ZERO LIQUID DISCHARGE-ZLD SCHEME
CASE STUDY OF NTPC DADRI

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Introduction to ZLD

What is ZLD?

Definition: ZLD is a water management strategy that ensures no liquid waste is discharged into the environment. It involves the 3R concept – Reduce, Reuse and Recycle i.e recovering, treating, and reusing all water within a closed-loop system.

Why ZLD in Power Plants?

Water-Intensive Nature

- Power plants consume large volumes of water for cooling and steam generation processes.
- This demand places significant pressure on local water supplies, especially in water-stressed regions.

Regulatory Compliance

- Strict environmental discharge regulations globally mandate reduced water pollution.
- ZLD ensures zero wastewater discharge, helping power plants adhere to these norms effectively.

Sustainability Goals of ZLD

Addressing Global Water Scarcity

- ZLD plays a vital role in tackling the increasing global challenge of water scarcity.
- Recycling and reusing water within power plants conserves freshwater resources for other uses.

Aligning with Corporate Responsibility

- Adoption of ZLD demonstrates a commitment to sustainability and environmental stewardship.
- Builds a positive corporate image and enhances alignment with global climate goals.

Global Adoption Trends

Adoption in Water-Stressed Regions

- Countries leading the ZLD implementation:
  - India: Mitigates critical water shortages and supports industrial operations.
  - China: Regulatory push for sustainable growth and reduced environmental impact.
  - USA: Focused on long-term water resource management and pollution control.

Rising Technology and Awareness

- Increasing awareness of water conservation and improved ZLD technologies have made implementation more practical.
- ZLD is emerging as a standard practice globally, particularly in regions with significant water challenges.

How ZLD Works in Power Plants

Stages of ZLD Implementation:

- **Pre-Treatment**:
  - Removes suspended solids and organic matter.
  - Equipment: Clarifiers, filters, and chemical dosing units.
- **Evaporation & Concentration**:
  - Reduces the volume of wastewater by evaporating water using mechanical or thermal vapor compression.
  - Key Equipment: Evaporators and brine concentrators.
- **Crystallization**:
  - Converts concentrated brine into solid salts.
  - Equipment: Crystallizers or dryers.
- **Water Recovery and Reuse**:
  - Recovered water is recycled back for plant use in cooling towers or boiler feedwater systems.

Water Savings through ZLD

Quantifying Water Conservation:

- **Recycling Efficiency**:
  - Recycles 95-98% of wastewater.
- **Freshwater Reduction**:
  - Minimizes reliance on external freshwater sources.
- **Illustration**:
  - A typical 500 MW power plant consuming 10 million gallons/day can save up to 9.5 million gallons/day with ZLD.

Advantages of ZLD-Environmental

Environmental Benefits

- Preventing Water Pollution
- Eliminates liquid waste discharge, significantly reducing contamination of natural water bodies.
- Mitigates harmful effects on aquatic life and maintains water quality standards.

Promoting Groundwater Recharge

- Encourages the replenishment of groundwater through effective water recovery systems.
- Supports ecosystem balance by minimizing the extraction of natural water resources.

Ecosystem Health

- Reduces the strain on local ecosystems by ensuring minimal disruption to natural hydrological cycles.
- Promotes biodiversity conservation through sustainable water management practices.

Advantages of ZLD
Operational and Economic Benefits

Reduction in Freshwater Dependency

- Reduces reliance on external freshwater procurement, particularly vital for operations in water-scarce regions.
- Supports operational continuity even during droughts or water restrictions.

Lower Operating Costs

- Substantial cost savings achieved by recycling and reusing treated water within industrial processes.
- Decreases the need for water-related logistical and procurement expenditures.

Long-Term Financial Benefits

- Initial investments are offset by long-term savings from reduced water costs and potential tax incentives for eco-friendly practices.
- Water recovery and reuse provide a sustainable approach to future operational needs.

Advantages of ZLD

Strategic Advantages and Challenges

Strategic Advantages

- Regulatory Compliance:
  Ensures adherence to stringent local and international water discharge regulations, avoiding penalties.
- Eco-Friendly Image:
  Strengthens the corporate brand by aligning with sustainability goals and environmental stewardship.

Challenges

- High Capital Costs:
  Significant initial investments in advanced water treatment and recovery technologies.
- Energy-Intensive Processes:
  Advanced systems may require substantial energy input, increasing operational complexity.
- Maintenance Complexity:
  Specialized equipment demands skilled personnel for routine maintenance and troubleshooting.

Conclusion and Future Outlook

Key Takeaways:

ZLD in Power Plants: An essential technology for sustainable water management.

Environmental Impact: Helps mitigate the environmental effects of power generation.

Economic Viability: Provides long-term benefits despite high initial costs.

Future Trends:

Research and development to lower costs and energy consumption.

Integration of renewable energy sources to power ZLD systems.

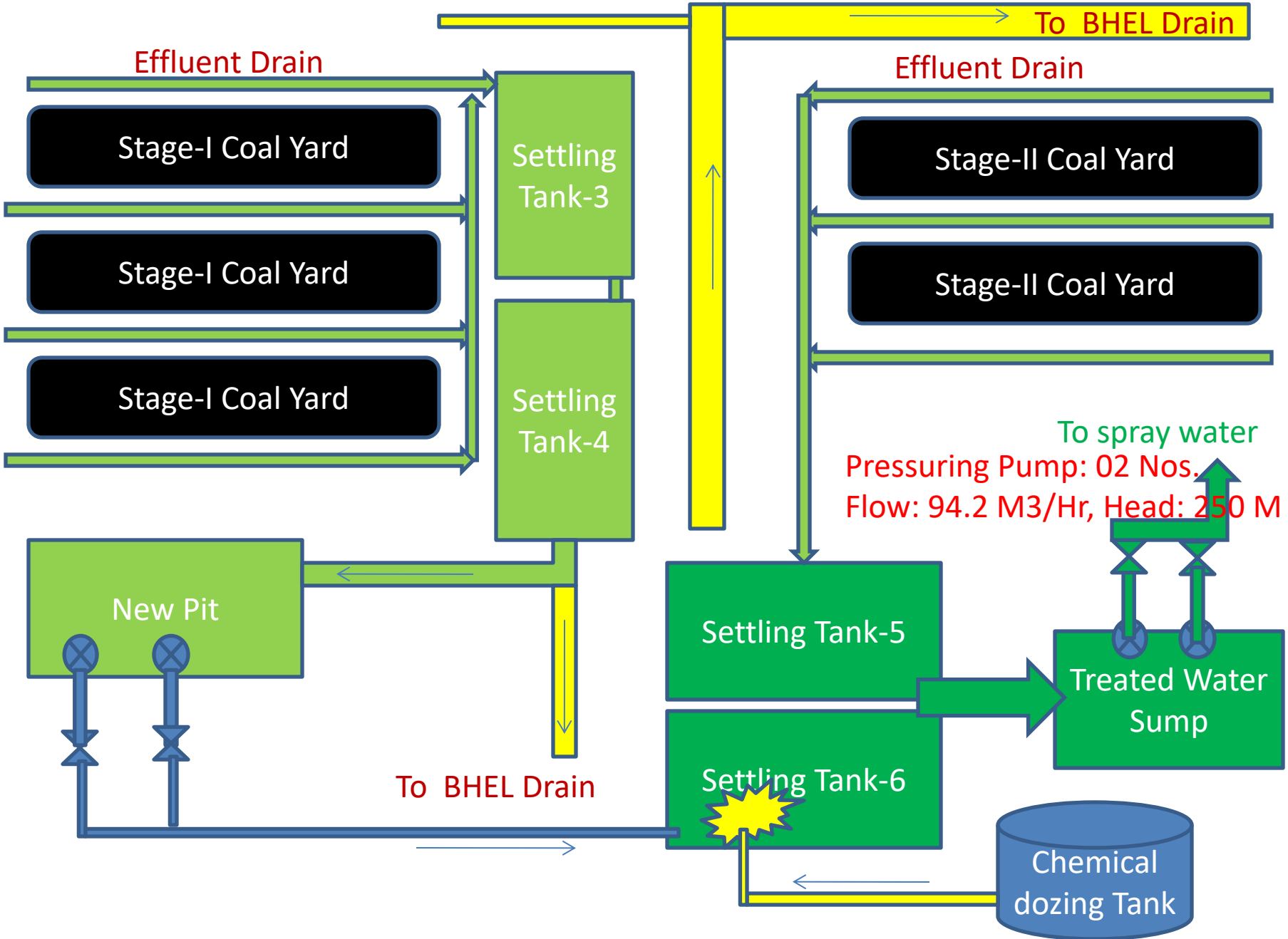
Government policies supporting ZLD adoption in industrial sectors.

