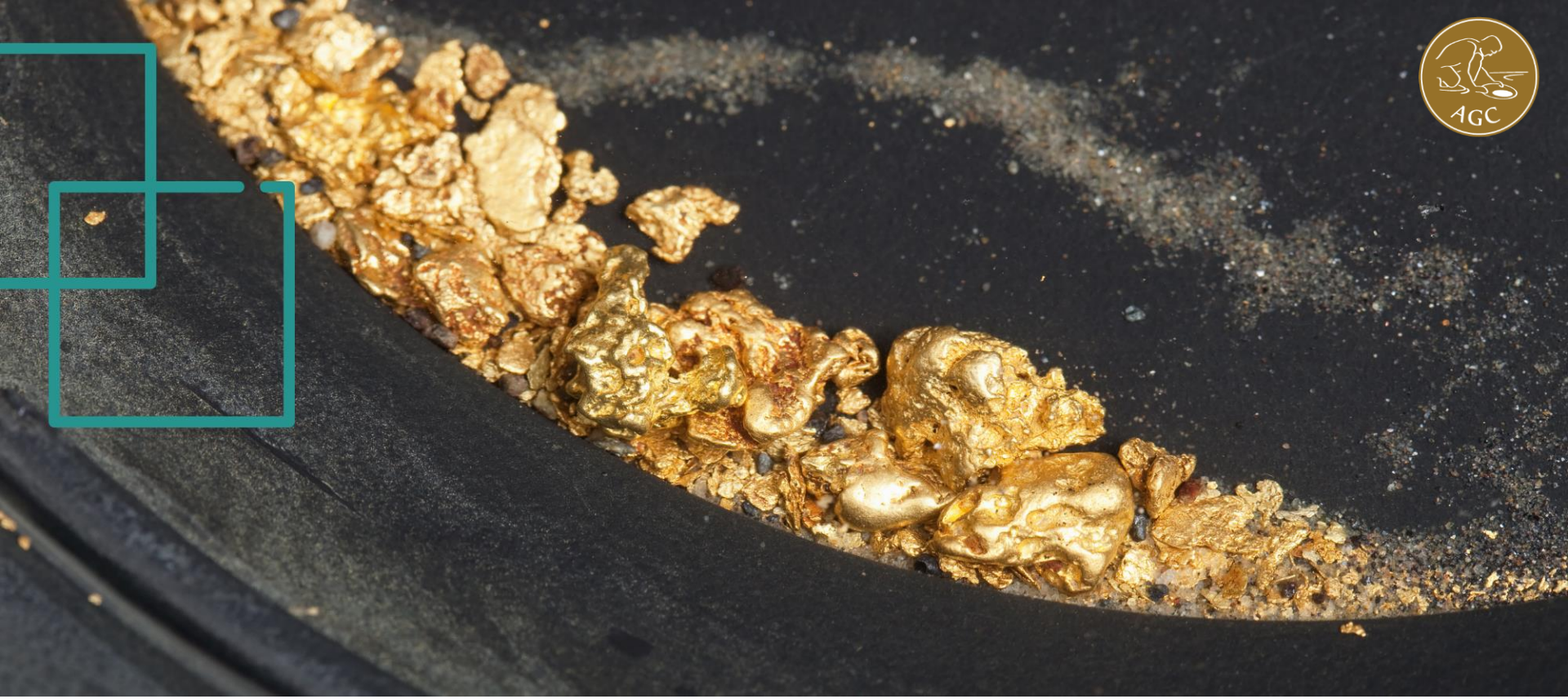
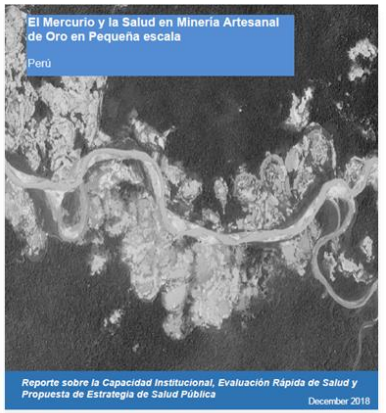


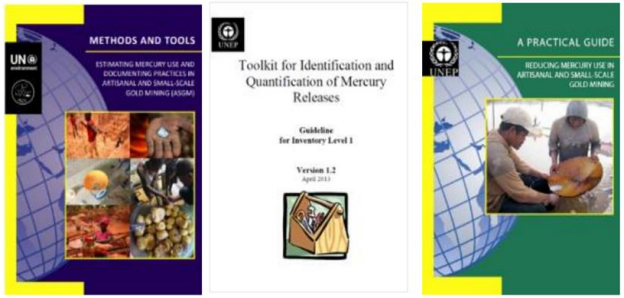
Technical Improvements and Training for Mercury-Free Gold Extraction in Colombia

ARTISANAL GOLD COUNCIL

About *Us*

- Canada-based organization (founded in 2007)
- **Strengths:** Deep knowledge of the field and experience with ASM communities, governments and industries.
- We have conducted ASGM inventory trainings in 12 countries.
- We have directly supported 8 countries to develop national ASGM inventories as part of their Minamata National Action Plans.





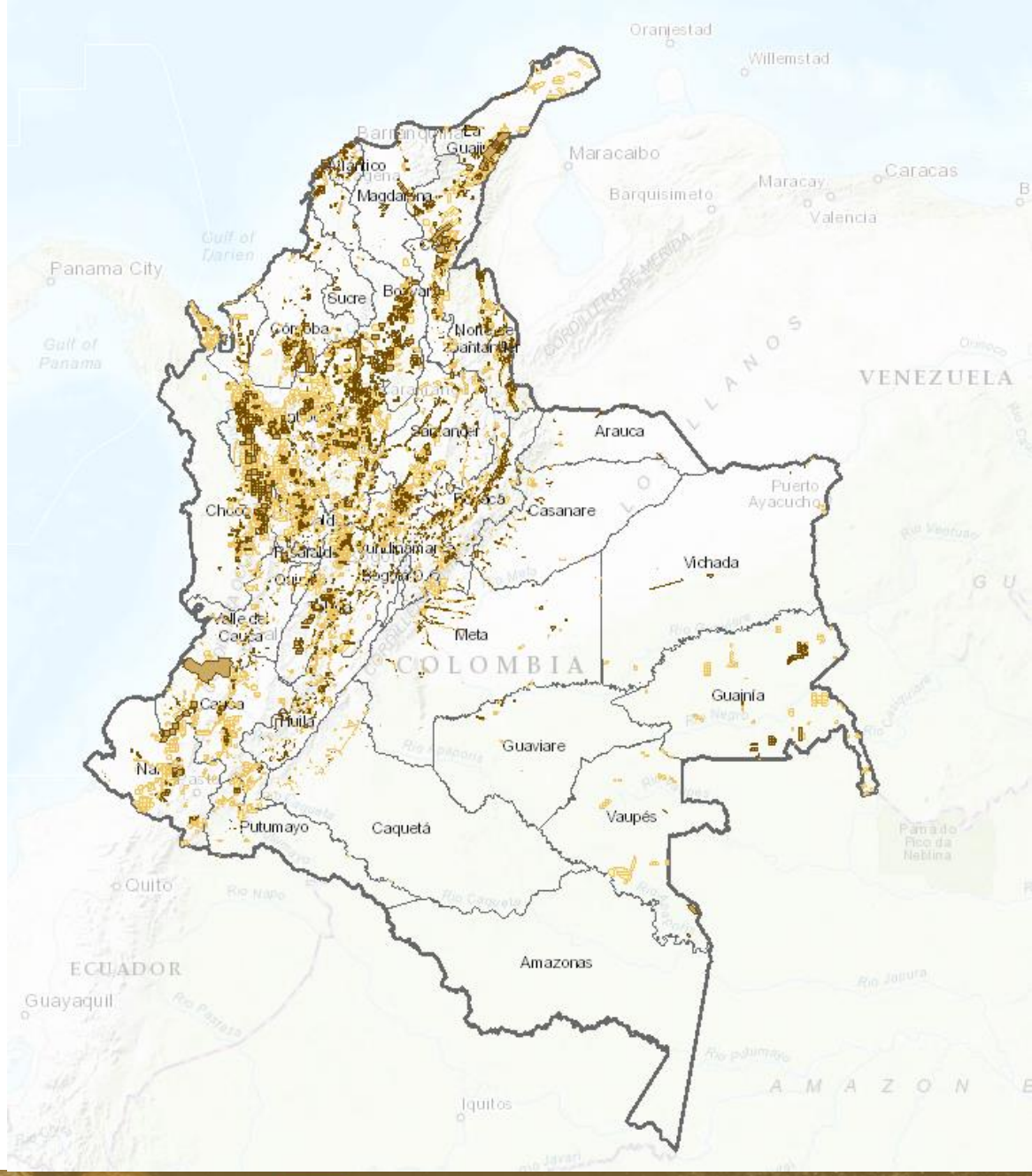
Our *impact*


ARTISANAL
GOLD COUNCIL
AGC
Victoria, BC
Vienna
Mongolia
Honduras
Nicaragua
Venezuela
Guyana
Columbia
Suriname
Ecuador
Peru
Brazil
Bolivia
Mali
Senegal
Guinea
Burkina Faso
Nigeria
Chad
Côte d'Ivoire
Sierra Leone
Ghana
Cameroon
Gabon
Tanzania
Mozambique
Zambia
Namibia
Laos
Philippines
Cambodia
Indonesia
Papua New Guinea

In *Colombia*

9,602 current mining concessions in Colombia cover 312 types of minerals, classified into 8 large groups, according to the use of each mineral.

- **Mining** *Operations*
- **Mining** *Concessions*
- **Mining** *Applications*



In *Colombia*

GENERAL LEGAL FRAMEWORK

The Minamata Convention, agreed upon in 2013 and active since 2017

The Basle Convention, adopted in 1989 and ratified by Colombia in 1996

OECD Recommendation, 18 September 1973 - C (73) 172

Decisions 516 of 2002 and 777 of 2012 of the Andean Community of Nations – CAN

Law 1658 of 2013

Law 1892 of 2018

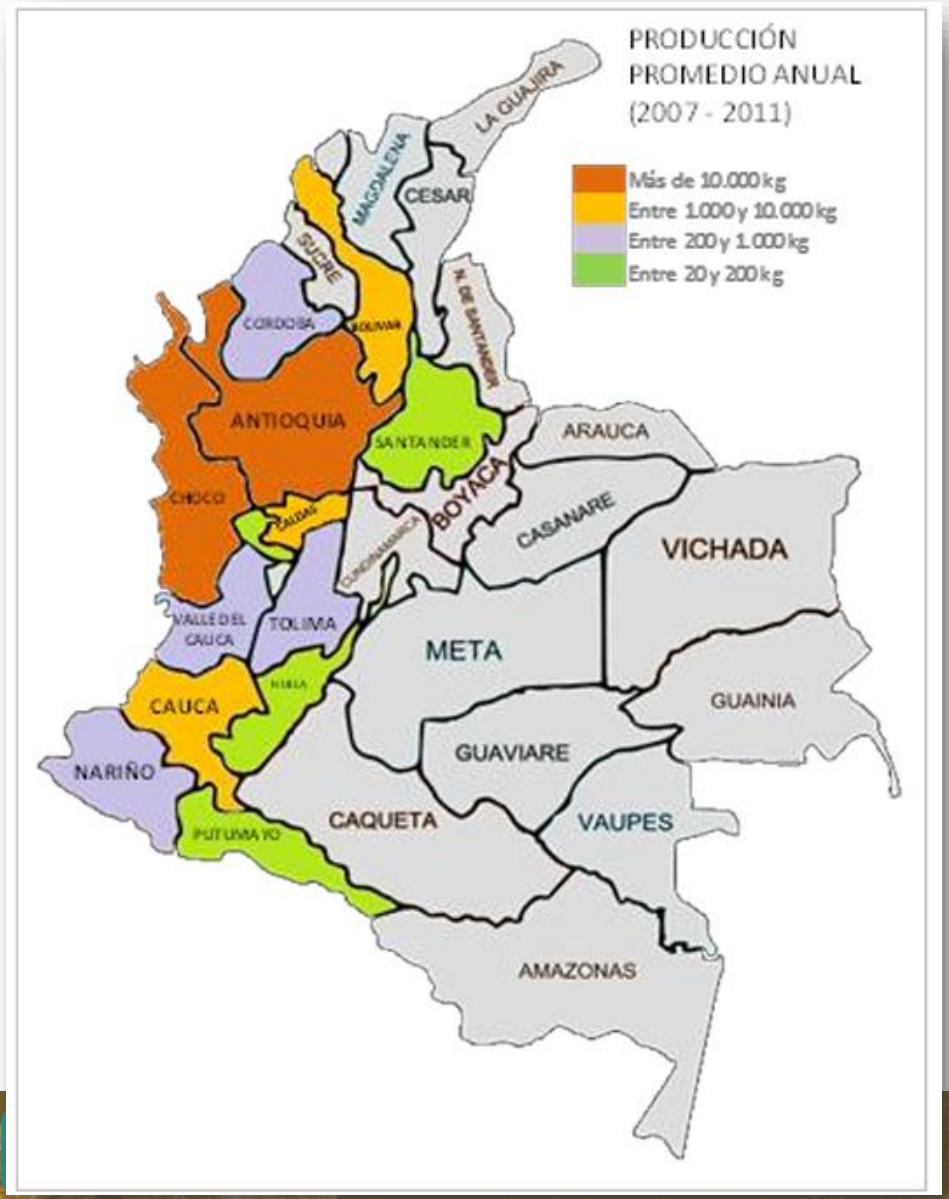
Decree 2133 of 2016

Decree 1041 of 2018

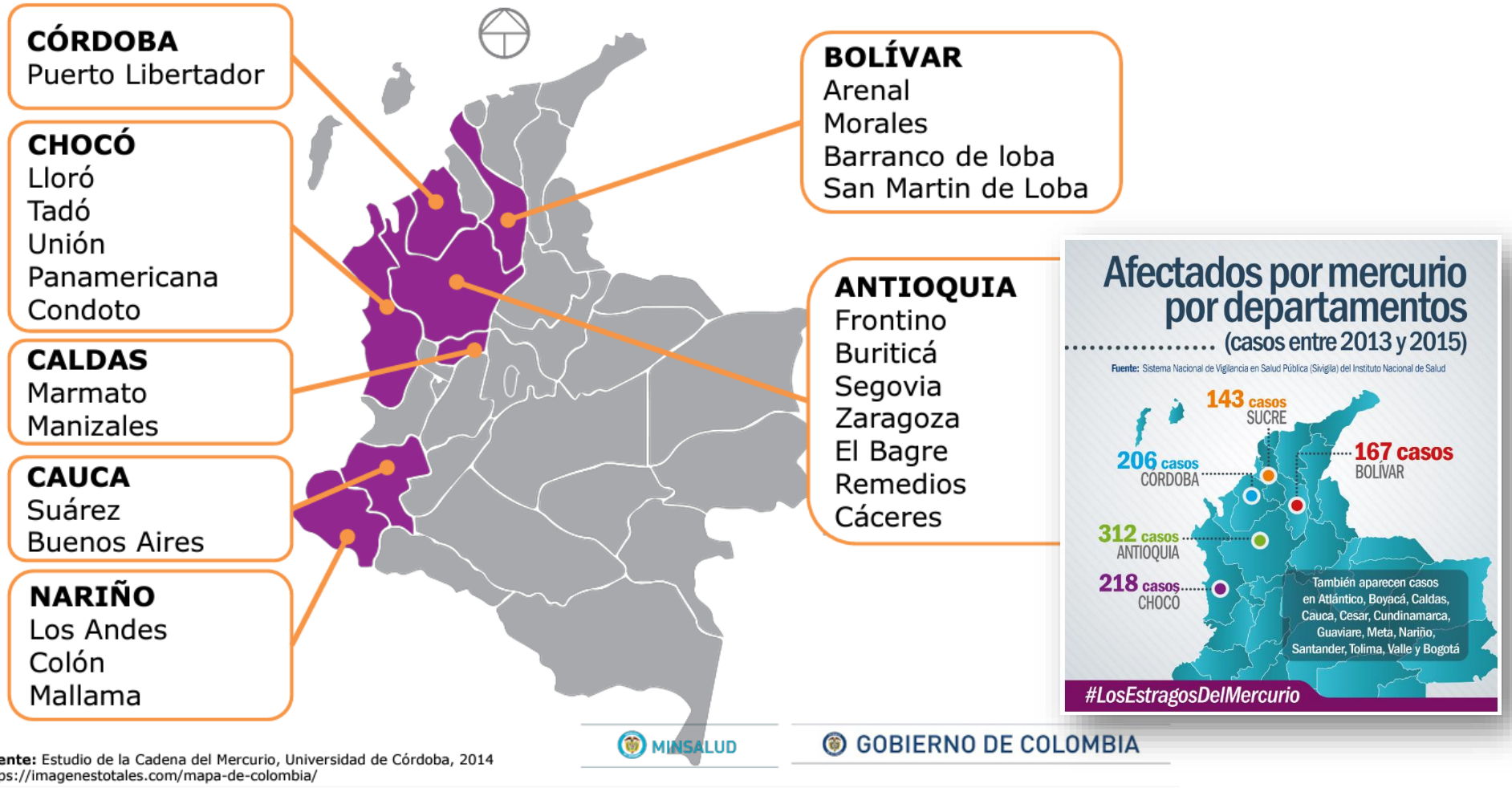
Government Mining Assistance Points	Concession	Área
Nobsa Point	17%	6%
Bogotá Point	16%	7%
Antioquia's Governorship	16%	22%
Ibagué Point	8%	9%
Cúcuta Point	8%	4%
Bucaramanga Point	7%	6%
Cartagena Point	6%	10%
Manizales Point	5%	3%
Cali Point	5%	9%
Valledupar Point	5%	10%
Medellín Point	2%	4%
Pasto	2%	2%
Quibdó	2%	6%
Total	100%	100%
TOTAL UNITS	9,602 Concessions	5,186,076 Hectares

Mercury use in *Colombia*

Province	Gold production per province (Kg)	Mercury use (Kg)
Antioquia	12,935	
Bolivar	**5,423**	**170,835**
Caldas	1,273	304,404
Cauca	**1,127**	**No calculation**
Choco	27,915	15,806
Córdoba	69	443
Huila	30	436
Nariño	235	3,268
Putumayo	73	1,012
Risaralda	36	526
Santander	60	199
Tolima	268	3,843
Valle del cauca	200	2,847



