G. Robert Pickert bio char

Soil Health Moonshot – Transform Brevard Soils into a Sustainable Living Filter for the IRL
CEER ID # 2026045 – Submitted Written Comments April 7, 2026

Good Evening Commissioners.

I am Bob Pickert and I propose a "Soil Health Moonshot" to transform Brevard's sandy landscaped soils into a sustainable living filter for the Lagoon.
Biochar is similar to activated carbon made from waste wood. As a soil amendment it:

- absorbs and conserves soil moisture,
- adsorbs and retains nutrients and contaminants to make nutrients bioavailable to plants but not leach to groundwater and the Lagoon, and
- provides the perfect habitat for beneficial soil microbes – the magic of biochar.

The intent is to create a healthy soil biome in landscaped soils around the IRL as a practical and sustainable way to protect and extend the County's investment in the Lagoon.

Over the past decade, the County has made great progress addressing major sources of pollutants to the Lagoon. But even if we continue to make progress through the SOIRL Programs (dependent on public funding) and implement new programs (such as low-impact development as suggested by others), the relative contribution of fertilizer losses from landscaped sandy soils, "miscellaneous baseflow", and atmospheric nitrogen deposition will grow from 26% to a majority of nutrients to the Lagoon in excess of a sustainable balance.

The Soil Health Moonshot could be a third pillar to complement, not replace, what SOIRL is already doing in **source control** and **legacy load removal** to restore the watershed function, much like a healthy gut biome is critical for human health. The scale is bigger, but the concept is simple – reduce the use of polymer-coated urea and non-conforming fertilizers that continue to release nutrients to the sandy soils around the Lagoon by adding biochar, worm castings, and other local natural ingredients to transform our landscaped soils into a live and sustainable trickling filter and nutrient sponge instead of nutrient pathway. There is no O&M required – soil microbes do the work. That is the magic of biochar. I have proposed additional testing of muck to identify the highest quality muck, demonstrate nutrient loading and leaching from a biochar-based fertilizer, and assembling a group of soil experts and stakeholders to establish a consensus on the appropriate soil health objectives. IRL muck would serve as a source of minerals, a binding agent for making pellets, and a galvanizing agent to inspire public participation. The result would create a soil health *industry* that would not only flourish here, but could be exported to other algae-plagued geographies.

The Circularity of IRL muck was intended to "***Get a feel*** for how this could finance SOIRL Programs" rather than a fully-developed shovel-ready specific project proposal. The SOIRL

COC responded by producing a self-described "White Paper" that is more of a myopic White Wash to dismiss the idea than authoritative White Paper on the potential for biochar to support the IRL restoration. It is full of incomplete, inaccurate, and misleading statements; omits important characteristics and SOIRL uses for biochar; and does a disservice to Brevard residents. I have provided an edited version to begin setting the record straight, and will reach out to the COC to get this right.

I'm not asking for a large new program today. **My CEER recommendation is to begin following a step-wise roadmap**, beginning with additional muck testing that should be occurring anyway, and a logical path forward that can be discontinued if data proves the concept infeasible. I have since become aware of the County's plan to dredge the canals of Indian Harbour and Satellite Beach. My comments include a proposed pilot scale project to demonstrate the Soil Health Moonshot concept, and to see if we can reduce the flux of excess nutrients from well-fertilized canal-front properties that will likely re-fertilize the canals. Biochar could be used as a treatment media to reduce the high cost of interstitial water treatment, with the savings helping to fund the pilot project. The CEO of Gator Dredging has indicated he is interested. I will provide more details in my future comments.

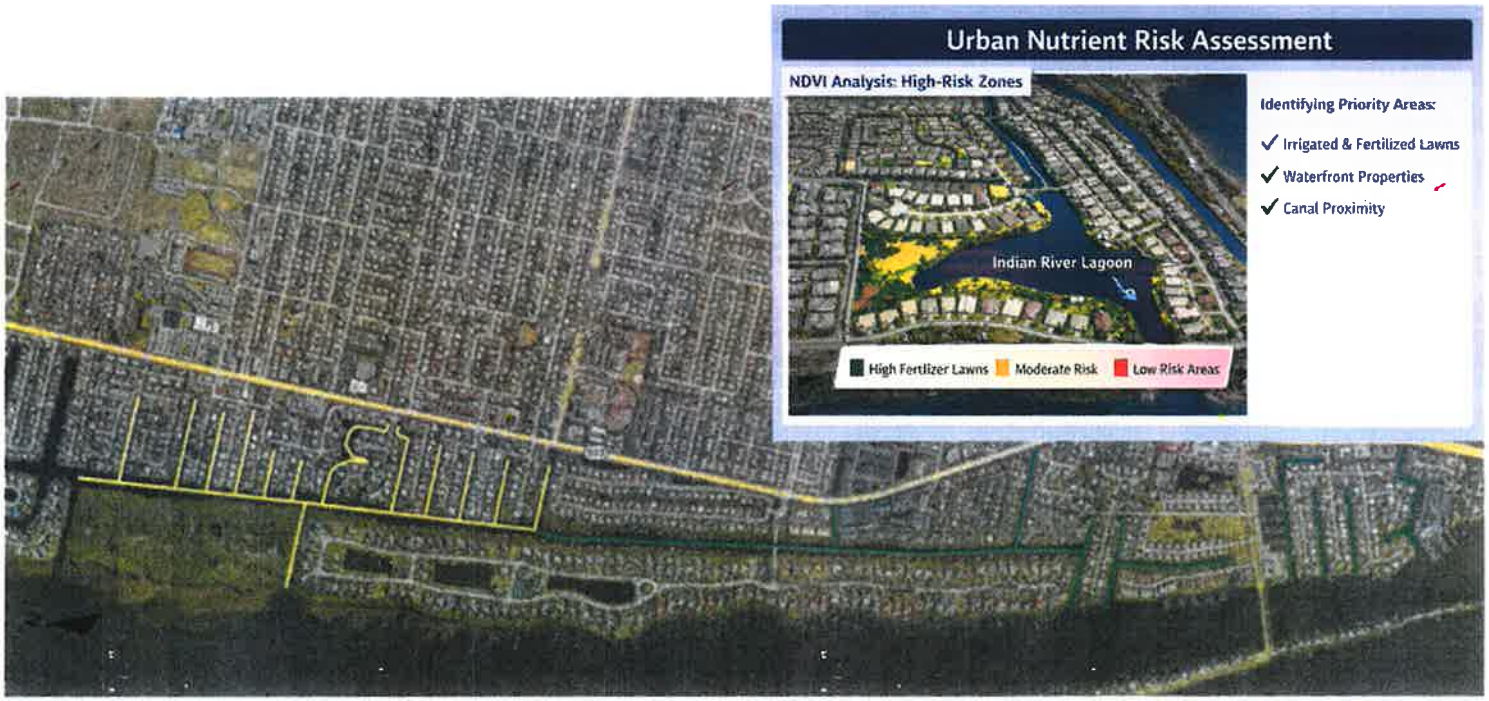
Add if time allows:

My CEER Recommendation included related recommendations to:

- **reduce garbage pick-up** to 1 day per week to fund biochar production from storm debris and curbside pick-up of woody yard waste (or return it to tax payers).
- **Discontinue the current practice of excluding private companies** from speaking to the COC and receiving SOIRL grants. The SOIRL mission belongs to everyone and should be an "all hands" mission. We can't afford the categorical dismissal of the potential of public-private partnerships.