Closing Thought:

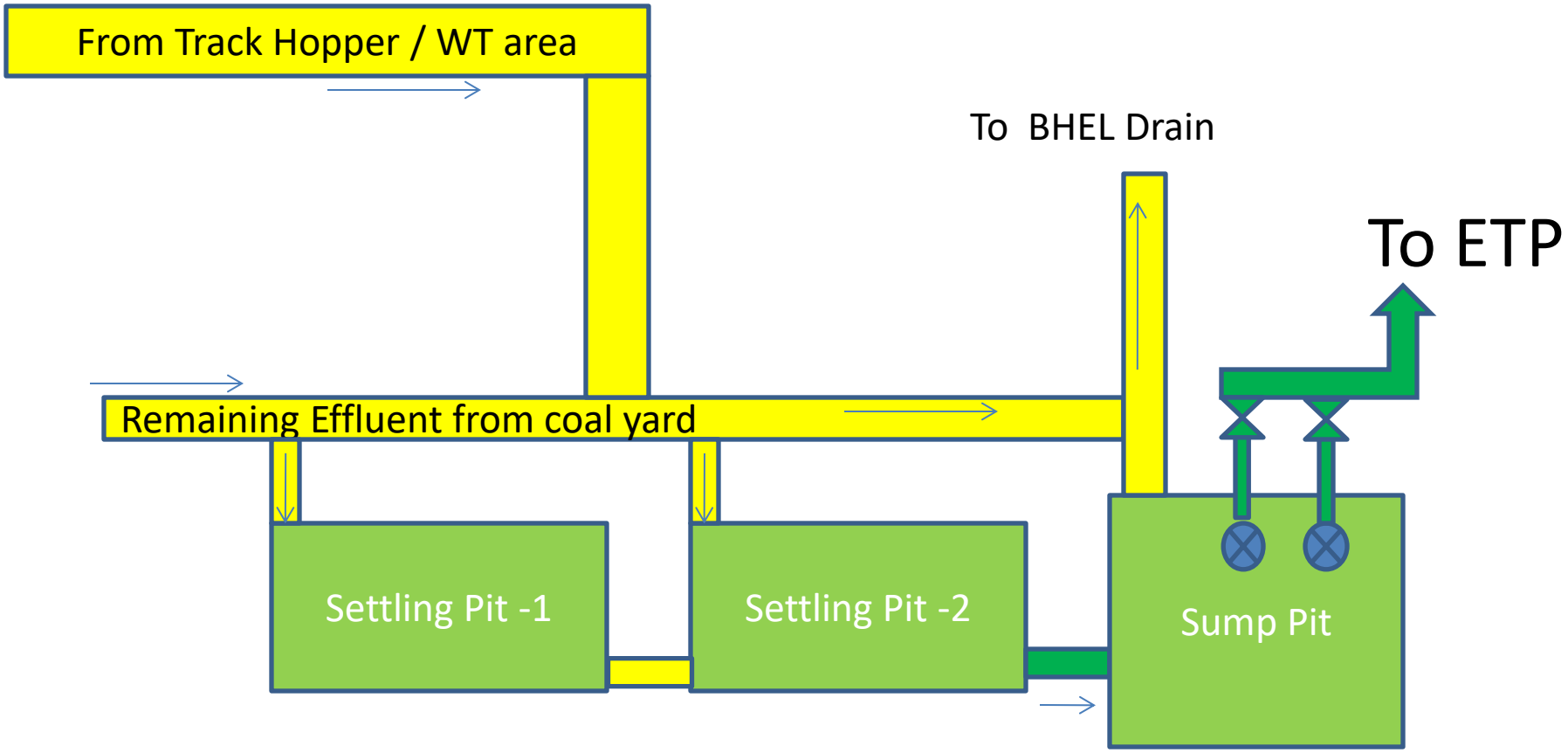
"ZLD is not just a solution—it is a commitment to sustainable and responsible power generation."

