Muck

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Presentation to Rivers Coalition

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FINAL REPORT

CHARACTERIZATION, SOURCES, BENEFICIAL RE-USES, AND REMOVAL OF MARINE MUCK SEDIMENTS IN THE ST. LUCIE ESTUARY

PREPARED FOR

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

UNDER

CONTRACT C-10281-A1

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LITERATURE REVIEW

Schropp (1994) defined muck sediments as “sediment with greater than 60% silts and clays, greater than 6% total organic carbon, and greater than 75% water.” This definition is as useful as any in the literature.

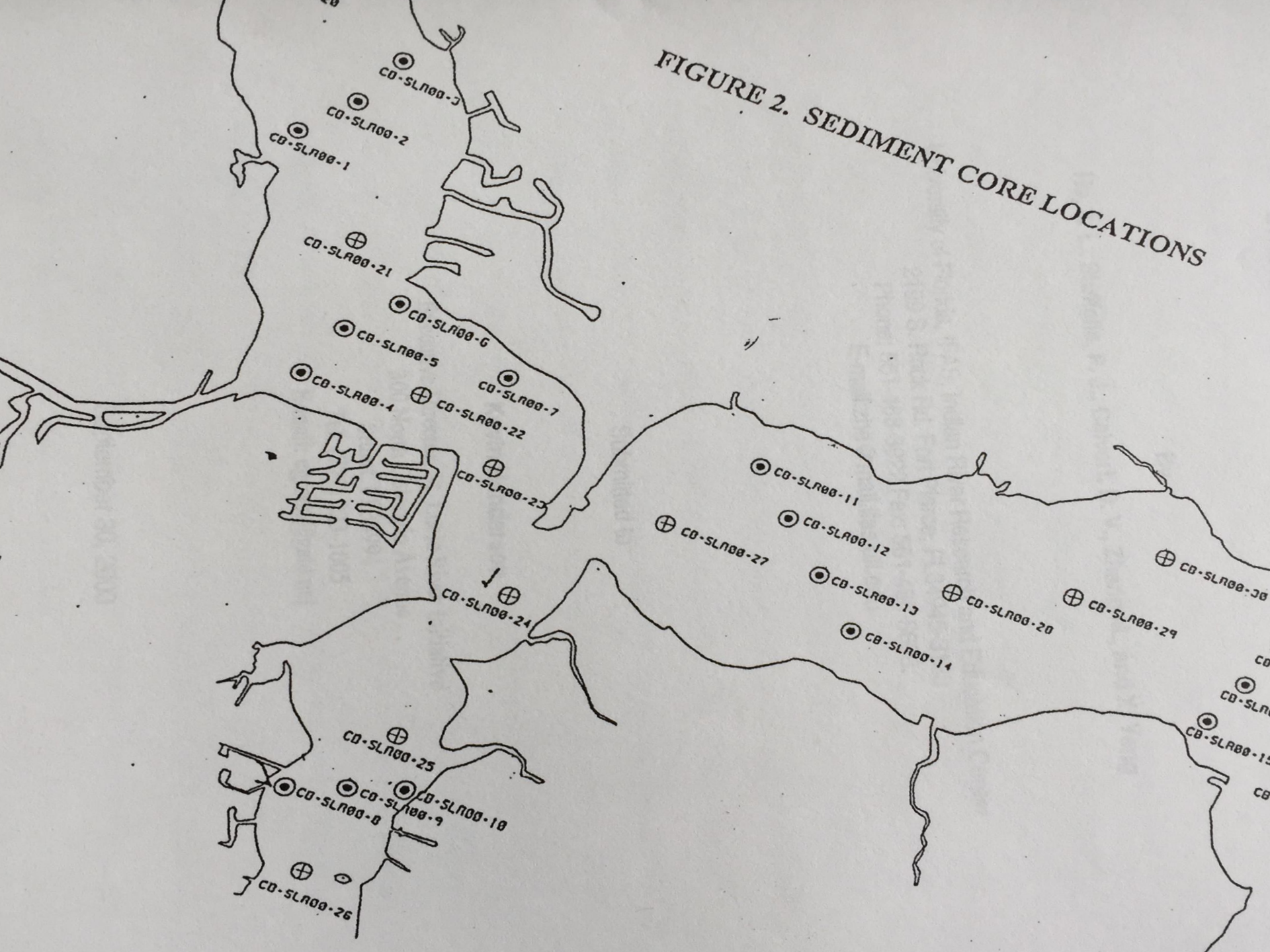
Organic content of muck sediments in SLR have been reported over 60%. Our experimental results were more 10-15%. Variance is due to Loss on Ignition lab test.