Urban Nutrient Risk Targeting | SOIRL Soil Health Pilot

Indian Harbour Beach and Satellite Beach | Precision Nutrient Mapping



Mathers Bridge Area Muck Removal Project
Indian Harbour Beach and Satellite Beach Canals

ATKINS

Member of the SNC Lavalin Group

Brevard

25 JANUARY 2022 – Indian Harbour Beach City Council Project Status Presentation

Mathers Bridge Soil Health – Muck Prevention Pilot

Demonstrate baseline and reduced nitrogen & phosphorus flux to canals / IRL by biochar-based fertilizer & soil amendment:

- Identify subject parcels with high impact for study (120 acres total)
- Remote sensing ($125K)
- Baseline monitoring ($200K)
- Materials (Biochar, muck, worm castings, seaweed extract); Pelletize; & Transport ($350K)
- Local dist. & apply ($200K)
- Post treat monitor yr 2/5/10 ($250K)
- Data analysis / report ($140K)
- $1.3 M (to be funded by savings from biochar treatment of interstitial water and/or reduced garbage collection to 1x/week.

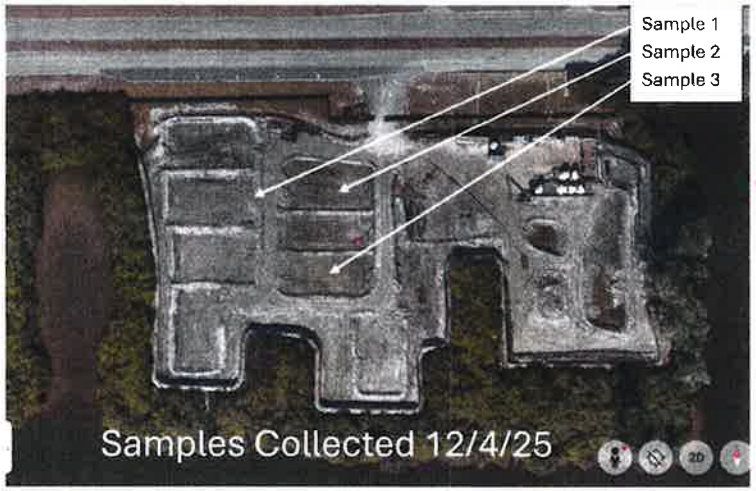
Muck dewatered to 50% solids

- 430 lb N/year (4,300 10 yrs)
- 40 lbs P/year (400 lbs 10 yrs)
- $279/lb N

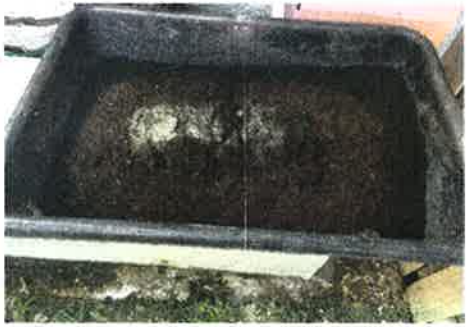
Demonstrated Plant Growth Media - Slow Release Fertilizer & Soil Amendment Concept – Using IRL Muck

The SOIRL COC White Paper "White Paper IRL Muck and BiocharNRM" by SOIRL COC member Charlie Venuto Feb 20, 2026 has stated "A recent study at FIT using IRL muck to germinate lettuce seeds was unsuccessful". The simple experiment below shows rye grass seeds germinate immediately and grow rapidly in a soil mixture of 55% muck, 40% biochar, and 5% compost; with the addition of worm castings / tea. 4/7/2026

IRL Slow-Release Fertilizer & Soil Amendment (v1)



Partially-dewatered muck samples - further dewatered to 39% solids using a well made of a plastic drainage grate w/ landscape fabric.



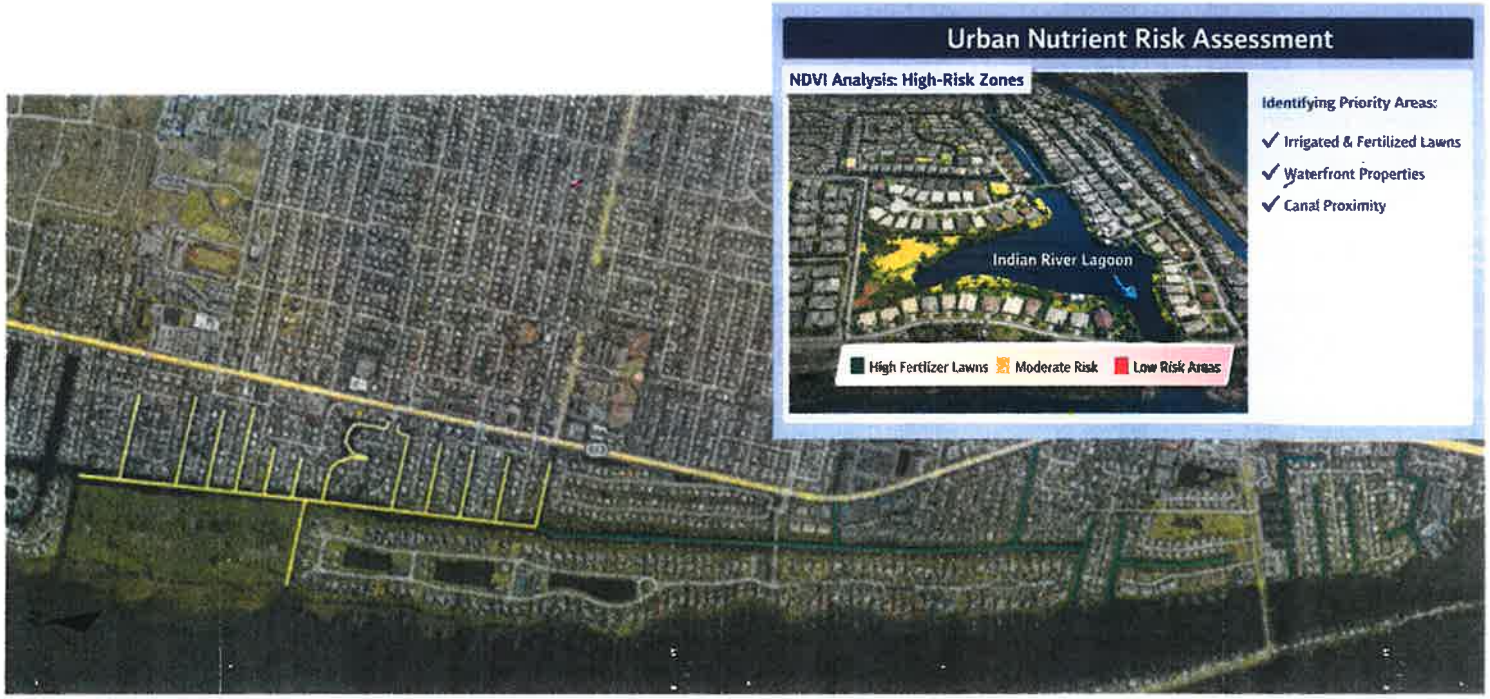
7.5 quarts biochar / 3 quarts muck / 1 quart compost
(40% biochar / 55% muck / 5 % compost (dry weight)
(65% biochar / 25 % muck / 10 % compost (volume)

