### Closing Out: Efficient Multi-Objective Optimization Procedures

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## Agenda

- Demonstration of the dashboard
- Last steps:
  - Development of the final documents
    - Technical system setup
    - Web application user manual
  - Tech transfer
  - Webinar

## Revised Timeline of the Project

Calendar Year	2020			2021	21			2022			2023			2024					2025				2026	
Calendar Quarter	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3 (	Q4	Q1
Project Year		Year 1			Year 2				Year 3			Year			ar 4			Year 5				Year 6		
Task 1: Development of an efficient single-objective																								
optimization procedure for cost-effective BMP allocation																						$\perp$		<b>↓</b>
1.1: Understanding CAST modules and effect of BMPs on																								
objectives and constraints						-																$\vdash$		—
1.2: Development of a simplified point-based structured single- objective optimization procedure																								
1.3: Development of a hybrid customized single-objective									-													$\vdash$		$\vdash$
optimization procedure																								
1.4: Verification and validation with CBP users and decision-makers																								
and update of optimization procedure																								$\perp$
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Task 2: Development of an efficient multi-objective (MO)																								
optimization procedure for cost-loading trade-off BMP allocation																								
2.1: Develop generative MO optimization using hybrid optimization												*.*.*.*												$\vdash$
procedure developed at Task 1																								
2.2: Develop simultaneous MO customized optimization using																								
population-based evolutionary algorithms																								
2.3: Comparison of generative & simultaneous procedures and																								
validation with CBP users & decision-makers																						$\vdash$		—
2.4: Develop an interactive multi-criterion decision-making aid for																								
choosing a single preferred solution						-			-												_	$\vdash$		$\vdash$
Task 3: Multi-state implementation using machine learning																	-:-:-:-:	******			$\vdash$	+		$\vdash$
and parallel computing platforms																								
3.1: Comparative study to choose a few best performing methods																						$\vdash$		$\vdash$
3.2: Scalability to State and Watershed level Scenarios																								
3.3: "Innovization" approach for improving scalability																								$oxed{oxed}$
4.4: Distributed computing approach for improving scalability						-																$\vdash$		₩
Task 4: Interactive optimization and decision-making using																				050505050	(0)0)00	1000000		
user-friendly dashboard																								
4.1: User-friendly optimization through a dashboard													 										·····	
4.2: Surrogate-assisted optimization procedures																								
4.3: Robust optimization method for handling uncertainties in																								
variables and parameters																								
4.4: Sustainable watershed management practices		$\Box$												$\Box$										

## Demonstration of the dashboard



## Development of the final Documents

#### **Technical System Setup**

Development of Efficient Multi-Objective Optimization Procedures: Web Application

Technical Setup Instructions

Development Team: Ritam Guha, Garrard Auden, Pouyan

Nejadhashemi, Kalyanmoy Deb

EPA Team: < To be inserted>

#### **Table of Contents**

- 1. Hardware Requirements
- 2. Software Requirements
- 3. Links to the codebase
- 4. Setting up the Environment
- 5. Create the Dockers

## Almost completed

#### **Web Application User manual**

#### Development of Efficient Multi-Objective Optimization Procedures: Web Application

#### Dashboard User Manual

Development Team: Ritam Guha, Garrard Auden, Pouyan <u>Nejadhashemi</u>, <u>Kalyanmoy</u> Deb

EPA Team: < To be inserted>

Overview of the System	2
The Optimization Problem	2
System Components	2
Dashboard Landing Page	3
Key Sections of the Dashboard	4
New Optimization Scenario Creation	5
Fields and Inputs	5
County Selection	6
Actions	6
Optimization Run	6
Pollution Load and Implementation Cost Specification	7
BMP Selection	9
County Selection for Manure Transport	11
County Selection for Manure Transport Page	. 12
Interpreting Results	12
Overview Page	13
Optimized Solutions Page for a Single Run	14
Download Page	18
Verification with CAST	. 19

## Tech Transfer



#### Will schedule soon:

- Meeting between EPA and MSU to finalize tech transfer instructions.
- Probable walkthrough with Demos.
- Complete documentation to support users and tech teams.
- Support during implementation on EPA tech stack.

## Webinar

 Depending on EPA needs, a final webinar to make stakeholders aware of this tool.

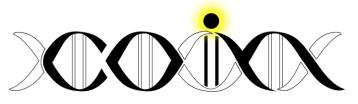
 Extension/Future Improvements discussions.

• Efficient use of the web application.





# Thanks to EPA for this opportunity \_\_\_\_\_



**Computational Optimization and Innovation** 

# We will be happy to collaborate further



