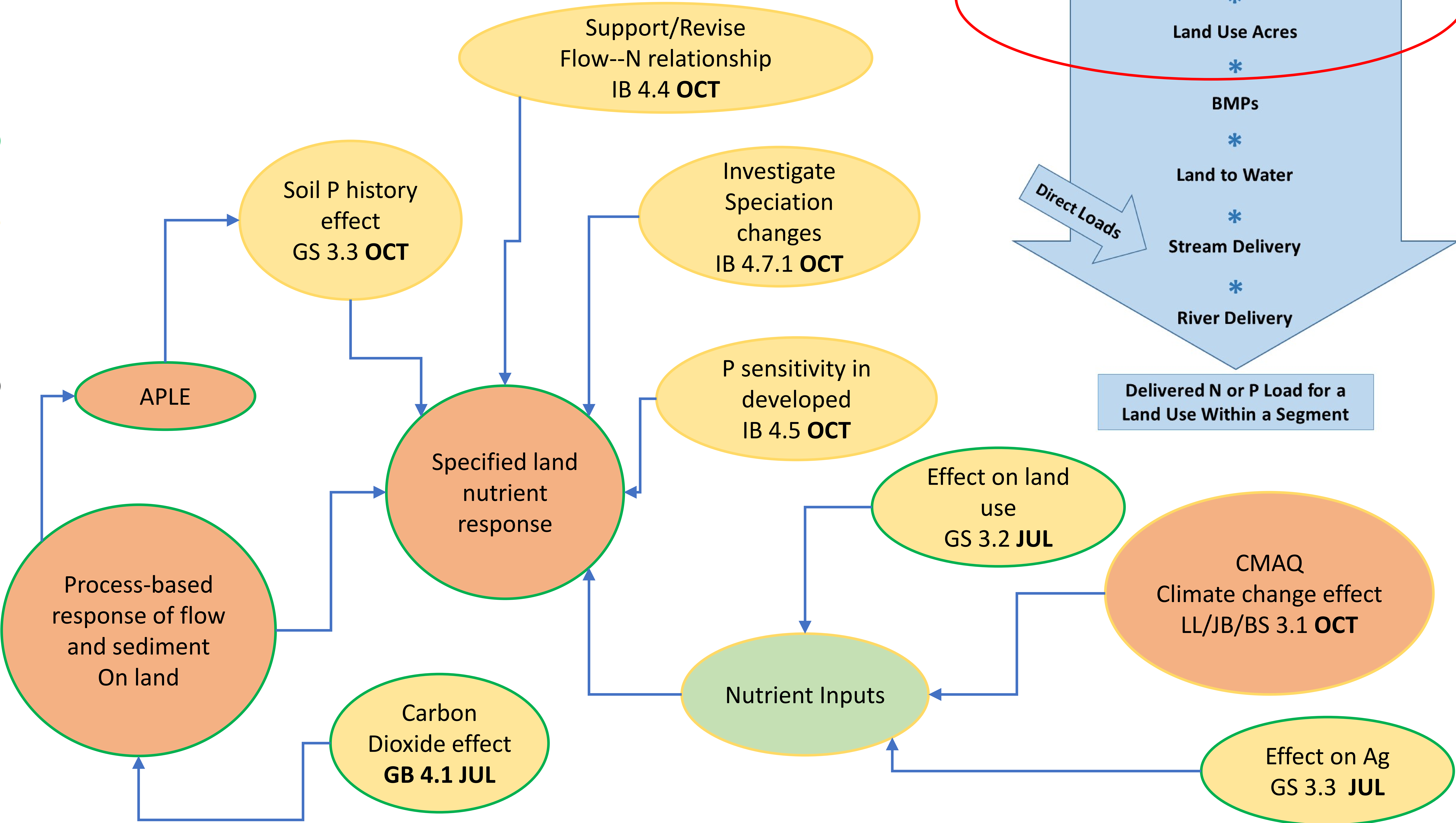
CMAQ
Climate change effect
LL/JB/BS 3.1 OCT

Climate Change Processes and Dependencies

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minor

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Climate Change Processes and Dependencies

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Complete

In Process

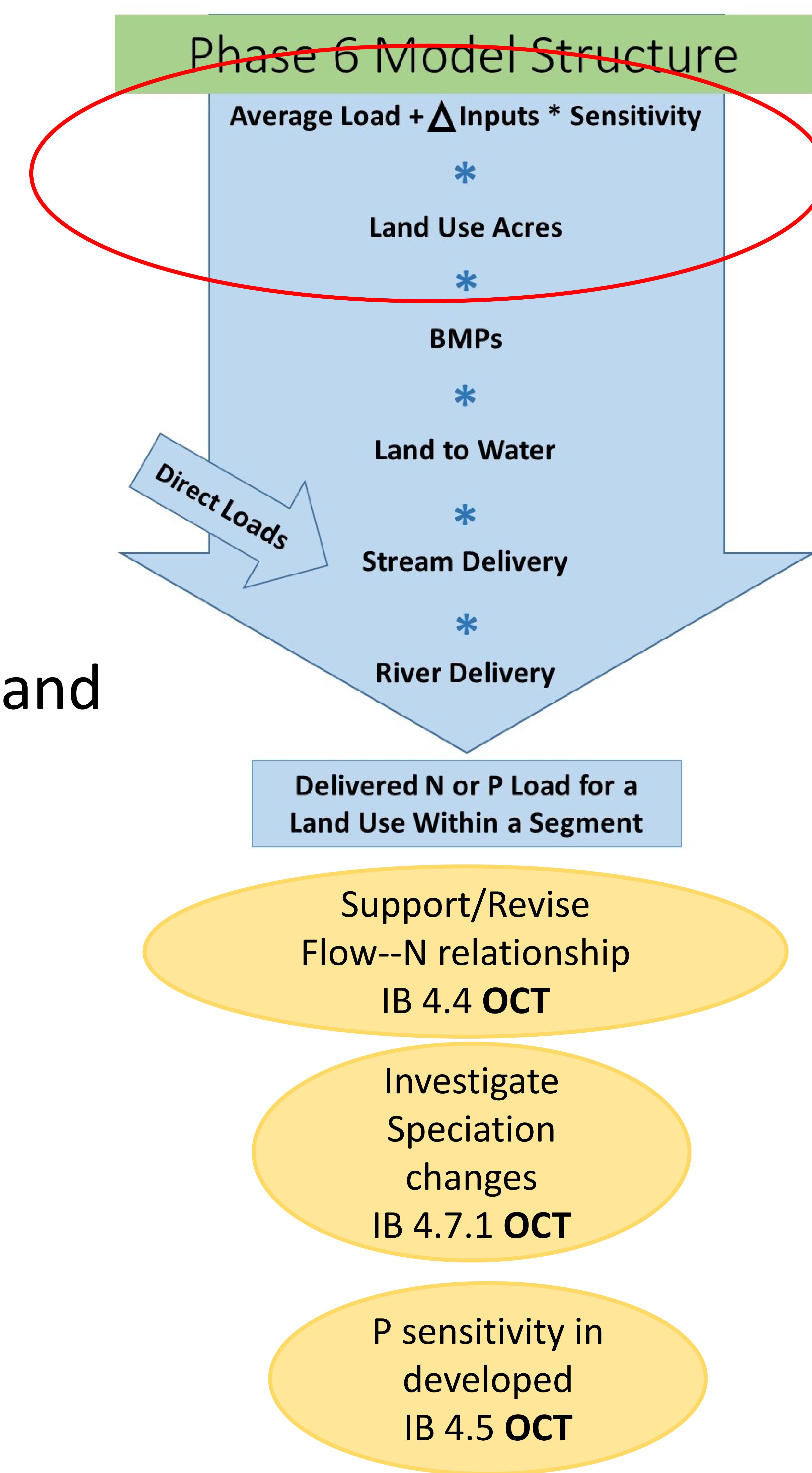
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- Literature Reviews for climate effects
 - Nitrogen change proportional to flow change
 - Literature review for P sensitivity in developed
 - Phosphorus sensitivities to climate already incorporated in phase 6 agriculture and natural
 - Investigate speciation changes relative to flow and temperature

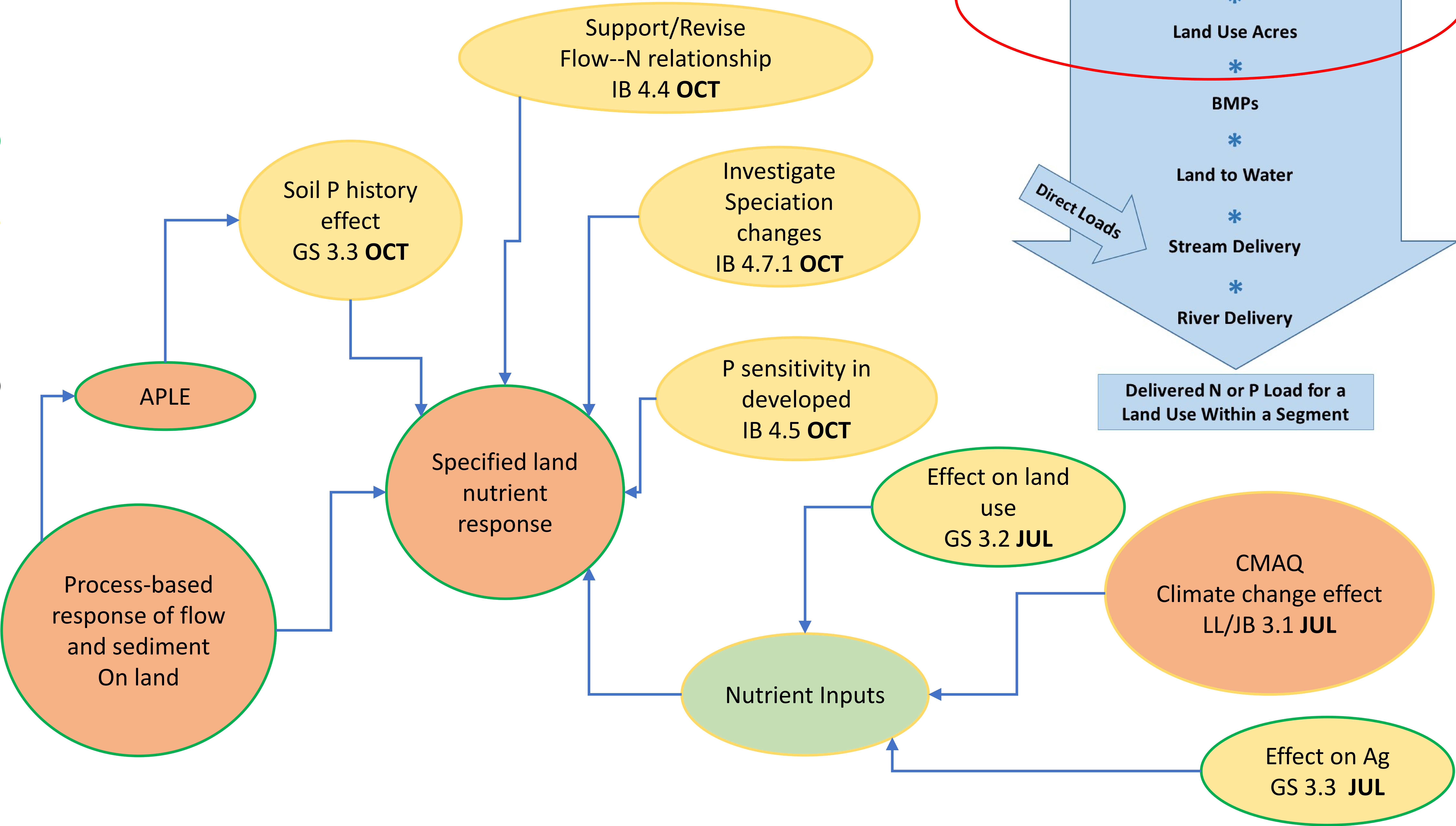


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Climate Change Processes and Dependencies