Worm castings eliminates muck odor. Worms go to work in enhanced muck.

Day 4 - Rye grass seed in muck-biochar-worm food / castings; muck-biochar-compost; and IRL Muck.

Urban Nutrient Risk Targeting | SOIRL Soil Health Pilot

Indian Harbour Beach and Satellite Beach | Precision Nutrient Mapping



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PROPOSED PROJECT CONCEPT

Precision Upland Nutrient Interception to Complement Canal Muck Dredging

Indian Harbour Beach & Satellite Beach Pilot Project **04072026**

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1. Executive Summary

The Cities of Indian Harbour Beach and Satellite Beach are advancing canal muck dredging projects to remove accumulated organic sediments contributing to nutrient release and water quality impairment in the Indian River Lagoon (IRL).

While dredging will reduce internal nutrient loading from sediments in deeper canal centers, significant muck will remain within 5–10 feet of canal banks due to docks, seawalls, and vessel constraints. Additionally, upland nutrient flux from residential landscapes and shallow groundwater will continue delivering nitrogen and phosphorus to canals, gradually re-accumulating nutrient-rich muck.

This project proposes a complementary upland strategy:

Identify and treat nutrient source and transport hotspots in canal-adjacent residential areas using precision mapping and engineered biochar soil amendments to reduce ongoing nutrient flux.

The pilot will target canal-front neighborhoods in IHB and Satellite Beach and quantify nutrient load reduction attributable to soil-based interception.

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2. Problem Statement

2.1 Canal Sediment Legacy

IRL canal systems in IHB and Satellite Beach:

- Have accumulated decades of muck.
- Experience limited flushing.
- Exhibit elevated sediment nitrogen and phosphorus.
- Act as both nutrient sources and sinks.

Dredging reduces internal loading from deeper sediments but:

- Cannot remove sediments near seawalls and docks.
- Does not prevent new nutrient inputs.
- Does not increase upland soil nutrient retention.

2.2 Ongoing Upland Nutrient Flux

Primary pathways:

- Fertilized turf nitrate leaching.
- Shallow groundwater discharge into canals.
- Storm-driven runoff pulses.
- Septic legacy plumes (where applicable).

In barrier island settings:

- Water table often 1–3 feet below surface.
- Sandy soils have low nutrient retention capacity.
- Vertical transport to canals is rapid.

Therefore:

Without upland interception, canals will continue receiving nutrient inputs after dredging.

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3. Project Purpose

To reduce ongoing nitrogen and phosphorus flux from canal-front residential landscapes into IHB and Satellite Beach canal systems by:

1. Identifying high nutrient storage and high transport risk zones.
2. Increasing soil nutrient retention capacity using engineered biochar pellets.
3. Quantifying reduction in groundwater and stormwater nutrient export.
4. Supporting long-term canal water quality improvements.

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4. Study Area

Target Area:

Canal-front residential neighborhoods in:

- Indian Harbour Beach
- Satellite Beach

Estimated pilot scale:

300–500 acres of canal-connected parcels.

Typical characteristics:

- 60–75% turf coverage
- Sandy soils
- Shallow groundwater
- Direct canal hydraulic connectivity
- Moderate to high fertilizer use

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5. Nutrient Load Model (Basin-Specific Estimate)

5.1 Assumptions

Residential canal-front area: 400 acres

Average turf coverage: 65%

Effective turf area: 260 acres

Literature-based nitrogen leaching for Florida sandy turf:

15–25 lbs N/acre/year

Use midpoint: 20 lbs N/acre/year

Annual N leaching:

260 acres × 20 lbs = 5,200 lbs N/year

Assume:

50–70% of leached nitrate reaches canals in shallow groundwater.

Use 60%:

5,200 × 0.60 = 3,120 lbs N/year delivered to canals

5.2 Phosphorus Estimate

Typical mobile P export from sandy residential landscapes:

1–3 lbs P/acre/year

Use midpoint: 2 lbs

260 acres × 2 = 520 lbs P/year

Assume 50% reaches canals:

520 × 0.50 = 260 lbs P/year

5.3 Total Estimated Upland Contribution

To targeted canal neighborhoods:

~3,100 lbs N/year

~260 lbs P/year

These are order-of-magnitude estimates but consistent with Florida coastal literature.

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6. Proposed Intervention

6.1 Precision Mapping

Develop a "Nutrient Storage + Transport Risk Index" using:

- NDVI / red-edge imagery
- LiDAR microtopography
- Soil maps
- Groundwater depth data
- Parcel-level fertilizer risk factors
- Canal proximity gradient

Rank parcels for intervention priority.

6.2 Engineered Biochar Pellet Application

Pellet Composition:

- High-CEC biochar
- Iron-enhanced fraction for P adsorption
- IRL muck (processed, screened, tested) as mineral binder
- Worm castings (microbial enhancement)
- Seaweed extract (root stimulation)

Application:

- Broadcast surface application
- Irrigation incorporation
- Optional core aeration pairing

Targeted treatment:

100–150 acres of highest-risk parcels in pilot phase.

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7. Expected Nutrient Reduction

Assume treatment of 120 acres.

Nitrogen

Baseline leaching:

120 acres × 20 lbs = 2,400 lbs N/year

Assume 30% reduction via increased retention:

2,400 × 0.30 = 720 lbs N/year reduced

Assume 60% transport to canals:

720 × 0.60 = 432 lbs N/year prevented from entering canals

Phosphorus

120 acres × 2 lbs = 240 lbs P/year

Assume 35% increased retention:

240 × 0.35 = 84 lbs P/year retained

Assume 50% canal transport:

84 × 0.50 = 42 lbs P/year prevented

Annual Load Reduction (Pilot Scale)

~430 lbs N/year

~40 lbs P/year

10-year effective life (conservative):

4,300 lbs N

400 lbs P

Without upland intervention, canals gradually re-accumulate organic nutrient-rich sediments.