Areas with greater mercury contamination in *Colombia*



Fuente: Estudio de la Cadena del Mercurio, Universidad de Córdoba, 2014
https://imagenestotales.com/mapa-de-colombia/

Source: Ministry of Health and Social Protection Promotion and Prevention Directorate Environmental Health Subdirectorate (2018)

Plans to reduce mercury uses in *Colombia*

NATIONAL STRATEGIC PLAN FOR MERCURY REDUCTION IN ARTISANAL AND SMALL-SCALE GOLD MINING IN COLOMBIA

MERCURY SINGLE NATIONAL PLAN

Ministry of Environment and Sustainable Development of the Republic of Colombia (2013)

TECHNICAL COOPERATION BETWEEN BRAZIL, BOLIVIA AND COLOMBIA: THEORY AND PRACTICE FOR STRENGTHENING HEALTH SURVEILLANCE OF POPULATIONS EXPOSED TO MERCURY

Pan American Health Organization and World Health Organization (2011)

MERCURY PLAN FOR THE HEALTH SECTOR

Promotion and Prevention Directorate Environmental Health Subdirectorate Government of Colombia and Ministry of Health (2018)

For *the USDoS project*

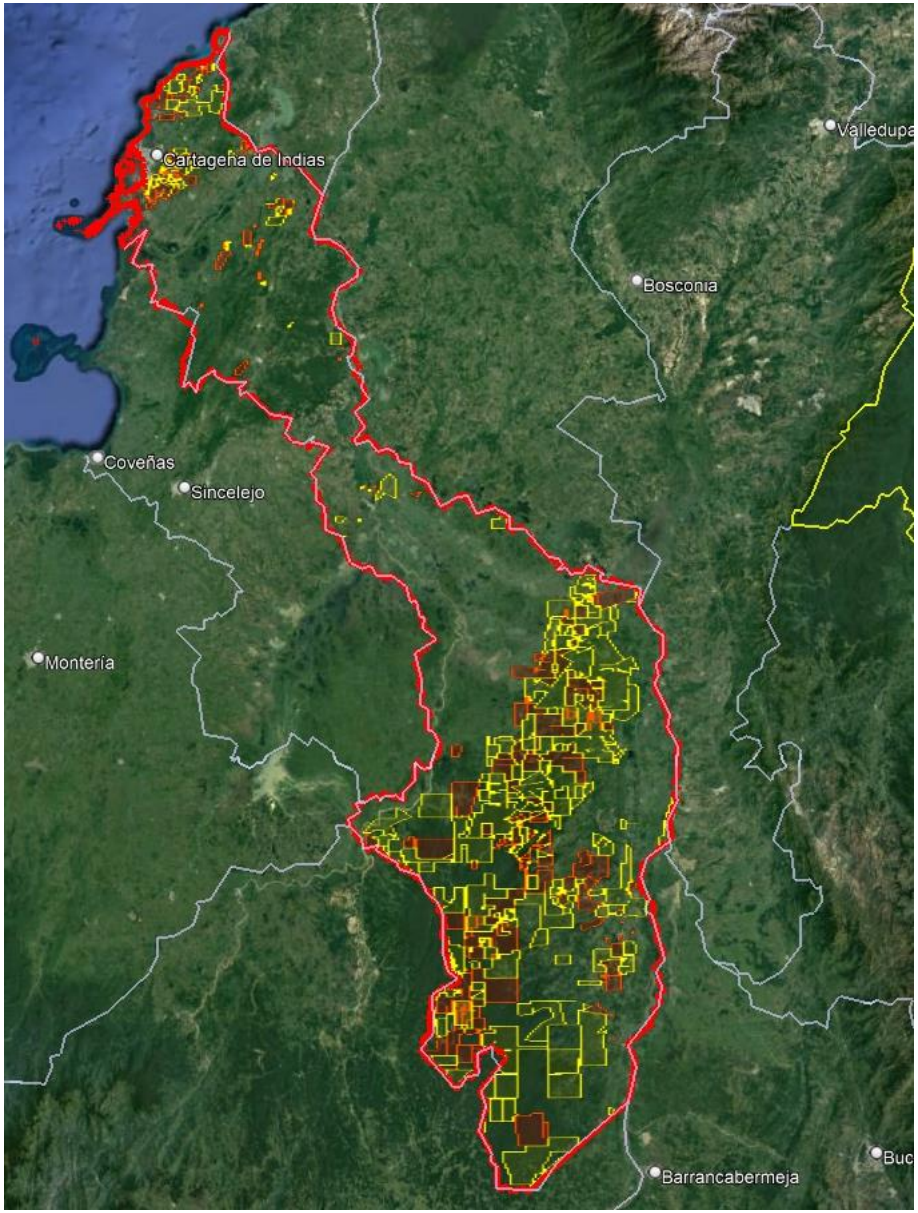
Colombia

Goal *for the USDoS project*

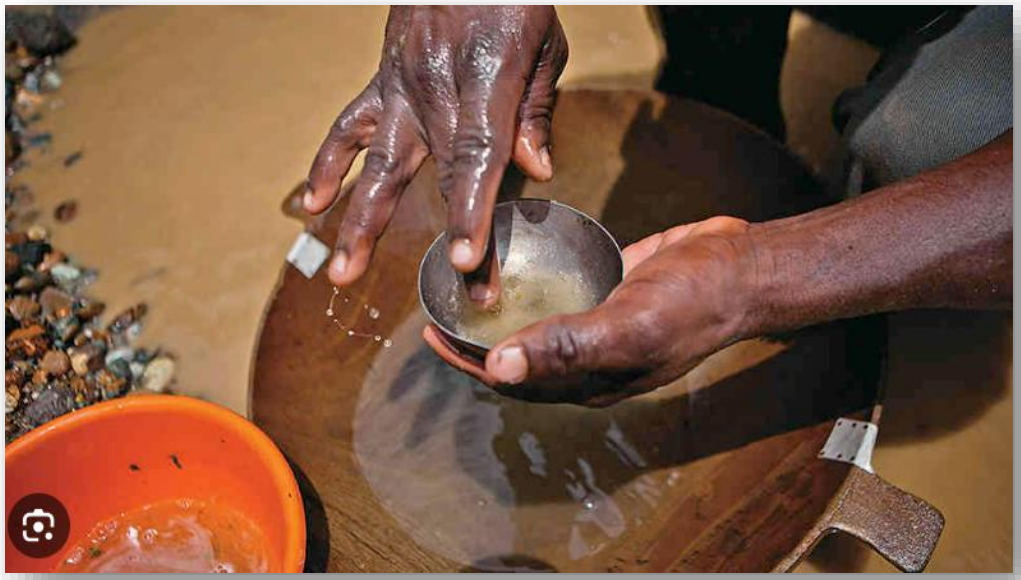
The goal of this proposed project is ***reducing the use of mercury in ASGM through piloting promising technologies for alternative extraction techniques for use in the ASGM context in Colombia***.

SUR DE BOLÍVAR

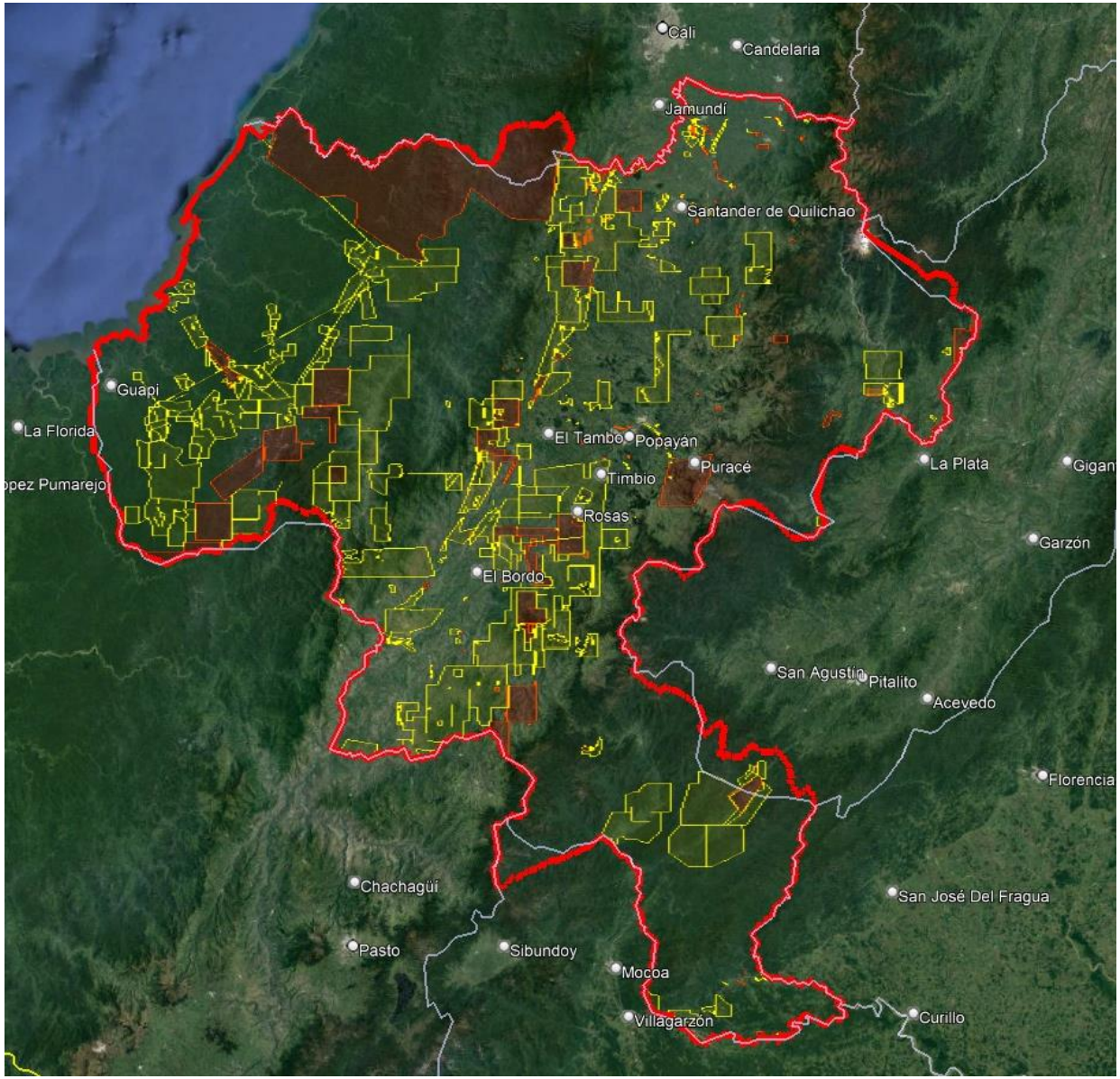
Mining in the south of Bolívar, Colombia, is an economic activity that currently stands out for its abundance of gold.



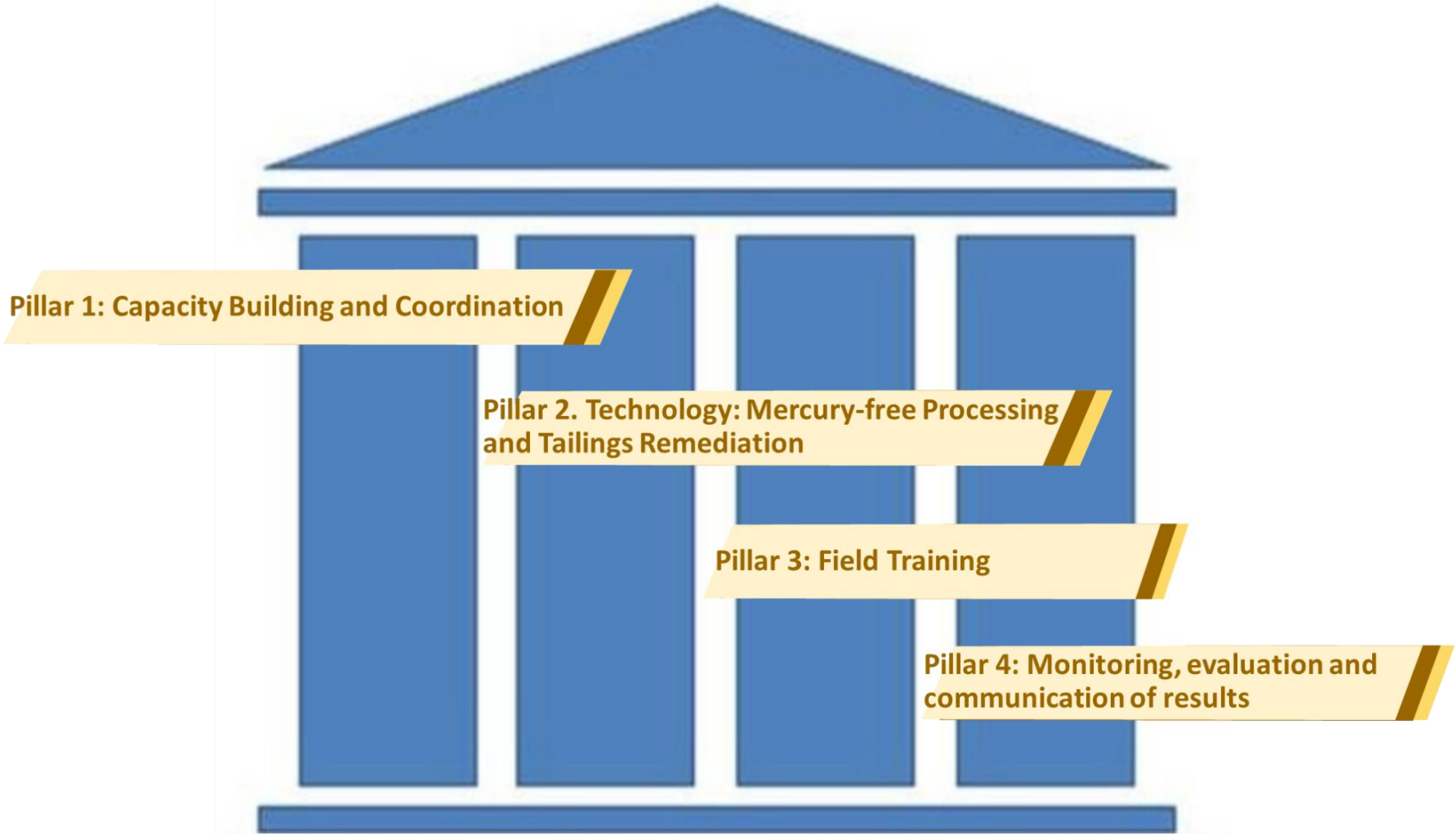
The most significant challenge in this area is to change the way gold is processed, the use of mercury raises serious environmental and public health concerns. In response to these concerns, a set of regulations and activities have been implemented to address the challenges of mining in the south of Bolívar



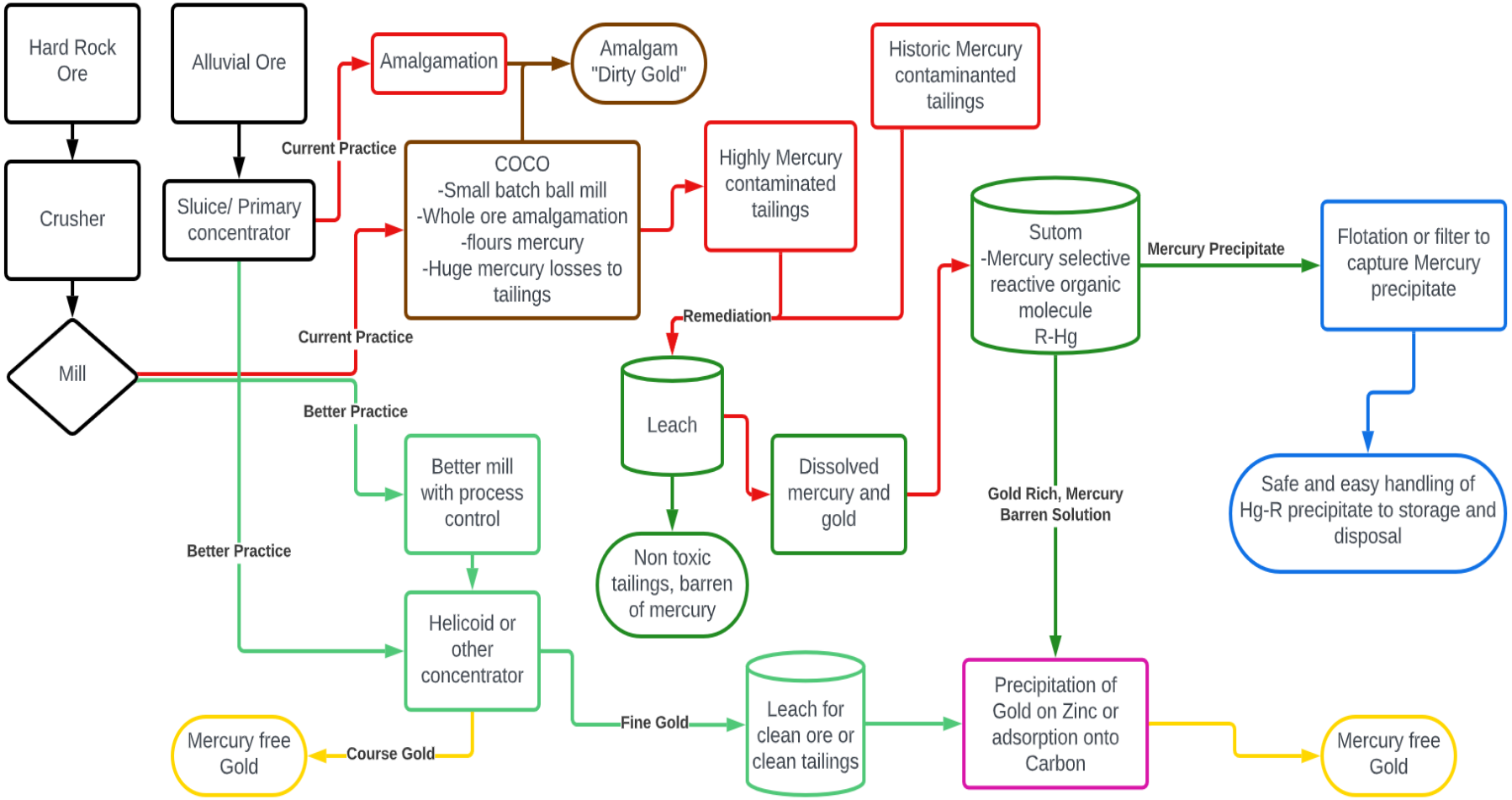
The province of Cauca, which has a mining tradition, its main economy is mining and agriculture. Exploitation occurs in areas such as gold, silver, coal and construction materials



Fundamental *pillars*



Mercury-free processing and tailings remediation *proposal*



Project schedule and *work plan matrix*

Activity	2023	2024				2025				2026			
	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1.1 Stakeholder engagement and desktop analysis													
1.2 Stakeholder meetings and validation workshop													
1.3 Data review and project inception report													
1.4 Site selection													
1.5 Regulatory policy workshops													
1.6 Workshops supporting the creation of action plans													
2.1 Acquire and deliver technology systems to two sites													
2.2 Perform technology demonstrations on two sites													
2.3 Develop/implement manufacturing and servicing plan													
3.1 Train and deploy local technology use & dissemination team													
3.2 Train government on tech benefits and health incentives													
4.1 Monitoring and Evaluation													
4.2 Project communication and results sharing system													
4.3 Project performance report: technology and regulations													
4.4 Project closure/lessons learned workshop													

The *team*

AGC Project Director – Dr. Kevin Telmer PhD - Canada based: Will oversee all project activities and will have lead responsibility for project design and communications.

