# Vegetable Garden Study
## Augusta Forestry Center

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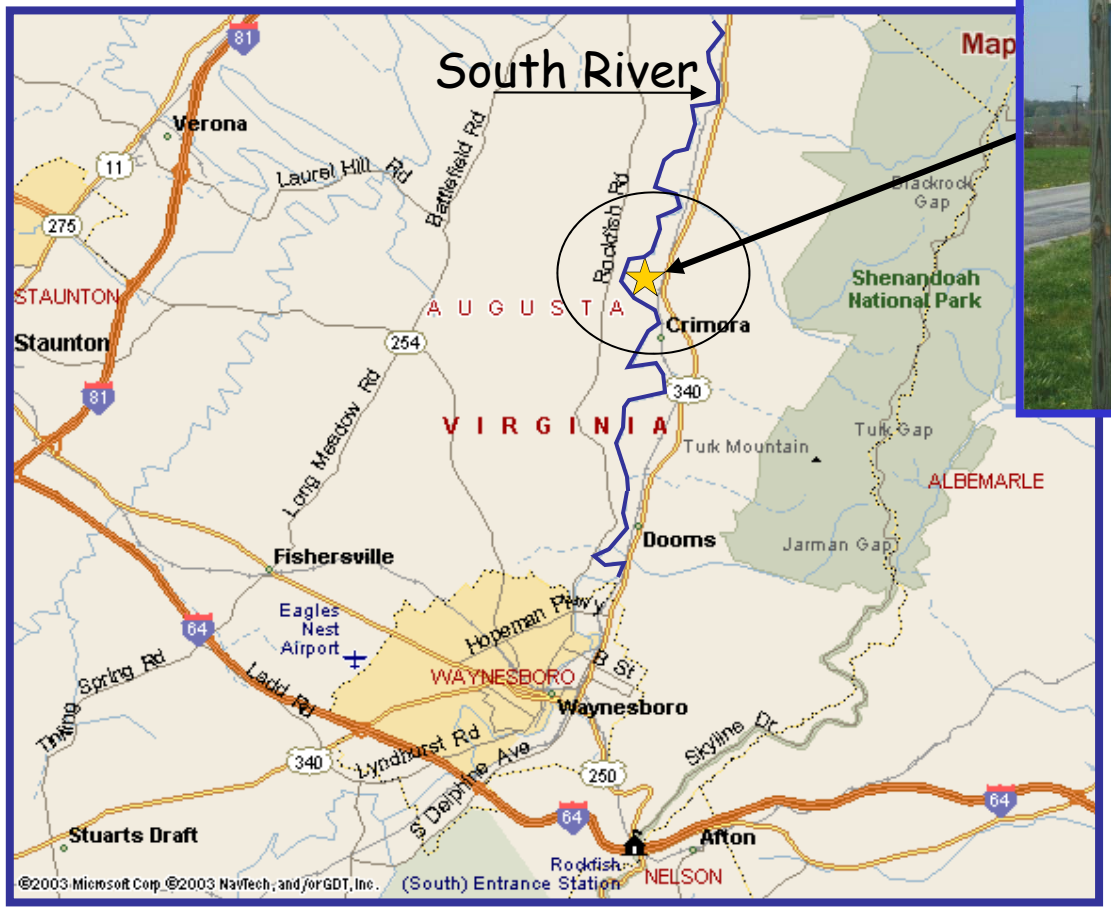
South River Science Team
October 21, 2003

# Vegetable Garden Study

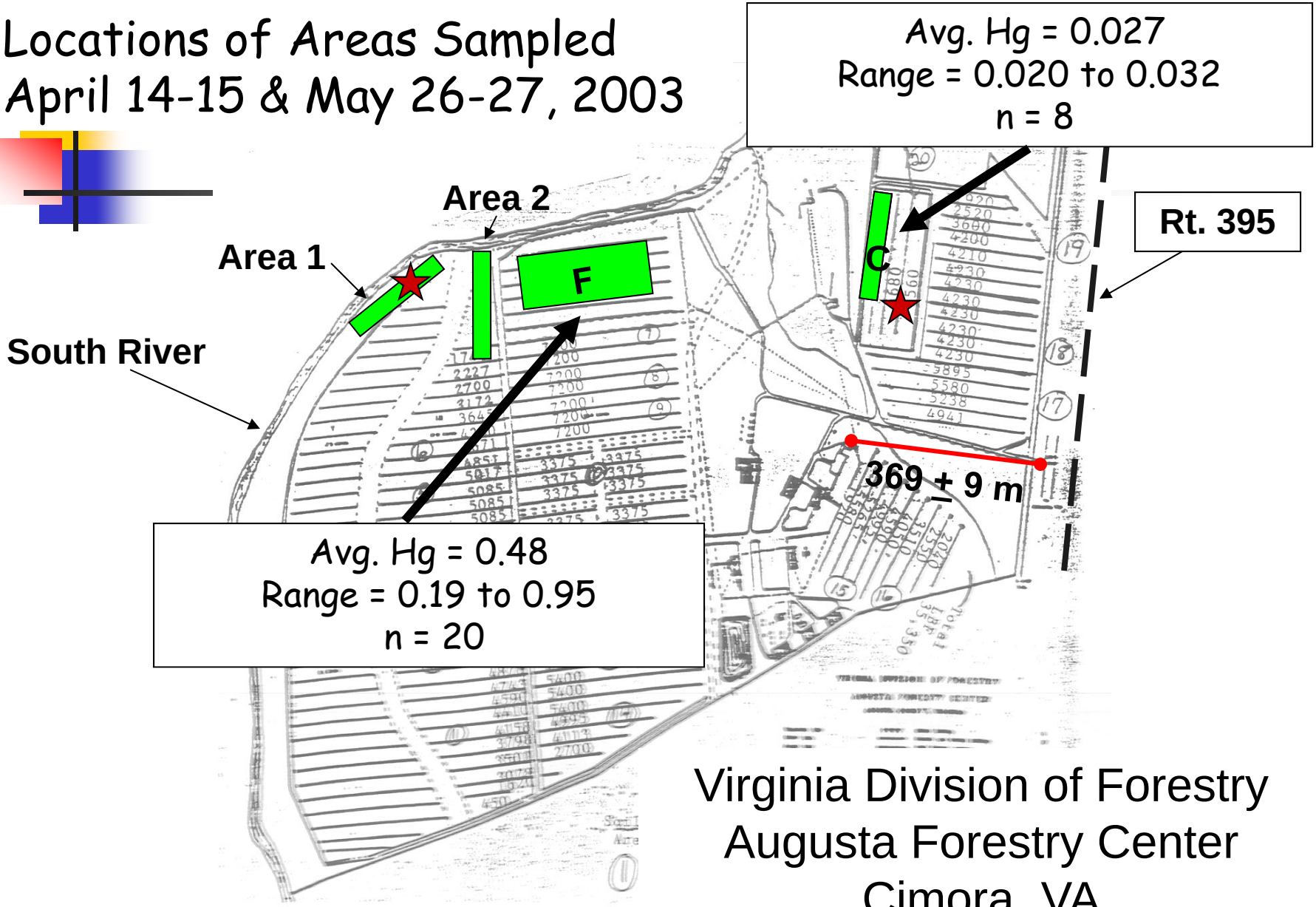
Objective –

Determine if soil-Hg is taken-up by vegetables at concentrations sufficient to be a health risk