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- Changes in soil P

- CBP Scenarios estimate soil P after 25 years of constant applications
- Increases in runoff and sediment cause higher P losses
- Higher P losses cause soil P to decrease

Complete

In Process

Not included
But important

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minor

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Phase 6 Model Structure

Average Load + Δ Inputs * Sensitivity

*

Land Use Acres

*

BMPs

*

Land to Water

*

Stream Delivery

*

River Delivery

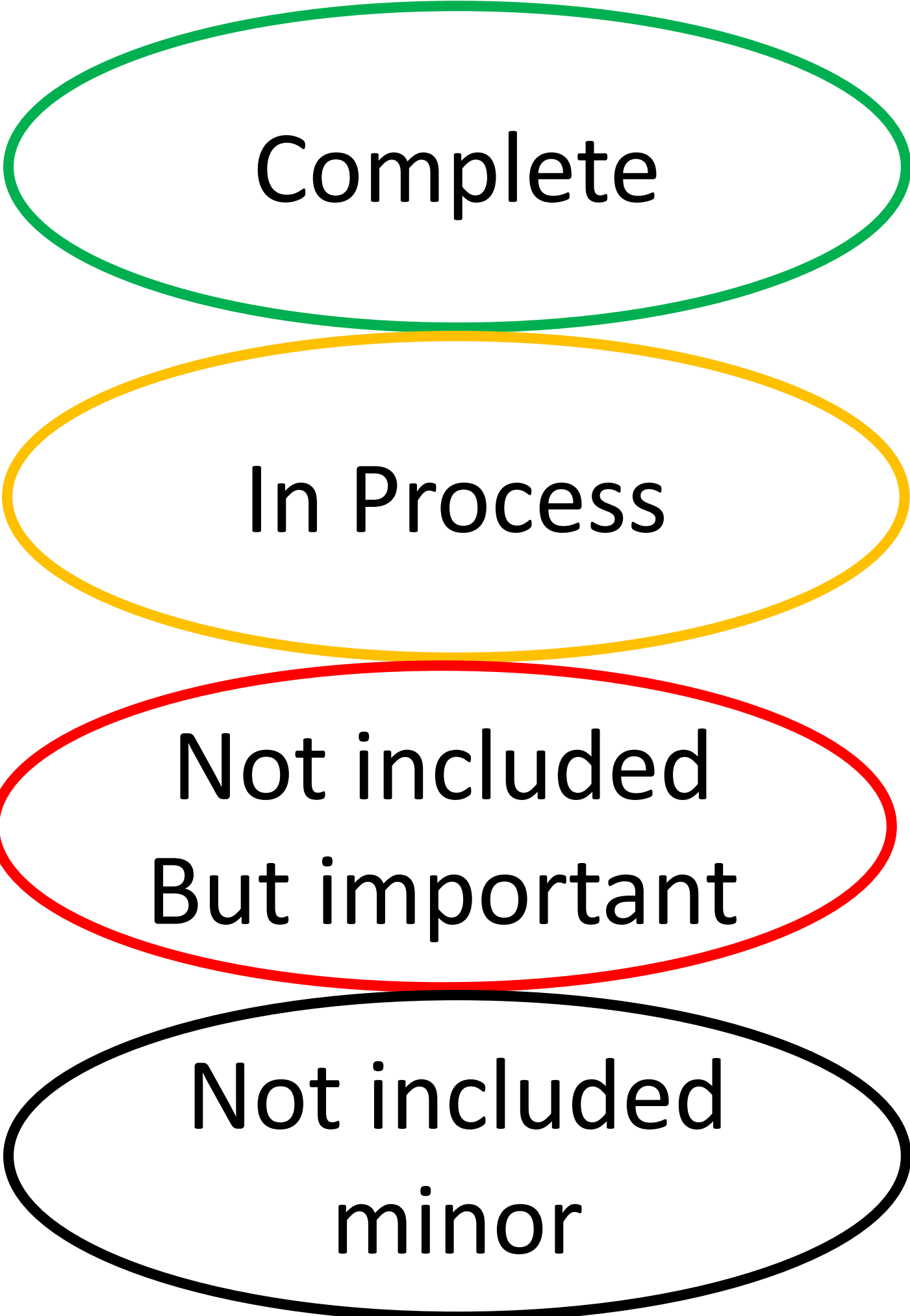
Direct Loads

Delivered N or P Load for a
Land Use Within a Segment

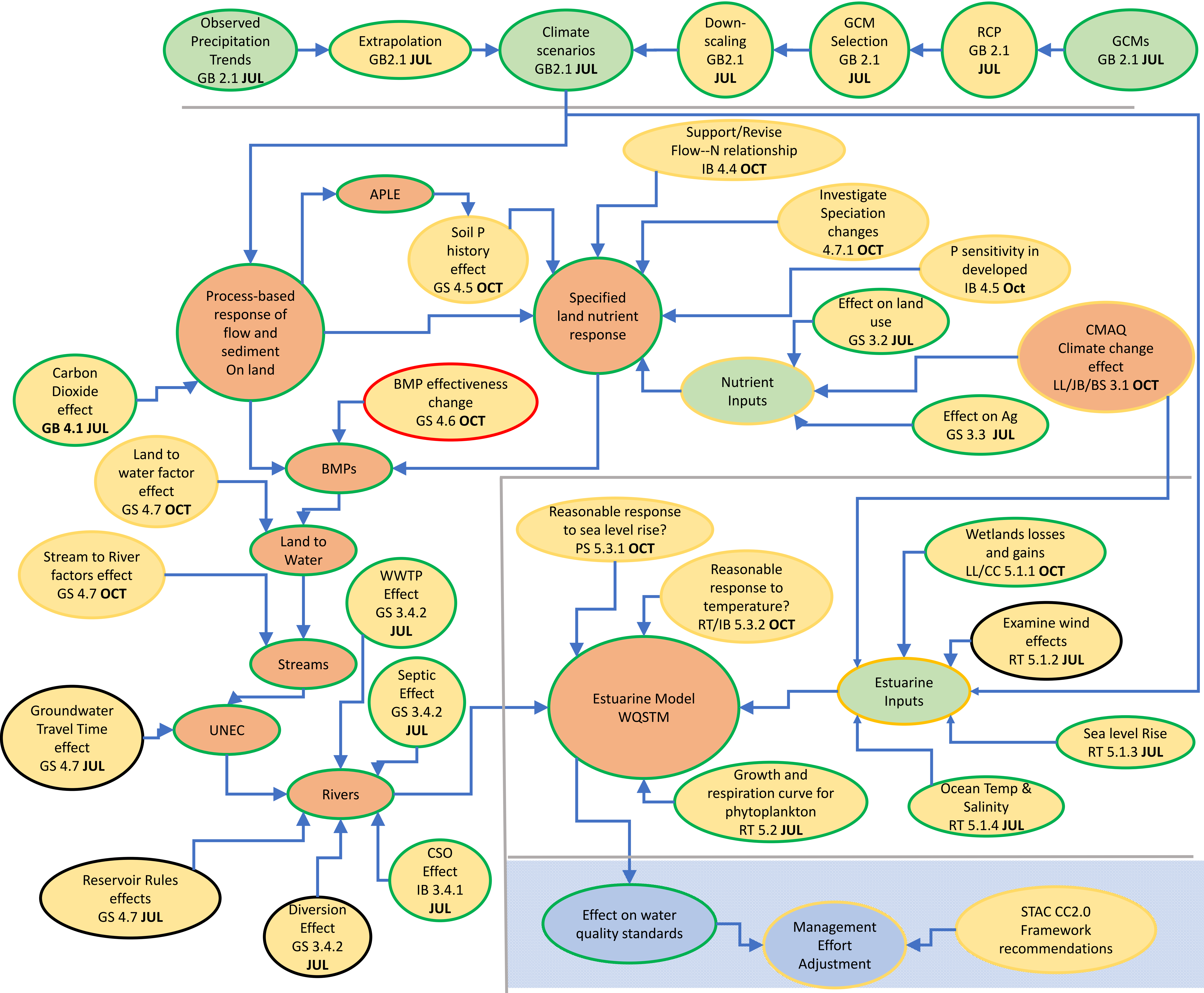
Soil P history
effect
GS 3.3 **OCT**

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Climate

Watershed

Estuary

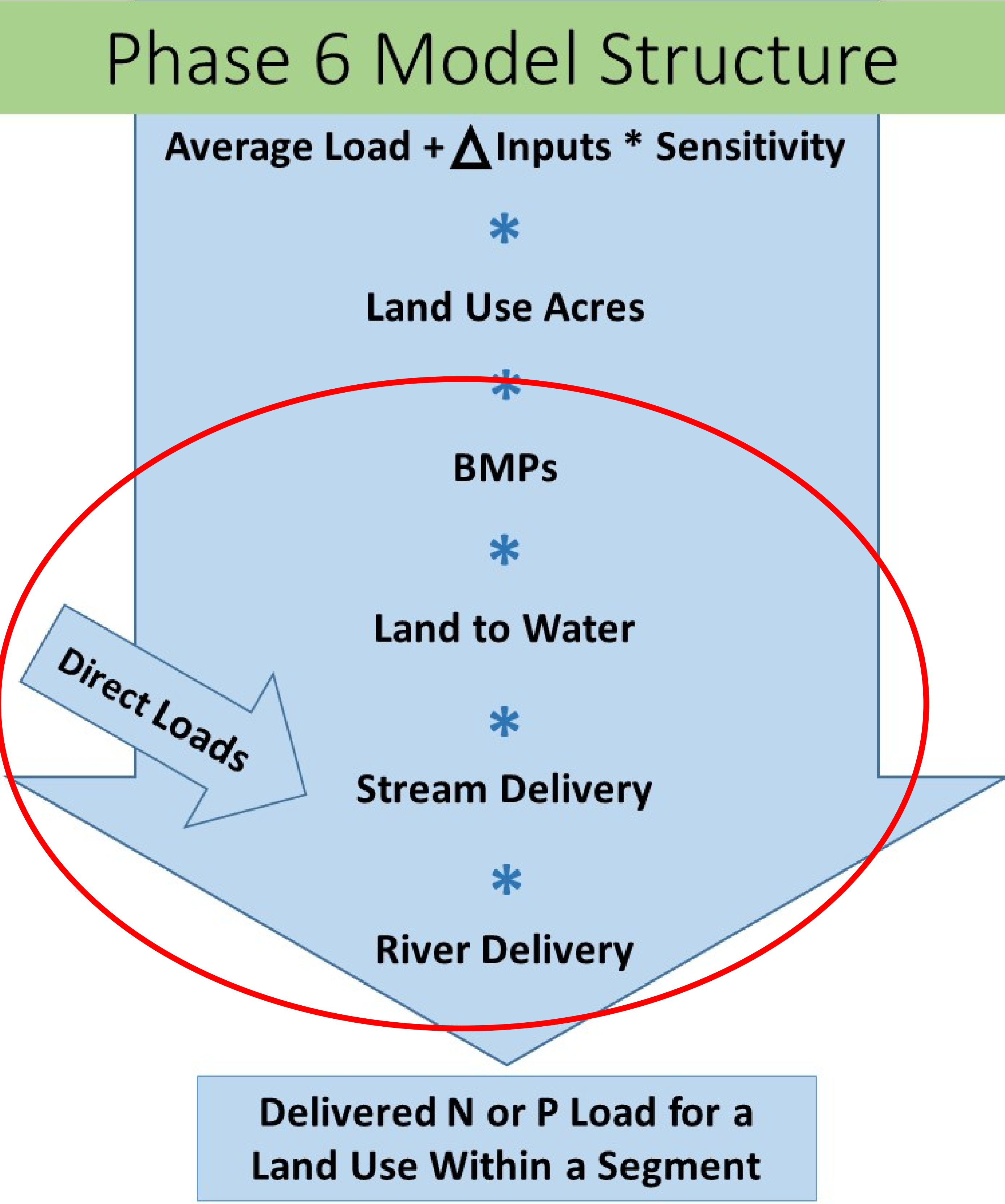
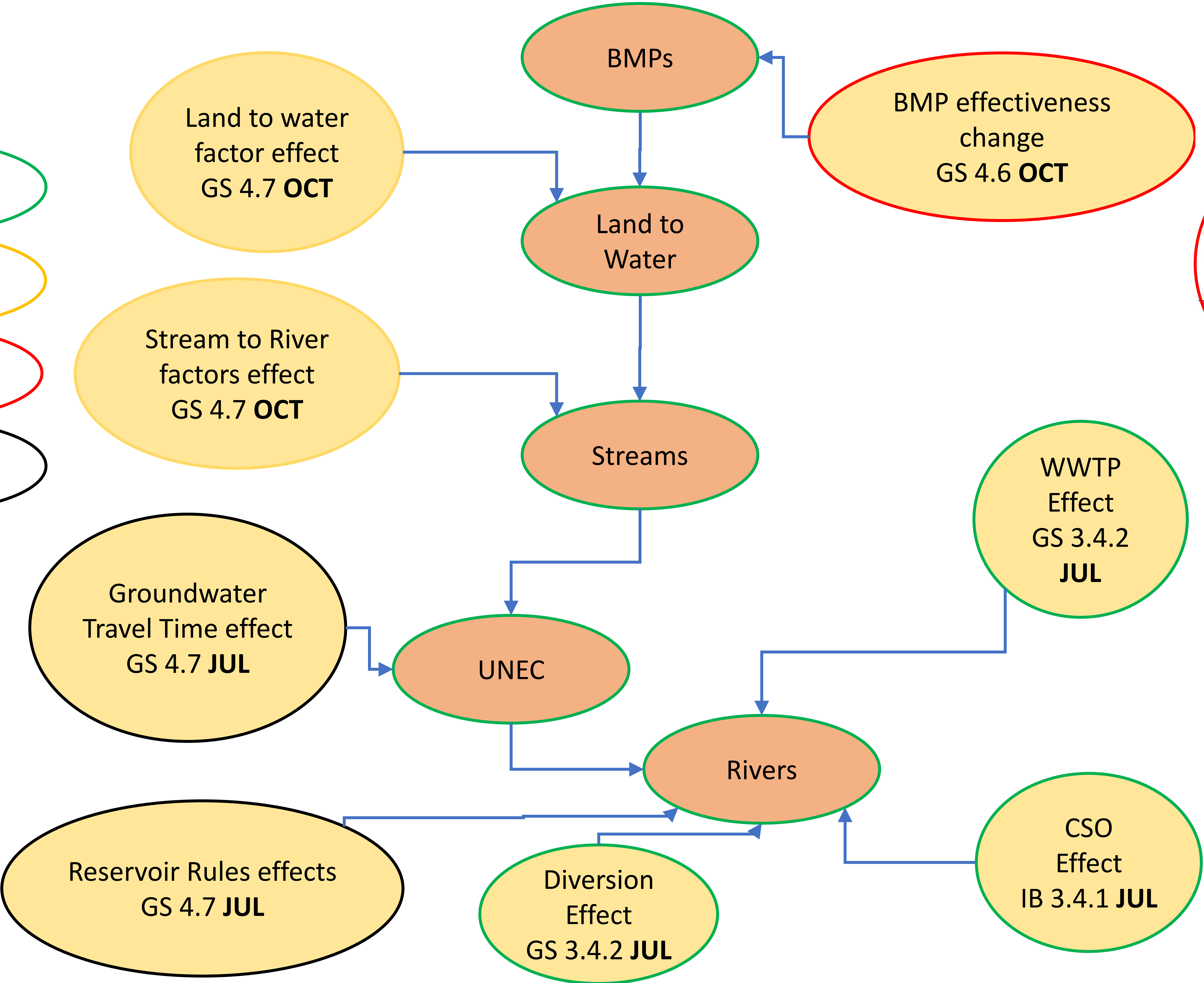
Management