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8. Monitoring Plan

Pre- and post-treatment:

- Shallow groundwater sampling wells.
- Canal water quality monitoring at neighborhood scale.
- Lysimeters in treated turf.
- Soil Mehlich-3 P and nitrate tests.

- Seasonal comparison with untreated control block.

Primary metrics:

- Groundwater nitrate concentration reduction.
- Canal dissolved inorganic nitrogen reduction.
- Reduced storm event nutrient spikes.

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9. Budget (Pilot Estimate)

GIS & remote sensing: $125,000

Baseline monitoring: $200,000

Biochar production & pelletization: $350,000

Application: $200,000

Post-treatment monitoring (year 2/5/10): $250,000

Data analysis & reporting: $140,000

Estimated total: $1.3M

Cost per pound N (10-year horizon):

$1,200,000 / 4,300 lbs ≈ $279/lb

Competitive with other SOIRL investments.

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10. Strategic Alignment with SOIRL

- Reduces nitrogen and phosphorus loads.
- Protects canal dredging investments.
- Distributed and scalable.
- Addresses legacy nutrient storage.
- Provides measurable load reduction.
- Supports BMAP compliance goals.

White Paper by SOIRL COC (Charlie Venuto) Feb 20, 2026
Edits and Comments by Brevard Citizen Bob Pickert (Noted as "EHS Roundtable") April 7, 2026

Introduction

Biochar is a product of the pyrolysis of woody and other organic matter. It is available at garden centers and big box stores as a soil amendment. It is primarily carbon which provides a surface area for the adsorption of inorganic and organic substances, and provides a habitat for beneficial soil microbes.

Biochar carbon credits are available in private carbon markets for transforming waste biomass that would naturally decompose to greenhouse gases (carbon dioxide and methane) into carbon-storing biochar. They often feature co-benefits including soil health, water retention, and nutrient cycling. These credits have increasingly been subject to rigorous verification and validation by registrars and 3rd party verifiers and are among the most durable . ~~producers claim that it is an effective carbon sequestration agent and can be used for carbon credits.~~ When "charged" with nutrients, biochar ~~it~~ can function as a slow-release fertilizer. It can also remove undesirable contaminantes including emerging contaminants such as PFOS/PFAS and tire rubber stabilizers. Biochar's effectiveness for certain pollutants (e.g., arsenic) can be enhanced through various techniques including steam activation to open biochar's pore structure and increase surface area (e.g., Donau Carbon in Dunnellon, FL) or impregnating biochar with iron and other metals or minerals for contaminant-specific activity.

A Brevard County resident that works for ~~n employee of the~~ Wakefield Biochar~~Company~~ (representing himself and not the company) has requested to provide the SOIRL staff or COC with a presentation about the origins & sources, production processes, qualities, and uses of biochar to educate the Committee. The request was denied; however the resident was advised of his right to address the SOIRL staff and COC as part of public comments. The resident provided comments on the nature and benefits of biochar during the November 2025 and February 2026 SOIRL COC meetings. To illustrate the potential benefits of biochar within the 3-minute window allowed, the resident ~~, a producer of biochar,~~ illustrated the potential benefit by providing an example scenario (Referred to as "Circularity of IRL Muck") where Brevard County (or some joint venture) transforms some portion of the muck into a slow-release fertilizer and soil amendment by adding biochar and other natural ingredients from Brevard County (e.g., worm casting, seaweed extract), ~~proposed adding IRL muck to biochar~~ and offering it for sale as a slow-release fertilizer and soil amendment ~~by the county~~ as an income producing product. It was suggested that income from the sales of biochar/muck could potentially replace or supplement the SOIRL tax. The SRF/SA ~~biochar/muck~~ could be applied on lawns and gardens. The citizen ~~proponent~~ recommended a step-wise path forward to build confidence with the circularity of the IRL muck that included using SOIRL funds for the following activities to assess the feasibility of this concept.

White Paper by SOIRL COC (Charlie Venuto) Feb 20, 2026
Edits and Comments by Brevard Citizen Bob Pickert (Noted as "EHS Roundtable") April 7, 2026

- Additional testing *and inventory* of dewatered muck from various dredge dewatering sites & management areas (to identify the quality of muck and its potential beneficial uses),
- Nutrient loading and leaching performance testing of a dewatered muck-biochar mix,
- Product formulation consensus-building with experts and stakeholders,
- Sales & Marketing ground game (big box & other retail, nurseries & distributors),
- Limited blending, mixing, pelletizing, confirmation testing,
- Limited production & distribution by the truckload (include bag label design).

The citizen has since proposed a "Soil Health Moonshot" as a Speak-Up Brevard Recommendation (#20260045) to "transform Brevard soils into a sustainable living filter" for the IRL and a soil health pilot scale project associated with the pending project to dredge the canals of Indian Harbour Beach and Satellite Beach with projected nutrient reductions competitive with other SOIRL investments.

The citizen has sought to obtain records from the Florida Department of Agriculture for the amount of fertilizer applied to Brevard County soils; however records that include residential purchase and application by county are not readily available. Further data analysis is required, but could be used to calculate nutrient losses and potential benefits from the wide use of biochar as a slow-release fertilizer and soil amendment.

The Brevard County Environmental Resource Director had advised the citizen to consider FDEP water quality grants that were available by September 1st. The citizen had 2 days to prepare and submit the application and submitted a grant request for $250,000, including $75,000 in sample analytical costs to demonstrate the nutrient loading onto mixtures of muck and biochar, and nutrient leaching from the 'charged' mixture to demonstrate and quantify the nutrient removal. The resident did not know that only non-profit organizations are eligible for FDEP water quality grants, and he did not represent a non-profit organization. The resident contacted the Executive Director of the Marine Resource Council and Dr. Austin Fox of FIT to see if either organization would be willing to serve as grant recipient and lead the study. The MRC advised the study was beyond the MRC competence and capability, and a grad student for Dr. Fox at FIT declined by stating that so much is known about biochar that the project would not be considered research. ~~Based on an unsuccessful FDEP grant application submitted by the proponent for this concept, the applicant calculated $250,000 to complete preliminary viability testing and analysis.~~

IRL Muck Background

White Paper by SOIRL COC (Charlie Venuto) Feb 20, 2026
Edits and Comments by Brevard Citizen Bob Pickert (Noted as "EHS Roundtable") April 7, 2026

There have only been four (4) samples of dewatered muck from all of the dredging and dewatering. Those 4 samples were collected from maturing geotubes at the Grand Canal (Pineda) dredge dewatering site between (May and November 2026). Grand Canal IRL Muck Characteristic (4 samples):