Aluminum concentrations average 4-5 times higher in the St. Lucie sediments than in the 1987 IRL muck data provided by Trefry.

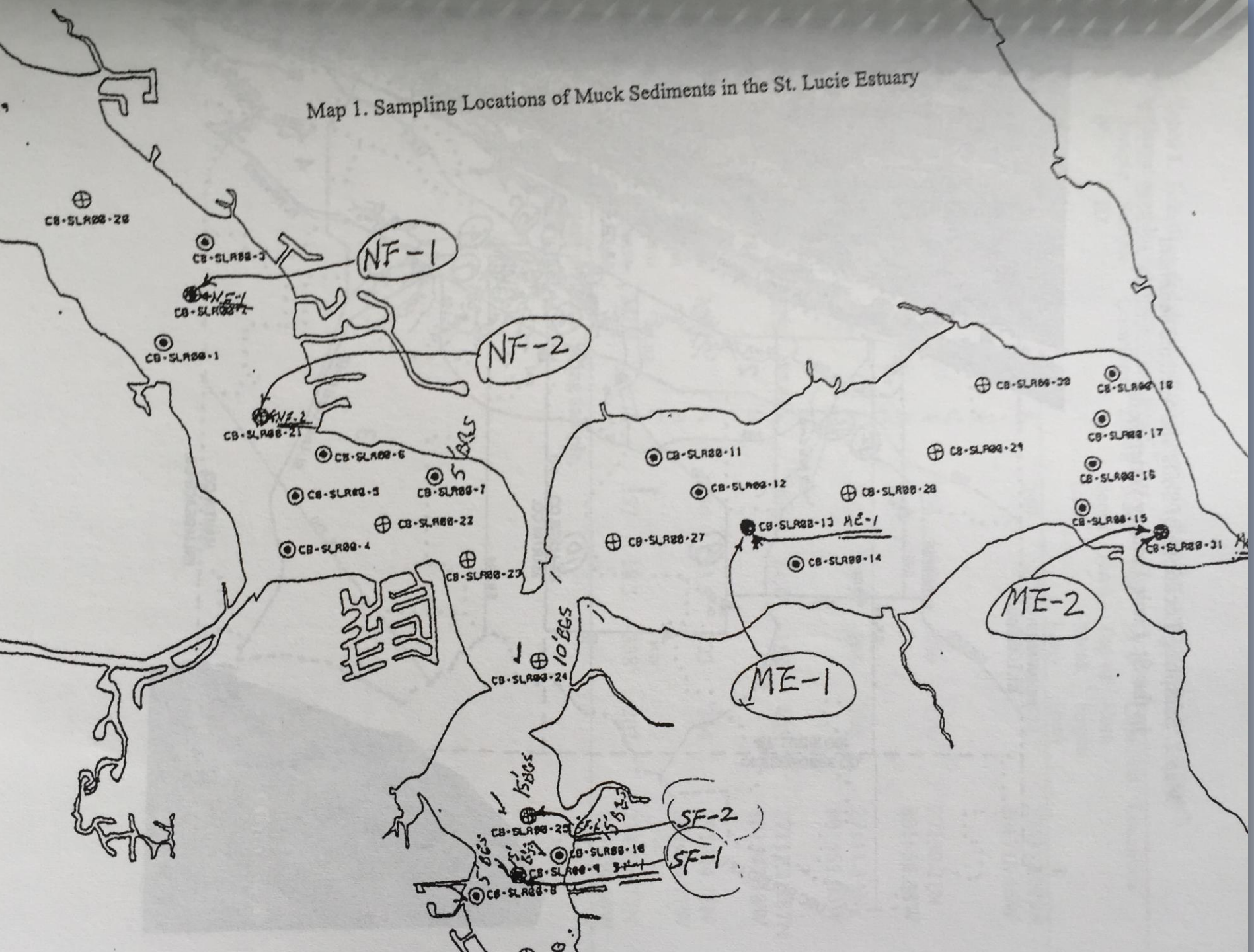
Total nutrient concentrations were not as high as previously reported. SLR muck sediments average 0.26% TN and 1% TP

Muck sediments naturally accumulate in estuaries like the St. Lucie. Past studies in the North Fork, and comparisons between 1884 and 1984 bathymetry, indicate deep muck sediments pre-date any impacts by man on the River basin.

