TATA STEEL MINING
#MiningForABetterTomorrow

TATA

Project Title – Sustainable Water Treatment Solution at Sukinda Chromite Mine

Organisation Name: Tata Steel Mining Limited (TSML)

Presenter: Mr. Dipak Behera & Ms. Jaya Pathak




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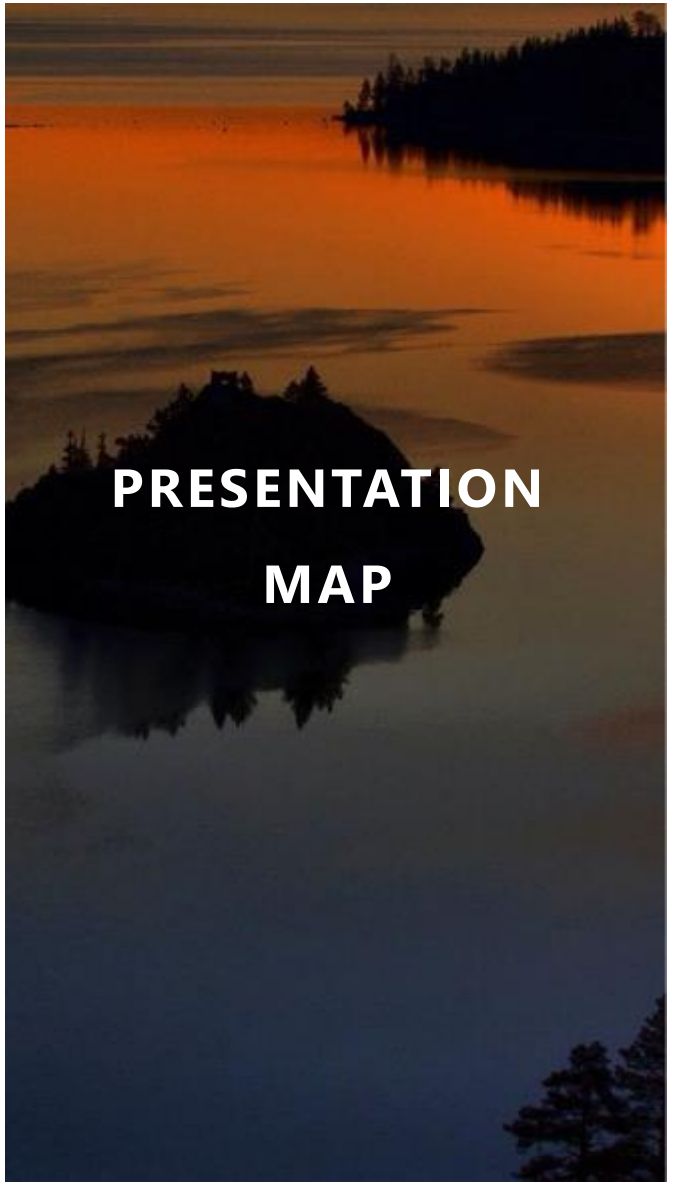

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TSML at a Glance - Responsible Mining for a Better Tomorrow

TSML is a 100% subsidiary company of Tata Steel Limited. The company is in the business of commercial mining.

TSML is one of the largest Chrome Ore producer in India with significant presence in Ferro Alloys. With 8 state of the art Ferro Alloys processing centers across 4 states , we have created a robust integrated value chain from mines to market.

OUR PURPOSE

Transforming natural resources sustainably for a better tomorrow"

OUR VISION

To be the most respected and valuable mining company in India"

OUR VALUES

- Integrity
- **Responsibility**
- **Excellence**
- Pioneering
- Unity
- **Zero Harm**

STRATEGIC OBJECTIVES

S01: Leadership in chrome business.

S02: Drive profitability through focused cost management.

S03: Grow in new businesses.

S04: Leadership in sustainable mining.