Climate Change Processes and Dependencies

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Climate Change Processes and Dependencies

Model

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Project/Decision

- For Approval Later Today
 - Combined Sewer Overflows
 - WWTP and other sources
 - Diversions
 - Groundwater travel time

Complete

In Process

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But important

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Phase 6 Model Structure

Average Load + Δ Inputs * Sensitivity

*

Land Use Acres

*

BMPs

*

Land to Water

*

Stream Delivery

*

River Delivery

Direct Loads

Delivered N or P Load for a
Land Use Within a Segment

WWTP
Effect
GS 3.4.2
JUL

Diversion
Effect
GS 3.4.2 **JUL**

CSO
Effect
IB 3.4.1 **JUL**

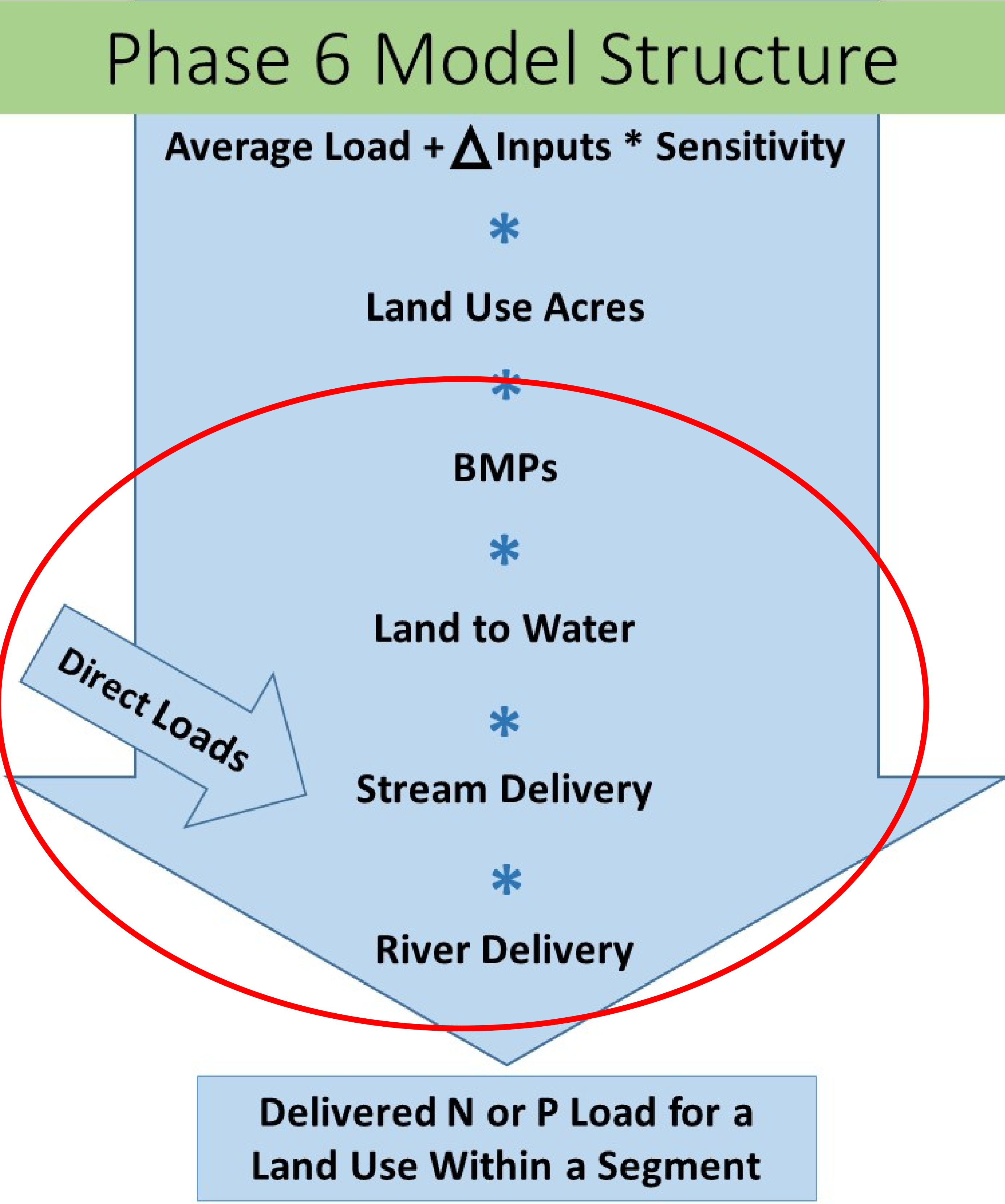
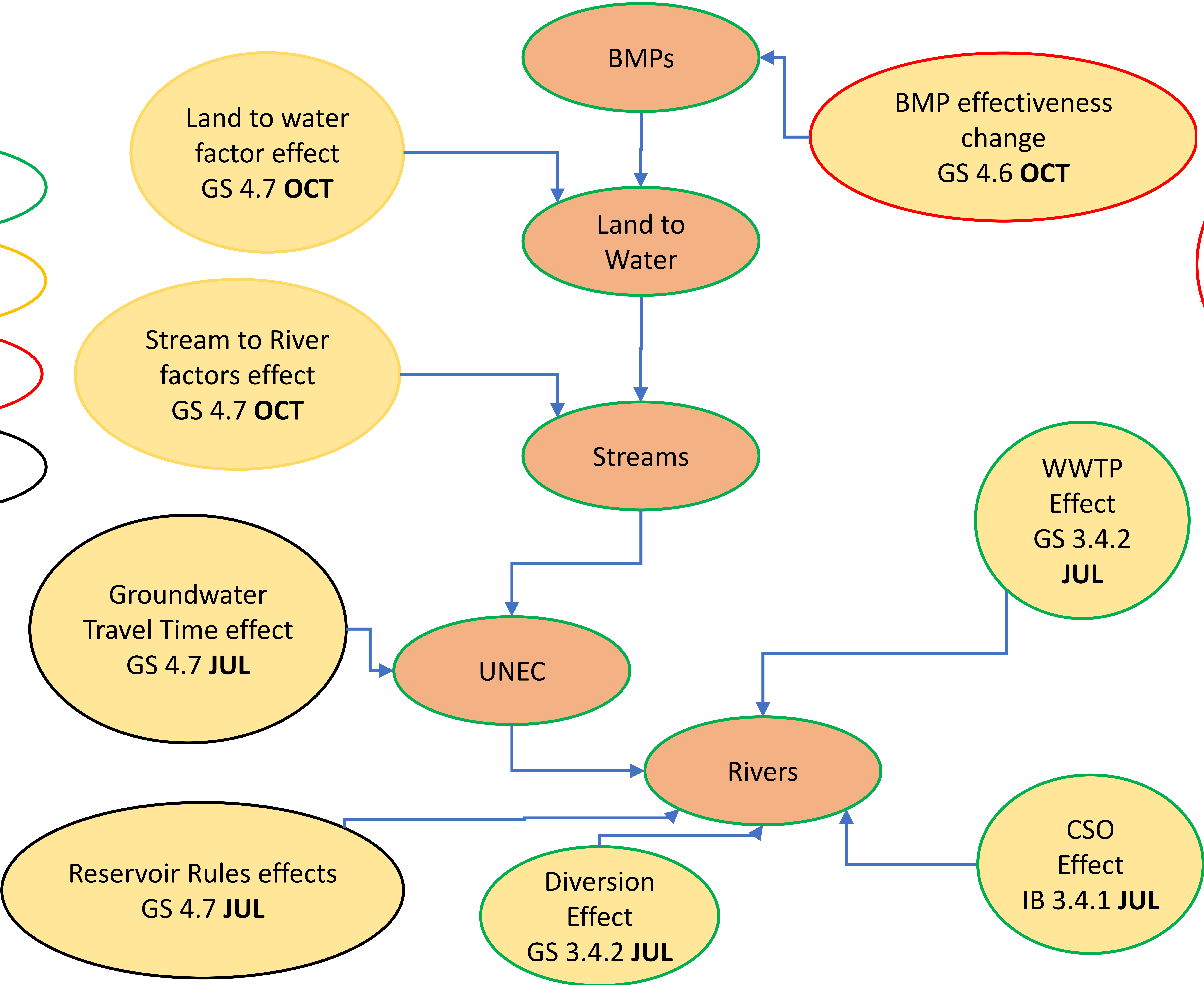
Groundwater
Travel Time effect
GS 4.7 **JUL**