CASE STUDY AT NTPC DADRI

ZLD SCHEME IN CHP



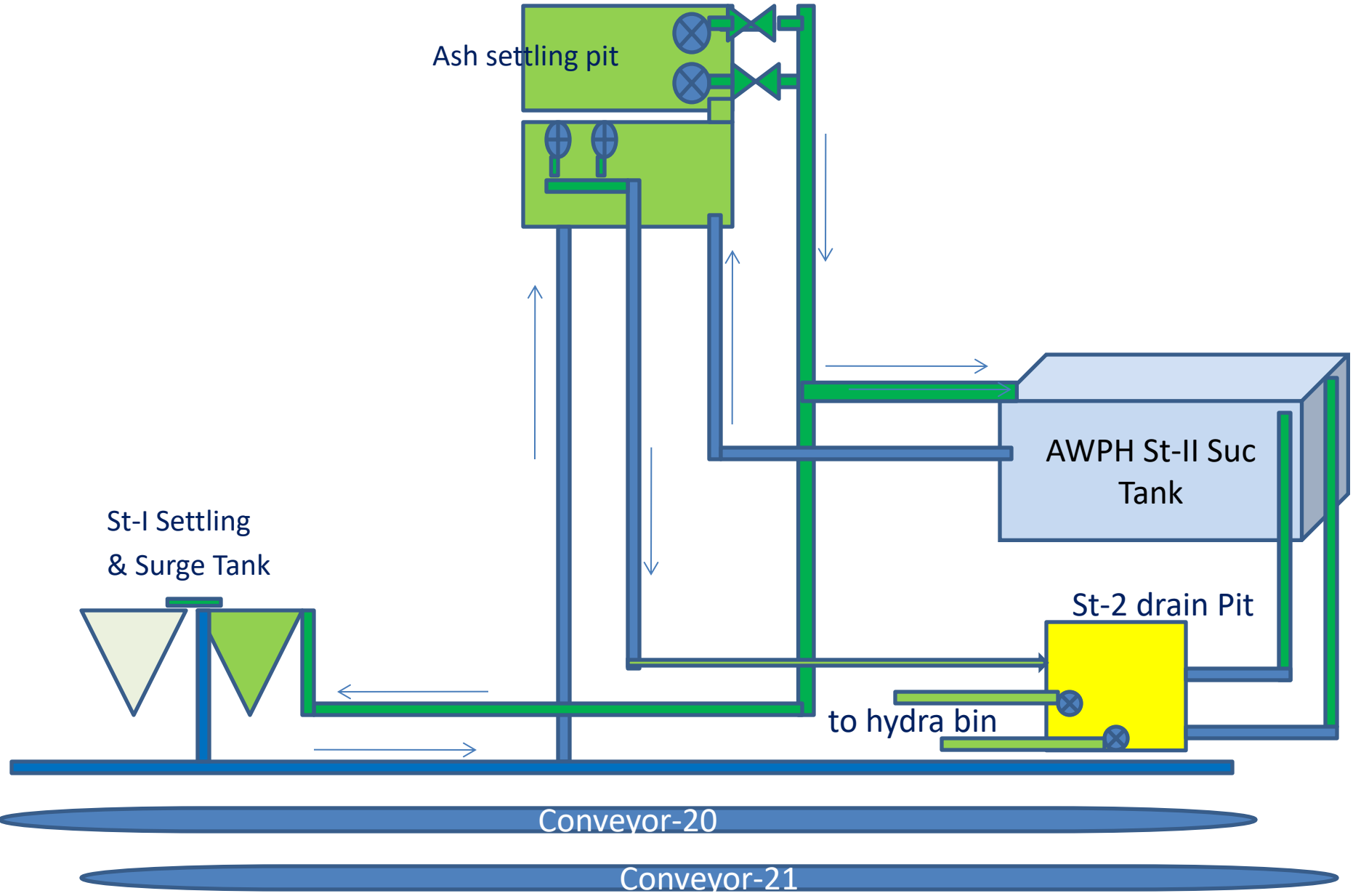
ZLD SCHEME IN CHP



ZLD Scheme in CHP

- The Treated water from CHP is being used within CHP area for Dust suppression spray in CHP area, if required make water taken from service water (treated water of ETP) tank and no fresh water is used.
- The treated water is being used in closed loop.

ZLD SCHEME IN AHP



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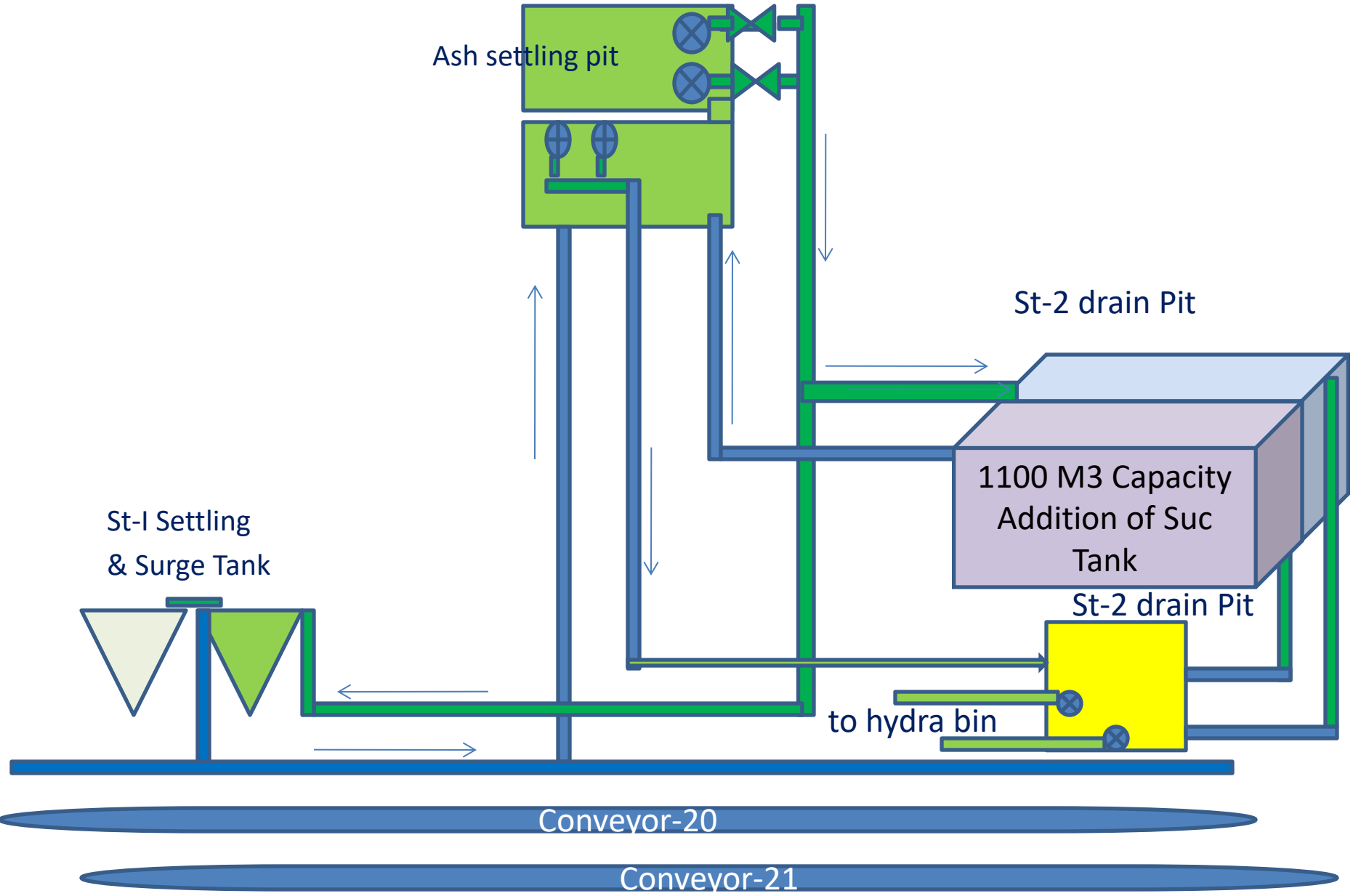
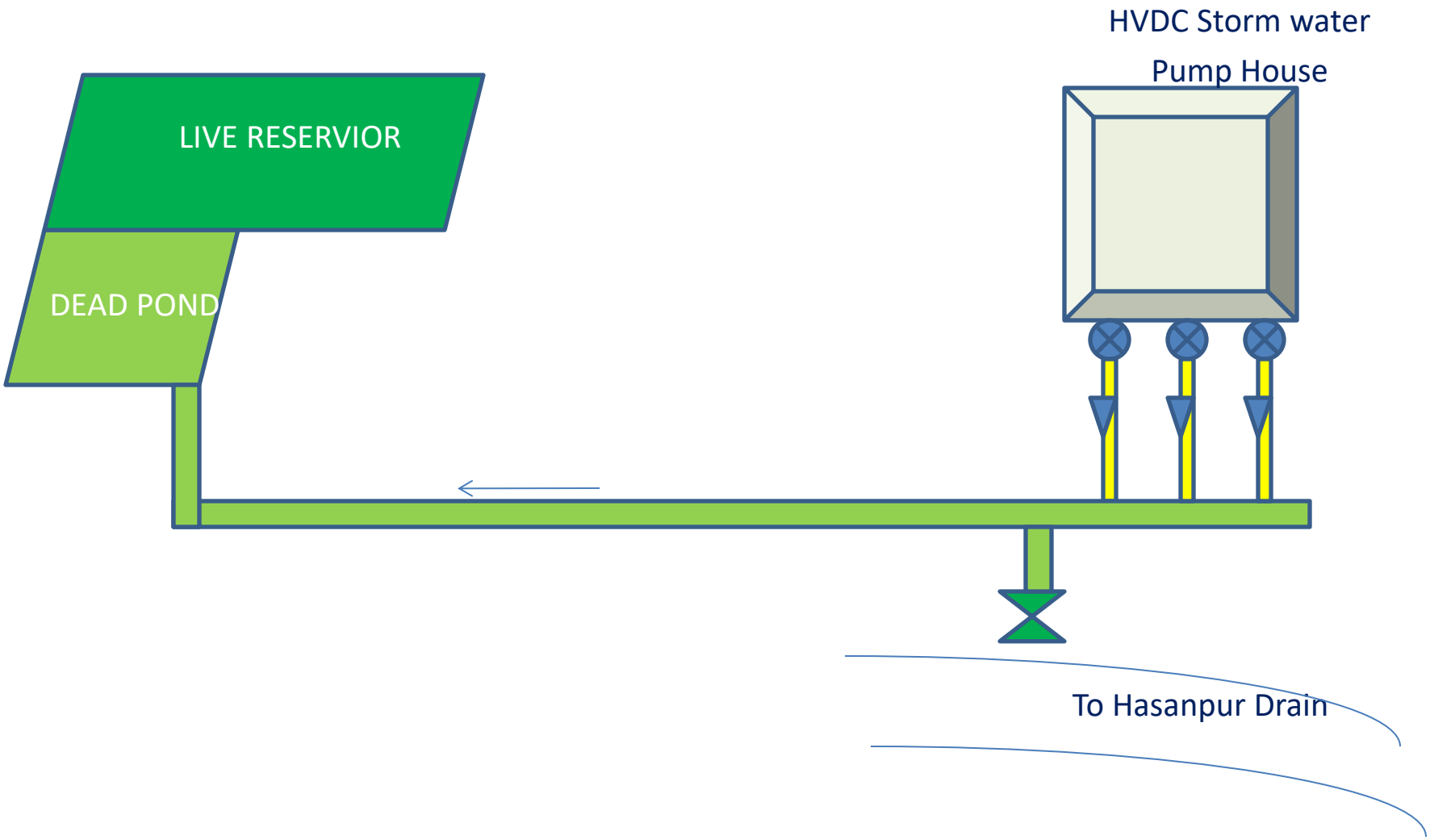