AGC Project Coordination and Financial Administration – Roger Tissot, MA, MBA; Ping Zhao, CPA, CA - Canada based: Will be responsible for ensuring that the project is governed well and executed in a timely and cost-effective manner and that the project is in tight coordination with other synergistic AGC projects and activities.

AGC Technical Expert and AGC National Project Manager in Colombia –Julio César Porras Ramírez (Julio Porras) M.Sc., Colombia Based: Will be responsible for coordinating ongoing project activities in Colombia and acting as a resource to project personnel and partners including government agencies. Will work with the project director on all aspects of the project. Julio has worked with the AGC since 2019 and with Dr. Telmer over the last decade. He is an experienced and published professional geologist with extensive Colombian ASGM experience.

AGC Technical Expert and Project Services Officer in Colombia – David Eugenio López Zuluaga (Eugenio Lopéz) – B.Sc. Colombia Based: Will acting as a resource to project staff and partners particularly with regards to environmental compliance, GIS and software needs, field work, geology, and social aspects of artisanal mining communities. Eugenio has been working with AGC since 2020 and has 9 years of experience in geological environmental and social economic aspects of ASGM. Reports to the AGC National Project Manager in Colombia.

AGC Technical Consultant, Roberto Vargas, PEng. – Peru based. Mr. Vargas and Dr. Telmer have worked together over the last five years on the technology described in this proposal. Mr. Vargas is the owner of a metallurgical fabricator in Peru called METASIL that has invented the SUTOM technology and METASIL has fabricated on behalf of Dr. Telmer the Helicoid Concentrator. Mr. Vargas will consult on the technological aspects of the project.

Technical experts and assistants – Colombia Based

The *team*

Rene Roger Tissot

Executive Director

Artisanal Gold Council

Julio César Porras R.

National Project Manager

Artisanal Gold Council

Colombia

jporras@artisanalgold.org

THANK YOU!

BUREAU OF OCEANS
AND INTERNATIONAL ENVIRONMENTAL
AND SCIENTIFIC AFFAIRS

OES

Office of Environmental Quality

Sustainable Mines Management Model for ASGM in Afro-Colombian Communities in the Chocó

Colombia Mercury Free Future

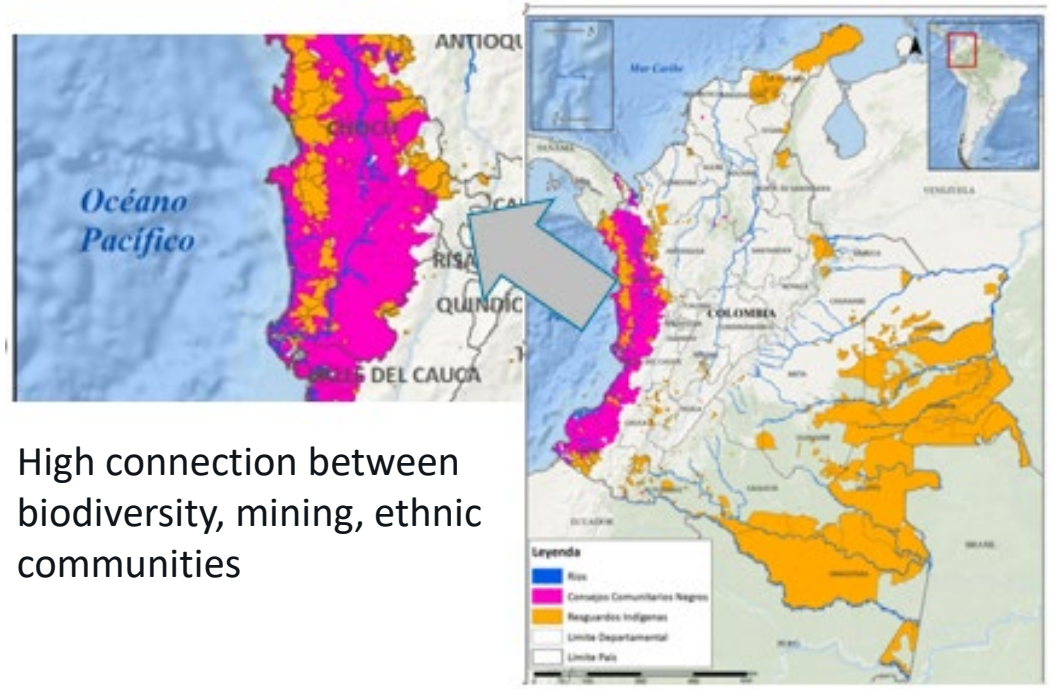
Sustainable Mines Management Model for ASGM in Afro-Colombian Communities in the Chocó Region

Colombia Mercury Free Future

Sustainable Mines Management Model for ASGM in Afro-Colombian Communities in the Chocó

Colombia Mercury Free Future

Natural- Social Context



High connection between biodiversity, mining, ethnic communities

WWF USA; WWF Colombia; Alliance for Responsible Mining (ARM); Environmental Research Institute of the Pacific (IIAP)

Ethnic communities: Afro-Colombian Community Councils of ASOCASAN and COCOMAUPA

ASOCASAN			COCOMAUPA		
Community council	**Special Reserve Area of mining**	**Special Concession Contract**	**Community council**	**Special Reserve Area of mining**	**Special Concession Contract**
2001 54.517 ha. 58% rainforest	2020 898,8 ha	2021 898,8 ha	2001 15.484 ha. 77% rainforest	2020 572,3 ha	2021 572,3 ha

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Sustainable Mines Management Model for ASGM in Afro-Colombian Communities in the Chocó

Colombia Mercury Free Future

Project Purpose

Two Afro-Colombian community councils (***ethnic people***) in the Chocó region will access new and legal gold markets, improve their productive practices, and maintain legality to ensure that mercury is not used in mining sites in their ***ethnic territories***. The project's goal is to strengthen the resilience of ASGM in ***ethnic communities*** in Colombia to withstand pressure from actors within the informal sector to sell gold outside the formal supply chain or to purchase mercury for gold processing.

October 1, 2020 to September 30, 2024

By the Numbers

2.0 140% completed	200 112.5% completed	2 99% completed	2 100% completed	100* 130% completed	150* 100% completed	200* 108% completed	4 100% completed	4 75% completed
Reduction of Hg release (in Metric Tons)	Hg-free gold produced (Kg)	mining organizations formalize their mining activities	mining organizations contribute to SDO 2030	people starting/ completing registration process to legal miners	people trained in Hg-free gold processing	people receiving training in NR / Biodivers. Conserv.	laws, policies, regulations Biodivers. Conserv. proposed, adopted or implemented	papers contribute to make better international policies

Sustainable Mines Management Model for ASGM in Afro-Colombian Communities in the Chocó

Colombia Mercury Free Future

Key Achievements and Lessons Learned

Key achievements

- The mining production registry was submitted to advance the traceability of the mineral (Asocasan).
- The process of reviewing and updating the environmental impact assessment was advanced and recommendations were made to update the Work and Construction Plans (Asocasan).
- The mining organization's access to formal markets was strengthened with improved conditions through ARM´s "Sustainable Mines" progressive improvement program based on CRAFT Code and Fairmined standard.
- Two decrees were supported by the project and effectively issued by the national government on 25 August 2023:

  Decree 1384 of 2023 in relation to renewable natural resources and the environment in the collective territories of Afro Colombian communities.

  Decree 1396 on the special mechanisms for the promotion and development of mining activities in the collective territories.

Lessons Learned

- Afro-Colombian Collective Territories (Community Councils) have different governance rules and planning processes that they want to implement in their territories.
- The concept of *traditional mining* is different for institutions and for ethnic peoples.

Sustainable Mines Management Model for ASGM in Afro-Colombian Communities in the Chocó

Colombia Mercury Free Future

Amendment 2023-2024

- Strengthen the capacity of Community Councils to complete environmental and socioeconomic monitoring in areas impacted by mining.
- Strengthen the community communication and governance processes between the Boards of the Community Councils and the miners who are part of the ASMs.
- Engage in advocacy on mining regulatory processes in the framework of the new National Development Plan.
- Strengthen a group of women ancestral artisanal miners in Unión Panamericana.
- Update and publish the Guide to Good Mining Practices.
- Design of Forest Smart Mining criteria for inclusion in the REDD+ prefeasibility Project.




Mercury-Free Artisanal Small-Scale Gold Mining

"Mercury-Free ASGM"

[November 2023]

Project Overview

The Mercury-Free Artisanal Small-Scale Gold Mining (ASGM) project is a two-year cooperative agreement between the U.S. Department of State and Global Communities (GC). The project aims to increase the use of mercury-free gold production techniques by artisanal and small-scale gold miners in the eastern part of the DRC, and to move the DRC towards ratification of the Minamata Convention. It will:

- Evaluate gold ores in order to set up mercury-free gold processing units and train cooperatives in the use and maintenance of the equipment;
- Develop sustainable financing and business models for the ownership and management of mercury-free ASGM processing centers and equipment;
- Facilitate the strengthening of dialogue between actors in the chain in order to extend advocacy efforts at national level for the ratification of the Minamata Convention by the DRC.

Project scope: five provinces covered by USAID-funded Zahabu Safi (Clean Gold) project, Haut-Uélé, Ituri, Maniema, North and South Kivu.

The project will contribute to the objective of the national action plan on the reduction of mercury use in ASGM to formalize and mechanize it, through capacity building of all stakeholders with the aim of mitigating environmental and health impacts, and unlocking the full potential of the sector's socio-economic and sustainable development

Project Targets

Global Communities

1) Setting up mercury-free ASGM processing units.

- Assess and analyze gold ore characteristics; design mercury-free gold processing technologies specific to each targeted mine site;
- Establishment of mercury-free gold processing technology at targeted mining sites;
- Training cooperatives in the use and maintenance of mercury-free gold processing equipment;
- Raising awareness among ASGM artisanal miners and local communities of the dangers of mercury to human health and the environment.

2) Development of sustainable financing and business models.

- Training cooperatives to manage a mercury-free gold processing center;
- Developing business plans with private sector players (mining cooperatives);
- Leverage on the RGIF in acquiring and continuing to use the technology after the project.

3) Ratification of the Minamata Convention by the DRC

- Case study, impact of mercury use in ASGM on health and the environment;
- Facilitation of dialogue between actors in the chain;
- Extending advocacy efforts at provincial and national level for ratification of the convention by the DRC;
- Setting up a steering committee (to ensure coordination of the players, strengthen the frameworks for dialogue and advocacy for ratification of the convention by the DRC).

Partners and Stakeholders

Global Communities

For implementation, Global Communities will draw on the expertise of the IFEDD-CEMC consortium, and on that of other independent consultants who will join the project as required.

The project collaborates with several stakeholders:

- Ministries of Mines, Environment and Health;
- General secretariats and provincial divisions of mines, environment and health;
- Services such as SAEMAPE, CTCPM, ACE, etc.;
- Civil society and other national and international organizations in the artisanal mining sector.

The project will carry out the activities jointly with the Alliance for Responsible Mining (ARM) and Justice Plus. An MOU of this collaboration is in the review phase.

Project Challenges/Risks

- Obstacles related to the legal framework and compliance with ASGM obligations in the DRC.
- Armed conflict in certain provinces may prevent project teams from accessing them once they are affected by the conflict, and delay project deployment.
- Political risk: unrest may arise from elections, particularly in the event of contested results. Changes in the leadership of public institutions following elections can interrupt the momentum of the project with the advent of new collaborators.
- The deployment of a mercury-free gold processing technology, with the constraints of accessibility to the mine site and access to electrical power, is likely to be costly, while the budget is limited.
- The closure of the USAID-funded Zahabu Safi (Clean Gold) Project, the main one implemented by GC, will affect the staffing of the country office by reducing technical and administrative support. Hence the need for an additional budget to fill the gap created by this closure.

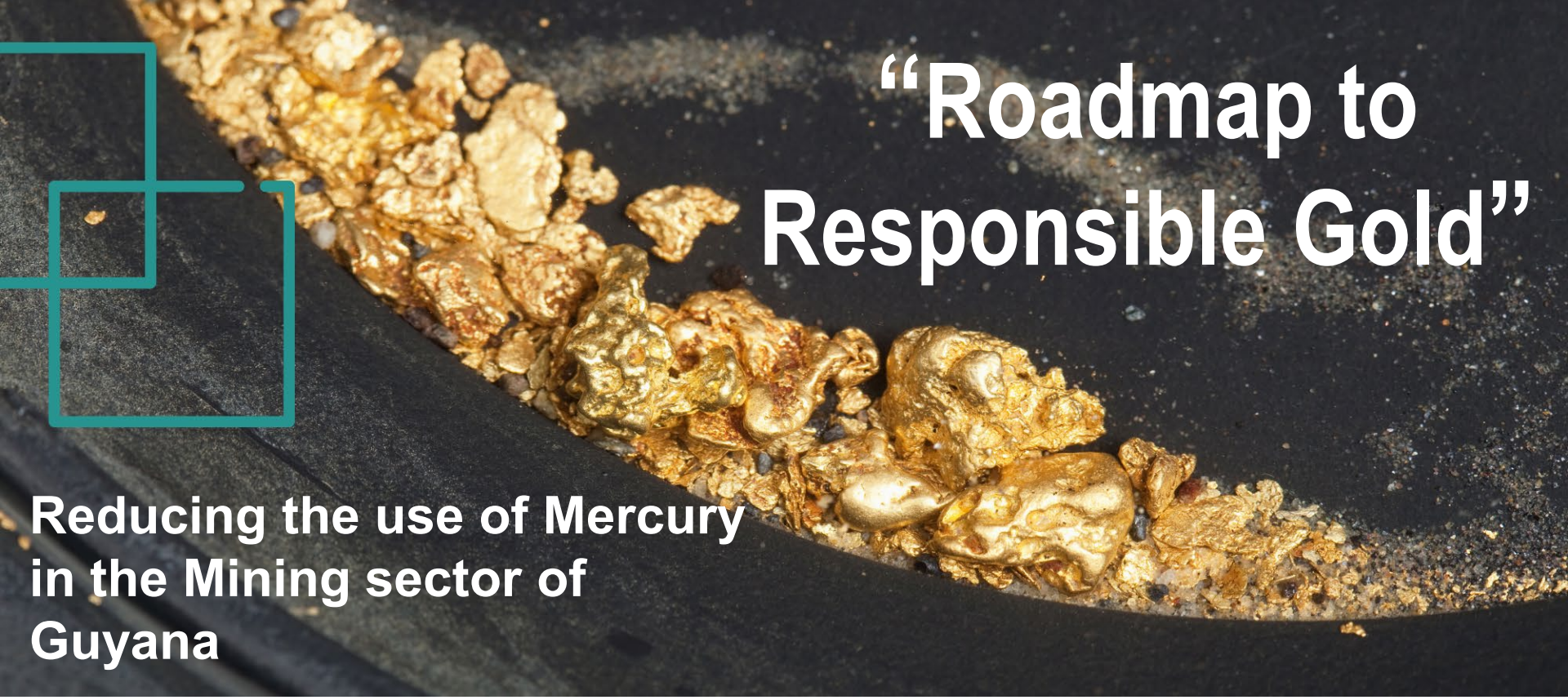
On the Horizon

Mercury-free ASGM can open up several possible horizons, for example:

- Lobbying gold exporters and buyers to recognize gold produced with the use of mercury as unfit and discourage its use;
- Control of the mercury supply chain in the DRC;
- Banning all sales of mercury for artisanal gold mining;
- Mobilization of funds for a nationwide mercury-free ASGM program;
- Development of environmental and health programs in the areas surrounding ASGM.

Global Communities

Thank You!



"Roadmap to Responsible Gold"

Reducing the use of Mercury in the Mining sector of Guyana

Presented By: Vasquez Ramdas, National Project Coordinator- Guyana
Artisanal Gold Council (AGC)

Title of Project : Roadmap to Responsible Gold.

THIS PROJECT IS DESIGNED TO ENHANCE EXISTING NATIONAL STRATEGIE TO BUILD A RESPONSIBLE MERCURY-FREE GOLD PRODUCING SECTOR IN GUYANA.

Aim/Goal/Objective- To **reduce the use of mercury** in the artisanal and small-scale gold mining (ASGM) sector in Guyana.

Purpose- To **identification of appropriate technologies** and **business models** for mercury-free gold production in the ASGM sector.

Funded by: United States Department of State funded project.

Implementation Agency: The AGC.

Duration: 36 months.

Grant total: USD 843,000.

Starting Date: March 2023.

The Four Pillars/Components of the Project.

PILLAR ONE	PILLAR TWO	PILLAR THREE	PILLAR FOUR
Coordination, scoping, identification of potential partnerships to build an in-country network of stakeholder support.	Identification of promising pilot sites and characterization of site conditions including the geological, mineralogical and metallurgical potential.	Define a road map for the creation of a Guyanese Hg-free small-scale gold mining enterprise.	Monitor project progress and results in order to share lessons learned with stakeholders.
Currently in Pillar two- Site assessment, screening and selection.			