Brief Project Description (1/3)

- TSML owns and operates one of **India's largest chromite mines** @Sukinda.
- Water that comes into contact with chromium ore and leaches soluble **hexavalent chromium** from the ore body.
- Mine water contains **0.2–4 mg/l of Cr+6, compared to a safe limit of 0.05 mg/l** hence requires treatment.
- More than **70%** of all contaminants released by mining activities end up in the water.
- As a responsible company, TSML is committed to **Net Zero** Wastewater discharge, **ZLD** and **ZDHC**.
- TSML has built a **closed-loop water-recycling set up** across all locations.
- In Sukinda, the company has built up **one of India's largest single location ETP**, with a capacity of **108 million liters/day** ETP and ZLD facility.

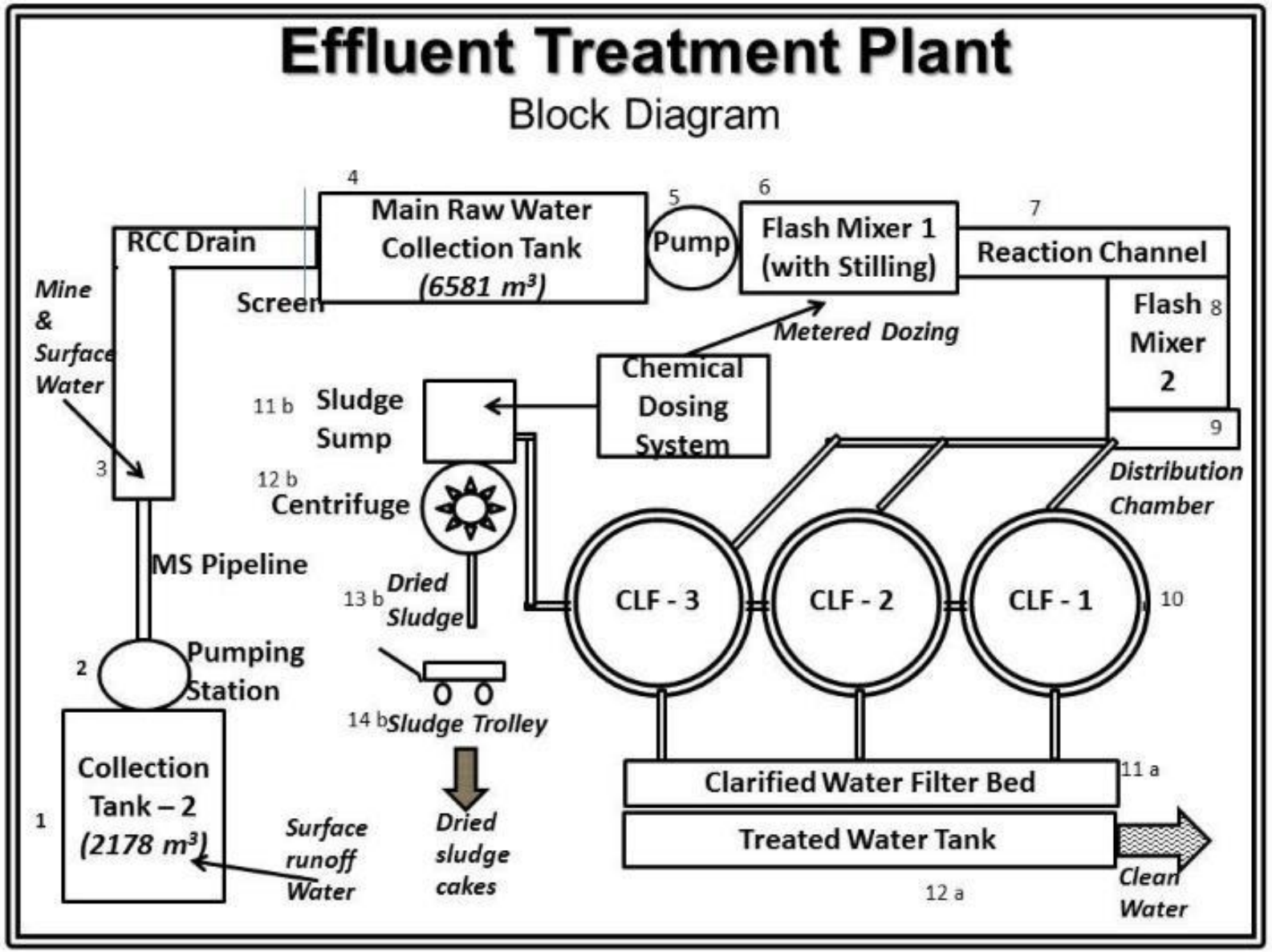
Brief Project Description (2/3)