ZLD Scheme in AHP

- The Treated Effluent from ETP is reused within AHP in ash water recirculation and hydro bins.
- Stage-I cooling tower blow down water is being used in stage-I bottom ash slurry pump house.
- Silo area washing and bulker washing water also recovered and settled in the ash slurry settling pit.
- The decanted water used within the AHP only .

ZLD SCHEME of OFFSITE AREA



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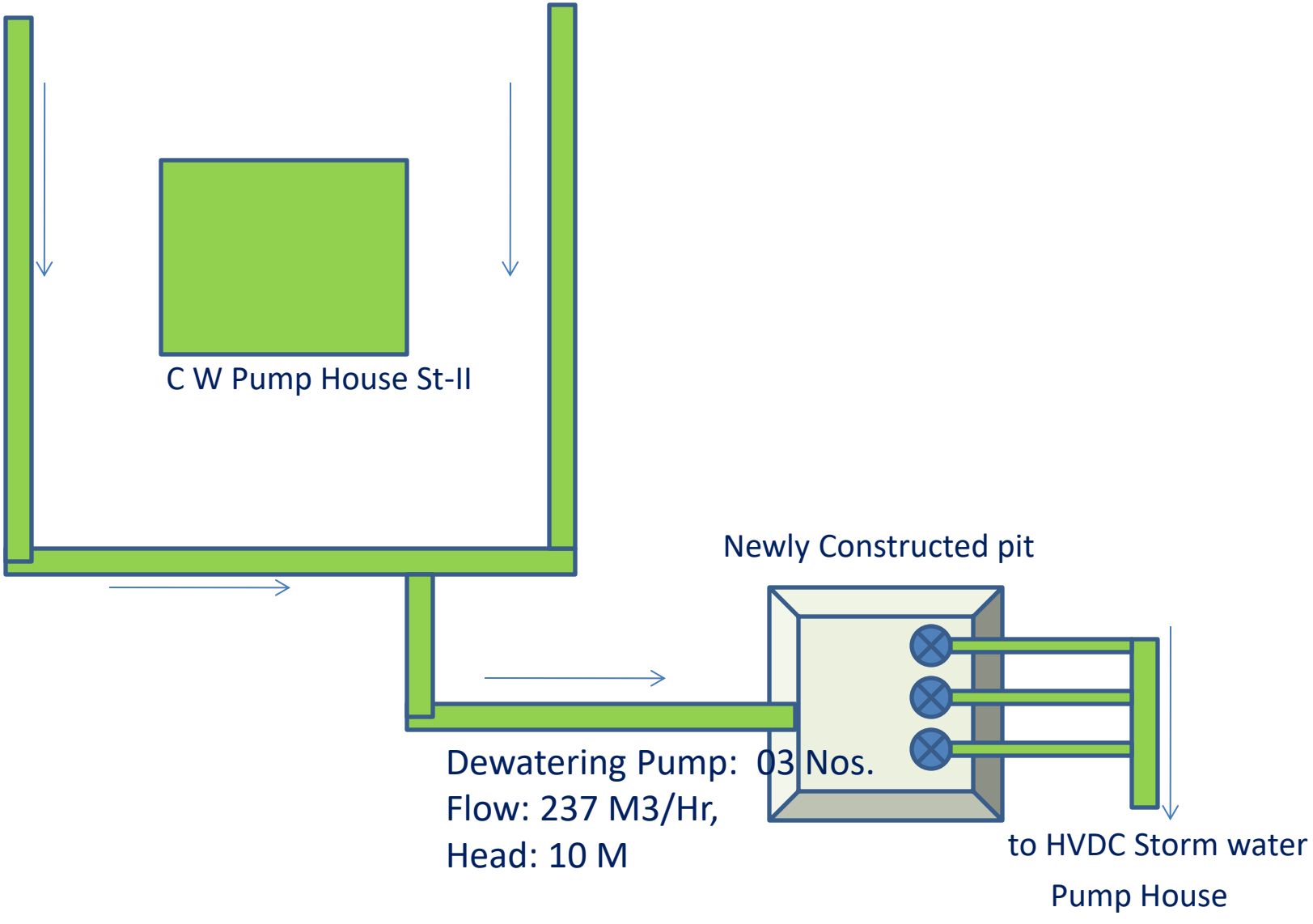
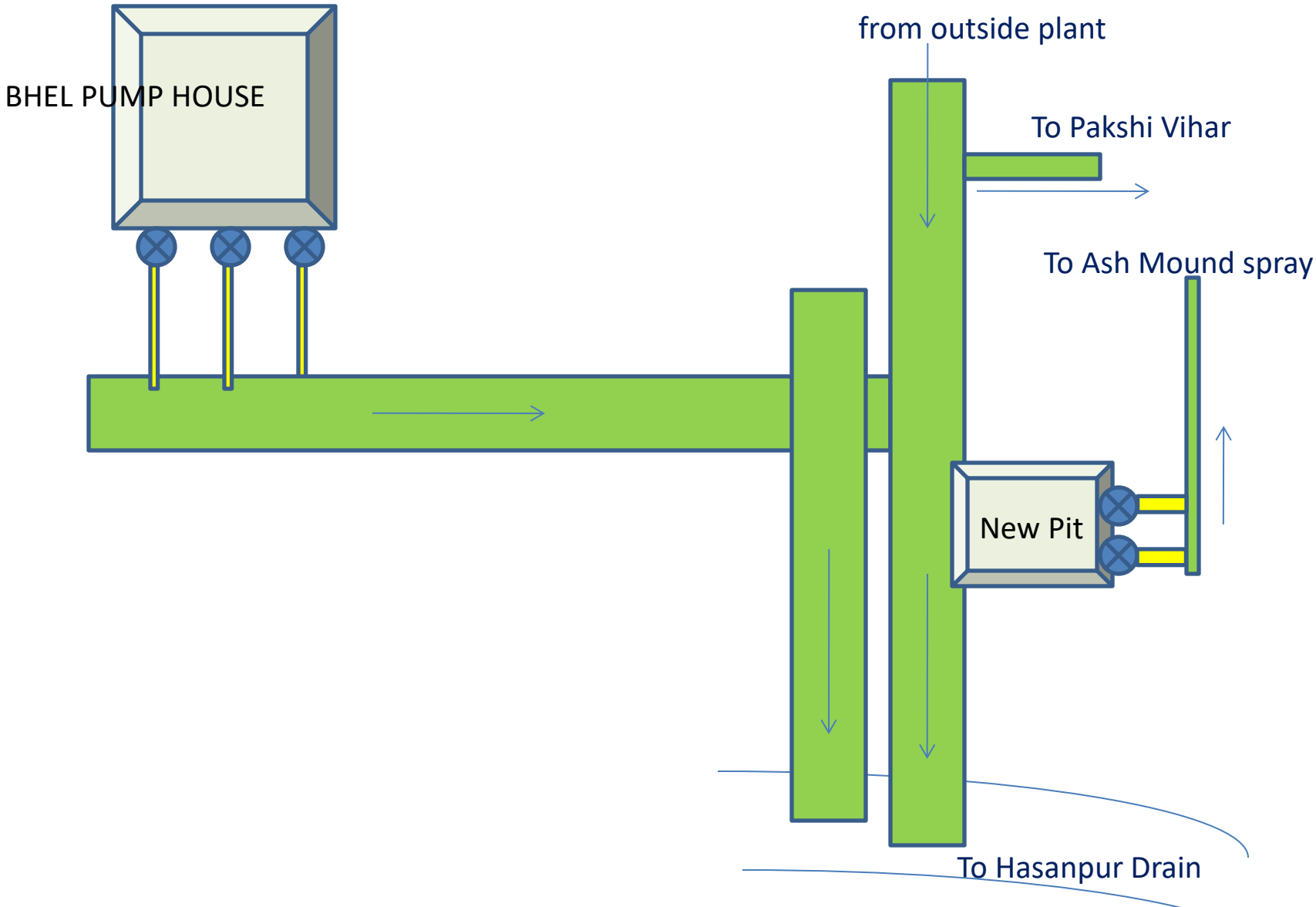