Milestone Achievement: Pillar #1

ACTION ITEM	MILESTONE	STATUS	START	END	NOTES
1. Stakeholder Mapping, Scoping and Coordination					
1.2 Id. Stakeholders- Roles and Responsibilities, SWOT analysis.	Stakeholder Mapping Scooping and coordination.	Complete	3/30/2023	4/30/2023	Stakeholder mapping report.
1.2 MoU with Stakeholder.	MOU and Agreements	Complete	6/1/2023	6/1/2024	-MNR support of the project (JPPR) -GGMC commissioner technical, to support the project; personal support in field activity; and access to the GGMC MPU-Lab. -One MOU was signed with the GWMO. -One agreement is to be signed pending the selection of the pilot site.
2.3 Analysis of the Sector	Contextual Study	First draft completed	9/1/2023	12/1/2023	Final document by December 2023.

Milestone Achievement under Pillar #2

ACTION Item	MILESTONE	STATUS	START	END	NOTES
2. Site Identification and Selection					
2.1 ID 7-10 sites for screening and assessment.	List of potential sites and Develop site screening criteria.	Complete	6/1/2023	6/30/2023	-List of potential areas: research from GGMC on high mining/high active areas, NAP-Mercury, list of high priority areas, data from previous projects, knowledge from previous work experience developed site screening criteria.
2.2 Develop a site resource assessment and gold estimation tool (RAGET).	Report on the RAGET developed for Guyana	Complete	6/1/2023	7/1/2023	-Template developed by AGC, past project template, and tailored to Guyana.
2.3 Conduct site assessments using the tools developed.	Site visit report on the assessment conducted.	Complete	9/8/2023	9/22/2023	-The AGC team visited 8 different sites in two major mining districts in Guyana (M.D. #2-Potaro and M.D. # 4-Cuyuni Mazaruni).executed the site resource assessment and collected soil samples for analysis.
2.4 Screening and Selection of Sites	Site selection report with selection tools attached	in Progress	10/1/2023	12/15/2023	-A selection report is being prepared. -Awaiting soil analysis results to complete the selection of the pilot site.
2.5 Geotechnical report on the selected site	Technical report on the selected site	in progress	10/2/2023	12/16/2023	-To be done by AGC consultant geologist Peter Holmes.

Milestone Achievement under Pillar #3

ACTION	MILESTONE	STATUS	START	END	NOTES
3.0 Creating a RoadMap for the developing of a Hg free social enterprise.					
3.1 Business plan for the selected site.	Template 43-101	In progress	1/1/2024	4/30/2024	-Together with GWMO and the local miner.
3.2 Creating a technical handbook on Hg processing technologies and their potential applications for Guyana environments	Technical handbook on Hg-free processing tech	In progress	1/2/2024	5/1/2024	-Together with the GWMO, GGMC, CI-Guyana, EPA, and other key stakeholders
3.3 Instillation of mercury-free technology	Mercury-free technology instillation	In progress	3/1/2024	4/30/2024	-Frequent meetings with the AGC tech team to discuss implementation plans, design, resource needs, etc.—AGC tech team to travel to Guyana within this period for the instillation
3.4 A workshop on the project to be held and documented.	Report on Workshop	In Progress	5/1/2024	8/30/2024	-Share project updates. Discuss collaboration and fostering good relationships moving forward.

Milestone Achievement under Pillar #4

ACTION Item	MILESTONE	STATUS	START	END	NOTES
4. Monitoring and Evaluation					
4.1 Develop M&E plan	M&E Plan	Not started	4/1/2024	4/30/2024	AGC template from previous projects.
4.2 Conduct monitoring	Implementation of the M&E plan	Not started	5/1/2024	5/30/2025	Independent person to conduct periodic data collection.
4.3 Report on Lessons Learnt	M&E report	Not started	6/1/2025	8/30/2025	-The final report is to be shared with stakeholders and mining communities. - Lessons learned and recommendations with best practices identified
4.4 Project Closure Meeting	Meeting Report	Not started	9/1/2025	10/30/2025	-Meeting with key stakeholders and with ASGM communities to provide feedback and updates on the project and to share lessons learned.
4.5 Close of Project	Final report on the project	Not started	10/1/2025	12/15/2025	Final project report.

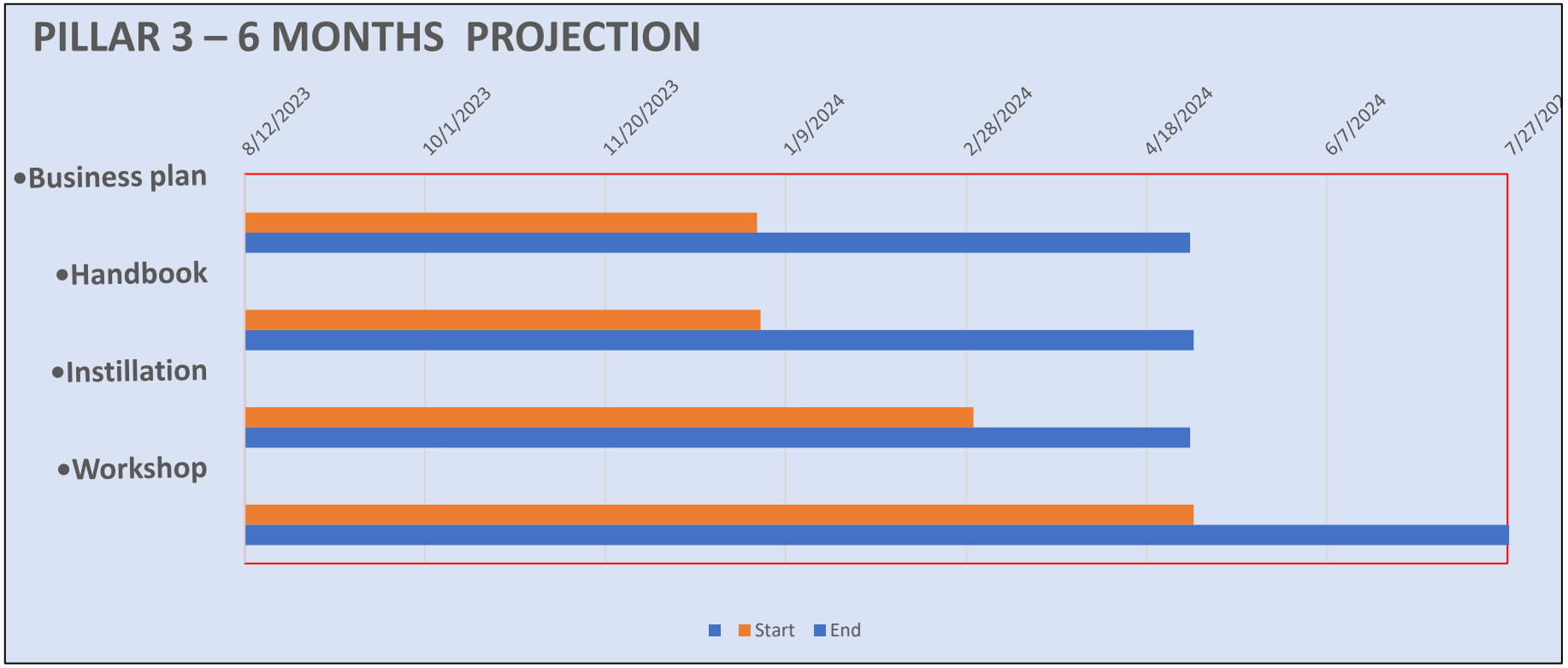
KEY ACHIEVEMENTS BY THE NUMBERS

3	2	2	7
Key stakeholder partnerships were established; 1. GGMC 2. GWMO 3. Local miner	MoU and Agreement; 1: Signed with the GWMO 1: With a local miner, pending selection of the pilot site	Public press release and website blog. 1. Ministry of Natural Resources (MNR) 2. GWMO and AGC, Blog	Mining operation is under review for the selection of a pilot site.

Next steps

Immediate task

- Finalize the site selection- Awaiting lab results on soil test to support selection.
- Preparing a site selection report and attaching the selection tool used.
- Geotechnical report for the selected site.



Major Challenge

- Reluctance of numerous medium-scale miners, who, as property owners and accomplished operators, to engage in any project initiatives—particularly those targeting the reduction of mercury usage.
- Their skepticism is due to the perception that previous projects failed to yield tangible benefits.
- Conversely, a contrasting enthusiasm is observed among many smaller miners, who express keen interest in the project and in enhancing recovery methods, while also seeking technical or financial opportunity/support.
- Despite their enthusiasm, these smaller-scale miners, lacking land ownership, encounter barriers to participation.
- Operating in a nomadic fashion, these miners have the largest direct environmental impact, underscoring the imperative for targeted intervention and improvement measures.

Lessons Learnt

- A critical issue observed has been the historical failure of projects to share crucial geological data, project updates, and final reports with miners.
- The ineffectiveness of previously tested mercury-free equipment, such as centrifuges and gravity systems, was largely due to their prohibitive costs and technical complexities.
- Equally important was learning that prior initiatives fell short in conducting proper exploration, ore characterization, and gold classification.
- This deficiency was reflected into incorrect flow sheets and mass balance calculations, rendering the selection of recovery methods and equipment for demonstrations inadequate for the chosen site.
- Given miners' interest in tangible outcomes, any mercury-free or reduction methods must prove both cost-effective and operationally efficient.
- Post-mining exploration is equally significant when contemplating any mine reclamation program.

Recommendations

- Establishing cooperative partnerships with miners, where the benefits are transparent and can be shared with them, is a priority.
- The selection of processing methods and equipment should be guided by a thorough understanding of ore characterization.
- The project must acknowledge that exploration and assessment programs can sometimes be expensive, and budgetary allocations should account for this aspect.
- The identified systems should demonstrate the potential for economic viability, ensuring profitability to sustain operations while considering ore grade and recovery percentages.
- Furthermore, investing in mercury-free technology, capable of recovering not only gold but also other heavy metals and minerals, can serve as a compelling incentive for miners to consider mercury reduction paths.

Conclusion

- The AGC USDoS RTRGP has made remarkable progress since its launch in March 2023. Our journey began with a strong start, characterized by hitting the ground running. We've successfully reached several milestones, including establishing key partnerships with the government, NGOs, and local miners.

- The feedback from our stakeholders and miners has been overwhelmingly positive, indicating a strong uptake and engagement with our program. Notably, the field visit assessments provided invaluable insights, allowing us to learn important lessons from our interactions with miners and the mining community.

- This early success sets a solid foundation for our continued efforts to promote responsible gold practices and sustainable development. We look forward to building on these achievements in the months ahead.

Documents to share

https://drive.google.com/drive/folders/1-MVPamkYFRc1ynllwBMZx7EcLALrUg7n?usp=sharing

Link to the following:

1. List of site ID for site assessment.
2. Site screening and selection criteria.
3. Site assessment and gold estimation tool.
4. Google earth map showing site visited during assessment.
5. Pictures from field visit assessment.

THANK YOU!

Geomorphic Mapping and Resource Assessment to Reduce Impacts of Artisanal and Small-Scale Gold Mining (ASGM)

IAA1931882Y0019

Peter G. Chirico, Jessica D. DeWitt, Marissa A. Alessi
U.S. Geological Survey, Florence Bascom Geoscience Center, Special Geologic Studies Project

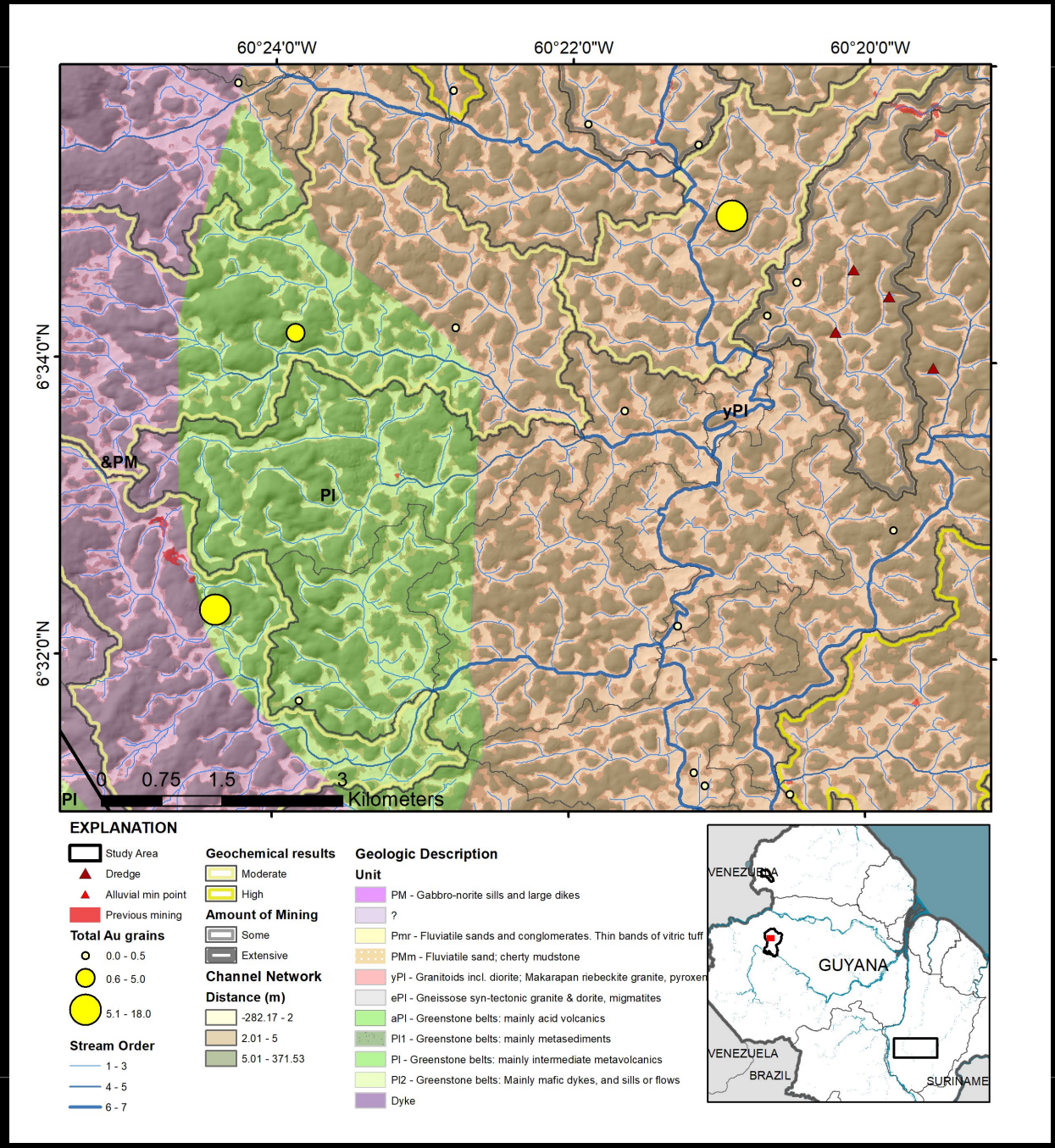
U.S. Department of State, Bureau of Oceans and International Environment and Scientific Affairs

Overview

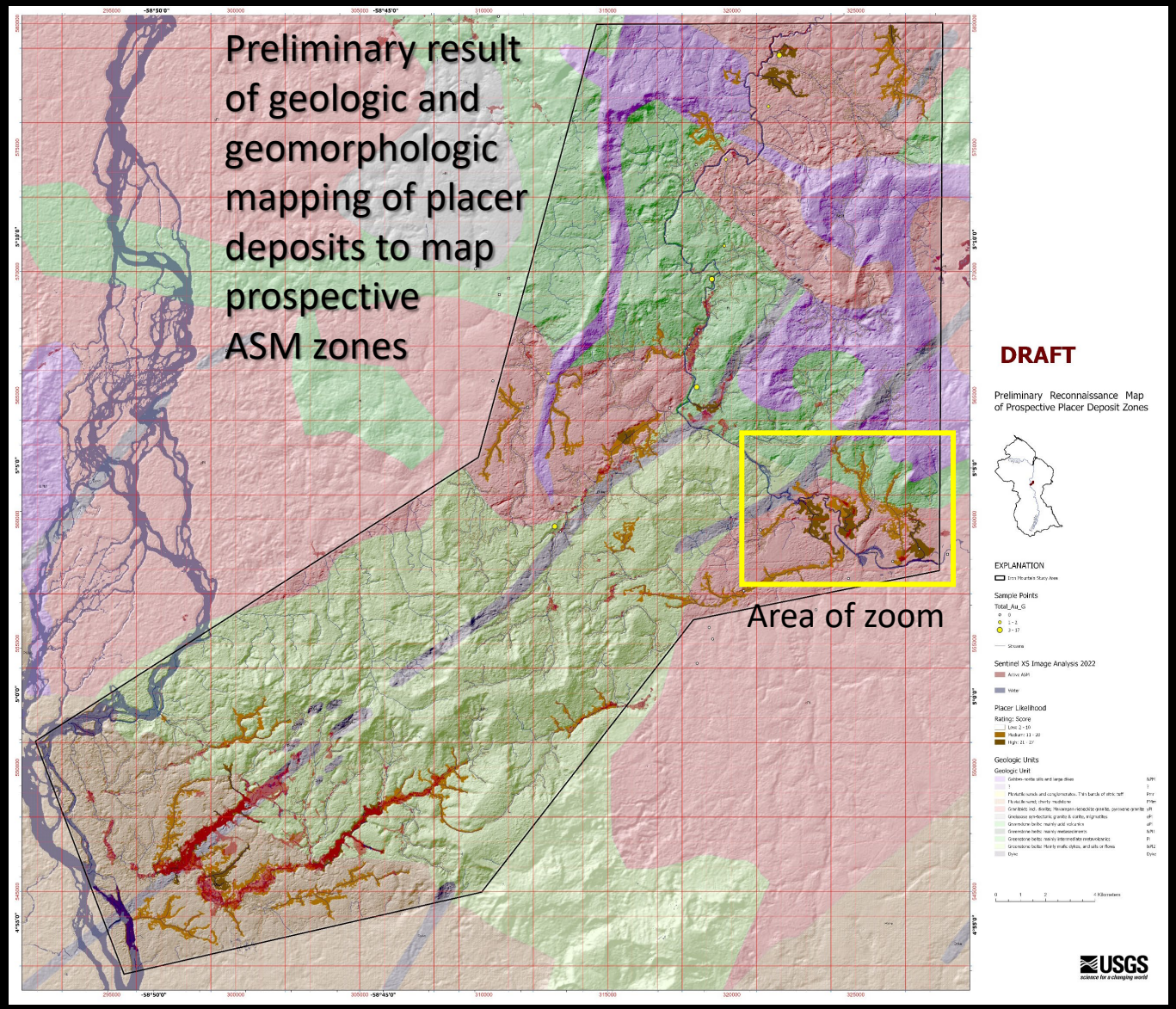
- Geomorphological Mapping Project
- Interagency Geoportal Development
- Turbidity Monitoring Project
- Training
  - Terrain Model Editing and Enhancement
  - Geomorphological Modeling and Mapping
  - Turbidity Monitoring
- Mercury Transit Routes
- Future Directions