# Augusta Forestry Center – Crimora, VA

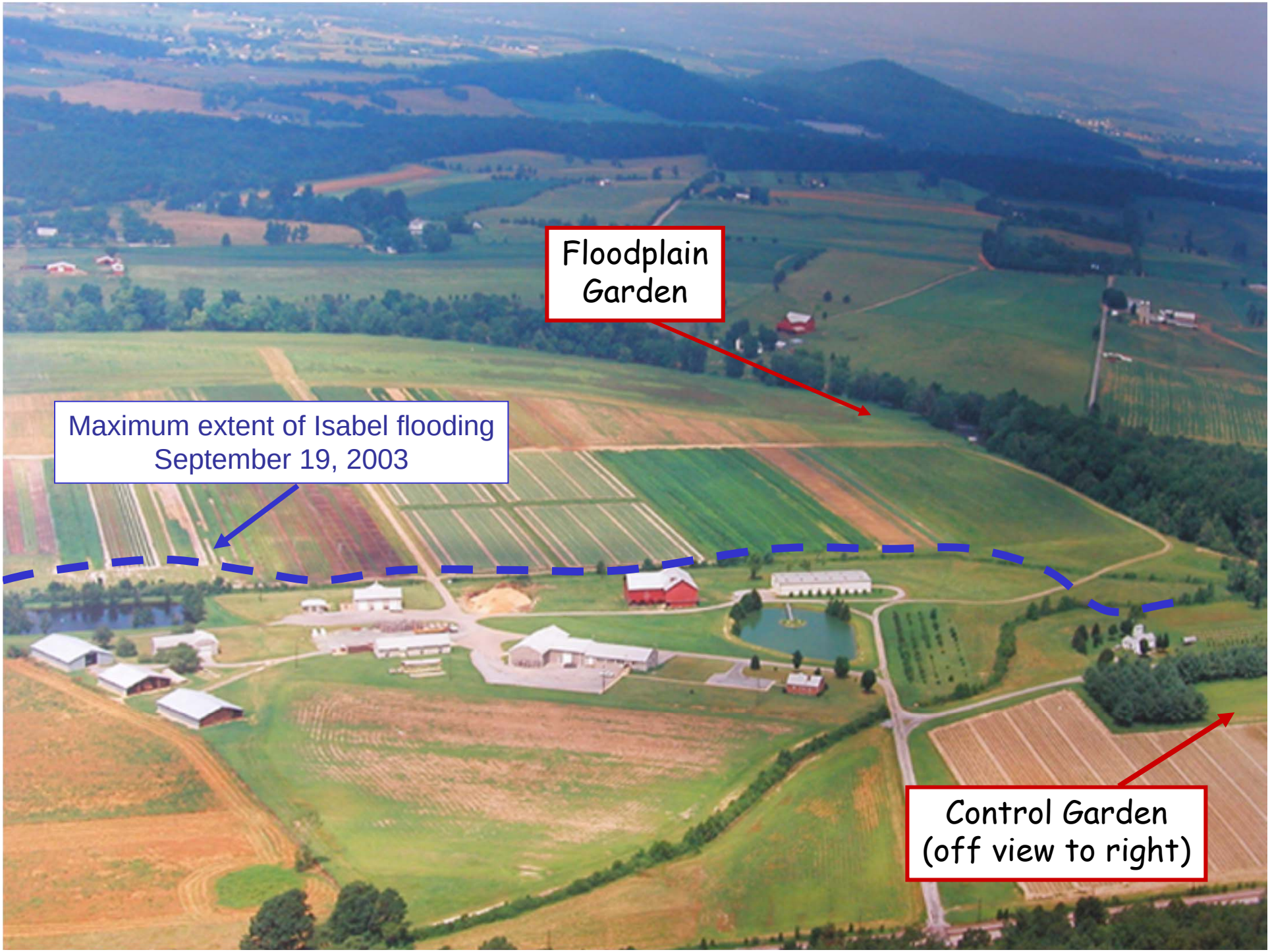



# Locations of Areas Sampled
# April 14-15 & May 26-27, 2003

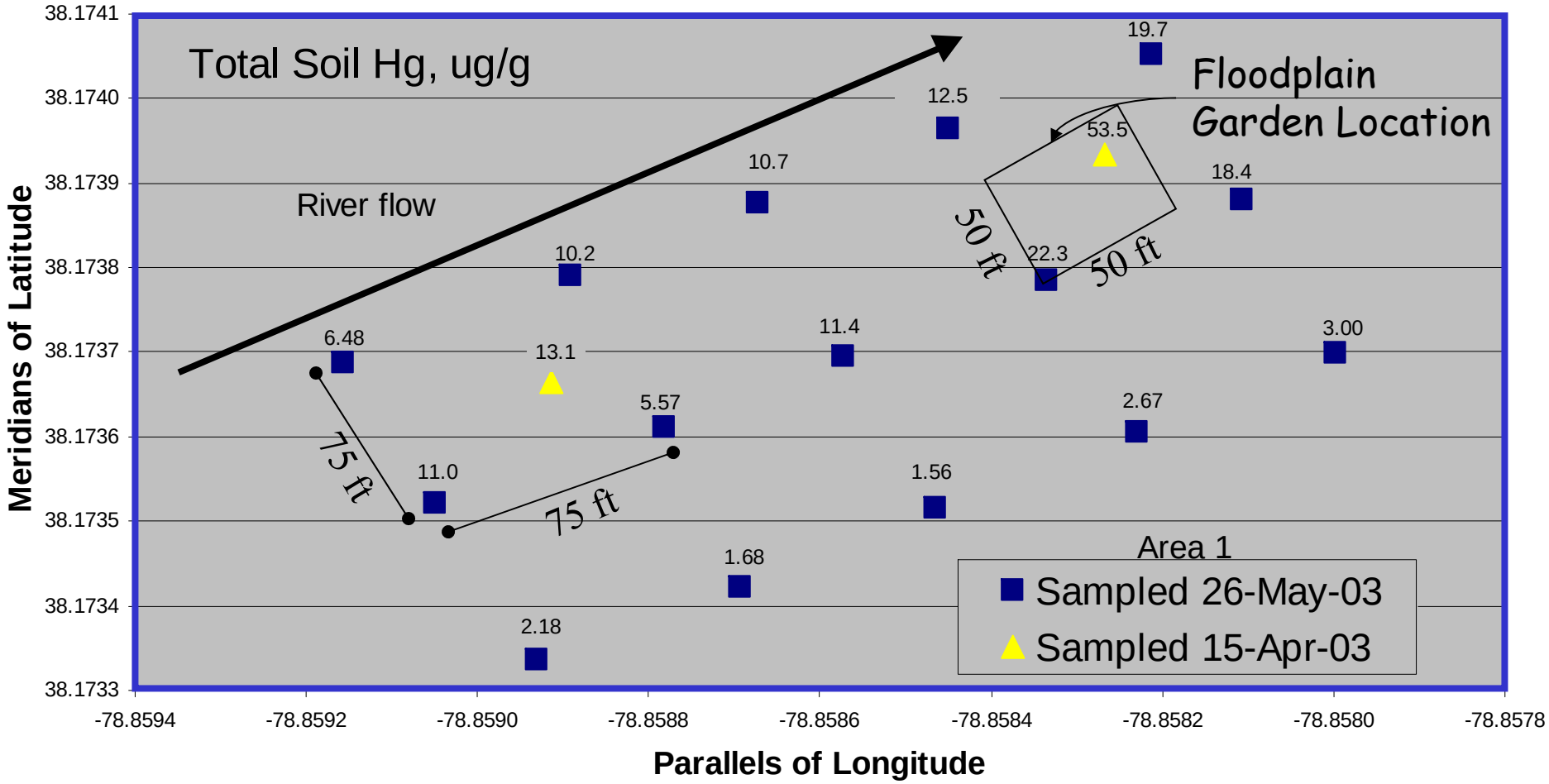



Virginia Division of Forestry