FIGURE 2. SEDIMENT CORE LOCATIONS



Map 1. Sampling Locations of Muck Sediments in the St. Lucie Estuary



WHERE IT COMES FROM

the organic fraction derives from uplands, as does the mineral fraction. The muck is essentially pine flatwoods soil hardpan, less the sand content.

The sediment samples reported do not include the flocculent sediment layer which floats over the more (at least semi-) consolidated sediments. This flocculent layer is suspected a source of the rapid increase in turbidity observed in the Estuary in response to normal wind shear.

Early investigations of complaints of excessive turbidity in the estuary conducted by the Army Corps of Engineers and USGS in the late 50's concluded that fine flocculent sediments were flushed out of the River and into the Ocean by freshwater inflows and tidal exchanges.

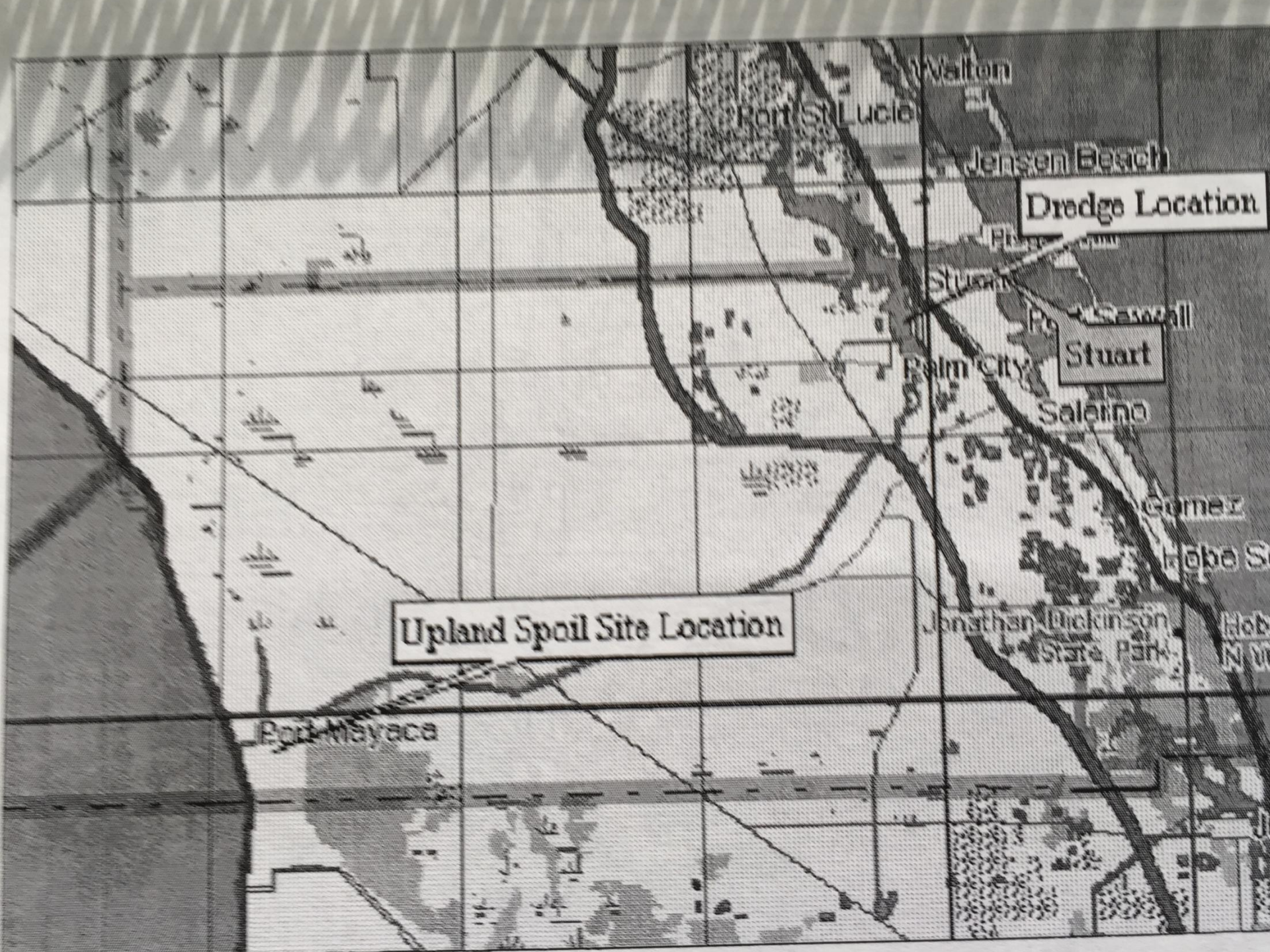
More recent studies, and re-interpretations of older data, indicate that fine flocculent sediments are also effectively trapped in the Estuary by the complex interaction of fresh and salt waters, and tidal movements. See Woodward-Clyde (1998) for an excellent summary of these processes.