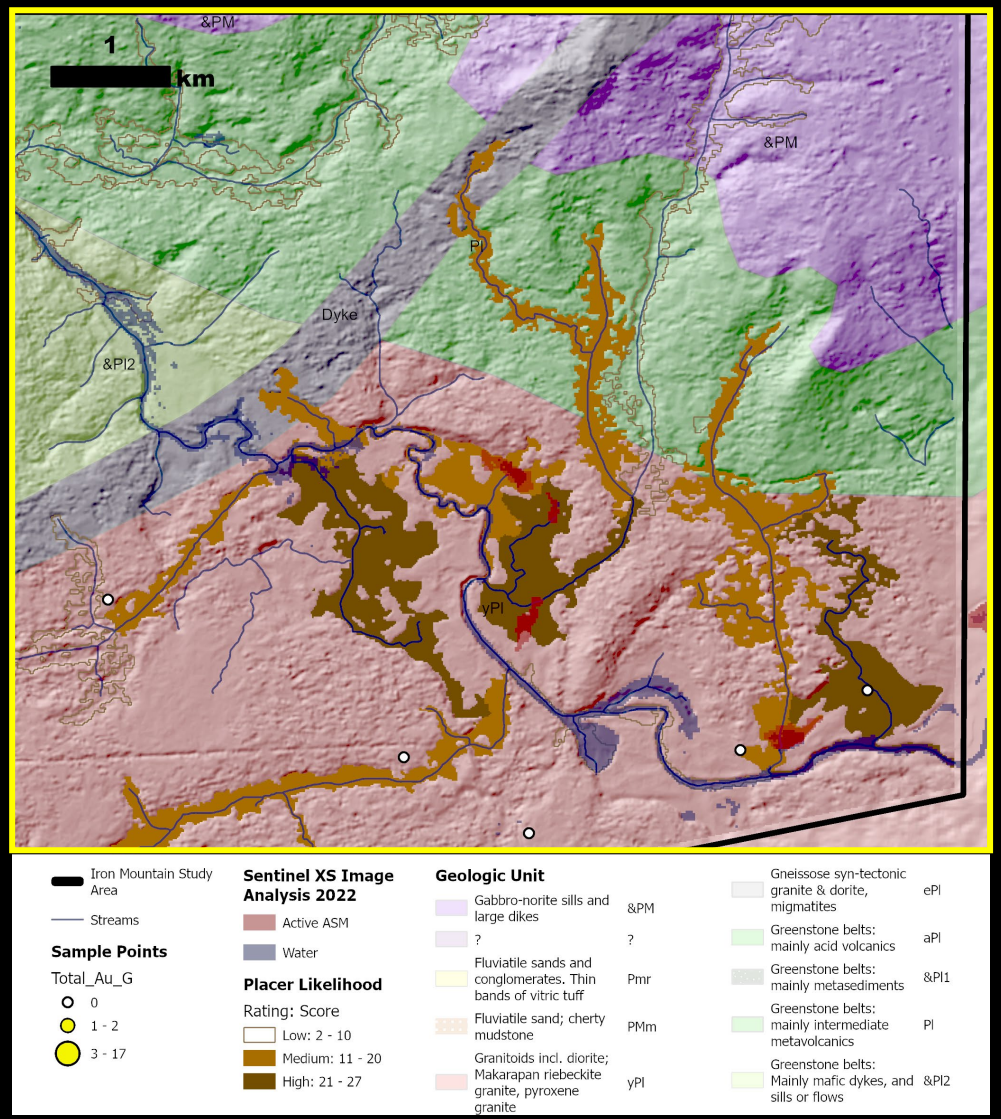
Geomorphological Mapping

- Phased, multi-scale approach.
- For both phases, substantial work was necessary to convert digital elevation models (DEM) to terrain models (DTM).
  - Phase 1: 2022
    - 3 AOIs (Isseneru, Baramita, and Iron Mountain)
    - Geomorphological mapping based on edited Copernicus (free) 30m DEM
    - Result: 1:60,000 scale map for each AOI
  - Phase 2: 2023
    - Per discussions in Working Geology Group, selected sub-watersheds of Iron Mtn AOI
    - Geomorphological mapping based on edited WorldView-12 ($) 12m DEM
    - Result: 1:24,000 scale map covering auriferous sub-watersheds



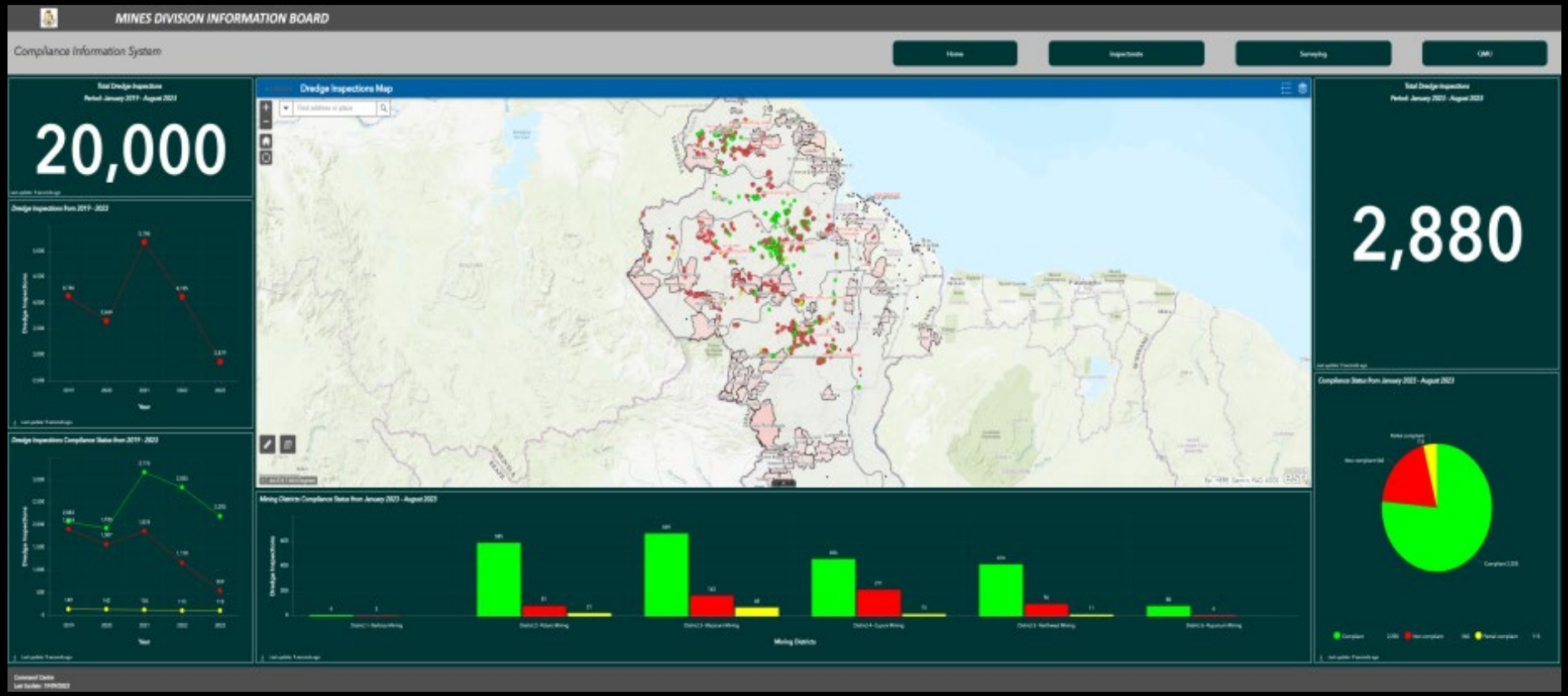
Geomorphological Mapping Phase 2





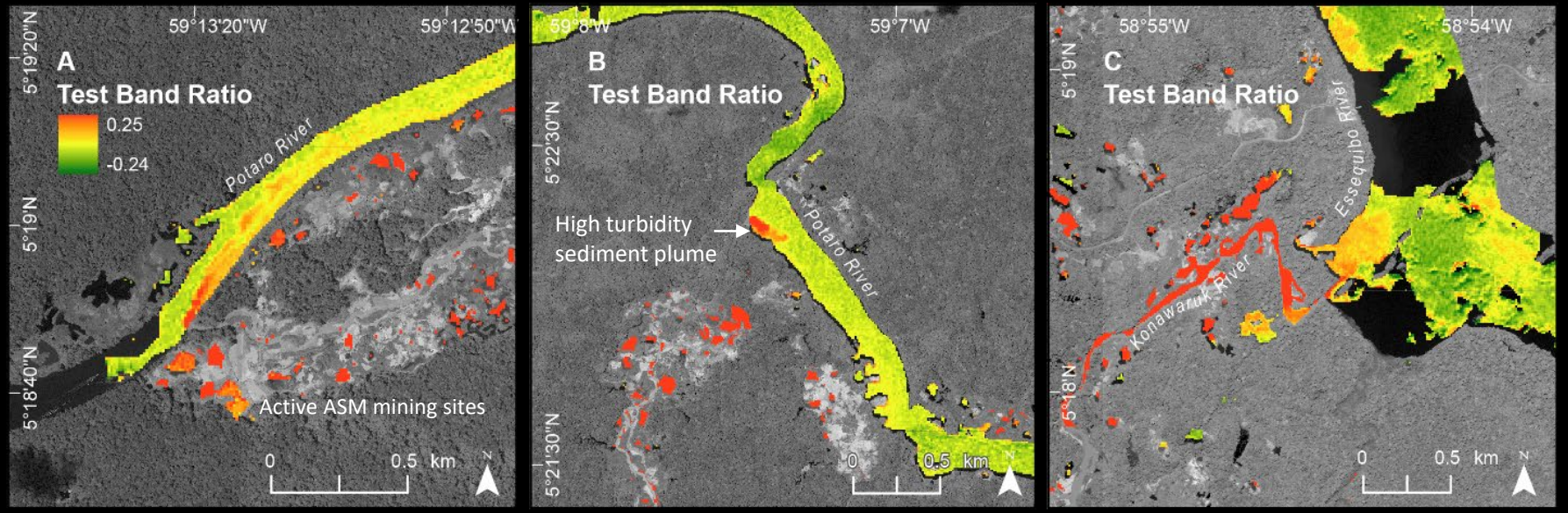
Geoportal Project

- MNR geoportal project began with US Emb. ESF project in 2020.
- Geoportal project continuation was a high priority need identified by MNR.
- Example at right is from GGMC Mines Division Information Board and monitors data on:
  - Data shows small and medium scale dredge operations' compliance status updated monthly.



Dredge compliance status is related to permitting, mercury use and disposal, and other compliance factors.

Turbidity Project



- Guyana EPA requested assistance in developing a procedure to monitor turbidity and environmental impacts of ASM in rivers.
- EPA, GGMC, and USGS collaborated to establish a methodology for mapping and monitoring turbidity in the rivers of Guyana through remote sensing and in-situ measurements on the Potaro River and the Puruni River.
- A correlation between Sentinel−2 satellite imagery reflectance values and in−situ turbidity values collected from the field work done in FY2022 is established, and a band ratio (mathmatical function) was created to estimate turbidity within the specific environmental conditions of Guyana.
- The ability to map turbidity in a timely and cost-efficient manner through remote sensing will aid in the monitoring of river health and the ASGM impact.
- Methods and findings have been compiled into a journal article (in review), which will be published early 2024.

Trainings

Mapping Turbidity with Remote Sensing Methods
2 weeks
18 participants (avg)
Described methods to estimate riverine turbidity near mining sites using satellite image analysis and remote sensing methods

"This would provide the EPA another method of assessing water quality [and] an early detection method of changes in water quality..."

"With a little more practice, I hope that I can [begin] remote monitoring of watersheds known to have a significant accumulation of mining operations."

Terrain Model Editing & Enhancement
8 weeks
29+ participants (avg)
Explained methods to convert a digital elevation model (DEM) into a digital terrain model (DTM) useful for hydrologic and geomorphological modeling

"The product of DEM editing is extremely useful in our field-based projects to guide logistics…[and] to delineate ground structures. This will be used to refine further projects in mineral exploration."

Geomorphological Modeling and Mapping
4 weeks
15 participants (avg)
Taught methods by which DEMs may be used to classify terrain into discrete units or landforms related to mineral deposition

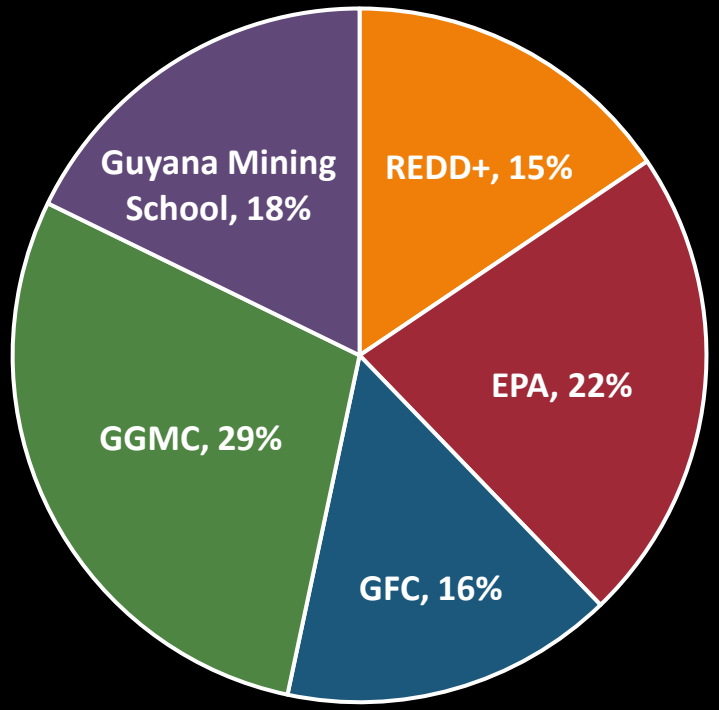
"The training will allow me to better design exploration surveys that incorporate remote sensing, geophysics, GIS and morphological analysis of the terrain and its sub surface, to target depositional sites for alluvial gold and diamonds and other structural controls of mineralization."

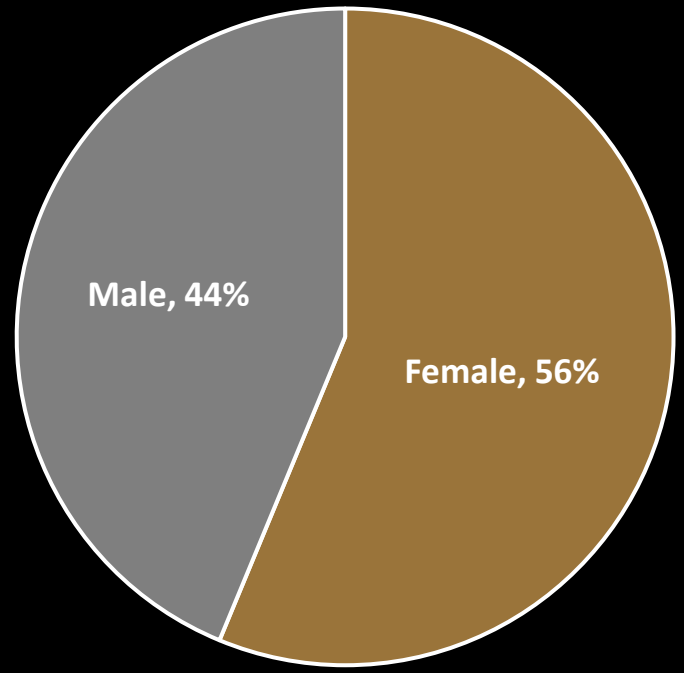
Trainings

- In total 48 participants attended at least one of the trainings.

- Participants learned a variety of skills including: remote sensing, basic image processing, digital elevation modelling (DEM), LiDAR processing, estimating canopy height, band math, geomorphic modeling, hydrological modelling, turbidity mapping.

- Each session has been recorded and is permanently available to all participants in an online format.



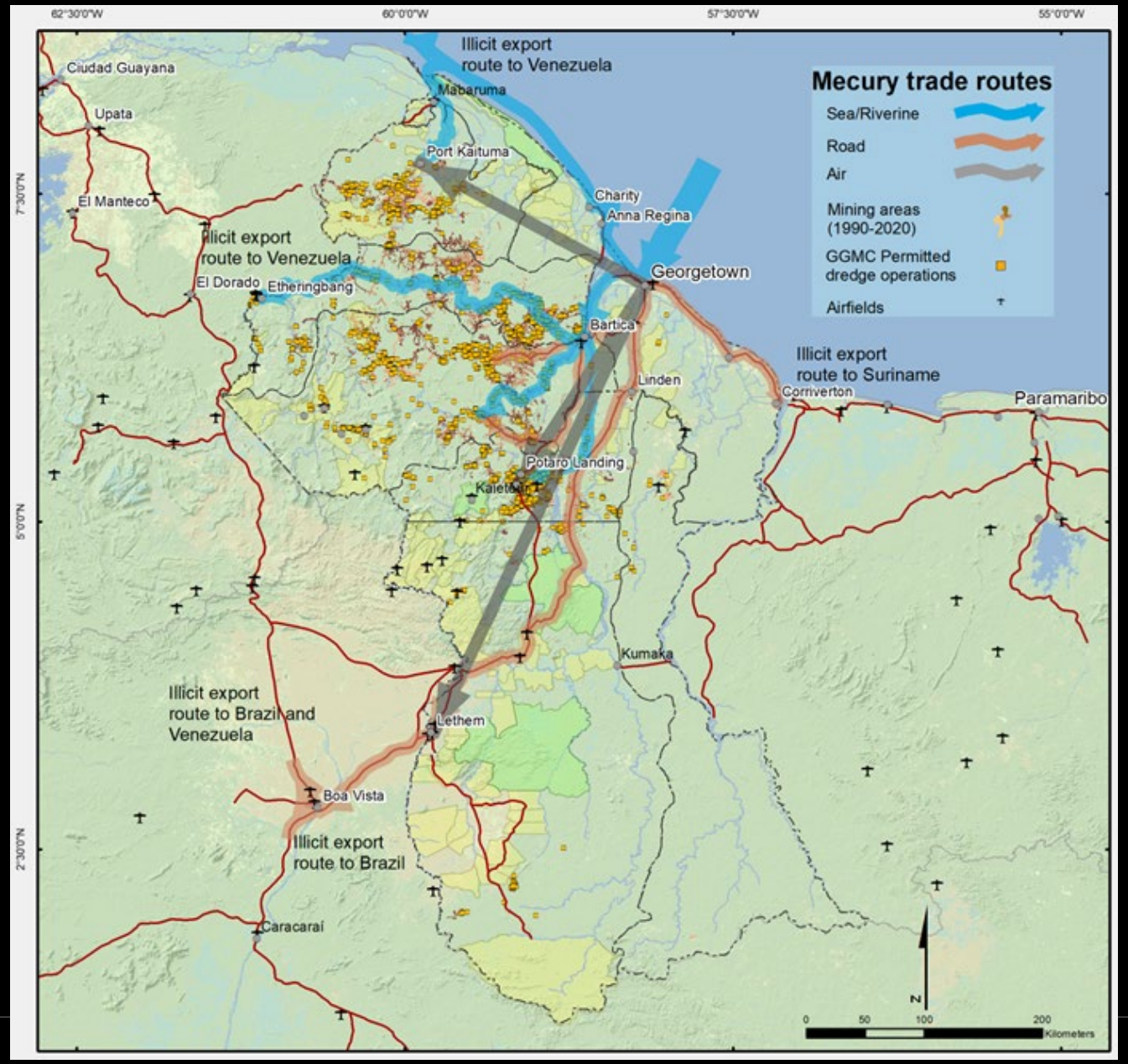


Synthesis of Hg and Au sources

Task 4.1 and 4.2 were originally focused on developing a conceptual framework regarding potential fractionation and ranges of isotope values associated with elemental Hg. This taks required a small preliminary data set to identify potential differences between elemental Hg sources.