Constituent	% or C (mg/l)	Comments
Nitrogen	<1*	This level of nitrogen would likely require supplemental nitrogen to serve as a substitute for nitrogen fertilizer(s).
Phosphorous	<0.1*	This level would make a SRF eligible to be a no-phosphate or phosphorus-free fertilizer
Total Organic Carbon	74,000 mg/L-4 (7.4%)**	Much of this is bound to silt and clay. The organic matter in in-situ muck reportedly varies from 10% to about 30% with typical values in the 10-15% range.
Electrical Conductivity	35-46,000 with an average of 41,000 mg/L	~30microS/cm, an indication of high salinity. Electrical conductivity is a non-specific indicator of total dissolved ions which could be marine salts, nutrients, and redox sensitive compounds including magnesium, calcium, potassium, sulfate, nutrients, iron, manganese. Samples were not analyzed for chloride, which could be a more direct indicator of saltwater impact. Biochar has a high cation-exchange capacity and resolves high salinity in soils by adsorbing excess sodium ions, holding them on its surface, and releasing beneficial ions like calcium, potassium, and magnesium. This reduces soil electrical conductivity, improves soil structure, enhances nutrient availability, and prevents salt stress in plants.
Chromium	43 mg/L	The worst-case TCLP would be 2.2 mg/L. The TCLP limit for chromium is 5.0 mg/L. The Florida soil cleanup target for unrestricted residential use of soil for residential use is 210 mg/Kg. The default commercial target for chromium is 470 mg/Kg. Chromium is not listed in Florida fertilizer Code limits on metals, so levels of chromium in fertilizers and soil amendments may be higher. Federal biosolids regulations (40 CFR Part 503) specifies limits for metals in biosolids that can be land applied, but chromium is not listed. Published studies for soil background levels in central Florida indicates a typical background chromium concentration is 25-100 mg/Kg. Chromium toxicity is highly dependent on its valence state. Chromium (Cr^{6+}) is highly toxic and carcinogenic, water

Commented [ER1]: If you're going to provide additional comments to provide perspective, please be complete and balanced.

Commented [ER2]: The Toxicity Characteristic Leaching Procedure (TCLP) requires a 20:1 dilution of the sample with mild acetic acid (to simulate conditions in a landfill). The result can not be more than 1/20th of the completely digested sample using strong acid. It is likely to significantly lower because the mild acetic acid does not digest nearly as much of the metal as a strong acid digestion.
The hazardous levels are based on 100 times the drinking water standard, based on the assumption that landfill leachate from hazardous waste would be diluted byat least 2 orders of magnitude (100 times), thereby limiting groundwater quality impacts.

Commented [ER3]: Arsenic occurs naturally in Florida soils and background levels of arsenic may exceed the default soil clean-up target concentration naturally.

Soil clean-up targets are intended as a general guide for the order-of magnitude estimate for single-contaminant clean-up targets. They are not a substitute for site-or scenario-specific risk assessments. These default concentrations are based on highly conservative exposure scenarios. For example the residential exposure target level is based on a child (15 kg body weight) eating 200 mg/day of impacted soil for 350 days per year until adulthood, and an adult (70 kg) eating 120 mg/day for 12 years (total exposure 30 years) to keep the lifetime cancer risk to less than 1 in a million (1×10^{-6}). Commercial default targets are based on soil ingestion of 50 mg/day for 250 days per year for 25 years and do not include child exposures.

Commented [ER4]: A liter of water weighs 1 kilogram, so mg/L (water) and mg/Kg (soil) can be roughly comparable for total metals analysis of fully saturated soils and dilute aqueous solutions.

		soluble, and mobile in the environment. Chromium (Cr^{3+}) has low toxicity and is an essential trace nutrient in small amounts, has poor solubility in water, and low mobility and bioavailability. Public health exposure limits are generally based assuming Cr^{3+}. The conditions of IRL muck may lead to reduction of $Cr+^{6}$ to $Cr-^{3}$, so the actual risk may be significantly lower. ~~Average 43 mg/Kg (missing data to determine TCLP concentrations for RCRA Hazardous Waste characterization)~~
Arsenic	12.0 mg/L	Worst case TCLP (hazardous waste) concentration would be 0.6 mg/L. The TCLP limit for arsenic is 5.0 mg/L. The Florida soil cleanup target for unrestricted residential use is 2.1 mg/L. Commercial use is 12 mg/L. Published studies for soil background levels in central Florida indicate the average arsenic concentration is 3.1 with a 97.5% probability that background concentrations of arsenic as high as 6.8 are naturally occurring, but this is only based on 2 samples and is not specific to Brevard. Florida fertilizer Code (FAC 5E-1.026) does not limit arsenic in fertilizers except that it considers fertilizers as "adulterated" (contaminated) if they exceed certain metals concentrations including arsenic. The ceiling limit for arsenic n commercial fertilizers is 75 mg/Kg. Federal biosolids regulations (40 CFR Part 503) specify limits for metals in biosolids that can be land applied. The limit for arsenic is 75 mg/Kg. Cumulative pollutant loadings rates limit arsenic application to 41 kg/hectare (equivalent to 41 kg/2.5 acres or 16.4 kg/acre.
Copper	55.8 mg/L	Copper is an essential nutrient and vital trace element for human, animal, and plant health. Very high levels of copper can have toxicological effects. The Florida soil cleanup target for unrestricted residential use is 150 mg/Kg. Commercial use is 89,000 mg/Kg. There is no TCLP limit for copper to be designated as hazardous waste.
Silt	65%	
Clay	26%	
Sand	9%	Much of the sand is settled out of muck during the initial muck dewatering process. This value represents what is left remaining in dewatered muck.

**fine-grained muck fraction only (not the sand)which is removed in the initial settling stage of muck dewatering and is not sampled ~~Average of all four samples~~*

*** only one sample result*

White Paper by SOIRL COC (Charlie Venuto) Feb 20, 2026
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These results do not necessarily represent muck throughout the IRL. According to Dr. Austn Fox, the organic matter in in-situ muck varies from 10% to about 30% with typical values in the 10-15% range. Much of the organic matter is tied up with the silt and clay.

A recent study at FIT using IRL muck to germinate lettuce seeds was unsuccessful, however a limited effort to grow ryegrass seed in amended IRL muck by amending it with biochar and worm castings was hugely successful in germination and growing rapid and robust growth of rye- grass seed, as shown in a handout at the February SOIRL meeting.

Over 800,000 cubic yards of muck has been removed using SOIRL funds. This muck has been deposited at permitted dredged material management areas and applied in uplands and other approved sites. In the upland sites, the muck is mixed and tilled into soils. The contractors handling the muck are not permitted to sell it.