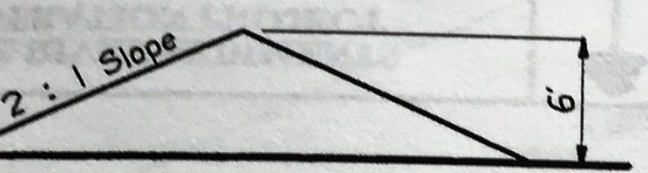
TOXCICITY

Trefry reports (1993b) concentrations of Polynuclear Aromatic Hydrocarbons (PAH) between 15 and 30 ppb are found in fine organic-rich sediments in Crane Creek, Turkey Creek, and Manatee Pocket. These are all locations where significant harbor activities have been located for many decades. The reported concentrations are high enough to have potential biological effects, but not high enough to be a disposal issue for dredge spoil.

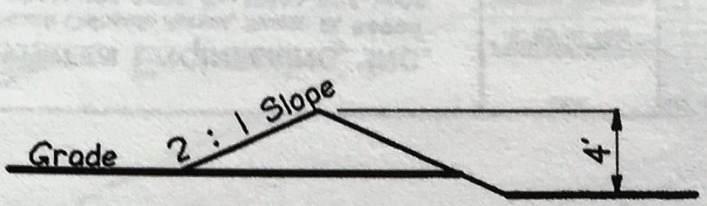
	Average (mg/kg)	Min	Max
Copper	26.5	12.7	72
Zinc	40.2	3.4	127
Lead	23.4	2.8	23.4

None of these concentrations of metals are toxic or hazardous according to the various published federal or state standards. At the same time, however, there is evidence that some sediments within the Estuary exert adverse effects on benthic biota.

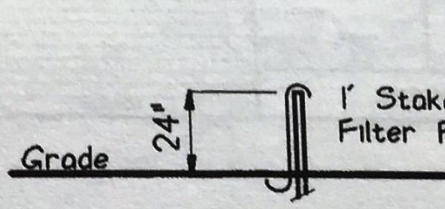

Dredge Location
Upland Spoil Site Location
Port St Lucie
Jensen Beach
Stuart
Palm City
Salerno
Jonathan Dickinson State Park
Port Mayaca



(A–A)



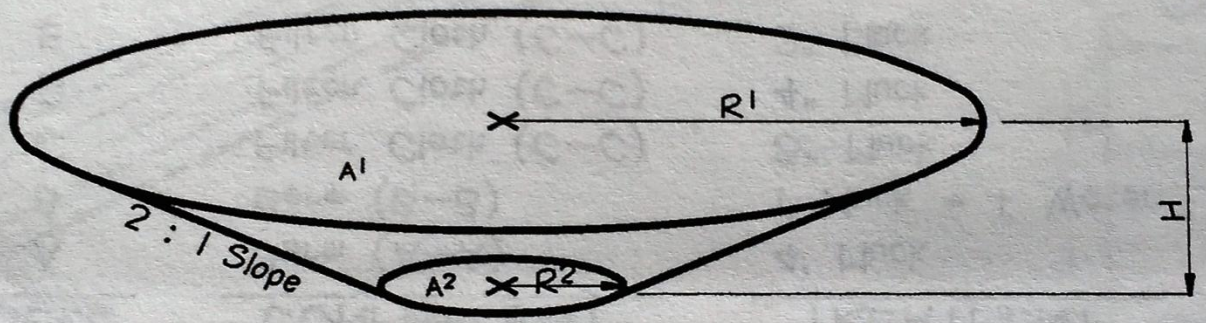
(B–B)



(C–C)

1 Section Cuts

Not To Scale



$R^1 = 40'-0"$	$R^2 = 10'-0"$	$H = 15'-0"$
$A^1 = 5024$ sf	$A^2 = 314$ sf	$V = CY \pm 1220$