During the in person visit to Guyana the USGS and US Embassy met with two local organizations and determined that mercury sampling and transport back to the US for analysis would not be feasible at this time.

Instead, the project created this pathways map to understand major transportation routes, major trading hubs, and how the mercury makes its way to mine sites.



Future Directions

- GGMC is preparing to deploy a mission to collect field data for validation of the placer deposit zones we identified.
  - We would like to do a validation study dependent on time and funding.

- Expand the turbidity project from two river reaches to priority mining districts and possibly utilize Maxar contract with EPA to conduct the analysis over time.

- Continue to work with GGMC and the mining school on methods to educate and distribute mapping results to ASGM miners.

- Partner with GGMC in deployment of RMS RIVEN Fine/Flat Gold Recovery System.
  - A mercury free gold recovery system pilot plant will be used in the gold saprolite ores and alluvial gravels at the test mine site to increase the successful economic recovery of finer and flatter gold values.
  - 20-40 metric tons per hour.

USGS

US DOS Annual Mercury Program Workshop

Promoting a Mercury-free Mali (Pro-MsM)

Jorden de Haan, Senior Officer
Halimata Barry, National Project Coordinator
Aly N. Diarra, Technical Expert on Gold Mining
Daniel Stapper, Manager

Friday 17 November, 2023

ASGM in Mali

- ~ 500,000 direct livelihoods
- ~2.5 million indirect livelihoods
- About **40-50% women**, 9% children, **50% youth**
- Annual production of **26-50 tonnes of gold**
- Uses > **33 tonnes of mercury**
- Largely **informal**
- But critical to **socio-economic stability** in Mali, good **alternative to non-state armed groups**

Promotion d’un Mali sans Mercure (Pro-MsM)

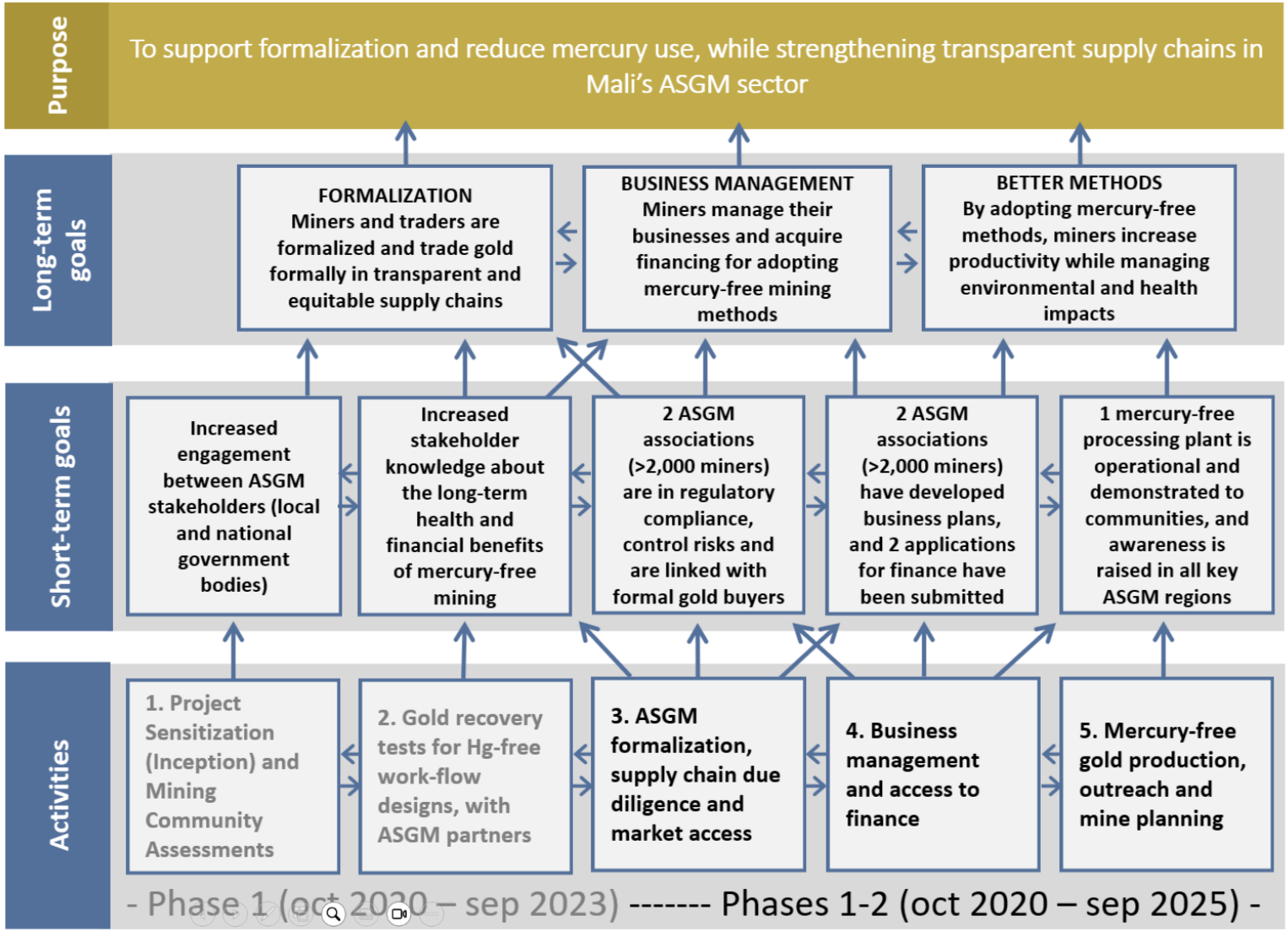
Project Overview

- Objective: Support formalization and reduce mercury use, while strengthening transparent supply chains in Mali’s ASGM sector
- Duration: October 2021 – September 2025
- Partners: Ministry of Mines, ASGM Association Dje Kabara (Keniéba, Kayes), ASGM Cooperative Damangule (Kangaba, Koulikoro), local authorities, private sector, civil society & media

Key components

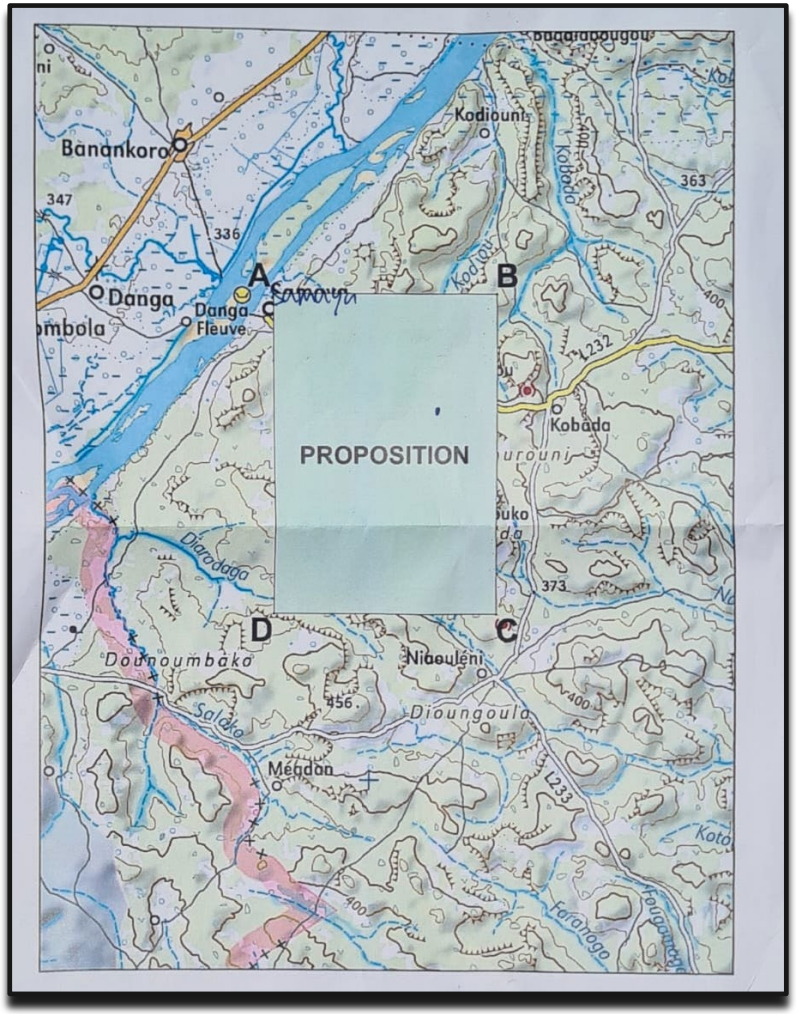
1. **Formalization, due diligence & market access**
2. **Business management & access to finance**
3. **Mercury-free gold production, awareness raising & sustainable mine planning**

Promotion d'un Mali sans Mercure (Pro-MsM)

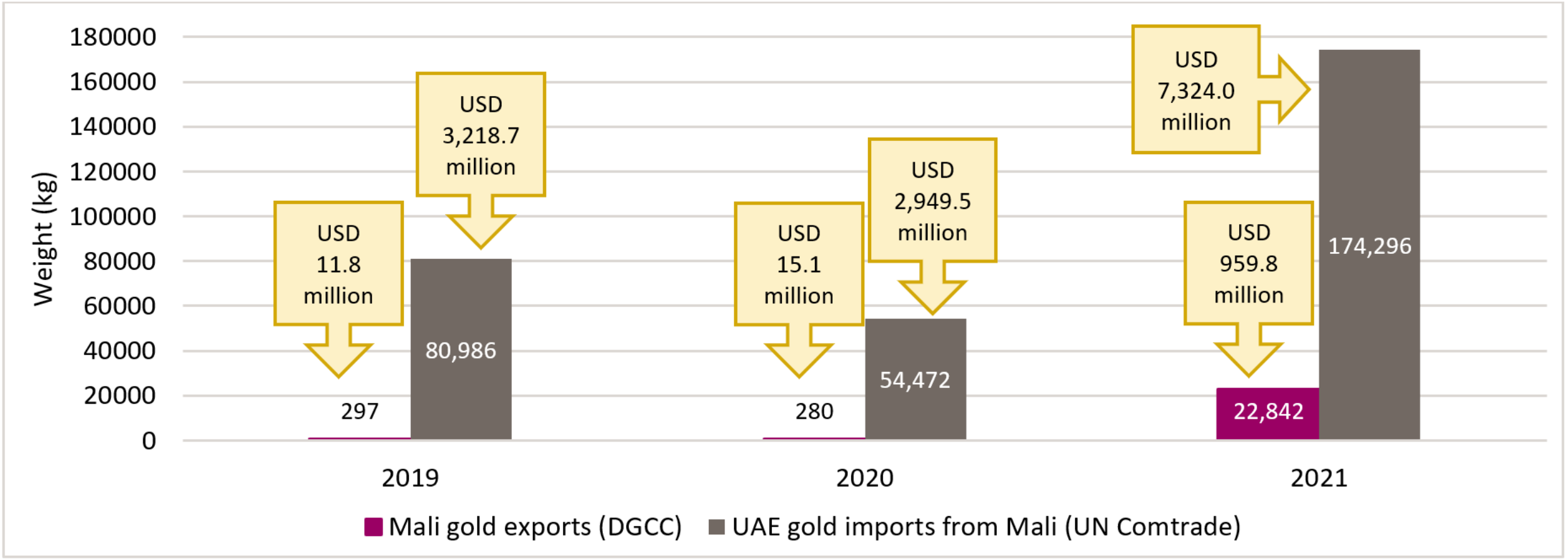


1) Grassroots Formalization Progress

- ✓ Engaged local stakeholders for relocating Dje Kabara's processing site on a large-scale mining concession
- ✓ Trained 61 association members on business management and completed an ASGM business plan
- ✓ Trained 196 ASGM stakeholders on formalization steps and regulatory frameworks
- ✓ Completed field assessments in Koulikoro and Sikasso regions
- ✓ Selected *Cooperative Damangule* as a second beneficiary (cooperative of 210 members involved in ASGM and farming)
- ✓ Engaged Toubani Mining in facilitating Damangule's access to its mining concession

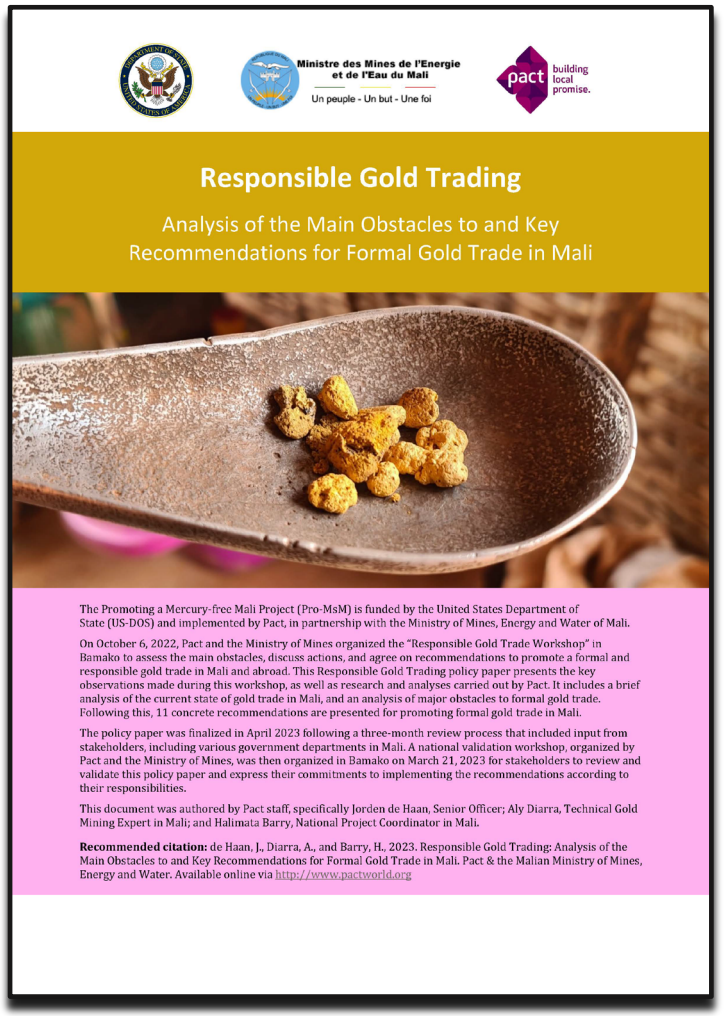


2) Formalization Progress Nationwide



3) Formalization Progress Nationwide

- ✓ Conducted two stakeholder engagement workshops in Bamako leading to the Validation of a *Responsible Gold Trading Policy Paper*
- ✓ Currently engaging the Prime Minister's office in establishing a 'comite de suivi' for overseeing the implementation of prioritized policy actions


Ministre des Mines de l'Energie et de l'Eau du Mali
Un peuple - Un but - Une foi

pact building local promise.

Responsible Gold Trading

Analysis of the Main Obstacles to and Key Recommendations for Formal Gold Trade in Mali

The Promoting a Mercury-free Mali Project (Pro-MsM) is funded by the United States Department of State (US-DOS) and implemented by Pact, in partnership with the Ministry of Mines, Energy and Water of Mali.

On October 6, 2022, Pact and the Ministry of Mines organized the "Responsible Gold Trade Workshop" in Bamako to assess the main obstacles, discuss actions, and agree on recommendations to promote a formal and responsible gold trade in Mali and abroad. This Responsible Gold Trading policy paper presents the key observations made during this workshop, as well as research and analyses carried out by Pact. It includes a brief analysis of the current state of gold trade in Mali, and an analysis of major obstacles to formal gold trade. Following this, 11 concrete recommendations are presented for promoting formal gold trade in Mali.

The policy paper was finalized in April 2023 following a three-month review process that included input from stakeholders, including various government departments in Mali. A national validation workshop, organized by Pact and the Ministry of Mines, was then organized in Bamako on March 21, 2023 for stakeholders to review and validate this policy paper and express their commitments to implementing the recommendations according to their responsibilities.

This document was authored by Pact staff, specifically Jorden de Haan, Senior Officer; Aly Diarra, Technical Gold Mining Expert in Mali; and Halimata Barry, National Project Coordinator in Mali.