Climate Change Processes and Dependencies

- Model
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- Project/Decision

- Complete
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Climate Change Processes and Dependencies

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- Transport factors

- Some information from SPARROW
- May not be necessary as climate sensitivities are already investigated at the watershed scale

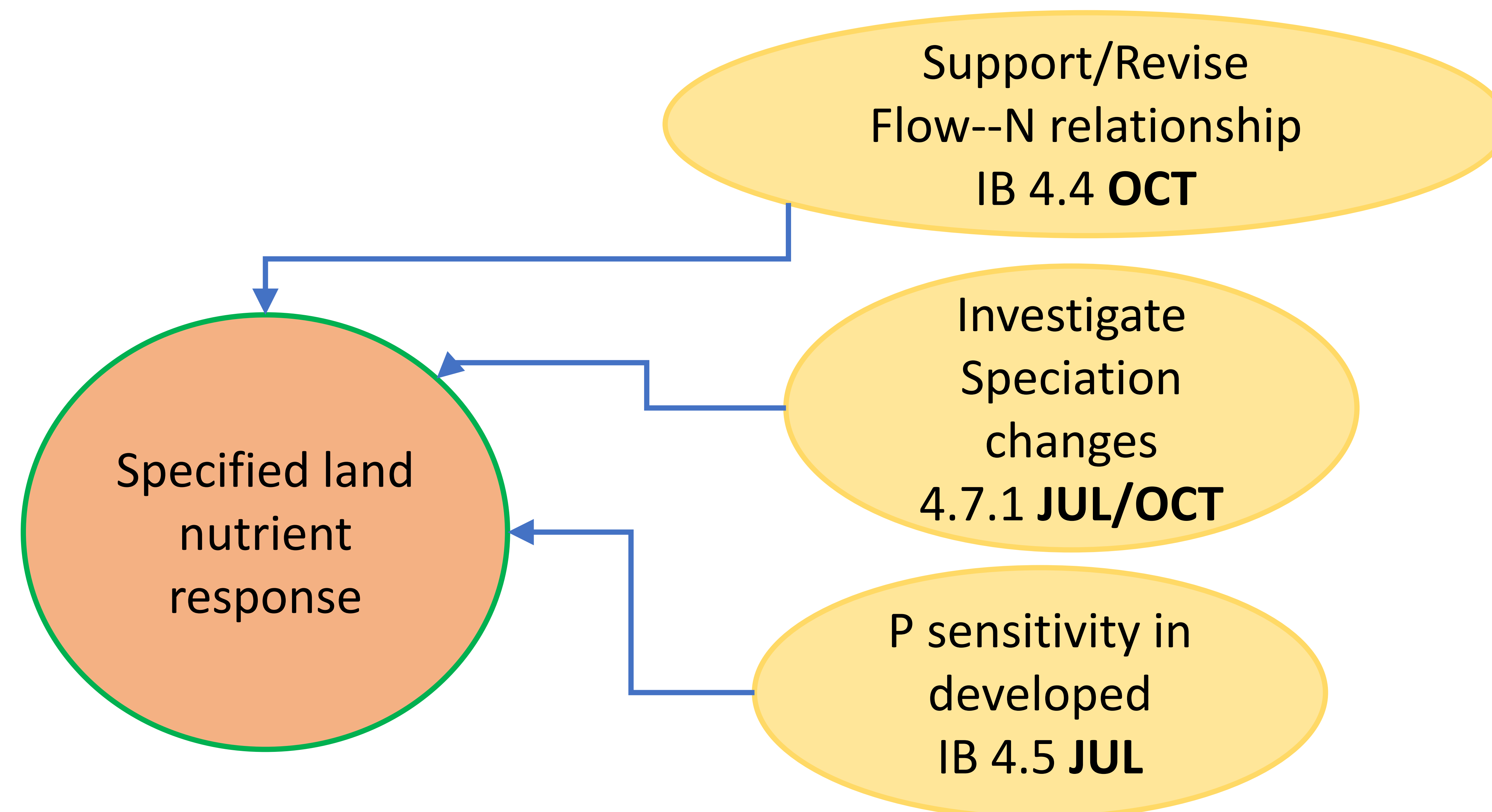
Complete

In Process

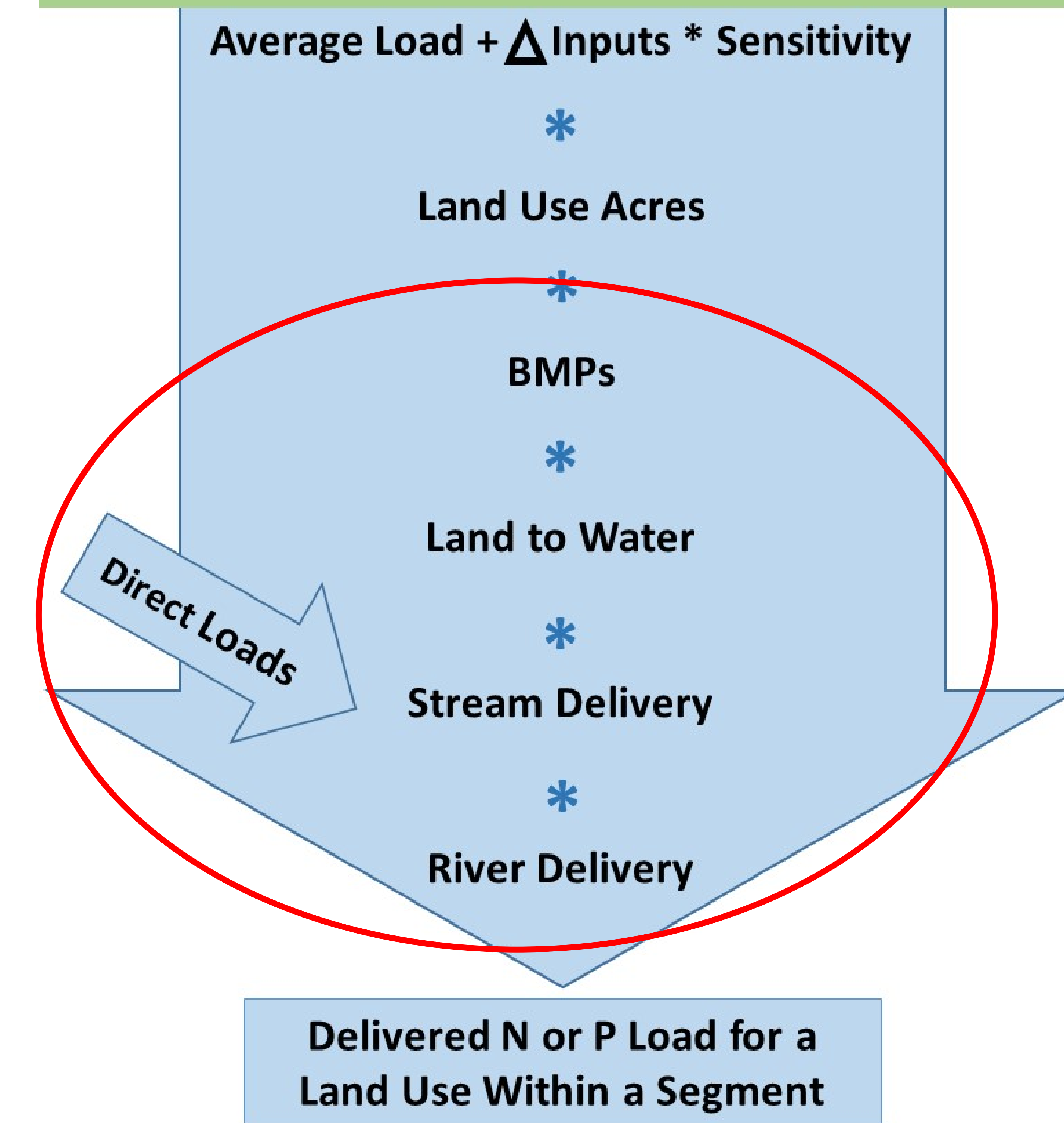
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Phase 6 Model Structure