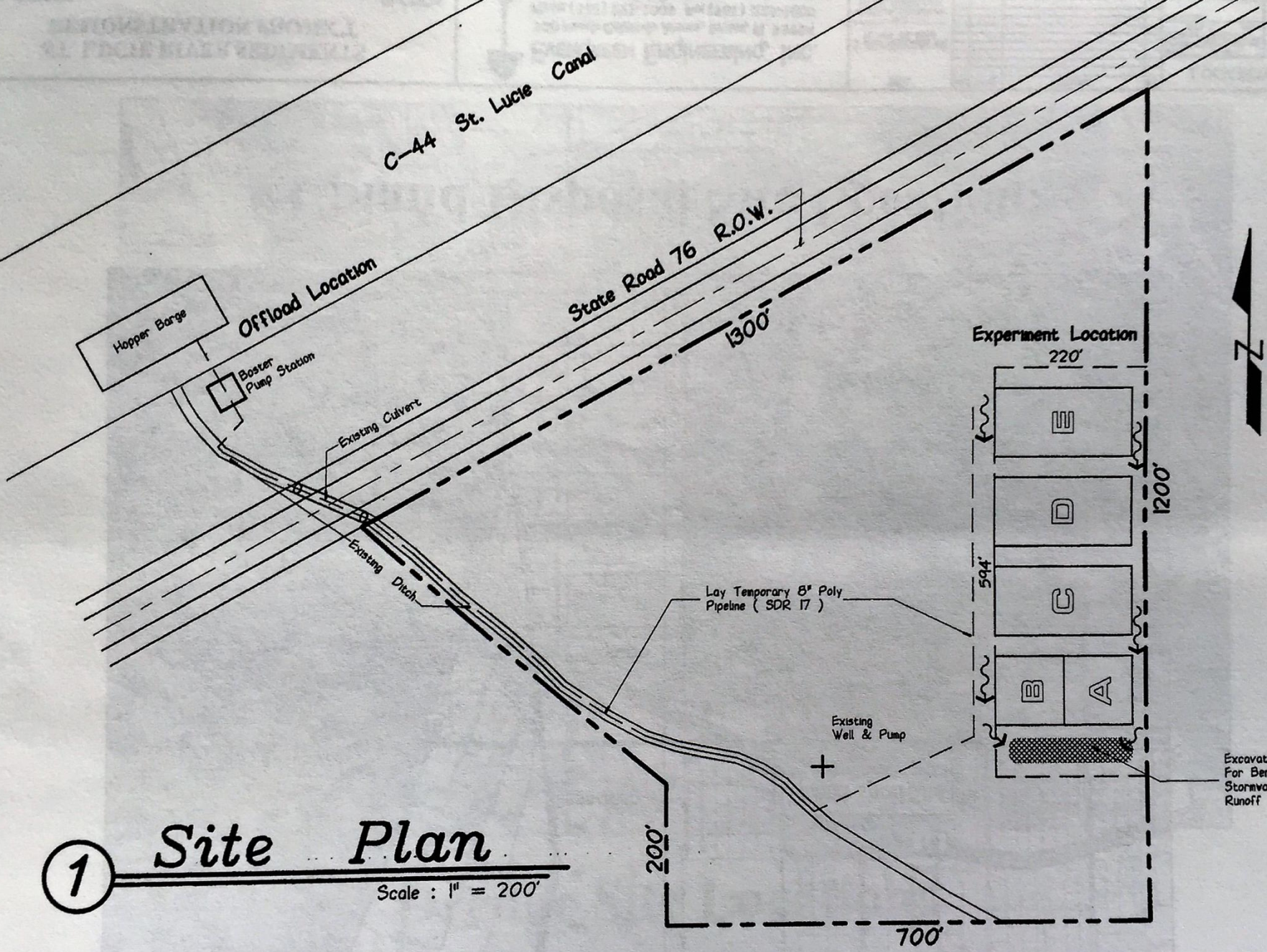
2 Excavation Area Detail

Scale : 1" = 20'

Locate Excavation Site @

Latitude N 27^ 11 1.14
Longitude W 80^ 15 51.00

See Location Map For Dredge Location



1 Site Plan

Scale : 1" = 200'