- The ETP is effectively treating **100%** of the effluent (mine dewatered water and surface run-off water)
- Reclaim up to **95% of recycled water** (5% evaporation loss).
- **70-80%** of recycled water is reused in mining process and self-sustaining Zero Liquid Discharge (ZLD)
- **20-30%** of the excess recycled water is discharged finally in Damsala Nalla.
- The discharged water has a better water quality than the water available in the local Damsala Nalla.
- Local communities use the reclaimed water for irrigation purposes after it is discharged.

Brief Project Description (3/3)

This is how, by implementing a strategic wastewater management system and making operational improvements, TSML is not just fulfilling its water needs but also benefiting farmers our local communities

Block Diagram of ETP



Key Installations:

1. Collection Tank
2. Flash Mixer
3. Reaction Channel
4. Clarifocculators
5. Sensors & Responders
6. Chemical Dosing System
7. Sludge Pumps
8. Sludge Drying System
9. Water Filter Bed
10. Treater Water Tanks

Key Highlights

- **100%** recycling of wastewater
- **70-80 %** reuse of recycled water.
- **Zero stress on local watersheds**
- State of art **online monitoring** & automation systems:

- Zero Liquid Discharge **(ZLD)**
- Zero Discharge of Hazardous Chemicals **(ZDHC)**
- Cutting Edge Technology

- Water quality is better than local Nala water
- **Benefitting and supporting local communities** in livelihood through irrigation
- Future ready

Trigger of the project (1/2)

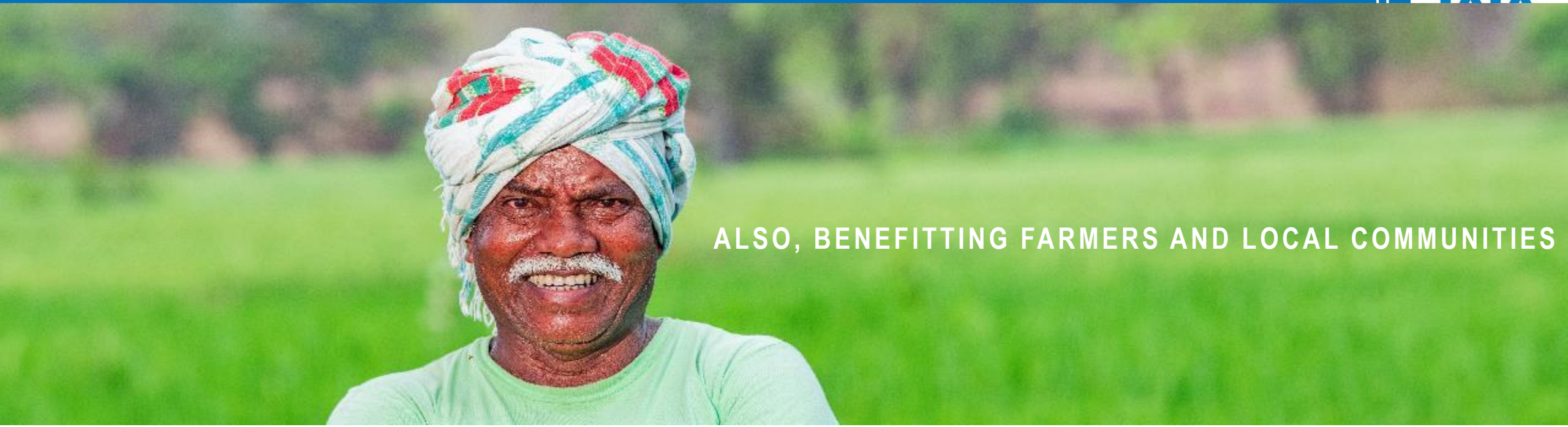
- **TSML aspire to be a water neutral organization** and made strong 2030 commitments under the umbrella of TSML's Sustainability Initiative – **"PLAN A",** as there is no plan B for our planet.
- **Sustainability** is central to TSML's business processes and practices.
- TSML is committed to – **Water stewardship, Energy stewardship, and the health, protection, and well-being of its stakeholders**
- In light of TSML's aspiration both FAP units are **ZLD,** and all three mines have **zero hazardous water discharge.**
- The wastewater generated contain toxic Cr+6, which, if released untreated, can have significant negative consequences for watershed health.