Land to water
factor effect
GS 4.7 OCT

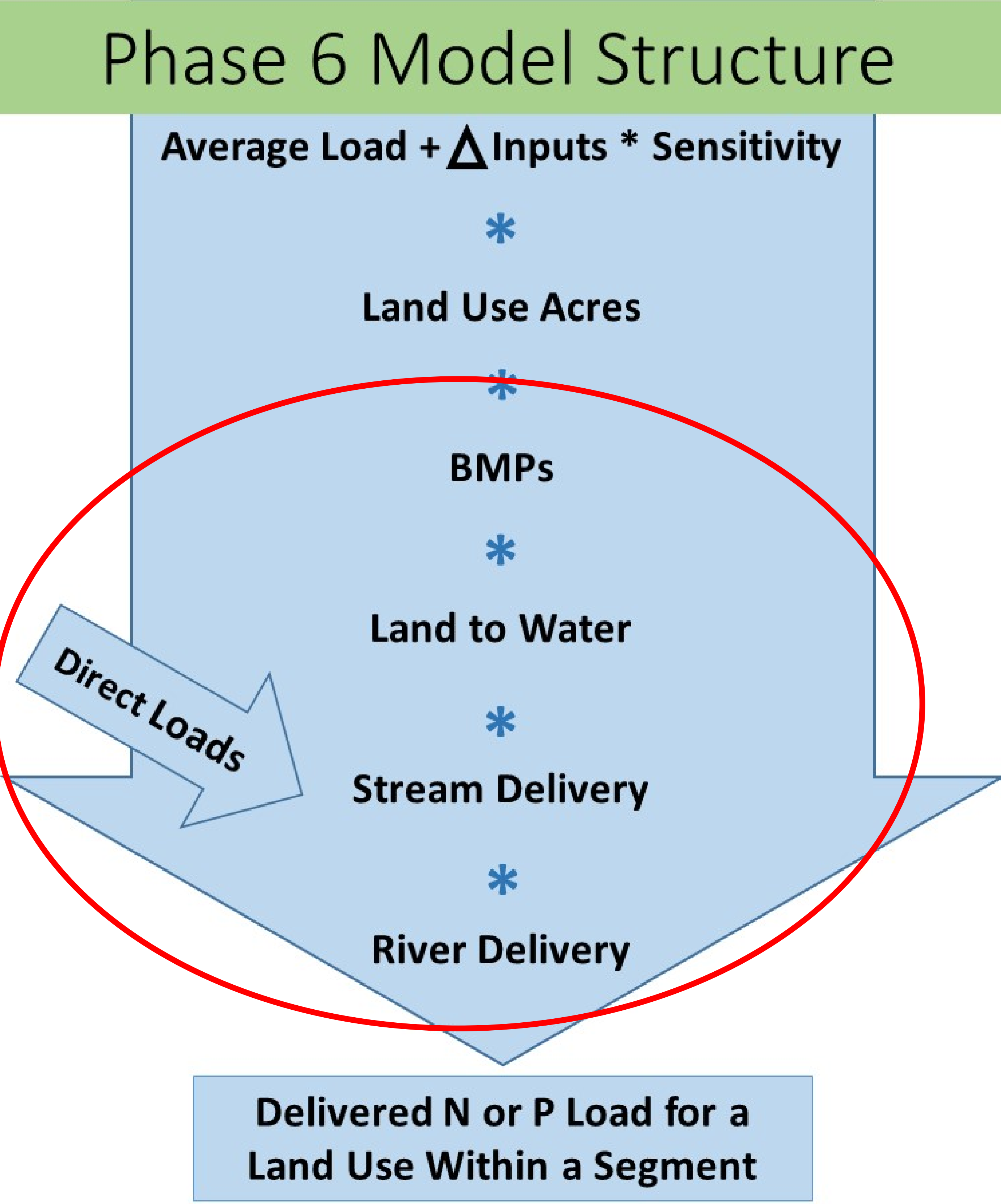
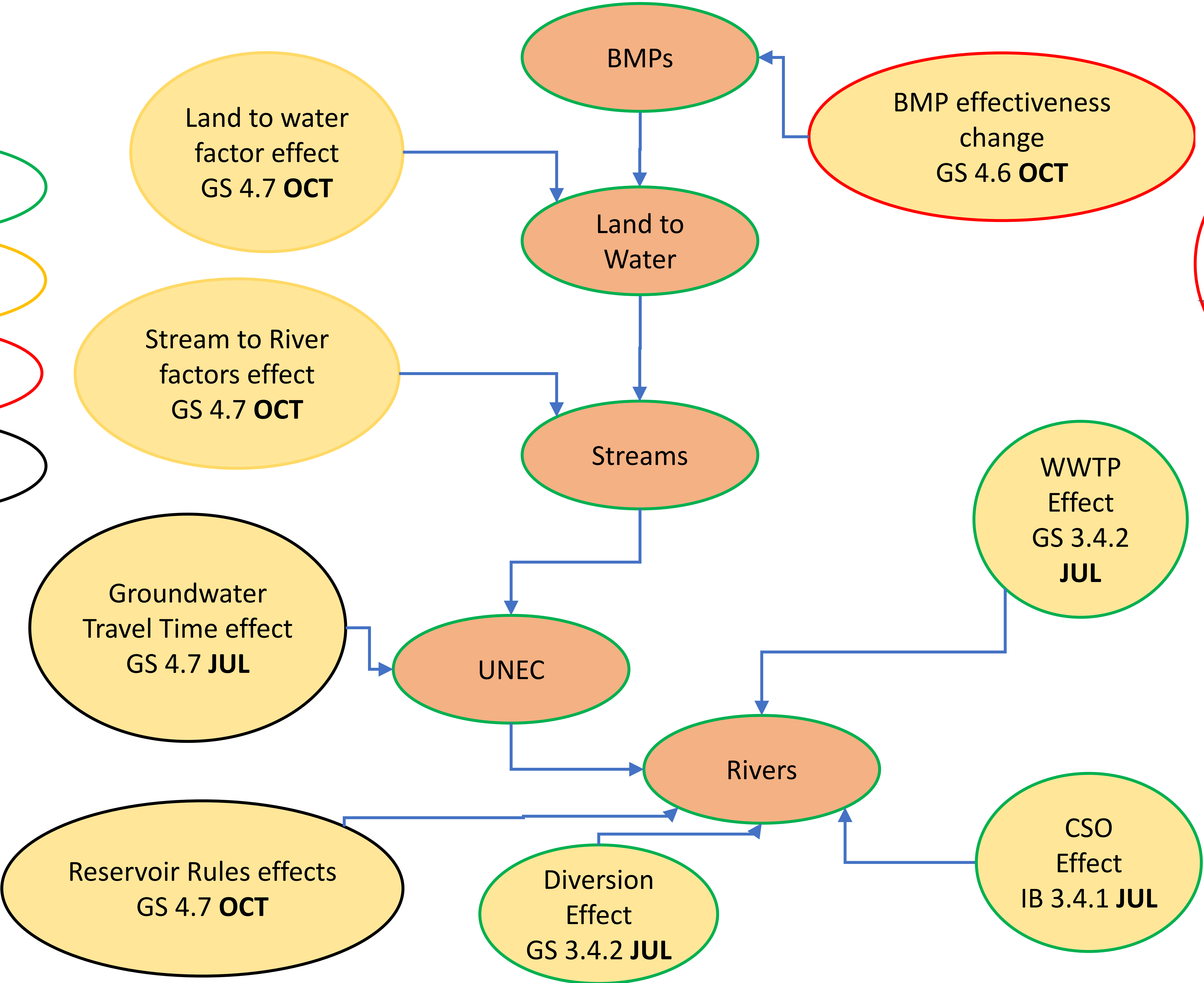
Stream to River
factors effect
GS 4.7 OCT

Climate Change Processes and Dependencies

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Climate Change Processes and Dependencies

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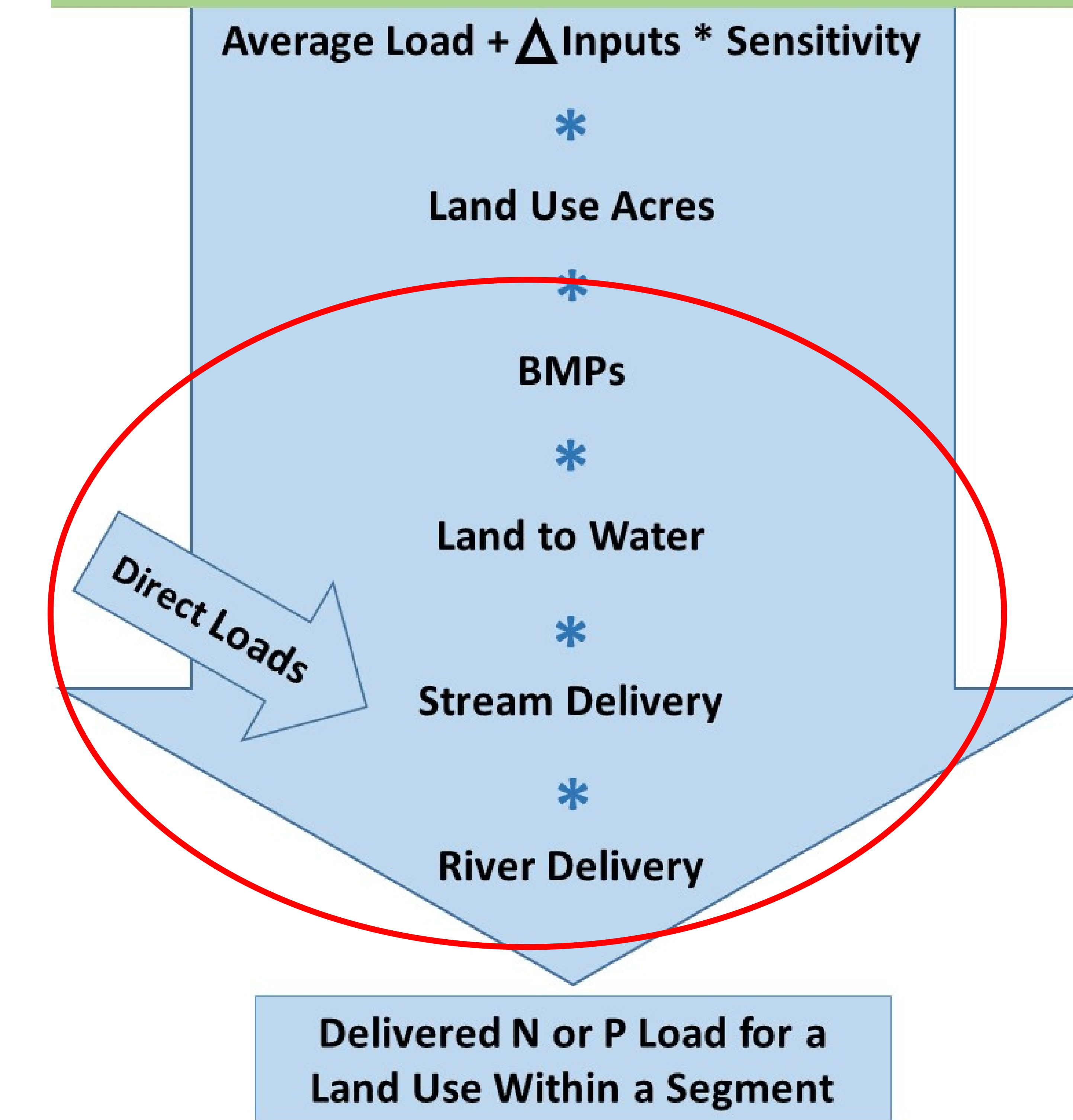
Not included
minor

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- BMP effectiveness
 - CBP understands that effectiveness changes with climate and that it is important
 - No way to address it at this time
- Reservoir rules
 - Likely not a large effect
 - No simple way to investigate