Undetermined issues

What conductivity levels would be acceptable for use as a fertilizer? Electrical conductivity was analyzed in the 4 muck samples, but chloride was not. Electrical conductivity is not just salinity (Na^+/Cl^-) but is a bulk indicator of total dissolved ions, which could include marine salts (e.g., magnesium (Mg^{2+}), calcium (Ca^{2+}), Potassium (K^+), and sulfate(SO_4^{2-}); and muck decomposition compounds (ammonium bicarbonate/carbonate, sulfides); and other compounds.

What material(s) would be added to the muck to increase the nutrient availability? The recommended pathway to move forward with beneficial reuse / circularity of IRL muck included product formulation consensus-building with experts and stakeholders. The muck amended to demonstrate ryegrass growth included biochar, worm castings, and a small amount of compost inoculated with microbes. Seaweed extract or other natural sources of nutrients could be added to increase nutrient availability. When biochar is charged with nutrients, they become bioavailable to plants but relatively non-leachable to soil, groundwater and the Lagoon.

What ratio of muck to biochar and charging agents is needed? The muck represented approximately 55% of the initial soil health mixture on a dry-weight basis (25% on a wet-weight basis) before the addition of worm castings. Mycorrhizae fungi could also be added. The appropriate product formulation would be developed with experts and stakeholders in an open process.

Has a market analysis been performed to assess the viability of this proposed product? There is a growing recognition of the importance of biochar and worm castings as effective beneficial ingredients for fertilizers and soil amendments, and is supported by UF/IFAS County Extension. There is great support for the IRL, and some reasonable expectation that a beneficial SRF/SA would be supported by the citizens of Brevard County if properly presented and marketed. The Scotts Fertilizer company makes and distributes a biochar-based "Soil Builder" as a spreadable

Commented [ER5]: None of these results necessarily represent muck throughout the IRL. That is one of the many reasons why muck should routinely be sampled to understand public exposure risks, potential for beneficial reuse, or applicable or relevant precautions for disposal

Commented [ER6]: What study is referenced here? Please provide a reference or copy for review. The limited effort to grow rye grass seed from a muck-biochar-worm casting mixture was provided to SOIRL staff and COC at the February 2026 meeting. If the study referenced planted any seed only directly into un-amended muck, it was a poorly-designed study. In any event, this comment - (provided with no explanation or detail) indicates a bias against the potential beneficial reuse of the muck.

Commented [ER7]: Additional information on the application of muck in uplands and other approved sites should be provided by SOIRL staff.

Commented [ER8]: No context is provided with this question. What is the point?

top dress for lawns, indicating the marketability of such a product. There is strong and long-standing support for the IRL in Brevard County that would likely translate to such a product, that could be strengthened by further analyses and pilot assessment(s) for a natural (muck-biochar-worm casting-seaweed extract) slow-release fertilizer and soil amendment.

It is important to distinguish between the mechanisms of slow-release fertilizers and biochar-based SRFs/SAs, and to recognize the critical importance of microbes to soil health. Most slow-release fertilizers are polymer-coated urea nitrogen. As the coating becomes weathered from the sun and rain, it dissolves, releasing the urea, not all at once, but the urea nitrogen is released around an average time measured in weeks and months. Biochar-based SRFs act differently. The high surface area of biochar is "charged" with nutrients and microbes, allowing microbes to utilize the nutrients and making nutrients bioavailable to plants, but with less leaching to soil and groundwater that should be quantified by nutrient loading-leaching studies. The citizen proposing broader use of biochar in restoring the IRL (including as a SRF/SA) proposed a Nutrient Loading / Leaching study to demonstrate the adsorption of nutrients to biochar-amended muck and the limited leaching to help quantify the nutrient removal / prevention potential to support the IRL restoration.

Regulatory Concerns

As Phosphorous levels detected in the 4 dewatered IRL muck samples contains phosphorous, at such low levels that it qualifies as a "No Phosphate Fertilizer" under Florida fertilizer rules and guidance adding it to biochar as a fertilizer could prohibit its application in Brevard County unless soil testing indicated phosphorous deficiency. (Brevard County Chapter 46 Article VIII Fertilizer Use on Urban Landscape, Section 46-341 Fertilizer Content and Application Rates).

Commented [ER9]: This statement is completely false and misleading. The author previously acknowledged the muck has < 0.1 % phosphorus.

SOIRL dredging projects must comply with strict FDEP permits[1]. Mixing muck with biochar, marketing, and selling it as a product is NOT authorized by any active permit, but neither is it prohibited. There is a permit modification process, but NRMD staff believe that FDEP will NOT authorize the proposed use, blended with biochar and sold to homeowners, for the following reasons:

Commented [ER10]: These statements are false and misleading for reasons noted in detail.

1) "Construction, alteration and operation shall not allow excavated or dredged material to be placed in a location other than a self-contained upland disposal site"[2].

   This condition only applies when someone is claiming an exemption from permitting (i.e., not under the full ERP or general permit – which would not apply), and a different placement is specifically allowed by the exemption itself. When a project is subject to a full ERP (individual or general) the conditions of that permit (not 62-330.050(9)(b)(6) determine where dredged material can go. FDEP routinely authorizes habitat

restoration placement in water, beneficial reuse for beach nourishment, and restoration for wetlands when water quality is protected. For example, one general permit (e.g., dredging for navigation channel cleanup) expressly allows placement for water quality or habitat restoration if authorized under a separate plan -even though it normally requires upland disposal.

~~1)~~2) The muck itself is "Sovereignty Submerged Lands" and owned by the State of Florida[3]. As such, the State's Board of Trustees must authorize any activities that are not specified on FDEP permits[4]. This condition do not prohibit the beneficial reuse of muck, they simply mean the permittee can't begin the dredge/use activity unless s/he has both an ERP and the submerged lands authorization, and it clarifies that even if dredging is exempt from an ERP, one still needs sovereign submerged lands authorization for work on those lands.

3) Permitted activities using Sovereignty Submerged Lands must "not be revenue-generating" [5]. Under Rue 18-21.003 (Definitions), the term "revenue-generating" means: "Any structure or activity on sovereignty submerged lands that generates revenue or income by any means or services as an accessory activity or facility to any revenue-generating or income-producing operation, such as marinas, restaurants, hotels, commercial fishing, shipping, and boat or ship construction, repair and sales." The rule also lists specific activities that are not considered revenue-generating in certain circumstances (e.g., mooring a commercial vessel at a private dock, incidental aquaculture on a private dock, etc.).

Rule 18-21.005 lists which activities require a lease rather than a letter of consent or other form. Among those listed in subsection (d) are: All revenue-generating activities, except as otherwise permitted in the chapter (meaning some revenue-generating uses may have specific exceptions elsewhere). This means if an activity generates revenue and is located on sovereignty submerged lands, it must be authorized by a lease (unless a specific exemption applies). The rule doesn't simply ban them outright. It requires a correct form of authorization (typically a lease) so the Board of Trustees can manage proprietary interests. This is not a blanket ban, but it's a management and proprietary control mechanism.