Trigger of the project (2/2)

The following are the main catalysts for starting this project:

- There is **no reliance** on local water bodies or rivers.
- **Cost Savings**: Recovering 95 percent of the water helps to free us from the high cost of obtaining freshwater
- **Improved community relations** by releasing clean water into local water bodies and rivers.
- Clean mining processes allow us to green our supply chain and **improve our customer relationships**.

Uniqueness (1/2)

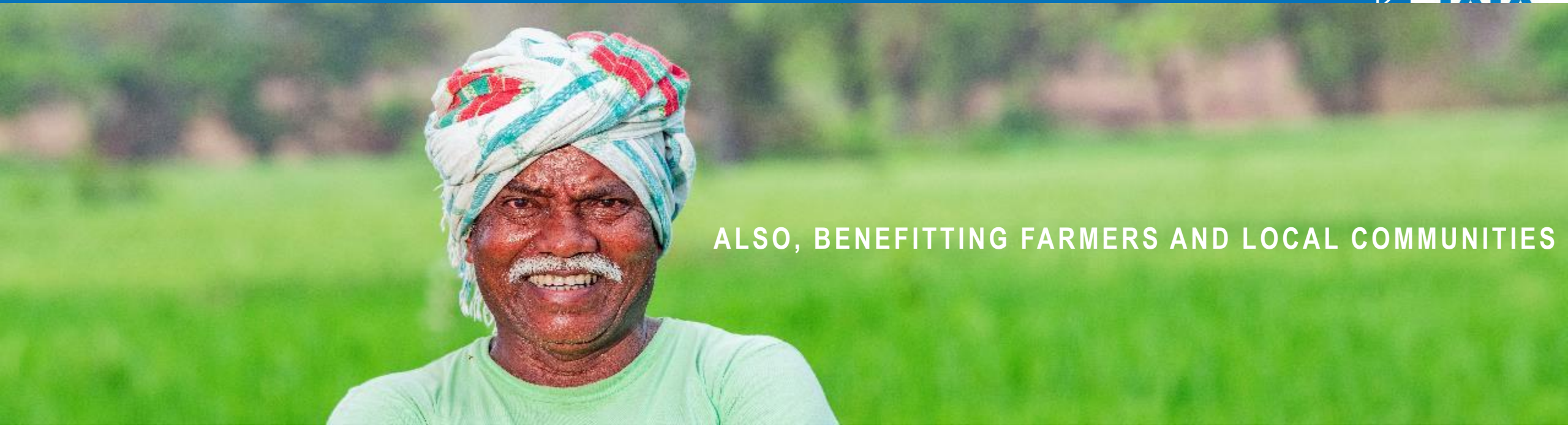


- **Greening the supply chain-** Treating 100% of the and reclaiming 95% of it
- **Net Zero negative impact**
- Benefit to **farmers and local communities.**
- Zero discharge of hazardous water.
- Zero liquid discharge facility (housing + administration).

- **Largest ETP plant in the Region/ Country**. ~108 million liters/day.
- **Significant cost savings –**
  - (1) No pumping from the Damsala Nalla,
  - (2) Less Chemical intake
  - (3) Lowering the cost of treatment due to the consistent better input water quality.