ZLD Scheme in Off Site

- The ETP treated water is being diverted to pakshi-vihar (a man make water body spread in 55 acre area) for natural purification.
- The water quality is being monitored regularly and finally transfer to the reservoir for power plant operation.
- ZLD water from offsite water is recycled in the Dead pond from where it is used in the power plant.

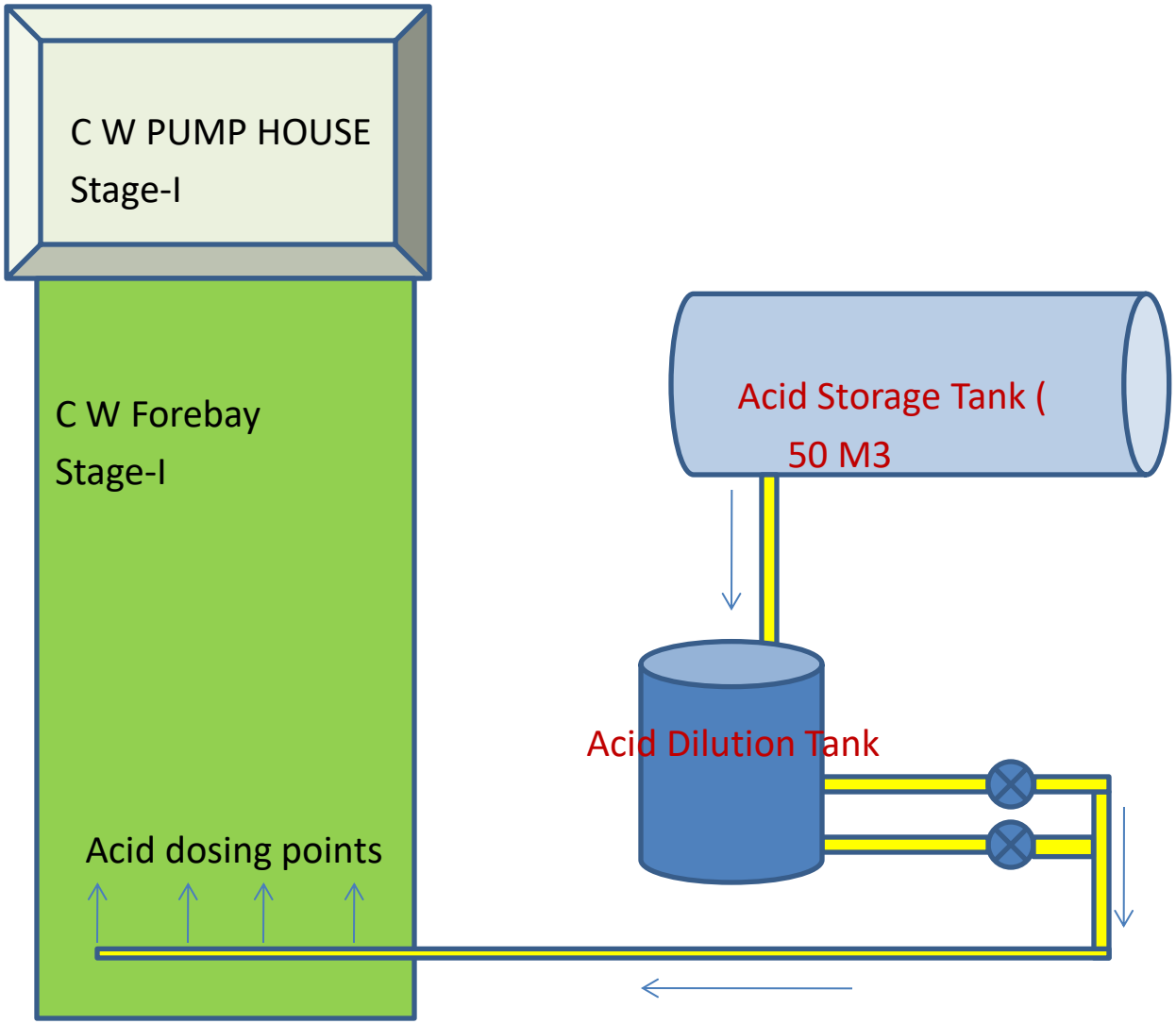
ZLD SCHEME AHP AREA



ZLD Scheme in AHP

- ETP treated water and stage-II cooling tower blowdown water is being used for dust suppression and water to the plantation at ash mound including Golf-course.
- Only ETP / blowdown water used to maintain ash mound area.
- No fresh water is being used for ash mound area
- The collected ZLD water is used for Ash Mound spray using sprinklers for control of fugitive ash. No fresh water is used.