ST. LUCIE RIVER SEDIMENTS

EVERGREEN ENGINEERING, INC

SEAL

NO.	DATE	REVISION	BY

SITE PLAN

SHEET

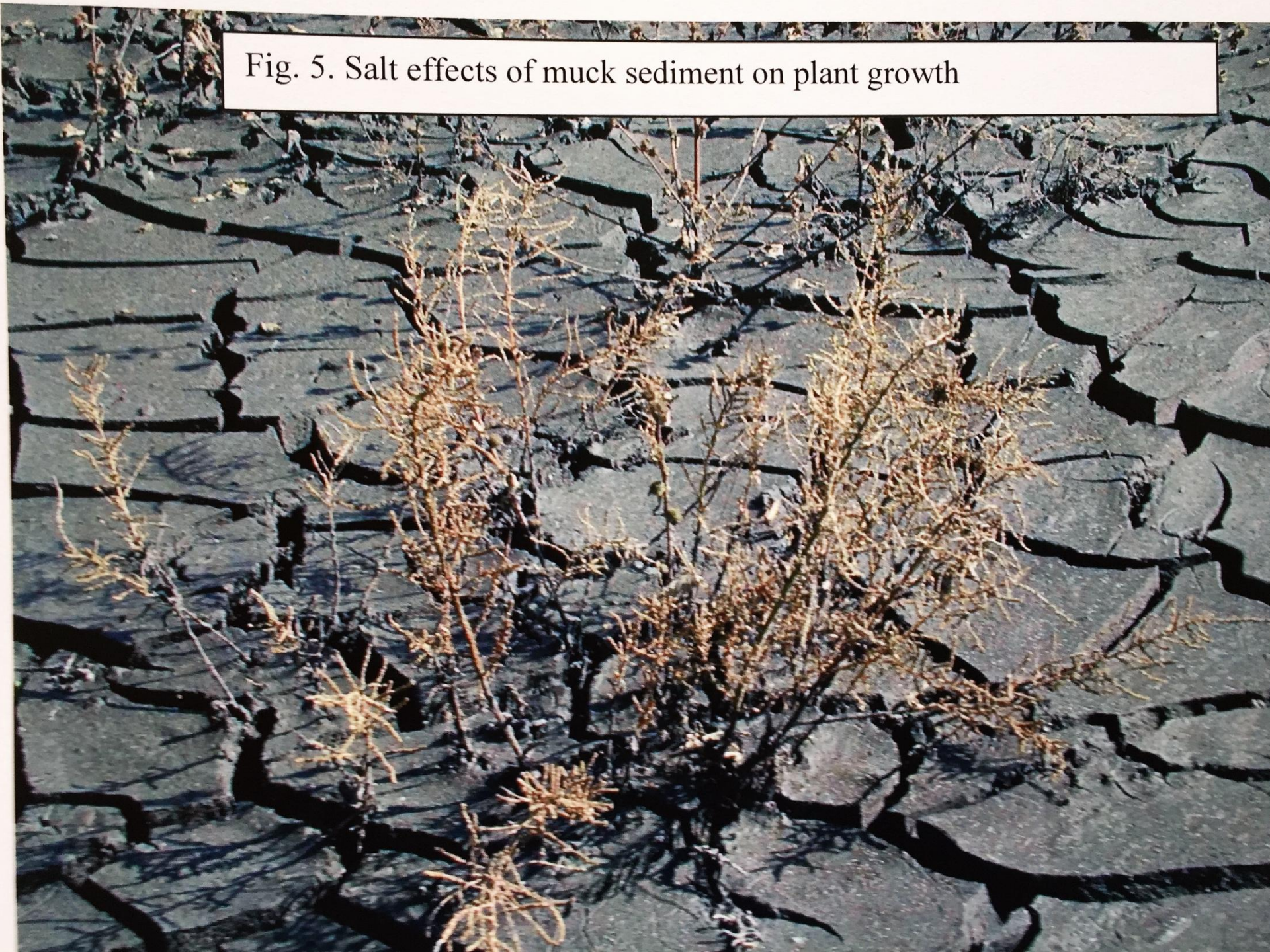


Fig. 5. Salt effects of muck sediment on plant growth

er, most of the pasture plants were recovered within a short term from this effect.

were generally faster to regenerate young shoot and leaves from under the muck

nts, as compared with other plant species (Figs 7-9).