- **Modular Design:** ETP is capable to handle wide variation in the quantity of wastewater water to be treated across different seasons.
- **Reuse of Water**: The output water quality of ETP is better than the water available in the local Nalla, giving TSML the opportunity to **reuse it for dinking purpose** after minor treatment at WTP

Uniqueness (2/2)



- The Effluent Treatment Plant is so designed that:
  - It is future ready. Can meet stricter norms for treated effluent which are likely to be imposed in the future.
  - ETP output has better than required:

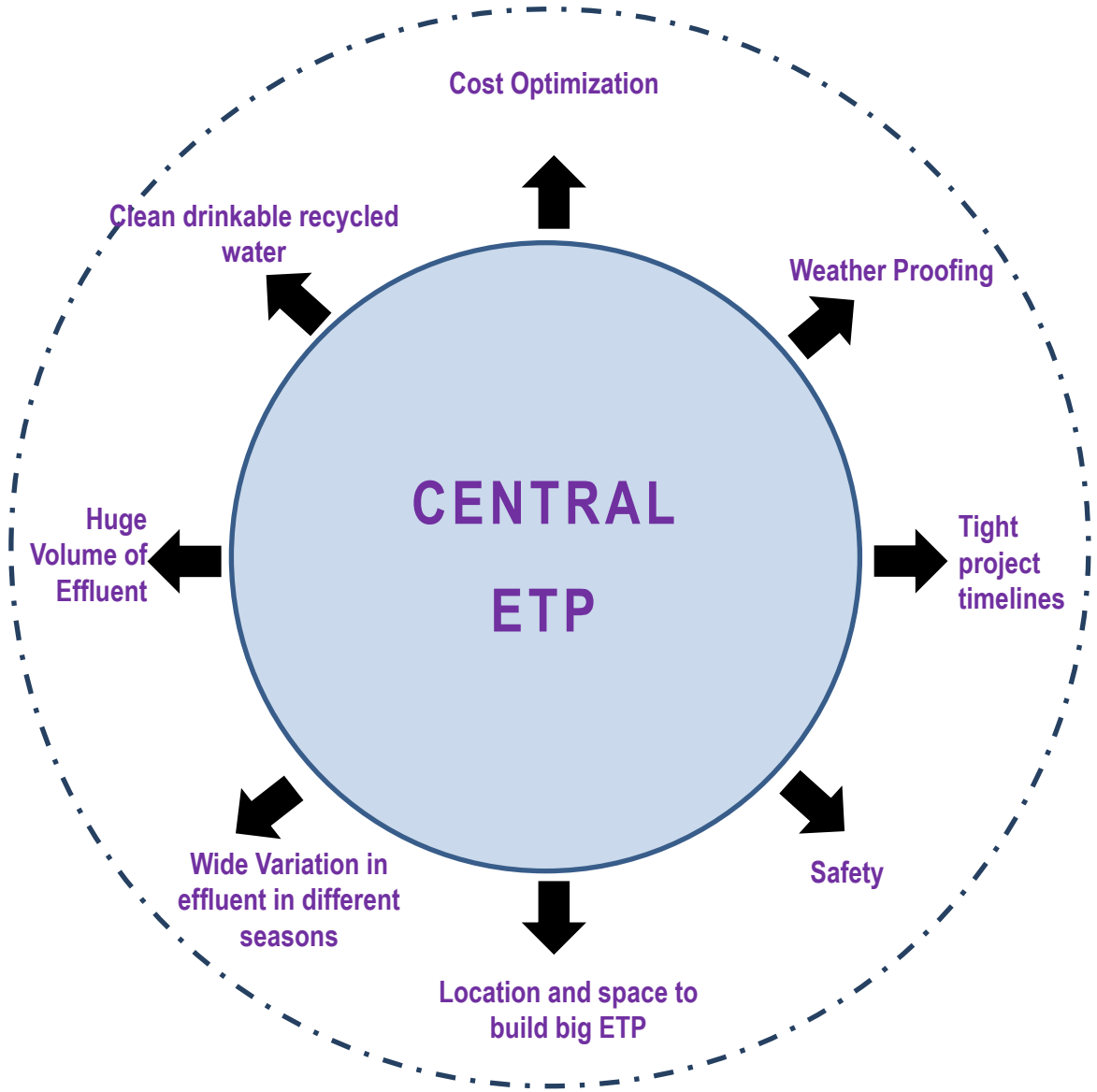
    Cr+6: 0.01 mg/l Vrs 0.05 mg/l,

    TSS: < 10mg/l Vrs < 100 mg/l.
  - The ETP treats both surface run off water and mine water ensure each drop of Water is treated