Phase 6 Model Structure

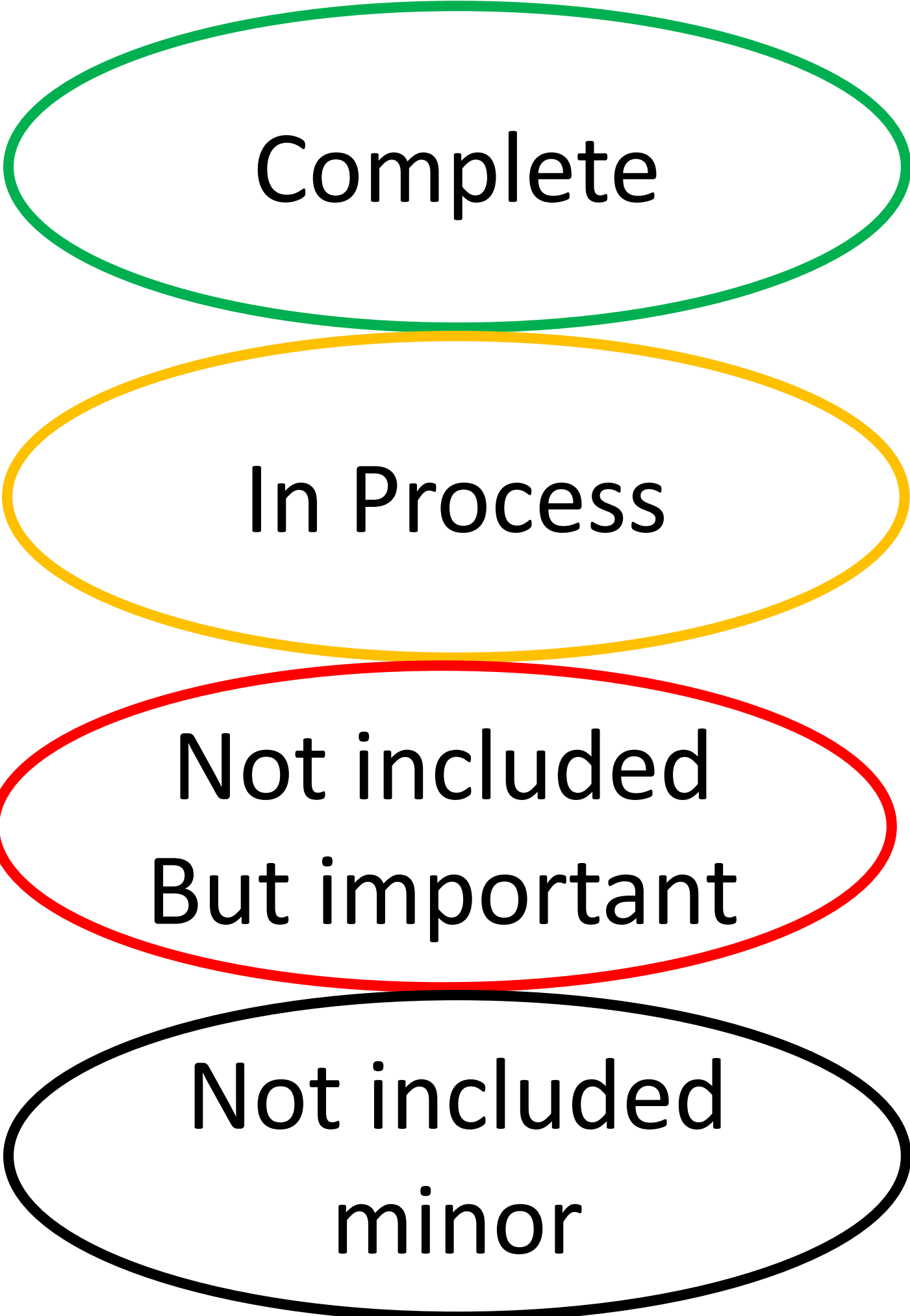


BMP effectiveness
change
GS 4.6 **OCT**

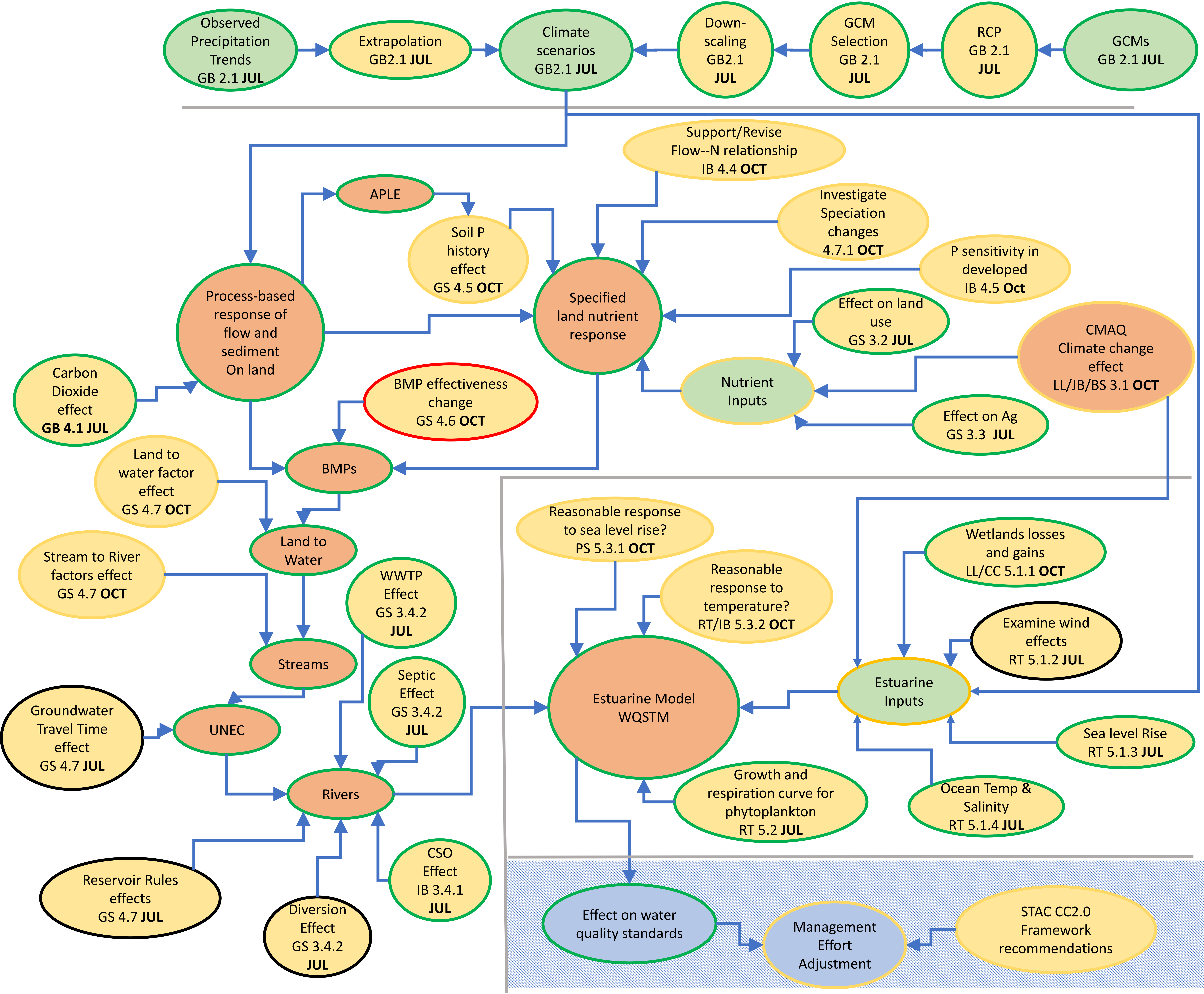
Reservoir Rules effects
GS 4.7 **OCT**

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Estuary

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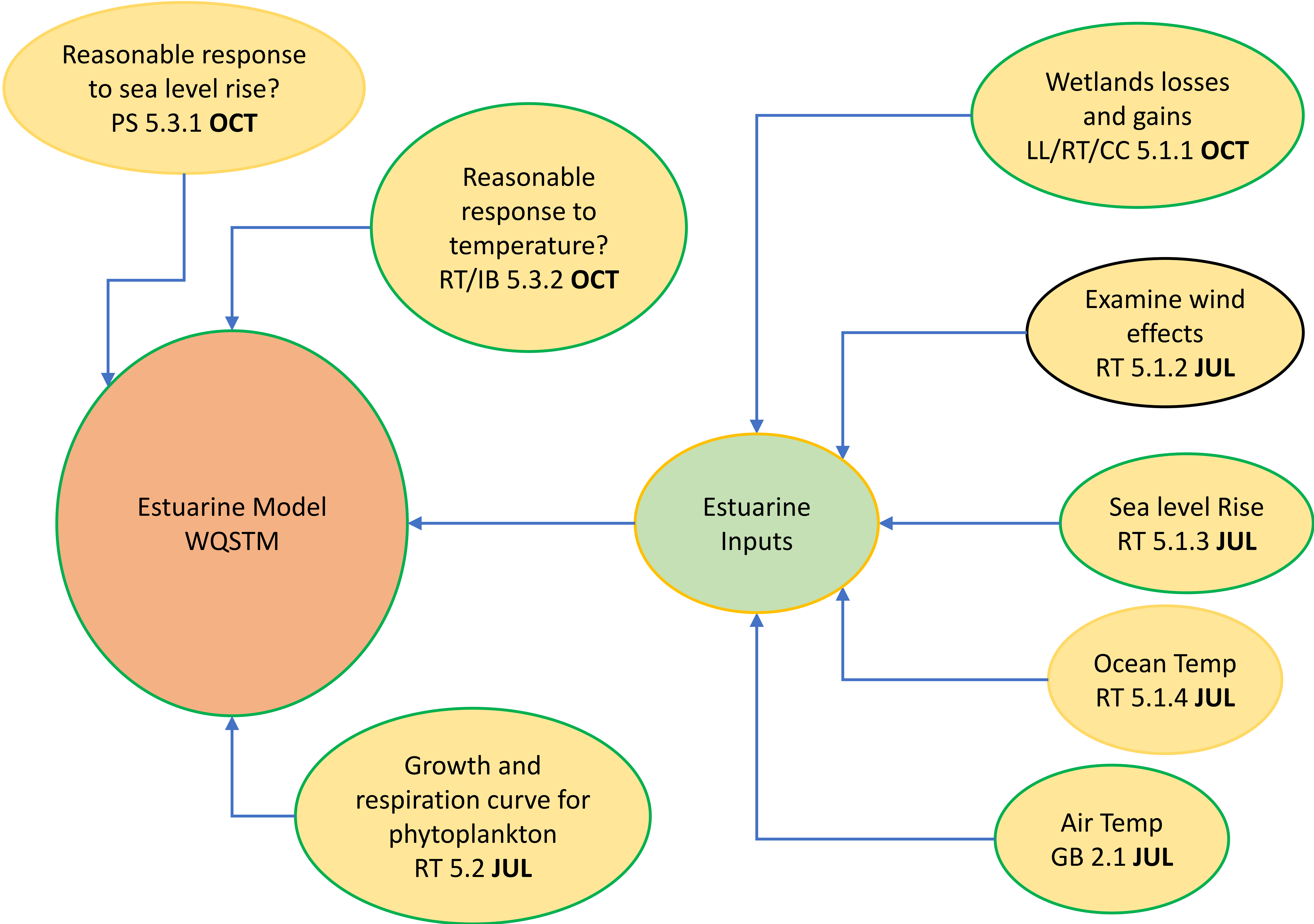
Complete