ZLD SCHEME OFFSITE AREA



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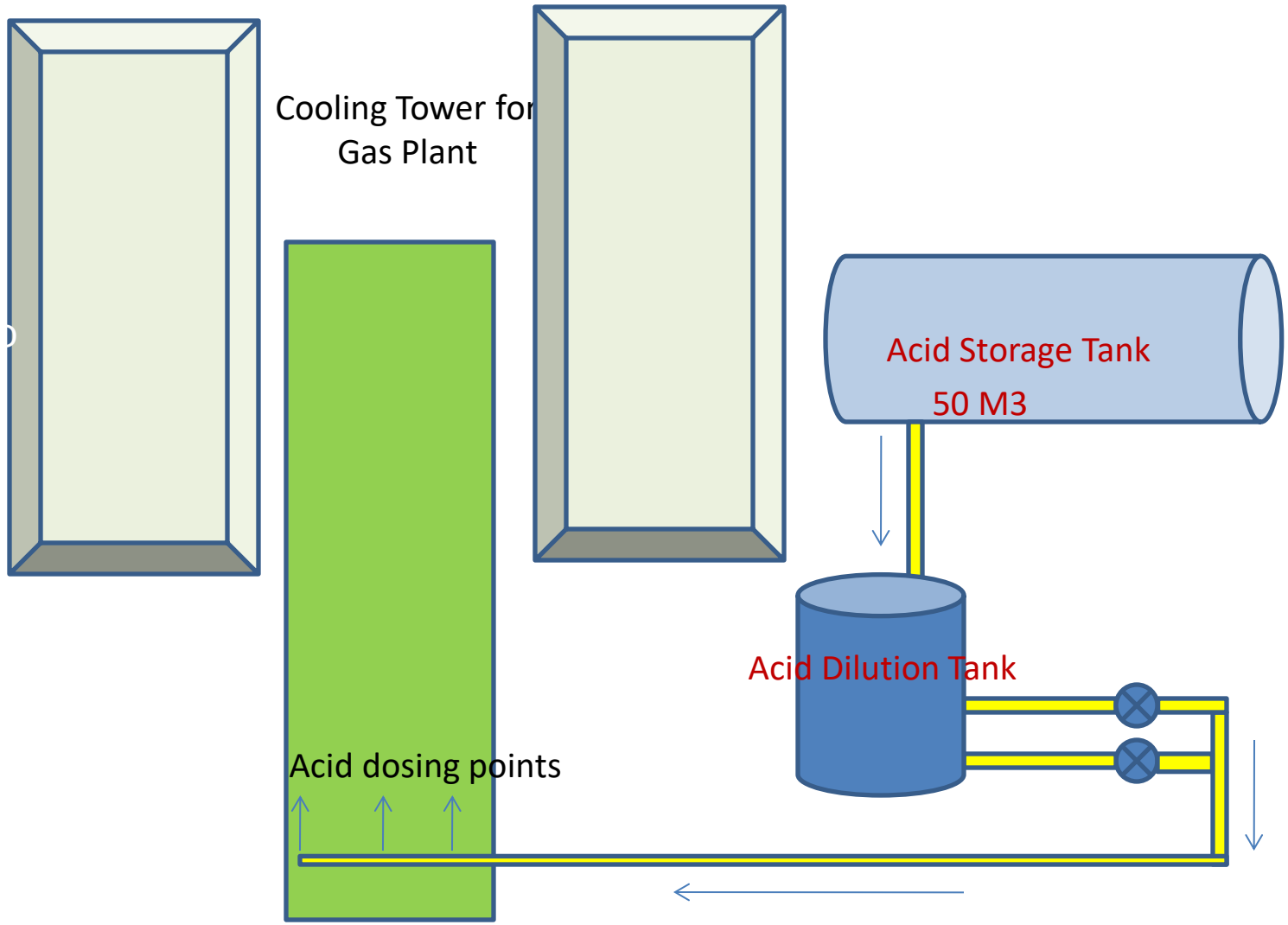
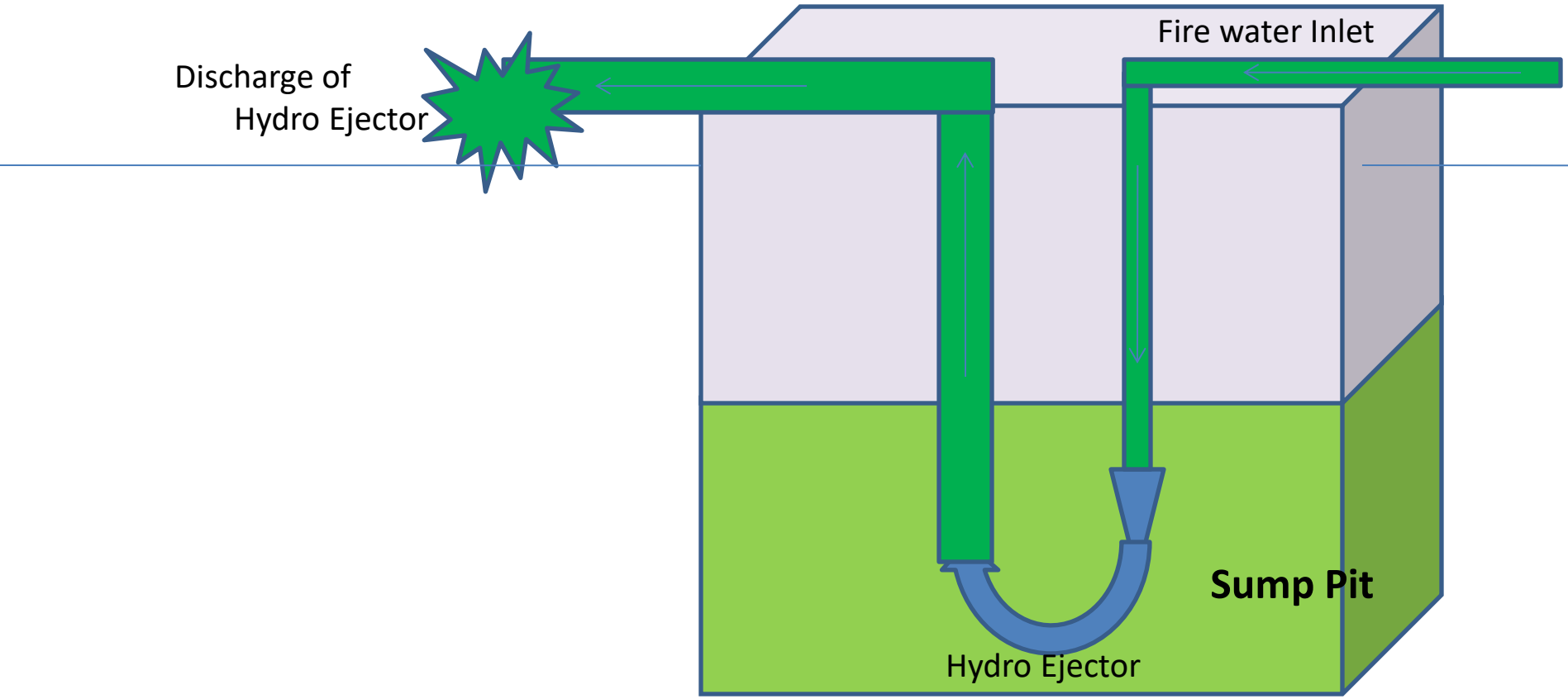