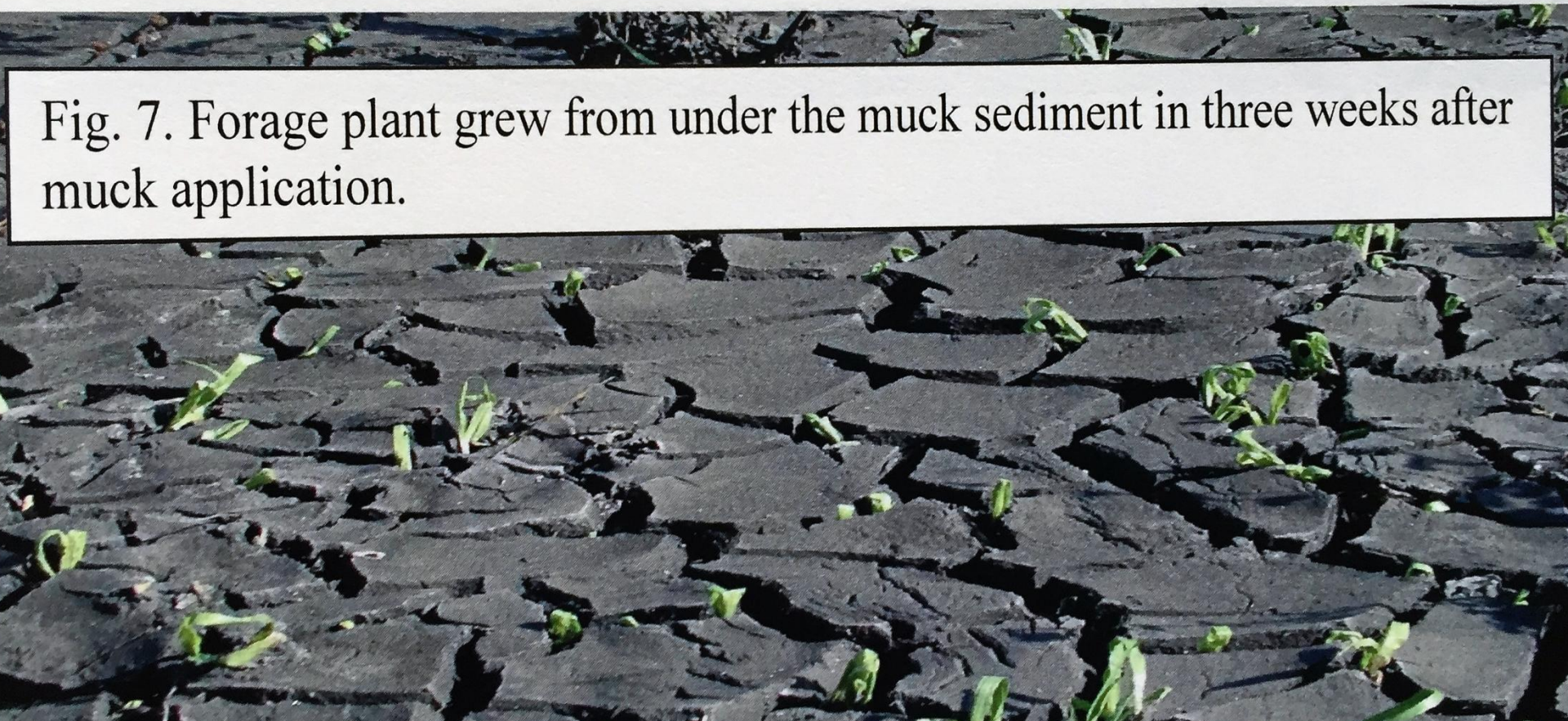


Fig. 7. Forage plant grew from under the muck sediment in three weeks after muck application.