- Online Monitoring & Automation: The ETP has state of art online monitoring & automation systems:
  - 24/7 real-time monitoring of the input raw effluent and output treated water for **Cr+6, pH and TSS**
  - **Automated backwash** arrangements for the pressure sand filters to ensure that the filters do not choke.

Challenges


THESE CHALLENGES WERE APTLY MET BY TSML BY MAKING NETZERO WASTEWATER DISCHARGE AS A STRATEGIC PRIORITY; IT IS REFLECTED IN ITS SUSTAINABILITY COMMITMENTS TO WORK IN A RESPONSIBLE AND TRANSPARENT MANNER, AS WELL AS IN ITS ONGOING EFFORTS TO MAKE THE WORLD A BETTER PLACE.


CENTRAL ETP
Cost Optimization
Weather Proofing
Tight project timelines
Safety
Location and space to build big ETP
Wide Variation in effluent in different seasons
Huge Volume of Effluent
Clean drinkable recycled water

Benefits – Tangible and Intangible

Tangible Benefits	Intangible Benefits
- Cost Savings of **INR 103 lacs/ annum:** Recovering 95 % of the wastewater and **reusing 70-80 %** - No reliance on local water bodies or rivers for freshwater requirements. - Zero Discharge of Hazardous Water - Zero Liquid Discharge (ZLD) - Clean mining processes allows TSML to green our supply chain and improve its customer relationships.	- Responsible mining, Health and well-being of local communities, - Benefits to farmers and local communities (discharge excess water into local Nallah is utilized by farmers for irrigation purpose) - Access to water clean enough to drink after some basic treatment. - Improved relationships with customers and local communities. - Competitive advantage in ferro-chrome production. - **Overall water stewardship**

Replication potential of the project in Indian Industry

- **Identify the area** to be covered.
- **Locating the ETP**: The ETP site was chosen based on two key considerations:
  - **Location**: Lowest point possible so that all of the water can be channeled using gravity.
  - **Space**: Enough space should be available to construct the ETP to the desired capacity.

- **Estimate the ETP capacity and design** based on volume of water input to the ETP during different season.
- **Channelizing the wastewater** to the ETP through low-cost channelizing medium.
- **Choose the technology** & implementation ETP technology should treat upto better quality than required to meet future requirements

- The technology chosen should **improve the ETP's throughput** and allow for the treatment of a large volume of water in a short amount of time.
- ETP output should not only meet the current specifications for treated effluents but also should be **future ready**.
- The recycled water should **be clean enough to drink** and reuse it

Performance Indicators

Financial Year	Raw water Treated (KL)	Reused in Process,KL	Reused in Domestic, KL	Discharged Outside, KL	% of conservation
FY 19	45,62,332	18,24,933	13,68,700	13,68,700	70%
FY 20	56,67,821	22,67,128	17,00,346	17,00,346	70%
FY 21	44,62,363	17,84,945	13,38,709	13,38,709	70%

Quality Indicators

Parameters	Unit of Measurement	Inland Water Std.	Inlet and Outlet Comparison	
			In-Let	Out-Let
pH	--	6.5 – 9.00	6.5 – 8.5	7.2
Total Suspended Solids	mg/l	100	400 -500	<10
Hexavalent Chromium as Cr +6	mg/l	0.05	0.2 - 2	< 0.001
Total Chromium (Cr+3 + Cr+6)	mg/l	1	0.2 - 5	< 0.2
Iron (as Fe)	mg/l	3	2	< 0.36
Zinc (Zn)	mg/l		1	< 0.1