Augusta Forestry Center
Cimora, VA

Values in mg Hg/kg soil,
dry weight basis

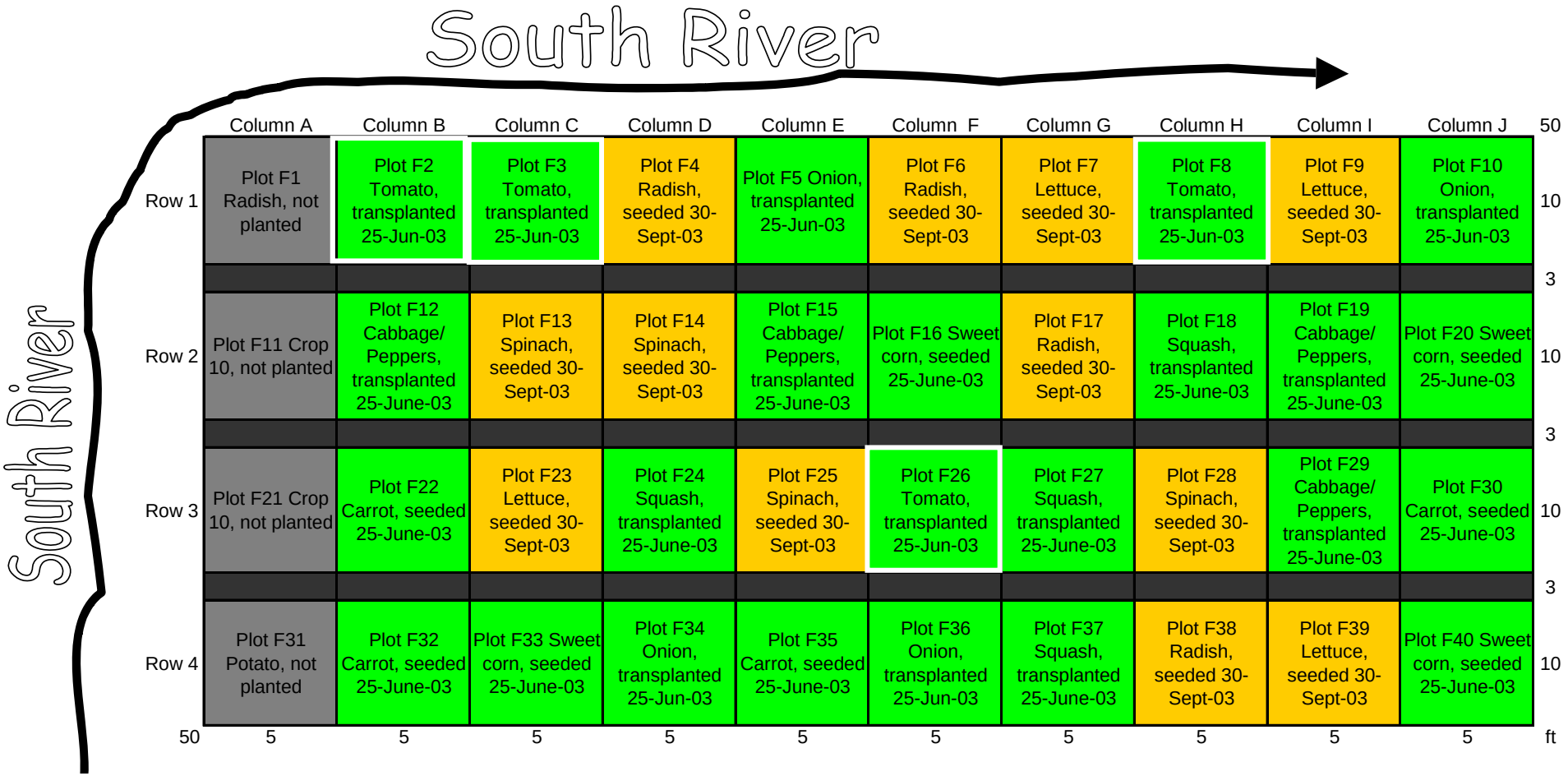

Floodplain Garden
Maximum extent of Isabel flooding September 19, 2003
Control Garden (off view to right)