Recommended citation: de Haan, J., Diarra, A., and Barry, H., 2023. Responsible Gold Trading: Analysis of the Main Obstacles to and Key Recommendations for Formal Gold Trade in Mali. Pact & the Malian Ministry of Mines, Energy and Water. Available online via http://www.pactworld.org

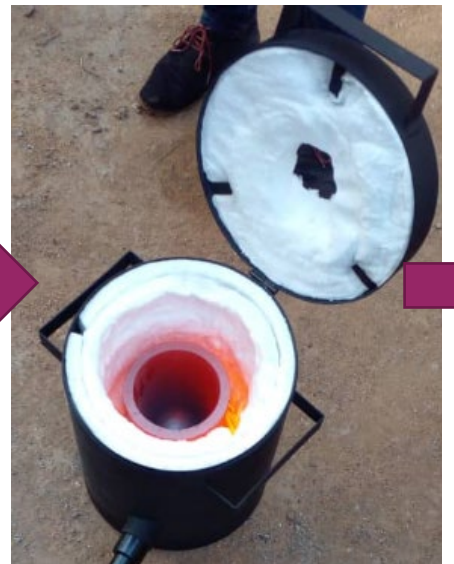
4) Progress in Sustainable Mine Planning

- ✓Successfully relocated Djeka Baara's Mineral processing site out of residential area to barren land
- ✓Constructed small hangar for equipment
- ✓Constructed fence, toilets, small office
- ✓Currently installing water & electricity

5) Recent progress in Mercury reduction

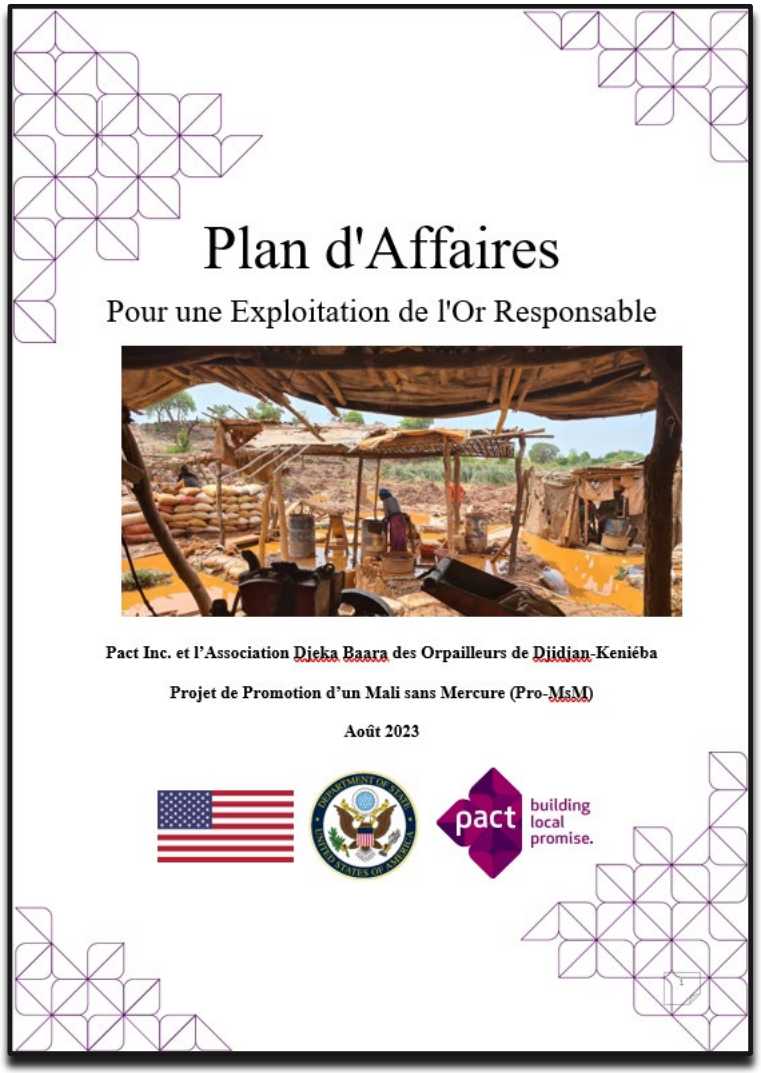
- ✓Completed laboratory tests to analyze ores
- ✓Trained 196 ASGM miners on mercury-free mineral processing
- ✓Completed all equipment fabrication with local manufacturer
- ✓Started awareness raising campaign

Crushing → Milling → Concentration → Smelting



6) Recent progress in Business Management

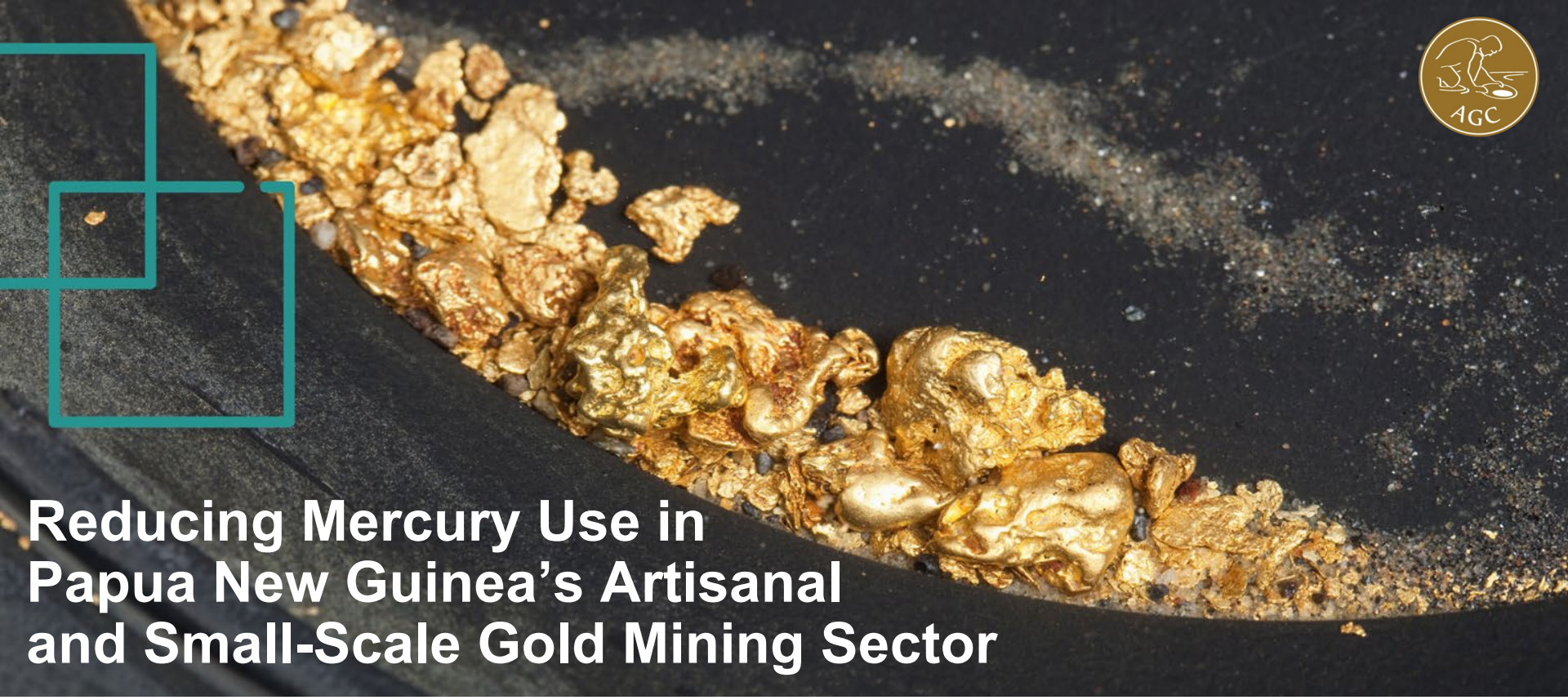
- ✓ Trained 61 members of *Djeka Baara* on business management & access to finance
- ✓ Completed *Djeka Baara's* Responsibe Mine Business Plan
- ✓ Engaged financial institutions in Bamako and Keniéba to review financial products and services
- ✓ Training Cooperative Damangule on business management & access to finance next week



Lessons learned thus far

- Land access remains the #1 formalization challenge in Mali
  - Importance of engaging industrial mining companies and local authorities in facilitating co-existence
  - Since this consumes considerable time and resources, they need to be allocated to such activities accordingly
- ASGM impacts all 17 SDGs
  - Importance of adaptive management, and encouraging & guiding ASGM associations to invest in broader sustainable mine / land planning issues
- Inefficiencies in sourcing mining equipment abroad
  - Importance of promoting local content by identifying, collaborating with and building the capacity of local equipment manufacturers
- Mali is becoming a *regional hub* for smuggling West African gold
  - Importance of adaptive management, prioritizing formalization and (high-level) government engagement to help *prevent* non-state armed groups from capturing gold supply chains

Questions?



Reducing Mercury Use in Papua New Guinea's Artisanal and Small-Scale Gold Mining Sector

Title of Project : Roadmap to Responsible Gold.

Papua New Guinea Progress Report

Activity 1 - A demonstration of mercury-free processing technology in Wau.

Activity 2 - Planning of the filming of an outreach video to be used for broad uptake of inventory and technology training.

Title of Project : Roadmap to Responsible Gold.

Papua New Guinea Progress Report

Activity 3 - Planning the deployment of outreach tools for a transect of 3-4 gold-producing areas, likely in PNG's highland interior.

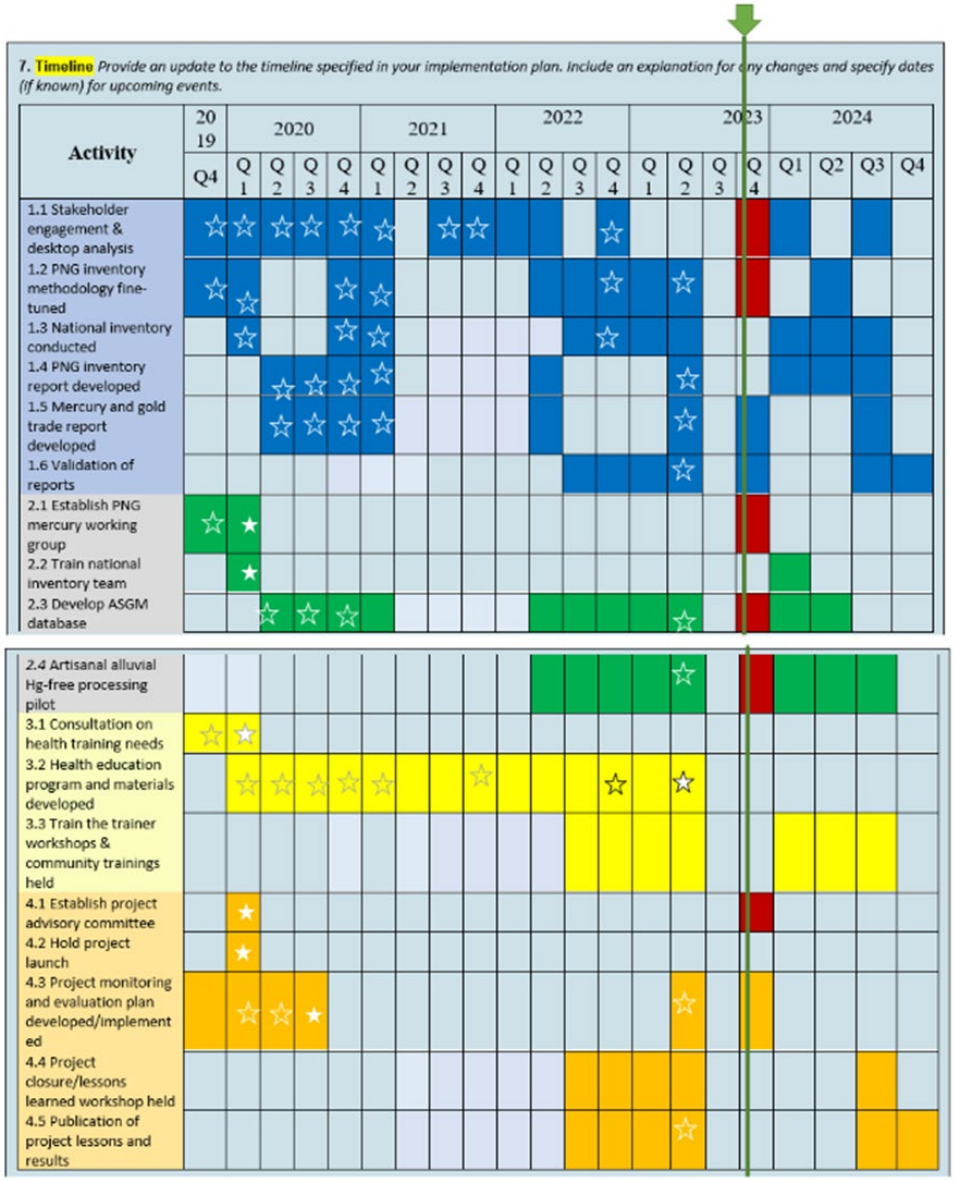
Activity 4 - Organizing assembly of miners from across PNG to attend in-person demonstrations and training in Wau in collaboration with the MRA, including health outreach workshop.

Title of Project : Roadmap to Responsible Gold.

Ongoing efforts:

- Meetings have been held with MRA, BPNG, and CEPA
- Agreement on strategy and activities for the completion of the project as per program approved (See progress chart below)

Title of Project : Roadmap to Responsible Gold.



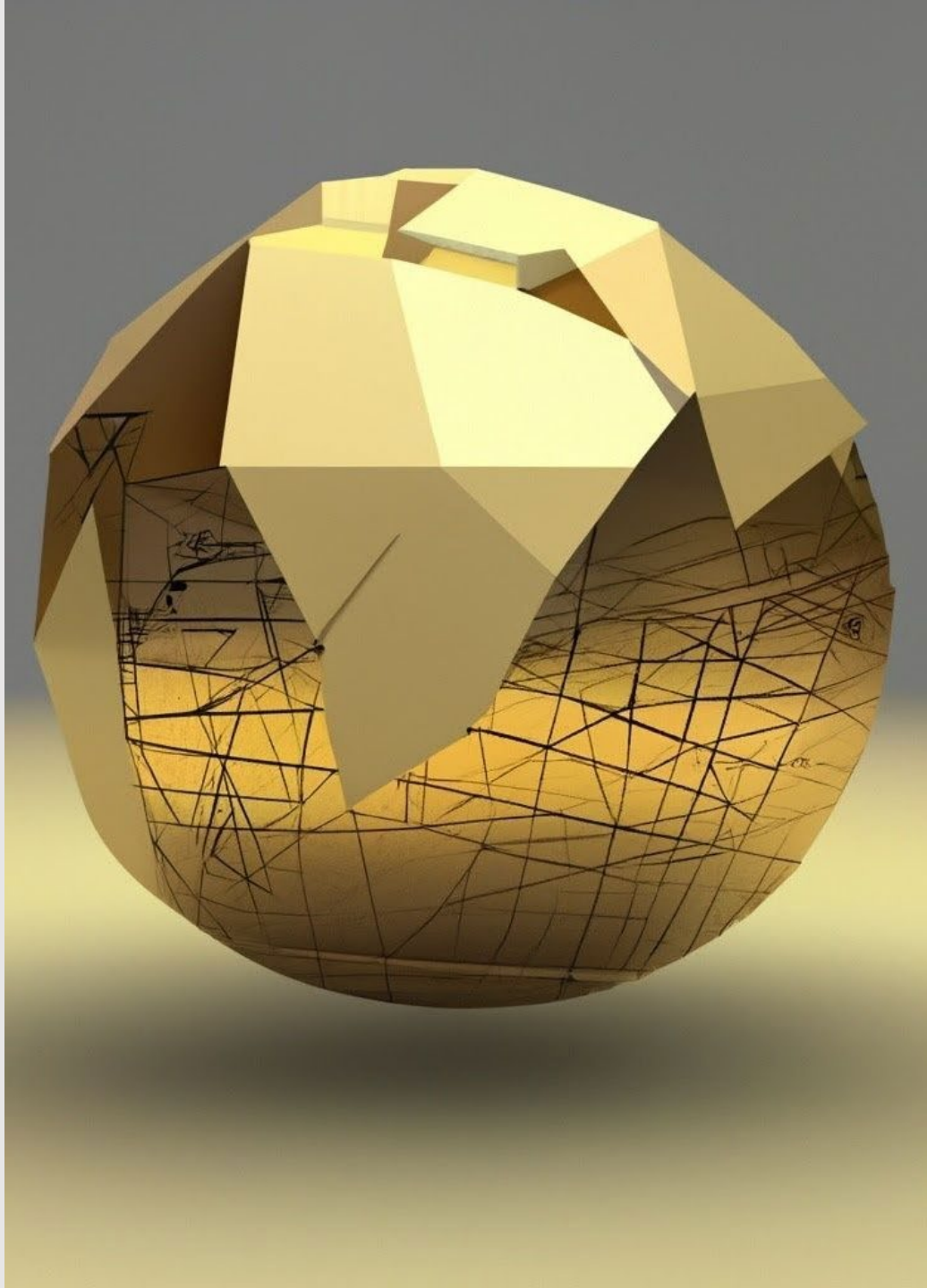
RED boxes indicated those activities which have seen progress since Oct 1, 2023.

THANK YOU!