Implementation Strategy

- Central ETP to provide a **long-term and sustainable solution** for high-volume dewatering and surface run-off that benefits the ecosystem and local communities.
- **Highly efficient design and technology** were adopted, which increases the ETP's throughput and allows to treat a huge volume of water in a short period of time.
- The ETP output not only meets current specifications for treated effluents but is **future ready** also.
- **Treats both surface run off water and mine water** in same way, which none of the other mines planned to do.
- Constructed a **central ETP** rather than three ETPs at different locations to optimize cost .
- The **modular ETP design** to further optimize the costs. 3 modules of 1500m3/hr capacity each were built instead of making a single large 4500m3/hr ETP.
- The cost was further optimized constructing the ETP at the lowest point of the mine so that all water could be channeled through existing garlands rather than through an underground steel.

National standards/ benchmarks

- TSML understands that water stewardship is critical to the company's long-term sustainability and adheres to international and industry-specific environmental requirements and guidelines, such as the ICMM Performance Expectations and Principles. Sustainable Development Goals (SDGs) of the United Nations: Clean water and sanitation, Responsible consumption and production.

- The output not only meets current standards for treated effluents in non-urbanized areas, but also meets the specifications for treated effluents in both urban and non-urbanized areas, as well as the potentially tougher treated effluent norms that will be enforced in the future.

- The ETP output contains less than 0.01 mg/l Cr+6 compared to a standard of 0.05 mg/l, and it follows the tighter TSS standard of 10 mg/l (drinking water specifications) compared to a standard of 100 mg/l (norms for treated effluents in non-urbanized areas)

- TSML's strategic wastewater management system and operational improvements in the process allows the company to not only its water needs but also benefits its local communities and farmers in their livelihoods

Way Forward

Past	Present	Future
Reclamation and Restoration of Overburden Dump **13 lacs trees planted**, using **Miyawaki Plantation** technique, on 100-hectare overburden dump (outside mining lease) and 406 hectares (within mining lease). Dump slope stabilization through **Vetiver Plantation**. One of India's largest single location, **108 million litres / day ETP,** to treat wastewater at mine. **ZLD** Ferro Alloy plants. **Recharging pits** in FAP Athagarh. **Zero Discharge of Hazardous Water** in Mines Green belt development across mine locations in accordance with **BMP study and plan made by IUCN** **Biodiversity awareness programs** for local communities, school children & TSML's employees to **sensitize and mainstream Sustainability and Biodiversity**	Backfilling of exhausted mine OB II **Dust Emission Reduction:** Water sprinklers in permanent haul roads, frequent haul road maintenance, and increasing water sprinkling frequency and coverage, Dry Fog Dust Suppression System (DFDS) system. **Abate GHG Emissions**: Lower-emission fuels, green energy, electric motors in machinery & vehicles, reducing energy consumption through operational & energy efficiency, advanced technology interventions. **17, 000 Mwhr** of **renewable energy** sourced. **3,63,584 KWhr** of energy saving through LED project **100%** Recycling of on-site process water at mines. **Zero Liquid Discharge** (ZLD) FAP units. Feasibility study to build **water recharge systems** **100% utilization of Ferro chrome slag** in filling in low lying areas inside plant premise. Site Surveys is ongoing for the **solar projects**	Various projects would be taken under the umbrella of **PLAN A Initiatives as there is no PLAN B for our PLANET.** 1. Ensure **5%** of energy requirement would be met from renewables: **Solar and Wind Energy** projects 2. Reduce **CO2 emission intensity by 20%:** Sourcing Green Energy, switching to low emission fuels, operational efficiency and technology advancement **3.** **Improve 5% of ambient/ stack air quality**: Dust emission reduction through permanent sprinklers, DFDS, plantation etc. 4. Ensure **Zero ground water drawl & 30% reduction in surface water**: building RWH structures, reduce, reuse and recycle water. 5. Ensure **50% utilization of solid waste**: Backfilling of OB II and OB X mines, reutilization of slag, Nickle trial. 6. Ensure **33%** plantation over mine & plant site


THANK YOU