# The Floodplain Area 1 soils contained Hg up to 53.5 mg Hg/kg where the floodplain garden was located.

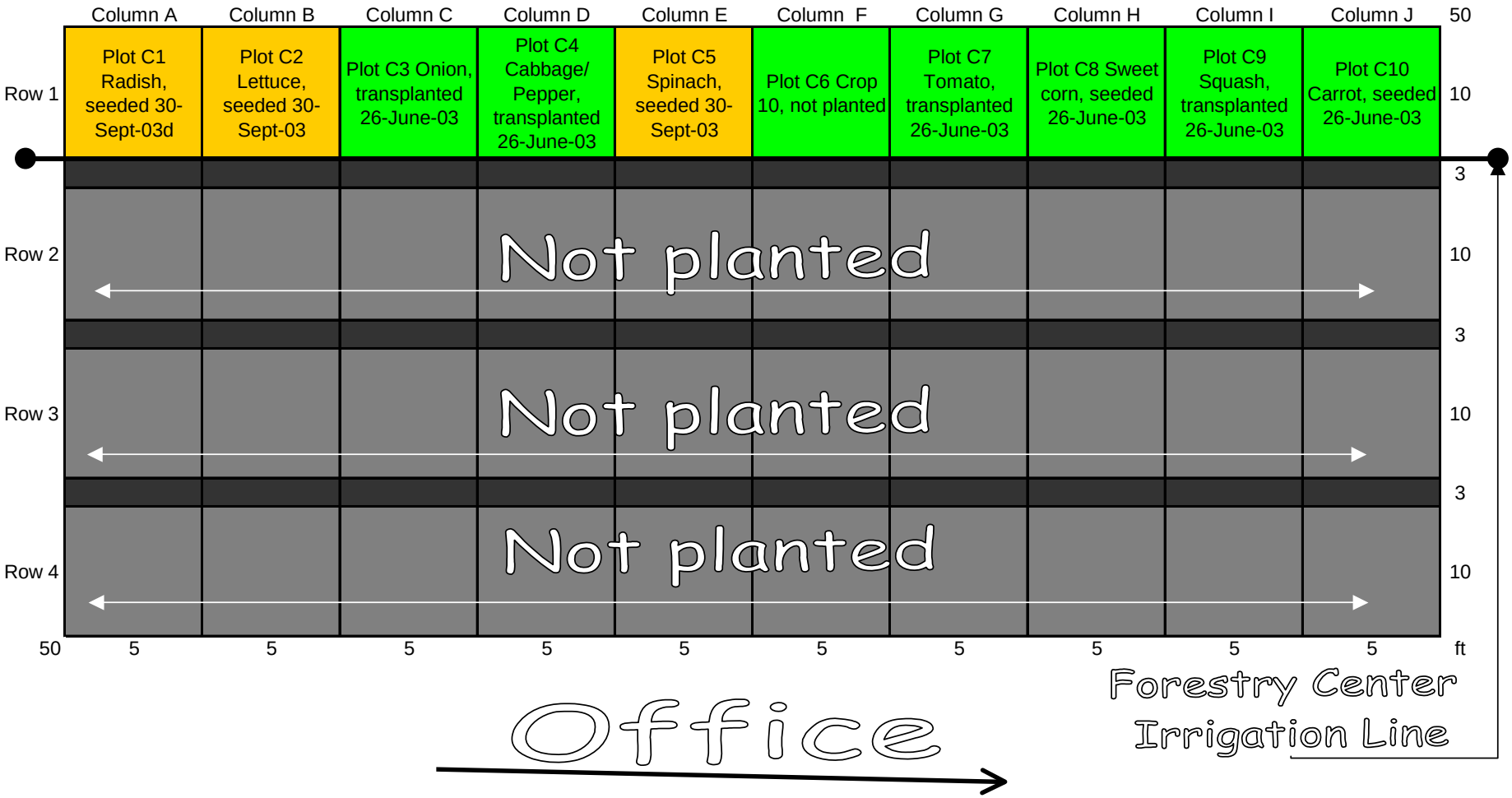



Not to scale

# Floodplain Garden



# Control Garden



# Garden Plants

| Vegetable | Supplier | Name | Comments | 2003 Seeding/ Transplanting and Dates | 2003 Harvest Dates |
|---|---|---|---|---|---|
| Cabbage | Riverside Plants Dayton, VA | generic | | Transplanted 25-June-03 | 28-Aug-03 |
| Pepper | Riverside Plants Dayton, VA | generic | | Transplanted 25-June-03 | 28-Aug-03 |
| Spinach | American Seed, Norton, Mass | Correnta Hybrid | A superior hybrid Spinach with great flavor and a versatile harvest period. Sow this unique, heat-tolerant variety spring through fall for a continuous harvest of tender, smooth, dark-green leaves. | Seeded 25-June-03; reseeded 30-Sept-03 | 28-Aug-03, from one plot in floodplain garden only |
| Squash | Riverside Plants Dayton, VA | Yellow Straight Neck | Generic - creamy yellow, 4 - 10", matures in 46 - 52 days | Transplanted 25-June-03 | 28-Aug-03 |
| Tomato | Riverside Plants Dayton, VA | Park's Beefy Boy | VFFFTt Full sun 70 days to maturity -main Season beefsteak type - 12 - 16 oz | Transplanted 25-June-03 | 11-Sep-03 |
| Sweet corn | American Seed, Norton, Mass | Golder Cross Bantam Hybrid | First hybrid sweet corn and still sets a standard for modern varieties. Each slender, eight-inch ear has 10 to 14 rows of golden-yellow kernels with fine flavor. The all-purpose ears are great for canning, freezing, and roasting. The salks mature to six feet tall. | Seeded 25-June-03 | 11-Sep-03 |
| Carrot | Burpee, Warminster, PA | Danvers Half Long | Fine-grained and tender with a very sweet flavor. Grows uniformly 7.5 inches long, about 2.5" wide tapering to a blunt end. Ready to harvest in about 75 days. | Seeded 25-June-03 | 27-Sep-03 |
| Onion | Hess Greenhouse Harrisonburg, VA | Walla Walla | 110 days. Large, flattened, globe shaped bulbs with light brown skin and mild white flesh | Transplanted 25-June-03 | 27-Sep-03 |
| Lettuce | American Seed, Norton, Mass | Loose Head | Loose Head 45 days | Seeded 30-Sept-03 | |
| Radish | American Seed, Norton, Mass | Cherry Belle | Round, red radish with white flesh; 21 days | Seeded 30-Sept-03 | |

June 25

July 19

July 26

August 9

August 16

August 23

Garden development at Floodplain site, 2003

# Harvest Results

Carrots Harvested Sept 27, 2003

# Sweet Bell Green Peppers

Harvested August 28, 2003

- **Generic transplants from Riverside Plants in Dayton, VA**
- **Grew well at both gardens.**
- **More than enough fruit for analysis**

**Floodplain garden**

**Control garden**

# Yellow straight neck squash

Harvested August 28, 2003

- **Generic transplants from Riverside Plants in Dayton, VA**
- **Grew well at both gardens but control was at maturity before the floodplain**

**Floodplain garden**

**Control garden**

# Head Cabbage

Harvested August 28, 2003

- **Generic transplants from Riverside Plants in Dayton, VA**
- **Grew well at both gardens once transplants took hold.**

**Floodplain garden**

**Control garden**

# Walla Walla Onions

Harvested Sept 27, 2003

- **Transplants from Hess Greenhouse, Harrisonburg, VA**
- **Grew well at both gardens .**

**Floodplain garden**

**Control garden**

# Park's Beefy Boy Tomato

Harvested Sept 11, 2003

- Transplants from Riverside Plants in Dayton, VA
- Grew extremely well at both gardens .

