

GPSD Stage 2 Enhancement Options

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Purpose

This document outlines recommended secondary filtration enhancements to the GPSD system for improved water clarity, chemical polishing, and ethical material sourcing.

Passive Enhancement Philosophy

GPSD Stage 2 filters must remain: - **Fully passive** - **Low-cost** - **Field-maintainable** - **Ethically sourced**

No forced regeneration, no proprietary cartridges, no ecological cost shifting.

Recommended Enhancement Media

Media Type	Purpose	Notes	
Biochar	Removes VOCs, odors, bacteria	Use only waste-based (wood shop, crop husk, NOT deforestation)	
Zeolite	Ammonia, nitrates, metals	Effective but hard to regenerate in coastal setups	
Sand	Polishing + support bed	Cheapest, durable, reusable	
GAC (activated carbon)	High-performance polishing	High cost, import-dependent	

⚖️ Recommended Ratio (Sand + Biochar Blend)

Configuration	Suggested Ratio	Yield Benefit	Notes
			Low-char blend 90% sand / 10% biochar ~10-15% polishing improvement Cheap, stable
			Balanced mix 70% sand / 30% biochar ~20-30% polishing + odor control Best value-performance tradeoff

| **High-char stack layer**| Top 20–30cm pure biochar over sand | 30–40% gain for taste/smell | Maintenance needed every 6–12 months

Performance Notes

- A biochar layer improves **VOC adsorption, color clarity, microbial polishing**
 - Does **not affect salinity**, but improves perceived water quality
 - Charcoal slows bacterial regrowth in storage tanks
 - Avoid dense compaction — biochar needs **loose structure** to avoid flow blockages
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Failure Case: Charcoal Collapse

Improperly aged or poor-quality charcoal can: - Collapse into fine particles - Clog the sand layer - Turn into mud if too moist

Solution:

Use **screened, granular biochar** (5–20 mm), preferably from kiln-processed dry woodshop waste. Avoid forest fire residue or powder fines.

Field Strategy Summary

- Use **sand as structural filter + support**
- Layer **biochar as polishing cap**
- Only use zeolite if:
 - Ammonia is high
 - You can dispose/replace yearly
 - You are not relying on it for salt-heavy water

All media should be renewable, non-toxic, and regionally sourced where possible.

Conclusion

GPSD Stage 2 filtration adds clarity and chemical polishing without sacrificing affordability or ethics. A simple 70:30 sand-biochar blend delivers a major water quality upgrade — with no need for regeneration or machinery.

Clean trench. Clear water. Honest footprint.