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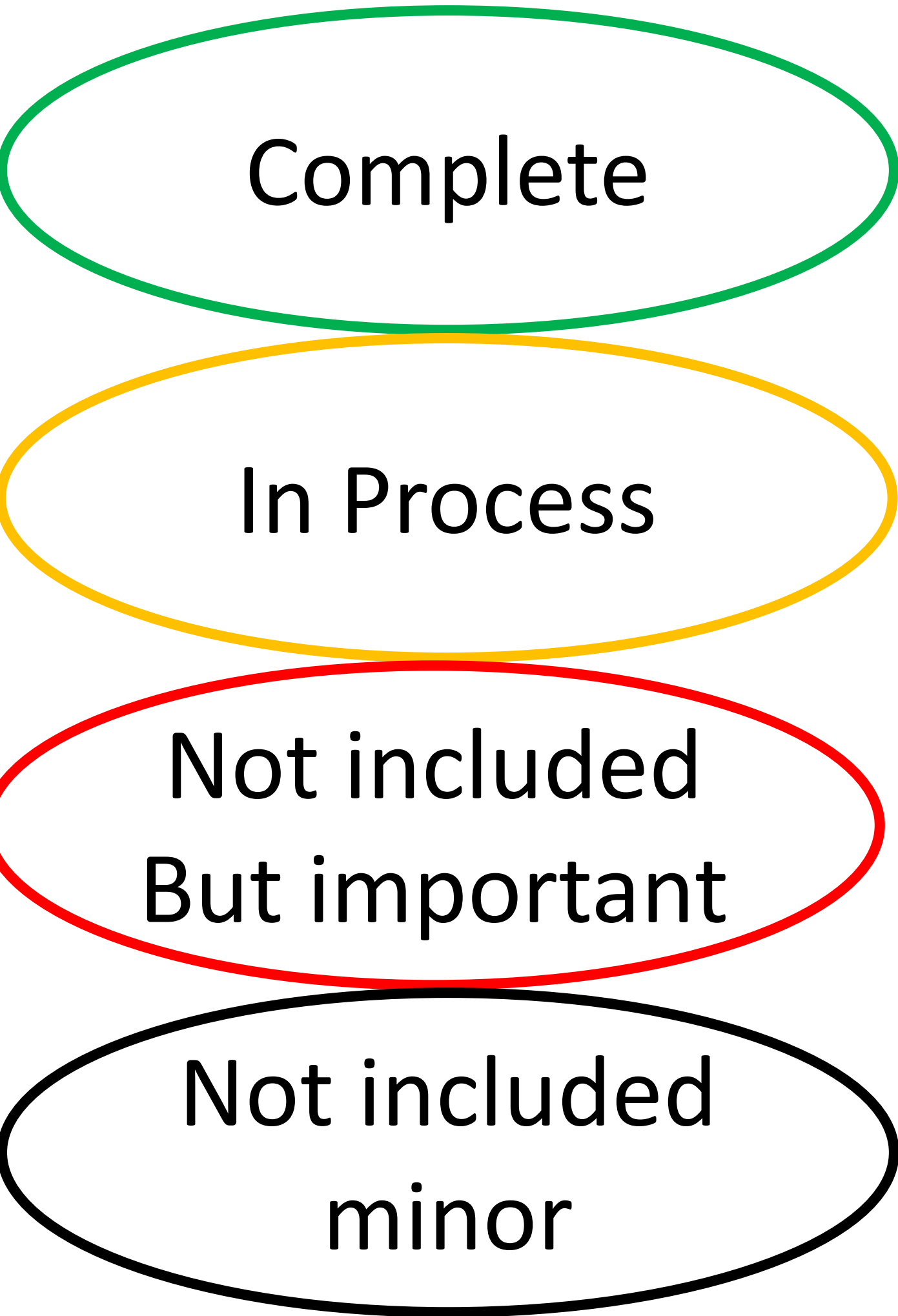
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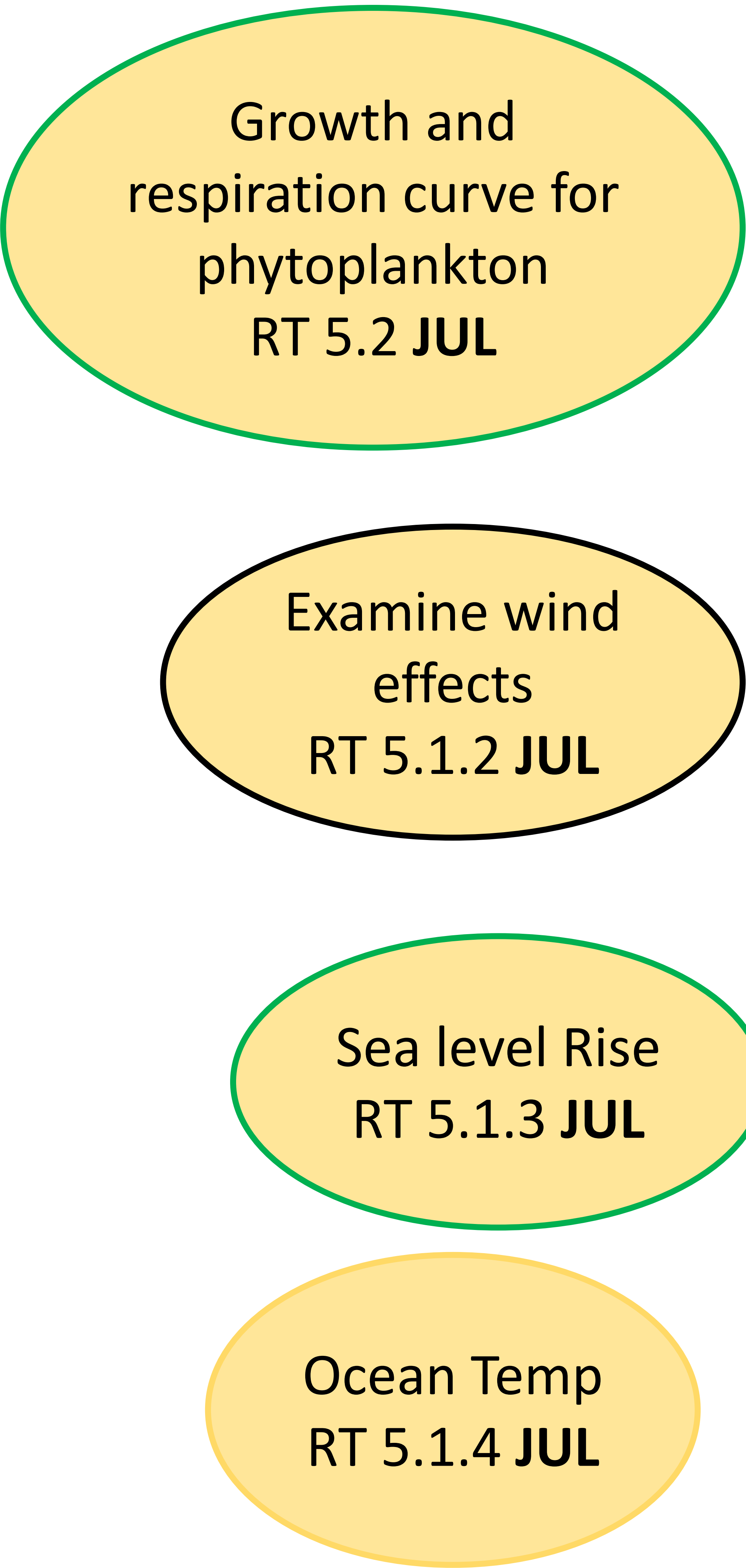
Climate Change Processes and Dependencies

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- For Approval Later Today
 - Growth and respiration curve modifications
 - Wind effects
 - Sea level rise
 - Ocean boundary temperature and salinity



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Climate Change Processes and Dependencies