Floodplain garden

Control garden

# Park's Beefy Boy Tomato

Harvested Sept 11, 2003

- A 70-day beefsteak type tomato few seeds, has a large amount of solid tissue

# Golden Cross Bantam Hybrid sweet corn

Harvested Sept 11, 2003

- The corn at the control garden grew much more rapidly initially

Floodplain garden

Control garden

# And then on September 19 it flooded

Fortunately the two remaining crops to harvest were somewhat protected below the surface

Onions

Carrots

# Floodplain garden - October 16, 2003 - Fall Crop

Spinach

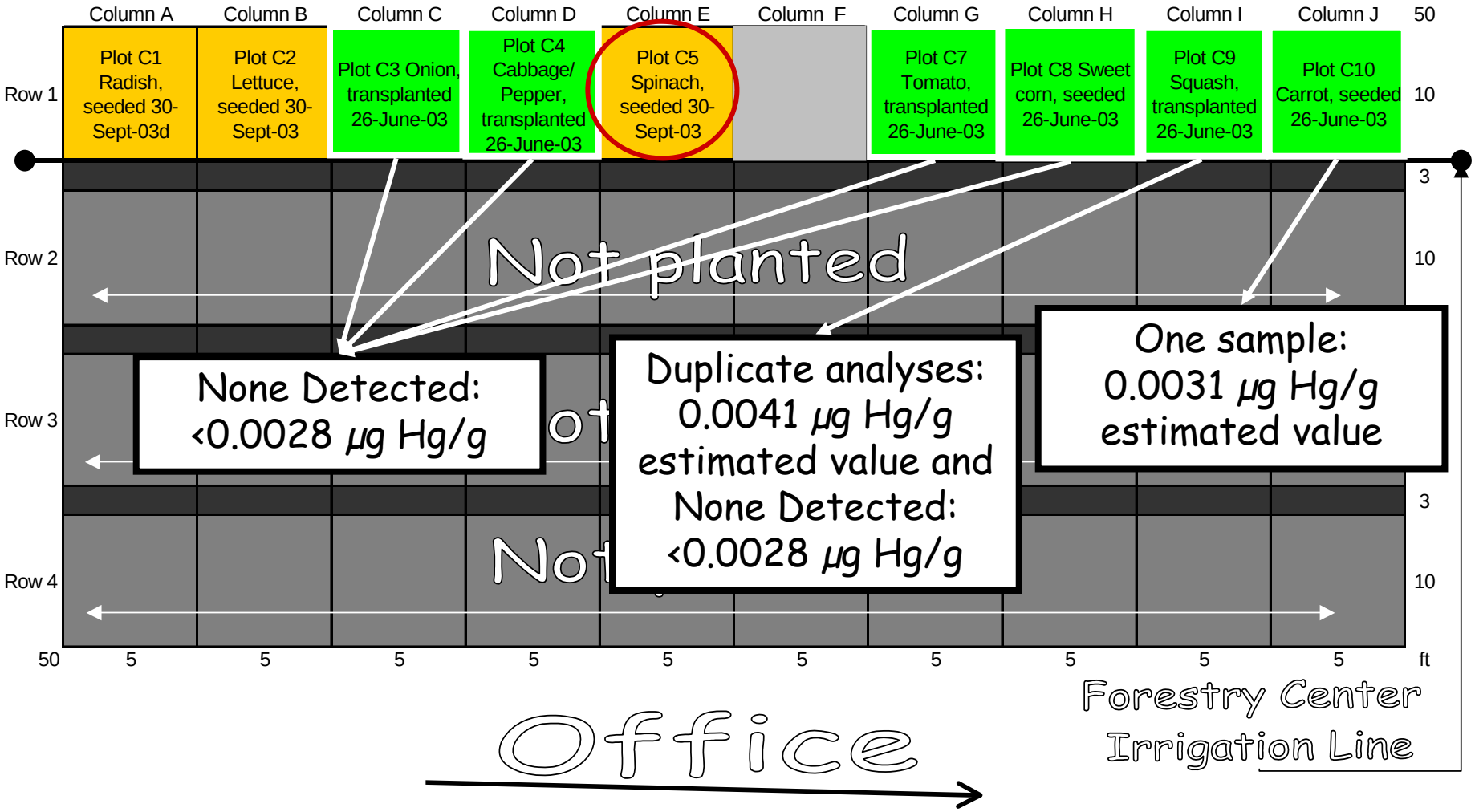
Lettuce

Radish

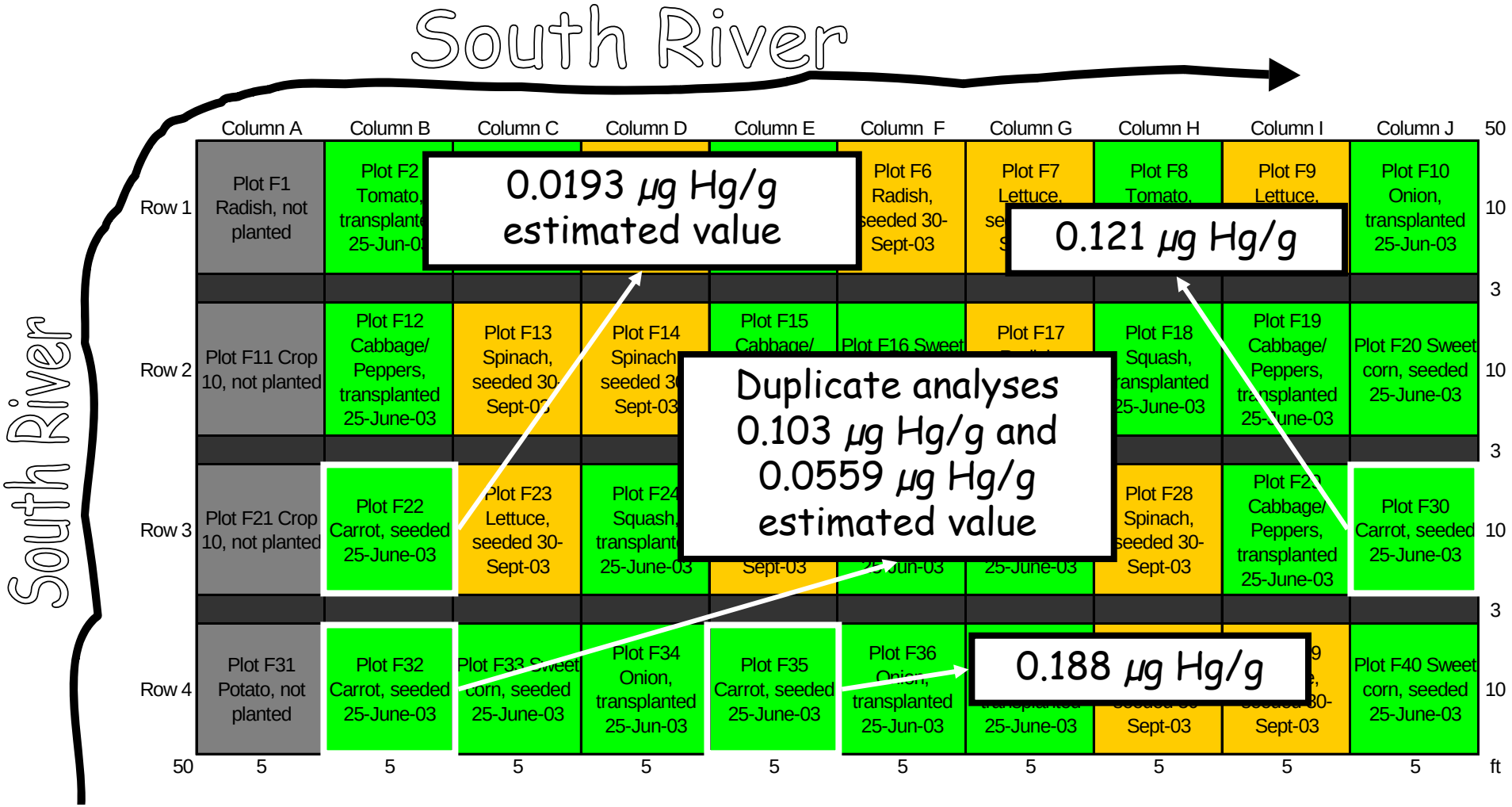
# Sample Preparation

- Harvested and stored cold
- Washed, sliced, and diced
  - Carrots were not peeled
- Shipped to Lancaster Lab for Hg analysis
  - "As is" samples digested and Hg measured
  - MDL: < 0.0028 µg Hg/g