RESOLVE

Developing a Global Coordination Model for ASGM

Project Overview, November 2023



Presentation Outline

1. Background
2. Context
3. OKRs
4. Implementation
5. Lessons Learned

Background

Rooted in "collaboration imperative" for the ASGM sector's complex global linkages

U.S. State Dept.-OES Mercury Program

- Largest anthropogenic mercury emissions source; integral to **addressing transboundary pollution**
- Lessons learned and best practices underscore **multidimensional drivers** to be fully factored in

RESOLVE Sustainable Resources Program

- 50-year experience innovatively **facilitating for action** in complex contexts
- NRM (incl. ASGM) expertise **creating innovative partnerships** where least likely and most needed

Core Group Participants/Orgs

- **Concerted effort to bridge** sustainable development and organized crime/int'l security elements in ASGM
- **Engagement initiated** with EC-INTPA, OECD, SECO, UNIDO, UNODC, USG (DOL, EPA, INL, OES, USAID)

Context

Global ASGM linkages are growing more consequential amid the coordination gap

Livelihoods for 50+ million people. Across 80+ countries, 20 million directly engaged (tripled over last two decades - **outpacing global pop. growth rate**)

Strong overlap between licit and **illicit trade; transnational organized crime**

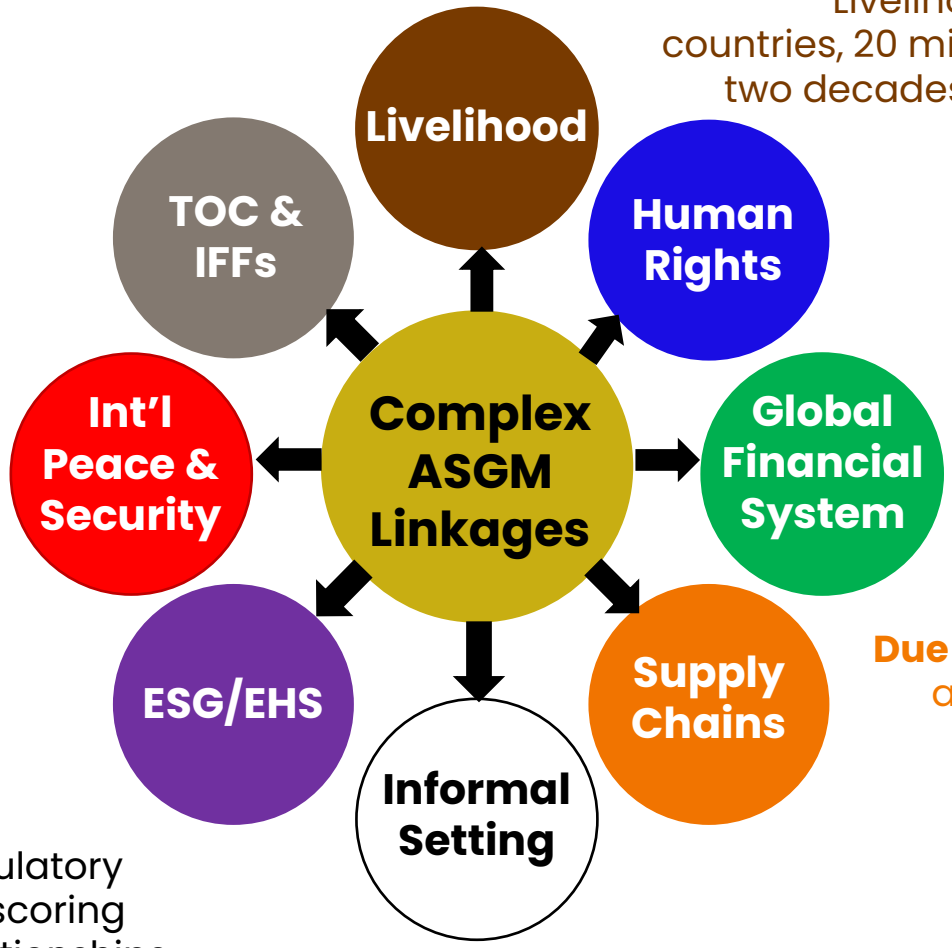
Multifaceted and **highly nuanced** individual/collective **vulnerabilities**

Underpins **conflict financing and dynamics** in **Sahel** crisis and **Russia-Ukraine** conflict

15-20% of annual newly mined prod. (official **gold reserves** are 17% of global above-ground stock)

ESG risks exacerbated by intersectional **EHS gaps**

Due Diligence chokepoints span upstream and downstream, cutting across Miners, Buyers/Traders, Refiners, End Clients

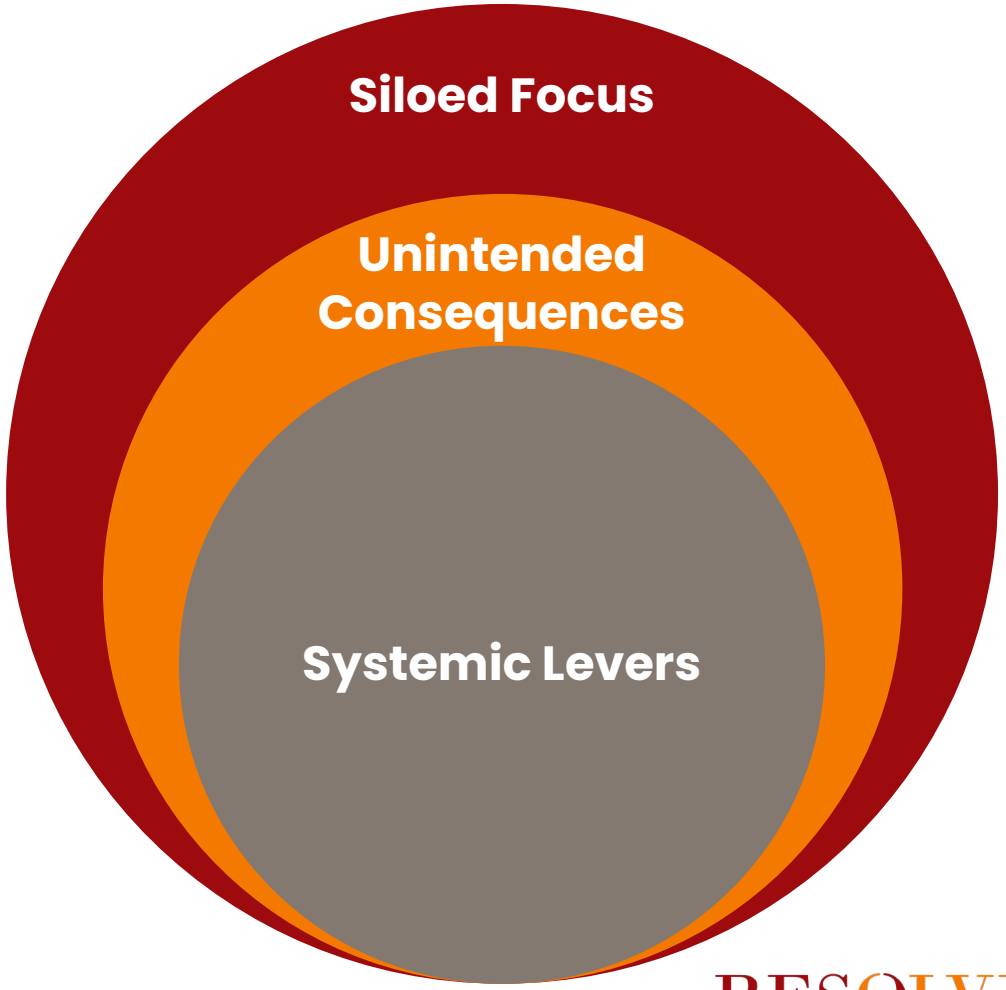


About **75% outside formal** legal or regulatory frameworks and fiscal regimes, underscoring internal logic for power dynamics/relationships

Context [cont'd]

Coordination presents opportunities for navigating ASGM's multilayered complexities

- Optimize collaboration among cross-sector actors, whose siloed focus limits success
- Mitigate significant negative impacts and unintended consequences
- Leverage coordinated access to systemic levers (financial, geopolitical, social, etc.)



OKRs

Progress is ongoing and OKRs evolving in development of ASGM Coordination Model

O Objective

- Facilitate Dialogue and develop a Coordination Model for bridging coordination gaps in global ASGM sector governance

K Key Activities

- Engage participants and launch process.
- Develop shared framework(s) and formalize Dialogue
- Design and operationalize initiatives/projects solidifying Dialogue

R Results & Desired Outcomes

- Engagement launched with core participants EC (INTPA), SECO, UNIDO, UNODC, USG (DOL, EPA, INL, OES, USAID)
- Cross-silo ASGM Framework developed
- Continuing, and Dynamic Roundtable established

Implementation Strategy

Adopting a "3D" Approach for coordinated engagement in the ASGM context

Implementation Strategy [cont'd]

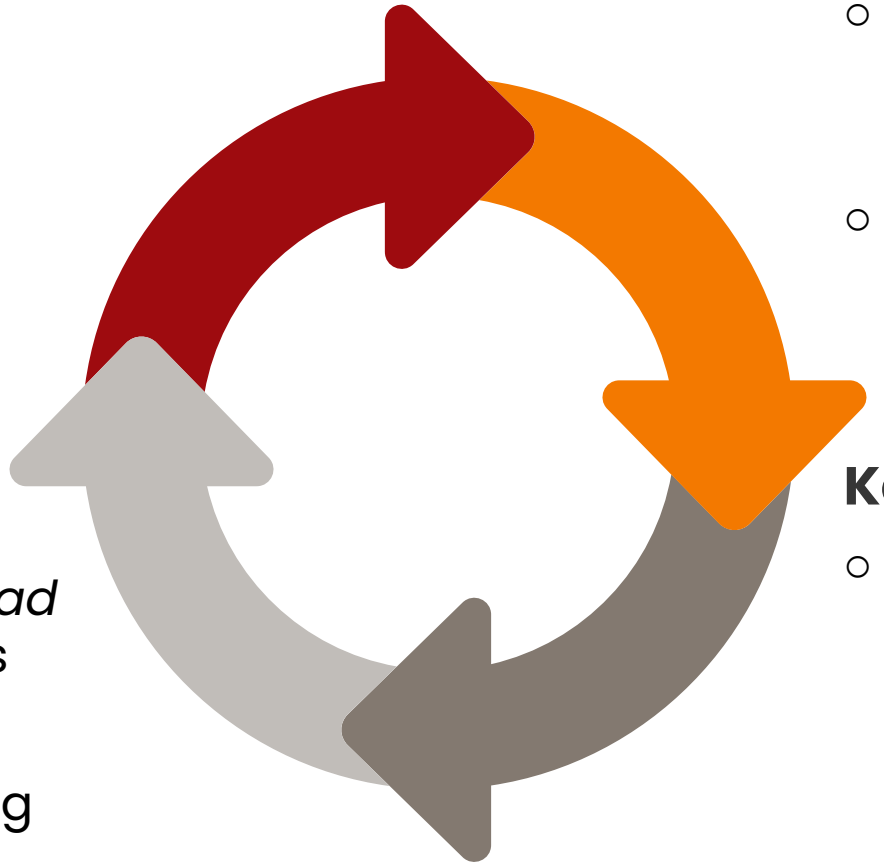
Establishing a Continuing and Dynamic Roundtable Initiative

Structure:

- Modeled on established norms for continuing and dynamic Roundtables
- Two-year time frame with participation modalities suitable for participants

Composition:

- Closed to selected interagency/int'l orgs with *ad hoc* participation for others
- Independent facilitation, servicing, and backstopping



Focus:

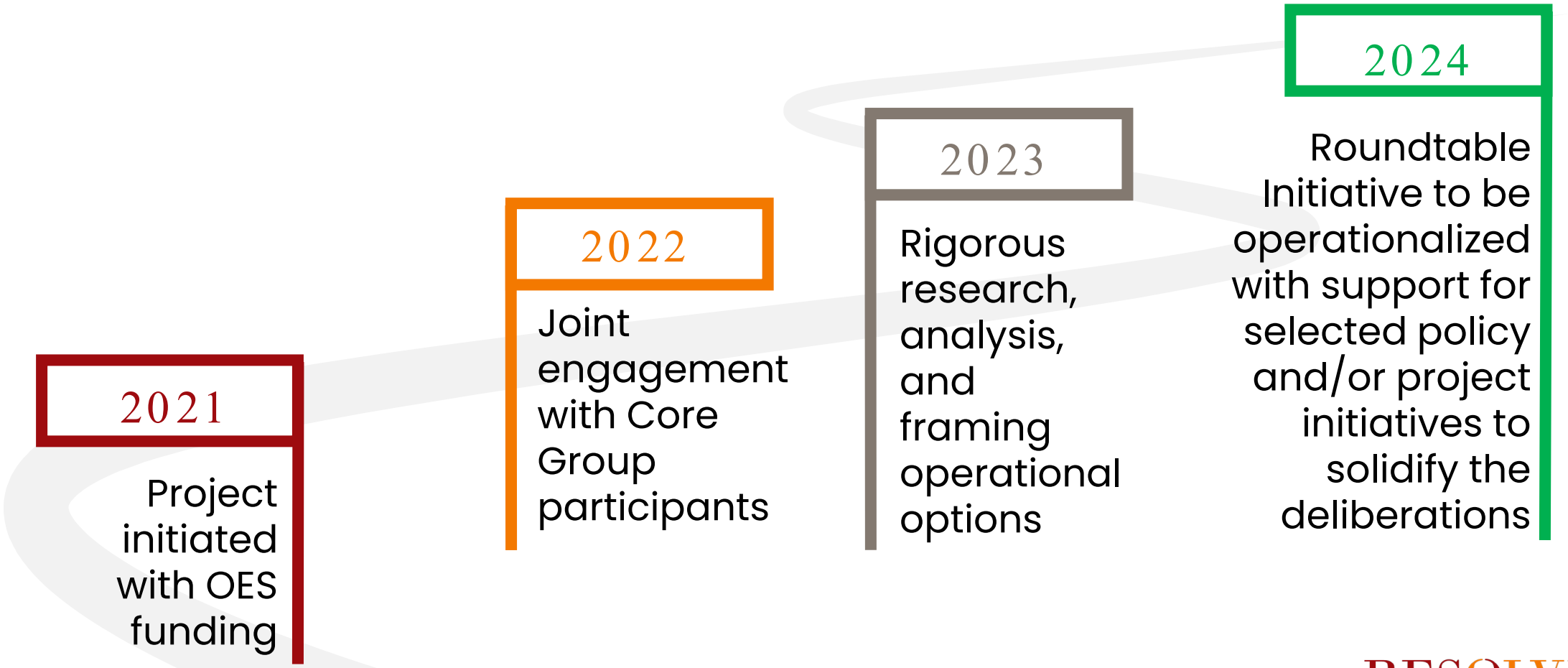
- Defense, Development, & Diplomacy synergies in navigating ASGM context
- Dialogue could feed into int'l instrument(s) and/or projectized initiative(s)

Key Considerations:

- Designed to operationalize Dialogue concept, while mitigating operational challenges

Implementation Progress

Progress is ongoing towards achieving major milestones in the project



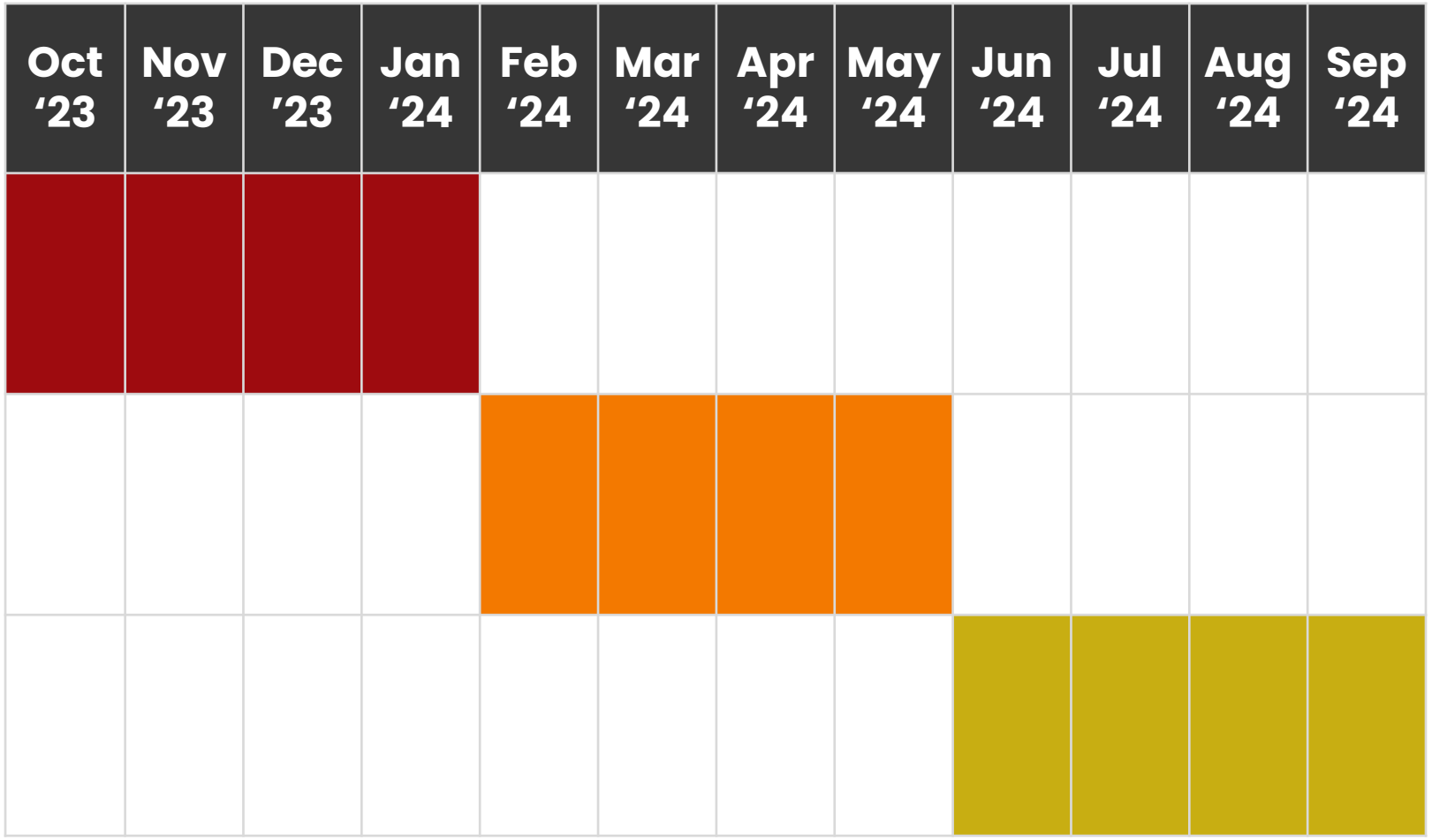
Implementation Progress [cont'd]

Project implementation is ongoing in close collaboration with OES and participants

Framing
Frame, document, and position Roundtable process and project

Setting Up
Set up Roundtable & policy/project collab. solidifying it

Operationalizing
Putting Roundtable & other activities into operation



Lessons Learned

Lessons Learned are Integral to the Project

Lessons Learned [cont'd]

Mitigating operational risks, i.e., people, processes, systems, external events

People
Participation and continuity

- Maintain active engagement with Core Group
- Fully document process to safeguard institutional memory

Processes
Stalled momentum

- Incorporate action-oriented engagements that solidify deliberations with concrete involvement in policy & project initiatives

Systems
Suitability for 3D communities

- Structure inputs, processes, & outputs to be practical in participants' inst. contexts
- Suitable clearances for participants

External Events
Geopolitical developments

- Focus on global systemic levers influenced or controlled by Roundtable participants
- Balanced approach to "3D" priorities

THANK YOU!

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