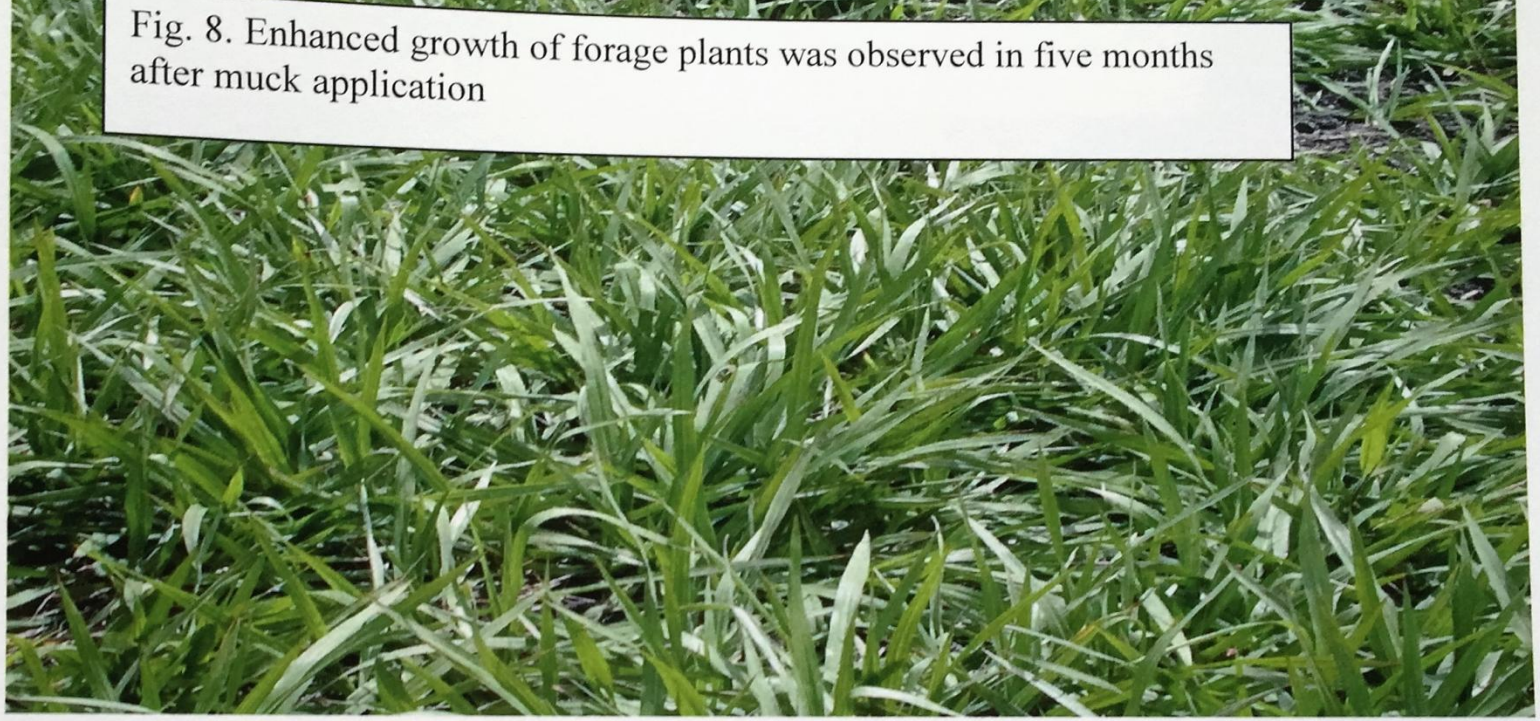


Fig. 8. Enhanced growth of forage plants was observed in five months after muck application

Fig. 9. The beneficial effects lasted until ten months after muck application

BENEFICIAL USES

No cost-effective beneficial uses

Disposal

Dewatering is a major obstacle to any use, including simple upland disposal

The most important aspect of simple disposal is availability of an uplands impoundment site large enough to contain the quantity of material being dredged without additional treatment or manipulation within the impoundment site.

PROJECT CONCLUSIONS

•Muck sediments in the St. Lucie Estuary originate in uplands within the watershed.

•Muck sediment composition, both mineral and organic content, is very similar to the hardpan soils layer found in the pine flatwoods landform that makes up a majority of the estuarine watershed.

•St. Lucie muck sediments are very similar to those found in other low energy tidal estuaries along the Indian River Lagoon.

•Muck sediment accumulation rates were historically less than 10% of rates measured since significant anthropogenic modifications to the watershed began, less than 200 years ago.

•Large areas of muck sediments in the wide North and South Forks and the Middle Estuary exceed 15’ in depth.

•Toxic and/or hazardous characteristics of St. Lucie muck sediments are below state and federal standards for toxic and/or hazardous classification. Metals, PCB’s, PAH’s and pesticides concentrations are not an obstacle with respect to potential beneficial uses.

•Cost-effective beneficial uses of St. Lucie muck sediments remain to be identified, and there may be none.

•Final dredge design should consider shape and location of sediment traps excavated into the deepest deposits of muck for control of turbidity in the Estuary, rather than attempting to remove loose surface layers from shallow areas.

•Final muck disposal should focus on simple upland containment as the least cost disposal alternative.

•Potential beneficial uses are affected by the Upland Disposal Site design.

THE END

Questions ?