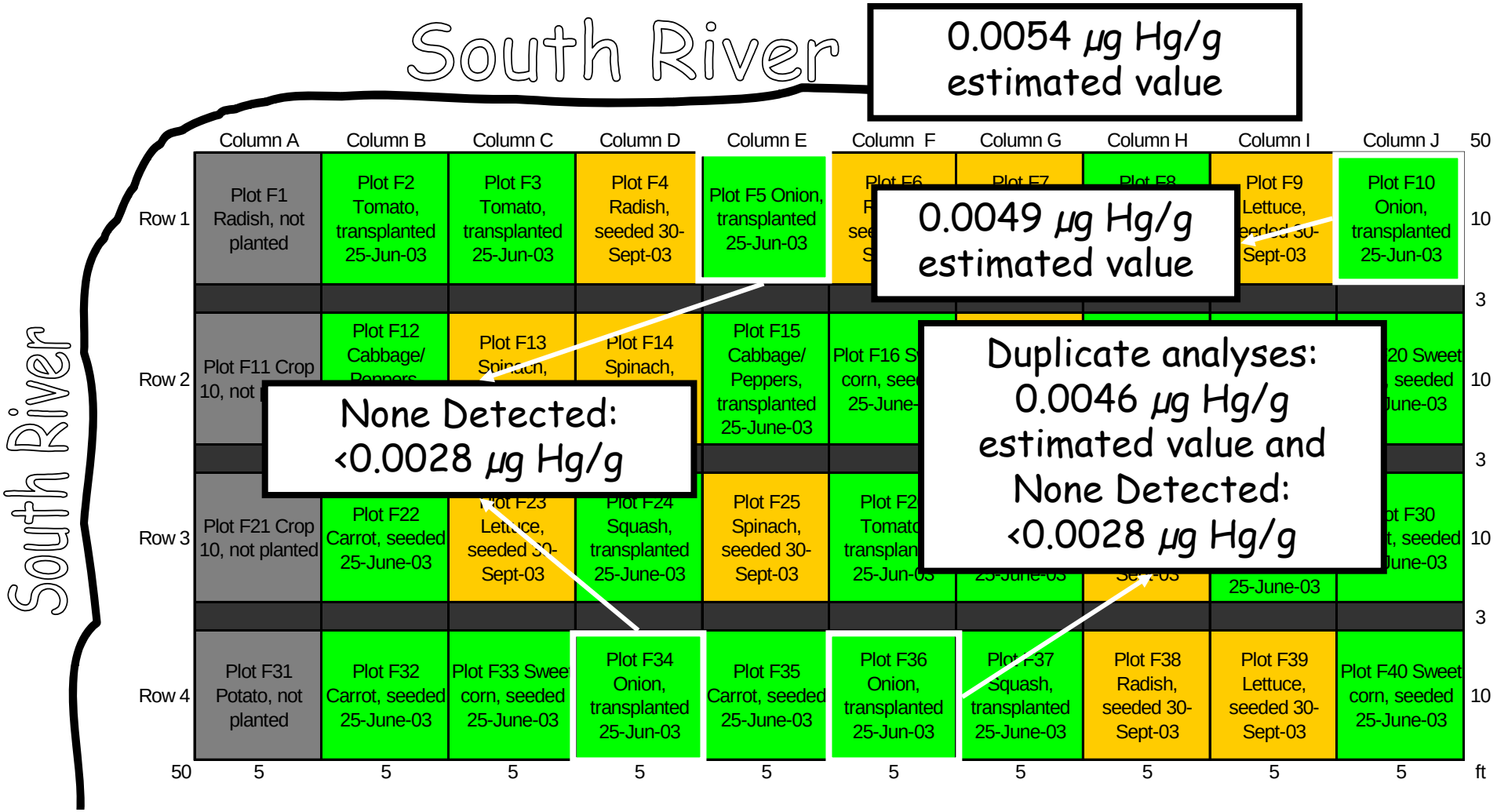
# Control Garden



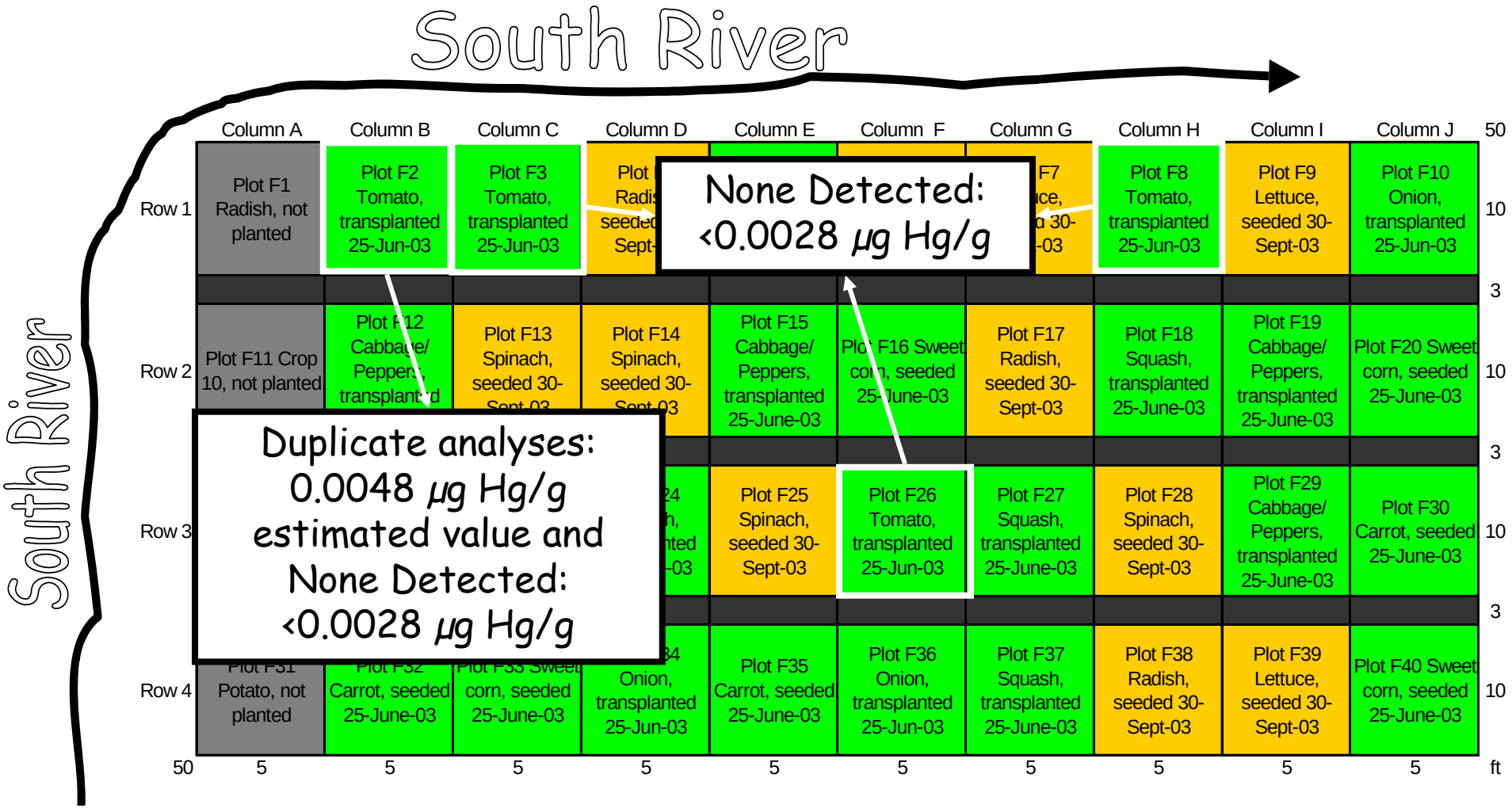
# Floodplain Garden – Carrot