Model

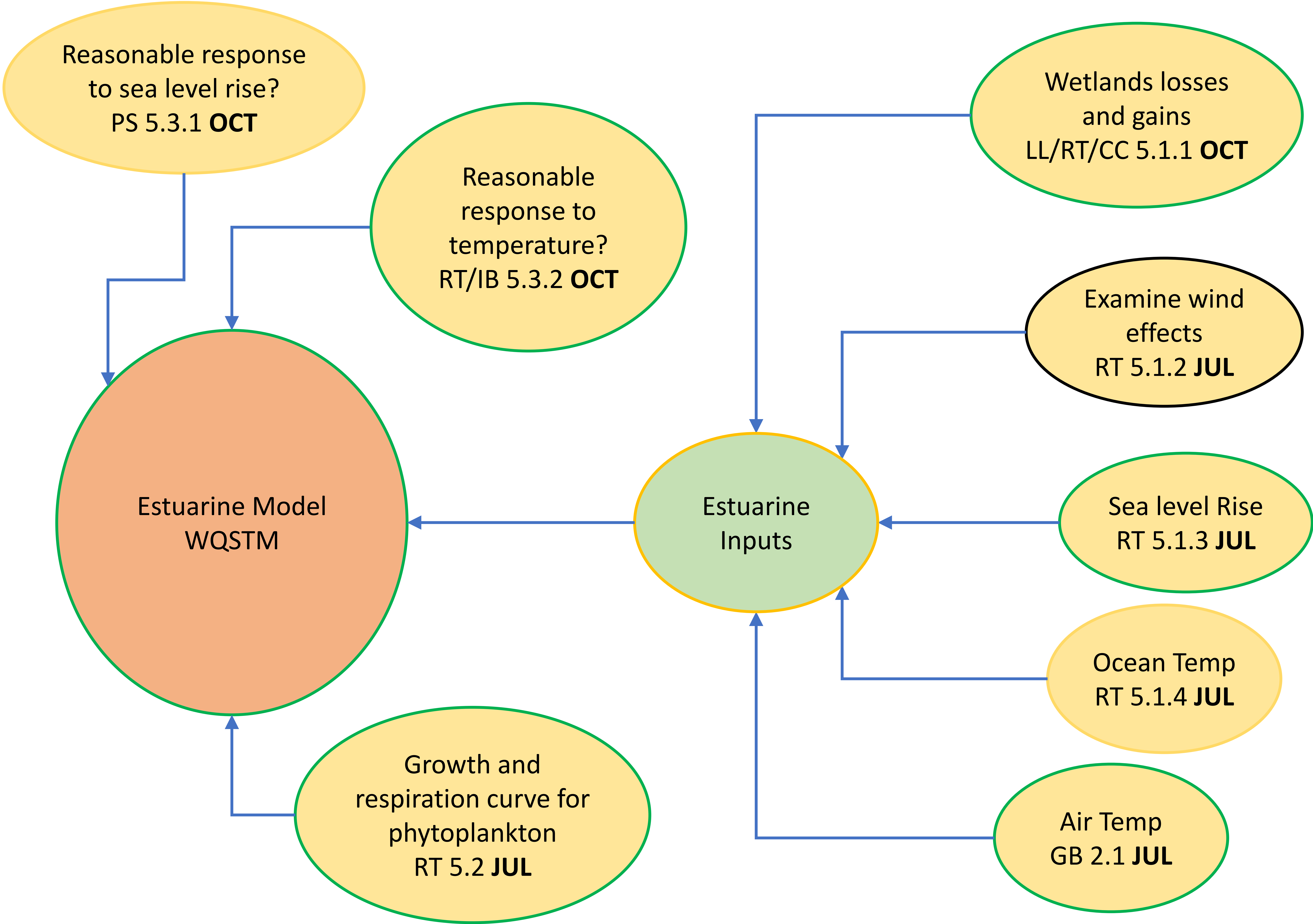
Data Set

Endpoint

Project/Decision

- Complete
- In Process
- Not included
But important
- Not included
minor

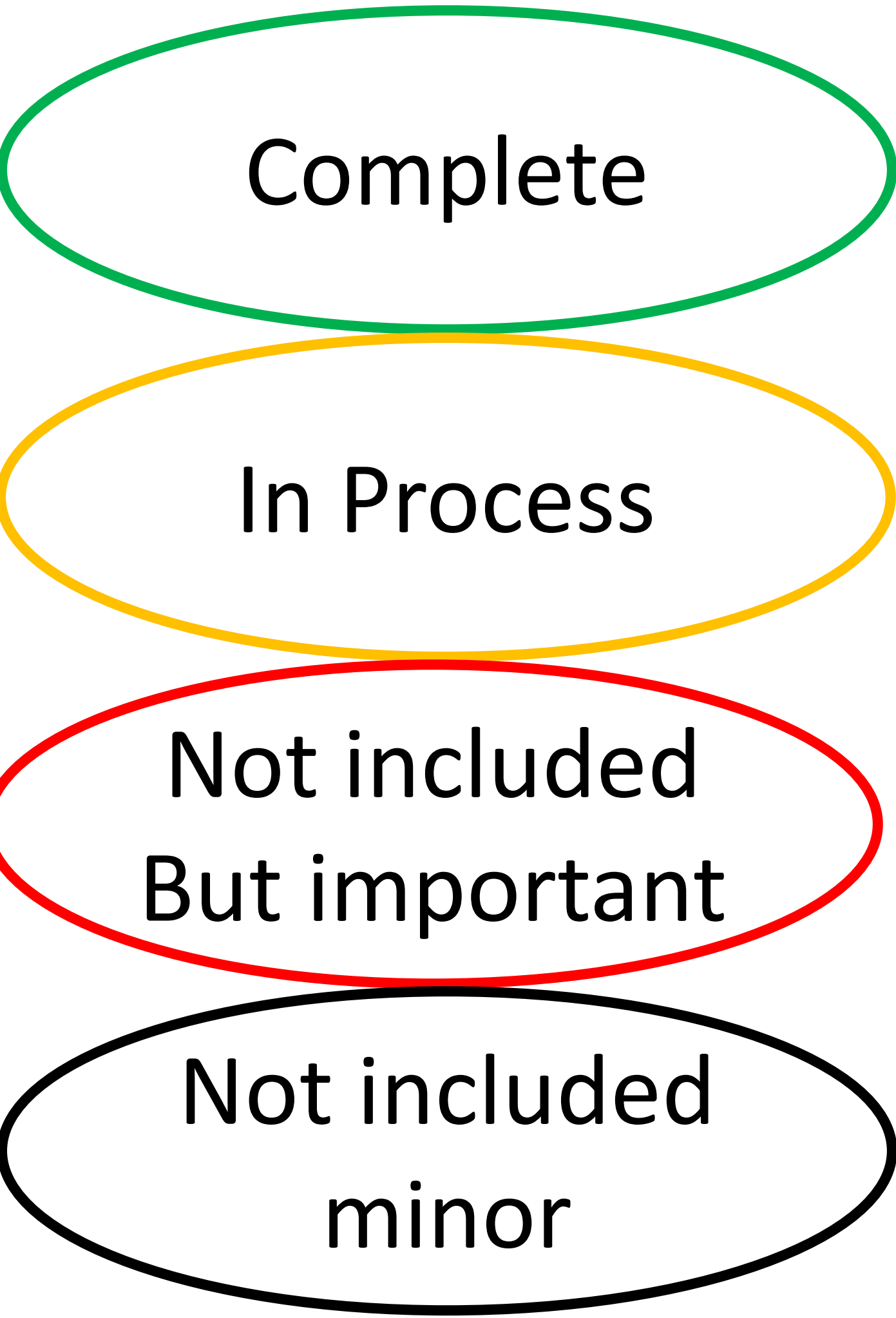
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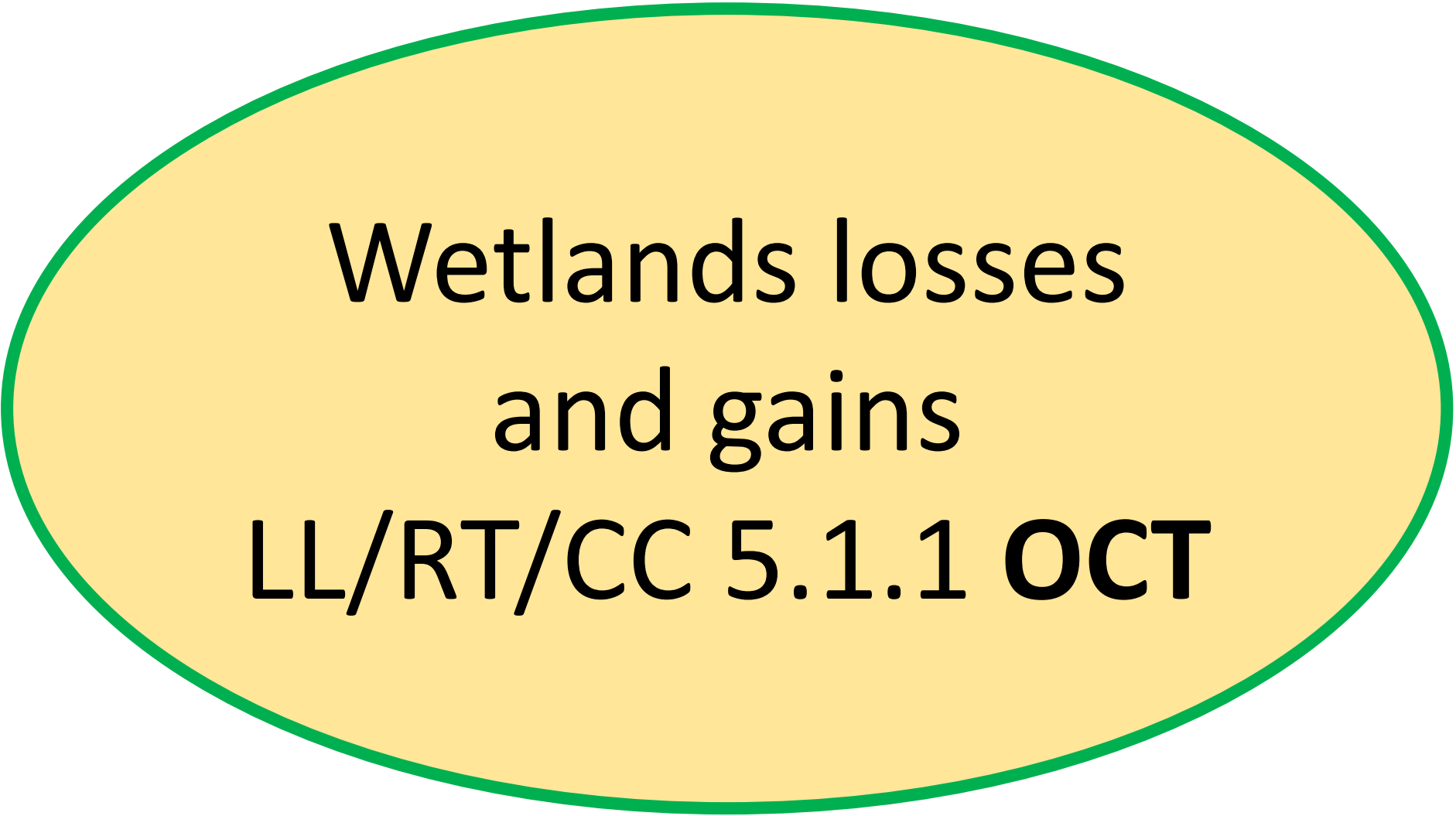
Climate Change Processes and Dependencies

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- Wetlands losses and gains
 - SLAMM model
 - Not yet documented
 - Improved modeling by USGS WHOI and Patuxent groups to be completed in ~5 years.



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Climate Change Processes and Dependencies

Model

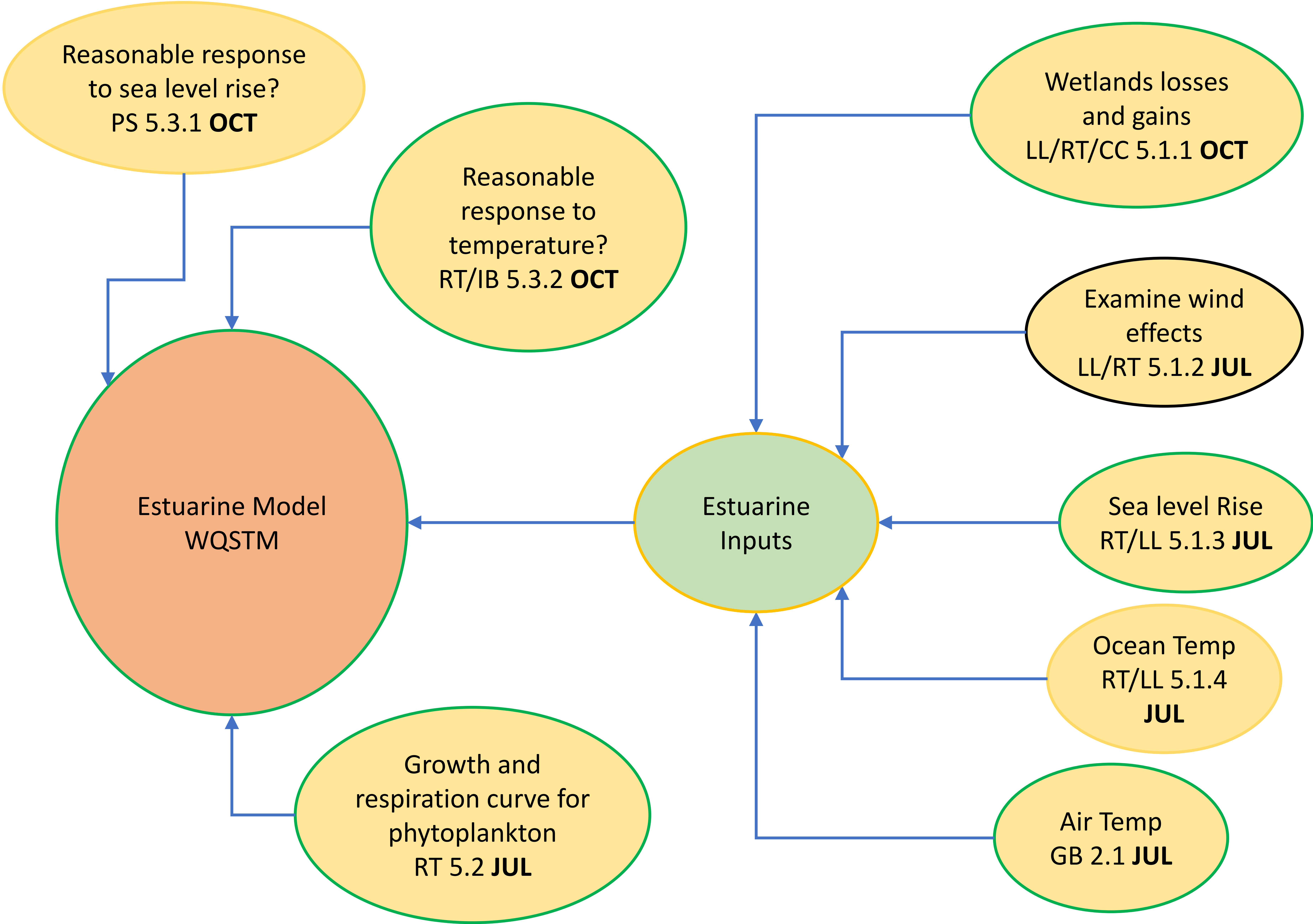
Data Set

Endpoint

Project/Decision

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Climate Change Processes and Dependencies

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- Validation of WQSTM response to CC
- Sea Level Rise
 - Pierre St Laurent's work in CHAMP
 - Comparing and understanding WQSTM and two versions of ROMS
- Temperature
 - Questions raised in the MWG about temperature propagation in the WQSTM
 - Addressed in CHAMP and observational studies

Reasonable response
to sea level rise?
PS 5.3.1 **OCT**

Reasonable
response to
temperature?
RT/IB 5.3.2 **OCT**