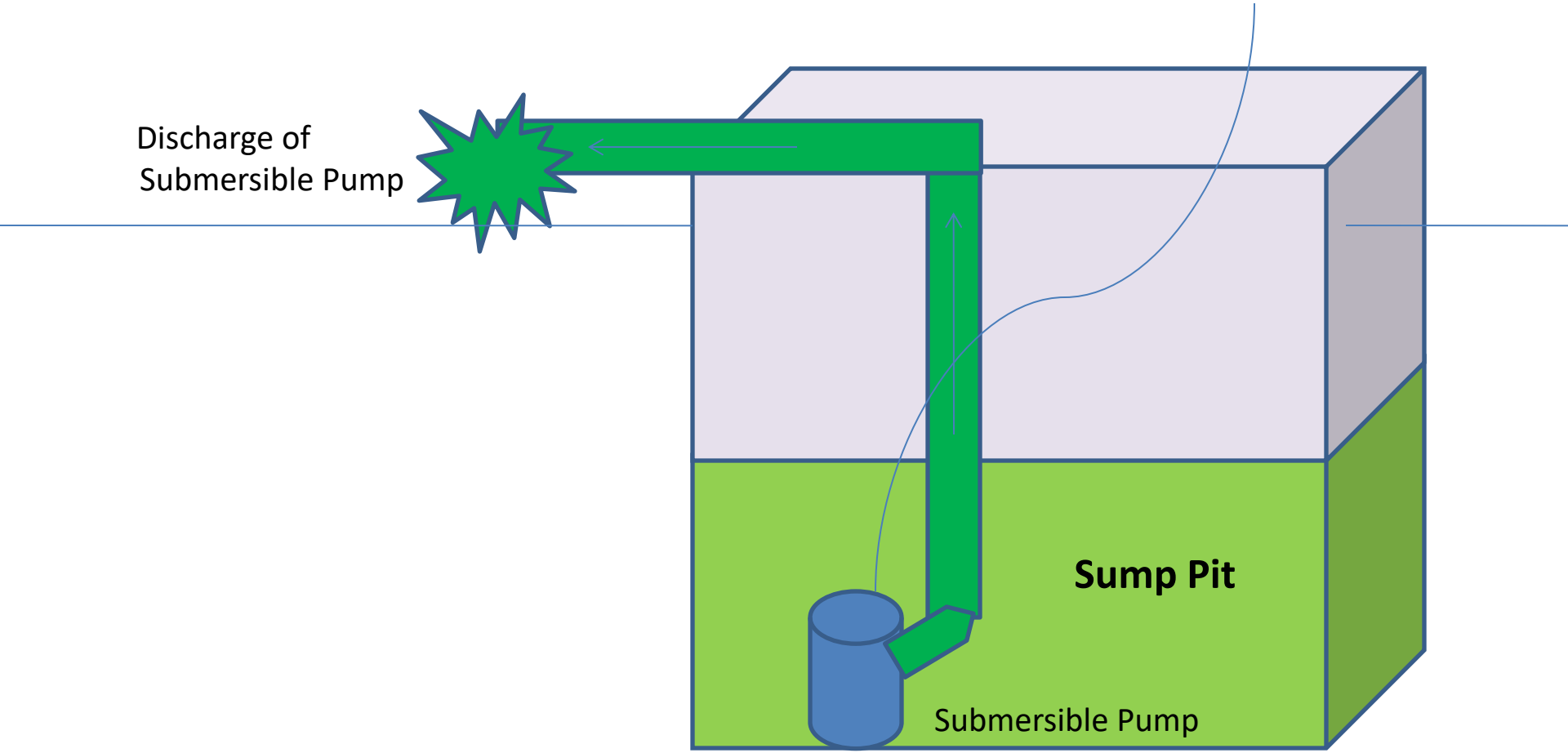
ZLD SCHEME BOILER AREA

Existing practice of sump dewatering

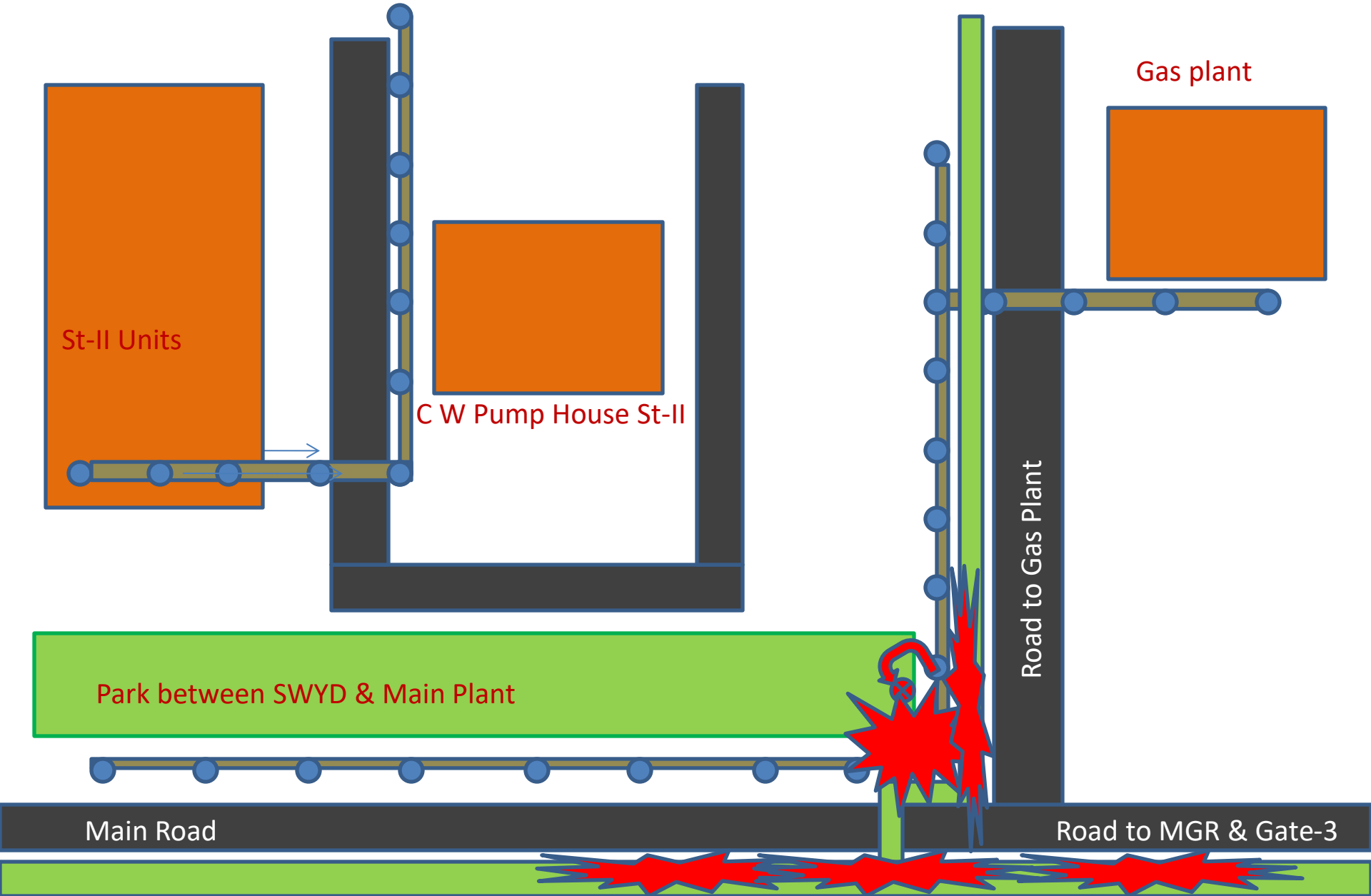


ZLD SCHEME BOILER AREA

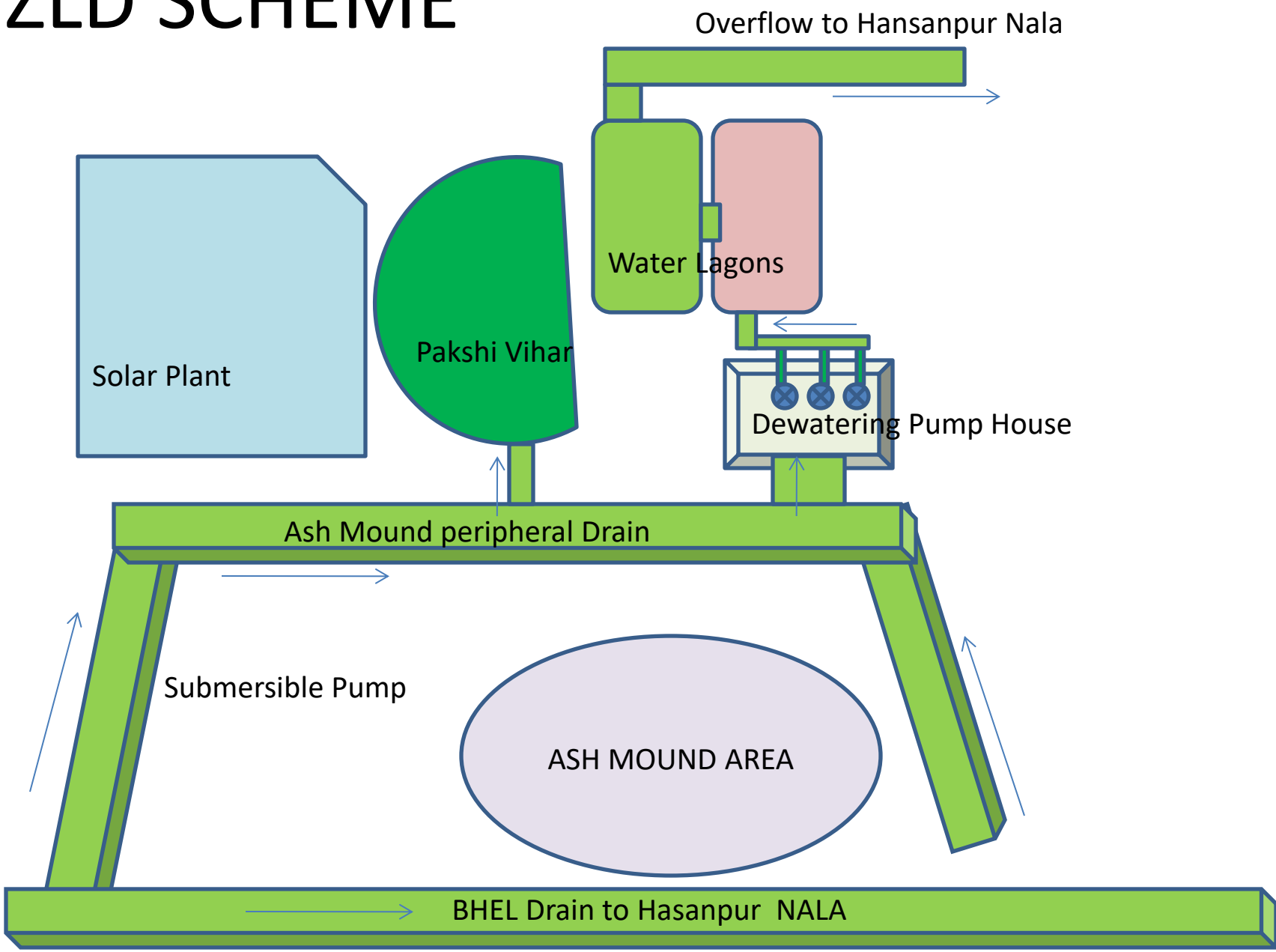
Proposed dewatering scheme

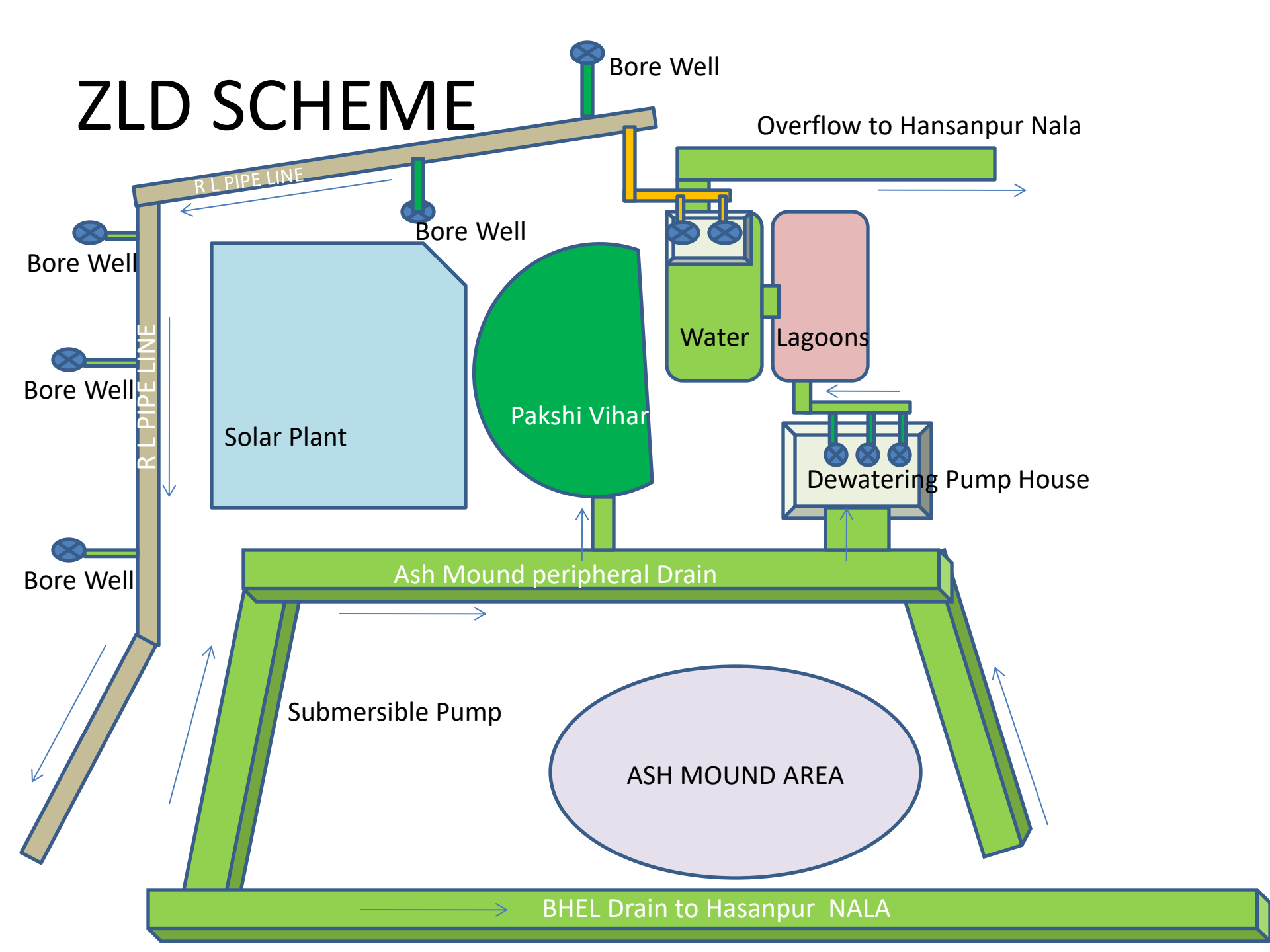


SEWAGE SYSTEM OF GAS PLANT



ZLD SCHEME


Overflow to Hansanpur Nala
Water Lagons
Solar Plant
Pakshi Vihar
Dewatering Pump House
Ash Mound peripheral Drain
Submersible Pump
ASH MOUND AREA
BHEL Drain to Hasanpur NALA


ZLD SCHEME
Bore Well
Overflow to Hansanpur Nala
R L PIPE LINE
Bore Well
Bore Well
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R L PIPE LINE
Solar Plant
Pakshi Vihar
Water
Lagoons
Dewatering Pump House
Bore Well
Ash Mound peripheral Drain
Submersible Pump
ASH MOUND AREA
BHEL Drain to Hasanpur NALA

ZLD Scheme in Ash Mound area

- Since entire area covered under ZLD therefore, to handle rain run off water additional pit also made near ash mound area.
- The rain water of entire plant area collected in the filter lagoon / storage lagoon and after filtration the same water is also being transferred to reservoir for power plant operation.
- The collected ZLD of ash mound peripheral drains is again collected and water is used for Ash Mound spray using sprinklers for control of fugitive ash. The water collected in RL pipe line is also used similarly.


thanks