harvested 27-Sep-03; Not peeled



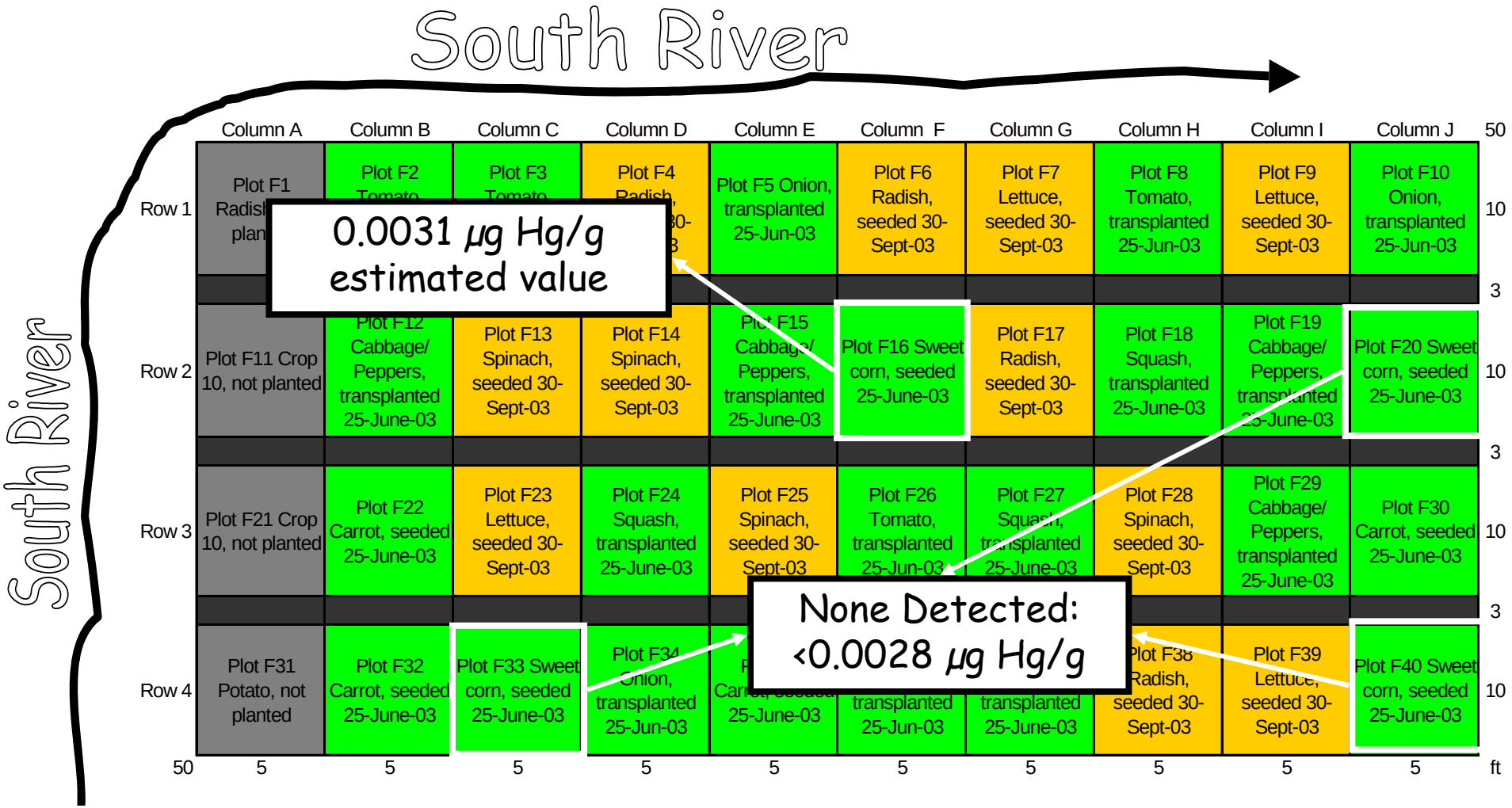
# Floodplain Garden – Onion harvested 27-Sep-03