The bottom line is that activities on sovereign lands must be authorized and not contrary to the public interest. The Board of Trustees can impose conditions, restrictions, or limitations in authorization to protect public trust resources, but it does not prohibit beneficial reuse of IRL muck. FS § 253.03(c) contains a provision dealing with dredged materials from state sovereignty tidal or submerged lands that states: "Any materials dredged from state sovereignty tidal or submerged lands by the public body and

deposited on public lands may be removed by the public body to private lands or interests only after due advertisement for bids. If no bid is received, the public body has the right to fully convey title to the material with no payment requirement to the Board of Trustees. This means there is a process for disposition of dredged material – including potential sale or removal – but it does not forbid beneficial reuse, it simply establishes procedures when such material is relocated to private lands and how proceeds are handled.

References

[1]FDEP *"General Conditions for Individual Permits"*

[2]Florida Administrative Code *62-330.-50 (9) (a)*

[3]FDEP *"General Conditions for Sovereignty Submerged Lands Authorization"*

[4]Florida Administrative Code 18-21.003 (67)

[5]Florida Administrative Code 18-21.005 Forms of Authorization

[6]This is based on NRMD staff review. A more detailed analysis would require County legal staff review.

The cited provisions do not categorically prohibit beneficial reuse of muck removed from sovereignty submerged lands. The requirements set conditions for authorization, disposal, and management and they require that appropriate permits / authorization be obtained, just as with most SOIRL activities, including and especially dredging.

Technical Issues

SOIRL projects' effectiveness are primarily based on nutrient reduction. What nutrient reduction would be realized by the application of biochar fertilizers to all homeowners (Brevard, Indian River, Martin and Volusia Counties) in the IRL watershed? The proposed project – The Circularity of IRL Muck – proposed a nutrient loading / leaching treatability study (commonly conducted prior to engineering design for site-specific application of proven technologies) to quantify nutrient reduction. The citizen would propose some modifications to include commercial fertilizers for comparison. The citizen has since proposed a Soil Health Moonshot Pilot Project to be associated with the pending dredging of the Indian Harbour and Satellite Beach dredging project (see attached). The initial estimates indicate the study of 120 acres would reduce 4,300 pounds of nitrogen and 400 pounds of phosphorus over a 10-year period for $1.3M, a removal investment of $279 per pound of nitrogen. This is among the better SOIRL investments, especially considering there is no O&M costs – the soil microbes do all the work.

White Paper by SOIRL COC (Charlie Venuto) Feb 20, 2026
Edits and Comments by Brevard Citizen Bob Pickert (Noted as "EHS Roundtable") April 7, 2026

This is especially important to reach and maintain a sustainable balance of nutrients to the Lagoon as specific sources of pollution to the Lagoon are controlled through SOIRL investments.

The citizen also proposed convening a panel of experts and stakeholders to recommend SRF/SA product formulation consensus-building. It would be helpful to have at least an initial consensus prior to the nutrient loading / leaching study.

The benefits of biochar to soil health has been reported in scientific journals. However, there is no evidence that the addition of muck to biochar will enhance its effectiveness. ~~It appears muck would act more as a filler.~~ The citizen has provided the SOIRL staff and COC a pictorial summary of the collection of dewatered muck from the Pineda processing location on December 4, 2025; the subsequent additional dewatering, and addition of biochar (40%) and compost with microbes (5%) to the muck (55% by dry weight); and the addition of worm castings. The muck will serve as a source of minerals, a binding agent for make pellets to facilitate residential use, and a galvanizing agent for IRL support.

Commented [ER11]: The citizen provided scientifically peer-reviewed articles that align with the Soil Health Moonshot recommendation, including use of biochar for
- •Contaminant adsorption for nutrients, metals, & organics
- •Slow Release Fertilizer, and
- •Home Gardens

None of this material was used or referred to.

Mohan, Dinesh; Sarswat, Jawaharlal; Sik Ok, Yong; Pittman, Charles; Organic and Inorganic Contaminant Removal from Water with Biochar, a Renewable, Low Cost and Sustainable Adsorbent; Bioresource Technology February 2014

Wang, Changging; Luo, Dan; Zhang, Xue; Huang. Rong; Cao, Yijun; Liu Gonggang; Biochar-Based Slow Release of Fertilizers for Sustainable Agriculture: A Mini Review, Environmental Science and Ecotechnology, Volume 10, April 2022.

Biochar: A Home Gardener's Primer, -Based Slow Washington State University Extension

Muck management projects are shifting to capping rather than dredging for deep areas of the IRL. It is not feasible to cap muck in shallow areas of the IRL, limiting the applicability of capping; however biochar would also be a powerful additive to in-situ muck and perhaps capping material to help stabilize caps and ensure the reduction of muck flux. The costs associated with capping are much less than dredging. There are existing inventories of muck that could be used, and pending muck removal projects, including the pending dredging of the canals of Indian Harbour Beach and Satellite Beach. The proposed beneficial reuse of IRL muck as an ingredient for a SRF/SA will only provide an outlet for roughly 5% of the removed muck, and will only focus on the best quality of muck, to be determined through additional testing. Therefore the availability of IRL muck for use as a SRF/SA should not be an issue. ~~Dredged muck soon may not be available to blend with biochar.~~

For the planned project to remove muck from the finger canals of Indian Harbour Beach and Satellite Beach, the CEO of Gator Dredging has responded favorably to the possible use of biochar to reduce expenses associated with interstitial water treatment. That project would provide an opportunity to demonstrate the benefits of biochar to dewater muck and beneficially reuse IRL muck.

Recommendations

While ~~As~~ no studies have been conducted by the citizen ~~proponent~~ to demonstrate ~~assess the viability of~~ this concept, that is a reasonable use of SOIRL funds, considering the step-wise roadmap including a proposed pilot project to be evaluated, and the potential to support a sustainable balance of nutrients in the Lagoon. ~~Extensive research would be required.~~ The

Commented [ER12]: Extensive research would not be required, only treatability studies similar to the application of any technology to support engineering.

White Paper by SOIRL COC (Charlie Venuto) Feb 20, 2026
Edits and Comments by Brevard Citizen Bob Pickert (Noted as "EHS Roundtable") April 7, 2026

~~SOIRL program does not include a category for primary research. To date, data collection through SOIRL funds has been limited to assessing project performance.~~

~~There would not be any reduction of nitrogen or phosphorus from this proposal (based on the FDEP grant application).~~

$250,000 is a significant amount of funds. The concepts in this idea are proven, however focused additional studies are needed for engineering and to quantify the costs and benefits of the approach and ~~, especially for an unproven concept~~. ~~This cost estimate does not include~~ the price to bring this proposed product to market. The citizen has proposed a stepwise pathway to evaluate the feasibility for the beneficial reuse of biochar as a SRF/SA. Investing $1.3M in the proposed pilot study, while removing nutrients at a rate competitive with other SOIRL investments, while helping to reduce the cost of interstitial treatment and an important strategy for a sustainable balance in the IRL represents a reasonable risk/reward for the SOIRL program.

In the FDEP grant application, Wakefield stated they have the "capacity to produce, ship, and blend bulk biochar for a larger-scale proof of concept project (Phase 2); and to establish and operate a company-owned & operated turn-key full-scale biochar production and fertilizer bagging operation using Brevard County waste biomass (e.g., IRL muck sludge, woody yard wastes, hurricane debris, and wastewater treatment sludge) for local and regional distribution through retail outlets in and around Brevard County while generating and selling carbon credits to enhance the project feasibility." Awarding a single source contract to Wakefield would be inconsistent with Brevard County's competitive procurement policies.

This is a project that should be funded with private funds (venture capitalist). The proponent should conduct the studies to assess the viability of their idea. Information needed includes how a muck/biochar fertilizer would perform in a lab as well as in the field. Does the muck/biochar fertilizer slowly release nutrients at an acceptable rate? Would the muck/biochar fertilizer adsorb other contaminates such as atmospheric nitrogen and PFAS? If testing proves IRL muck/biochar functions as they theorize, this concept could be brought back to the SOIRL COC. Brevard County cannot sell what is defined as sovereign submerged lands owned by the state of Florida. If requirements can be changed to allow the transfer of muck to a fertilizer/biochar company, any profits from the sale of the proposed would flow to the producer although they may be able to donate to the county for SOIRL.

The proponent could seek grant funding for innovative technologies from organizations such as the IRLNEP.

Commented [ER13]: This statement is inappropriate and does not apply to the proposed use of biochar - for transforming muck into a SRF/SA, interstitial water treatment technology, backfill material for septic tank removals, or blending with muck in-situ for capping projects. The nutrient adsorption / desorption treatability study proposed is not primary research. (see above comment)

Commented [ER14]: This is completely false. As stated previously, the proposed study would help quantify the exact nutrient and phosphorus removal benefit.

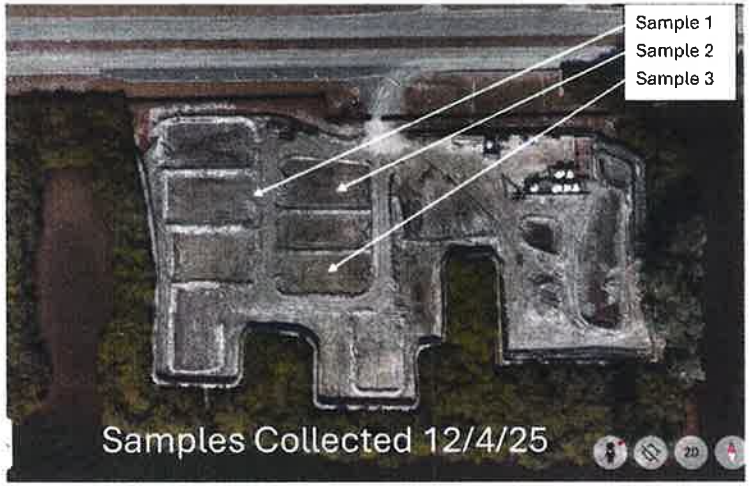
Commented [ER15]: The grant application process asks for a grant applicants capability to provide subsequent phases of any project. The citizen has never proposed any direct contract. In fact, the recommended pathway includes qualifications-based selection for limited production & distribution of the SRF & SA by the truckoad; and Competitive bid for expanded biochar supply and SRF & SA fertilizer production and distribution.

Commented [ER16]: This statement indicates a lack of understanding of the scientific literature (including articles provided by the citizen) regarding the effectiveness of biochar to adsorb contaminants and contribute to soil health; a lack of understanding of the potential for soil health to support sustainable solutions to help restore the IRL; and the permitting constraints raised and refuted in this review. No one is going to take the risks to move this forward without the buy-in of Brevard County and the SOIRL program, just as most of the other SOIRL activity would not move forward without SOIRL funding.
Perhaps most importantly, the focus on the proposal to transform the muck into a slow-release fertilizer and soil amendment is sadly myopic. The charge from the Committee was to evaluate the potential application of biochar to the SOIRL program. I used the proposal as an example of what was possible (within the 3 minutes allowed). There is a broader consideration of the utility of biochar to support interstitial water treatment, benefical reuse of IRL muck for recreational or commercial lands, backfill for septic tank removals, in-situ muck amendment for muck capping projects. The lack of technical curiosity and the active resistance - to the point of willful ignorance - is frustrating. This is not a white paper, it is a white wash. Perhaps the SOIRL COC would have a different view of the SOIRL tax does not get re-authorized.

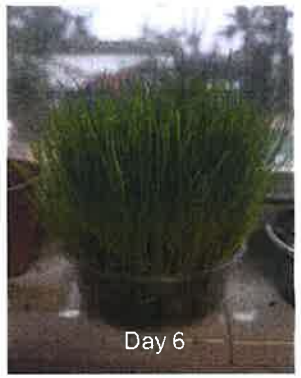
Demonstrated Plant Growth Media - Slow Release Fertilizer & Soil Amendment Concept – Using IRL Muck

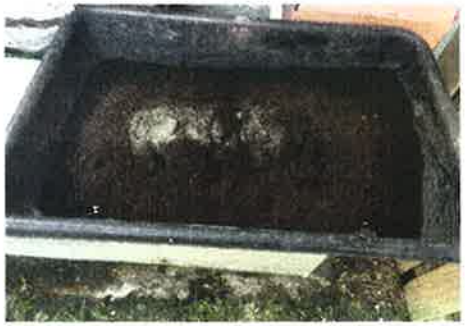
The SOIRL COC White Paper "White Paper IRL Muck and BiocharNRM" by SOIRL COC member Charlie Venuto Feb 20, 2026 has stated "A recent study at FIT using IRL muck to germinate lettuce seeds was unsuccessful". The simple experiment below shows rye grass seeds germinate immediately and grow rapidly in a soil mixture of 55% muck, 40% biochar, and 5% compost; with the addition of worm castings / tea. 4/7/2026

IRL Slow-Release Fertilizer & Soil Amendment (v1)



Partially-dewatered muck samples - further dewatered to 39% solids using a well made of a plastic drainage grate w/ landscape fabric.





7.5 quarts biochar / 3 quarts muck / 1 quart compost
(40% biochar / 55% muck / 5 % compost (dry weight)
(65% biochar / 25 % muck / 10 % compost (volume)

Worm castings eliminates muck odor. Worms go to work in enhanced muck.

Day 4 - Rye grass seed in muck-biochar-worm food / castings; muck-biochar-compost; and IRL Muck.