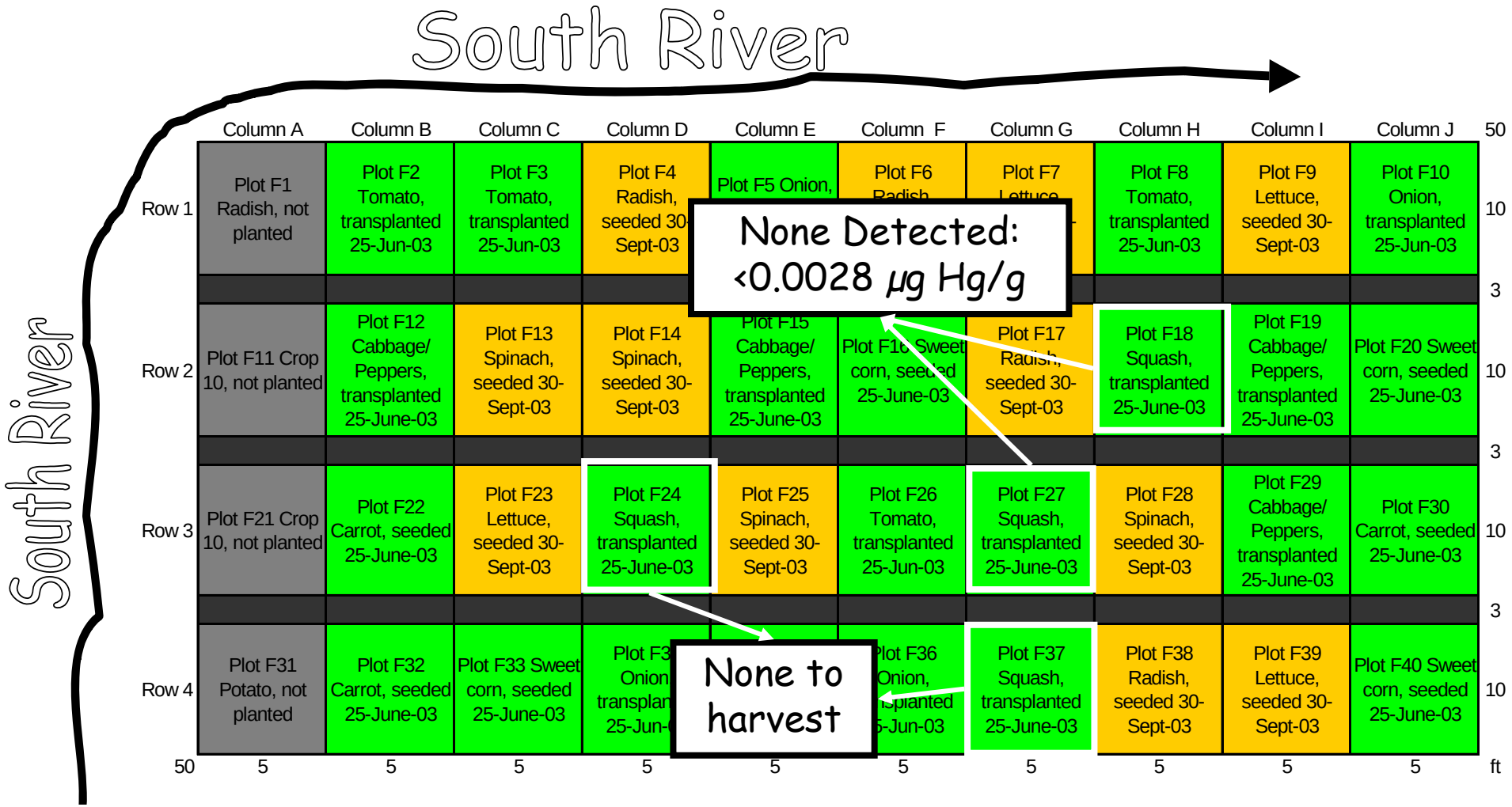
# Floodplain Garden – Tomato harvested 11-Sep-03



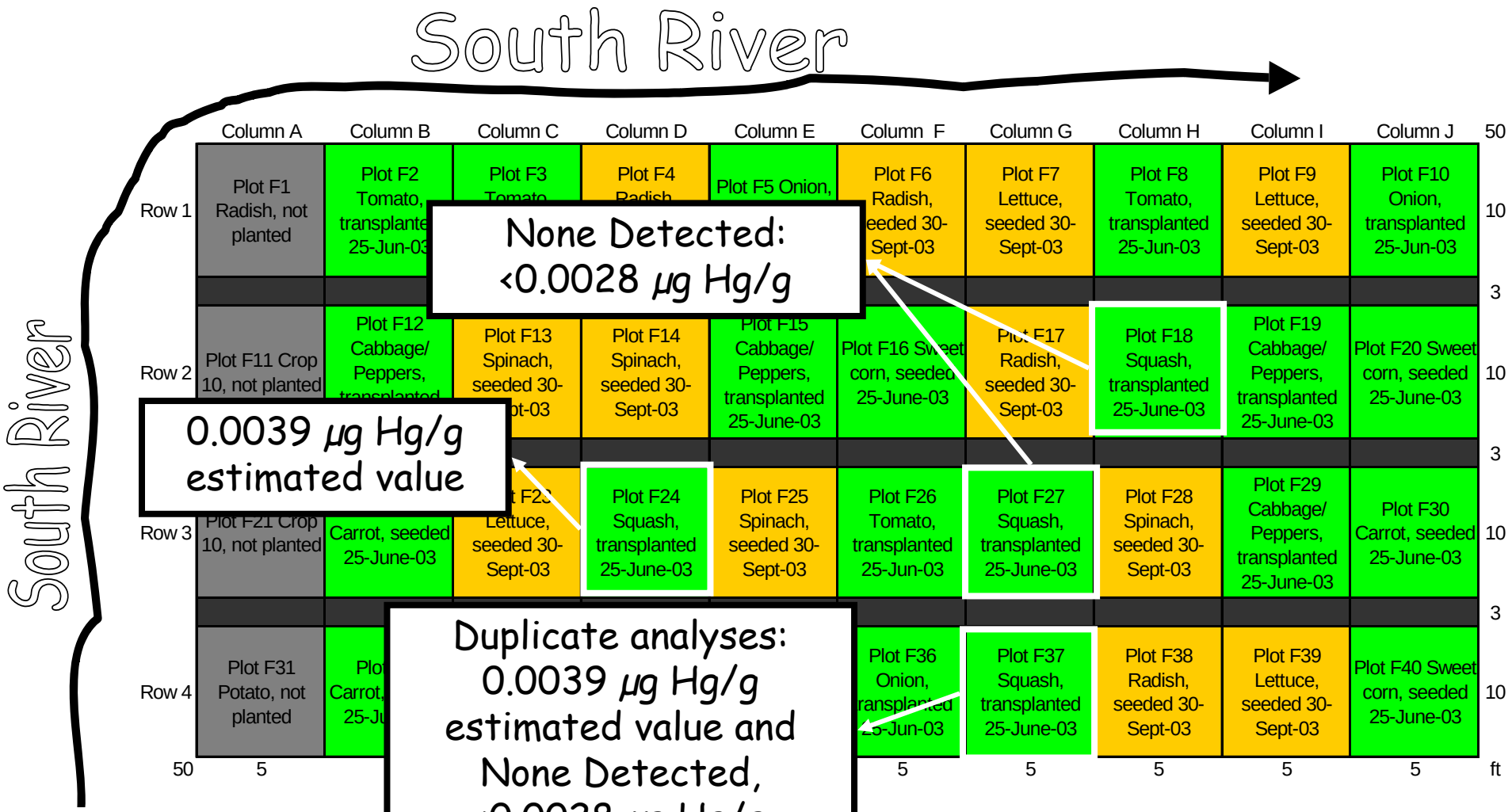
# Floodplain Garden – Sweet corn harvested 11-Sep-03



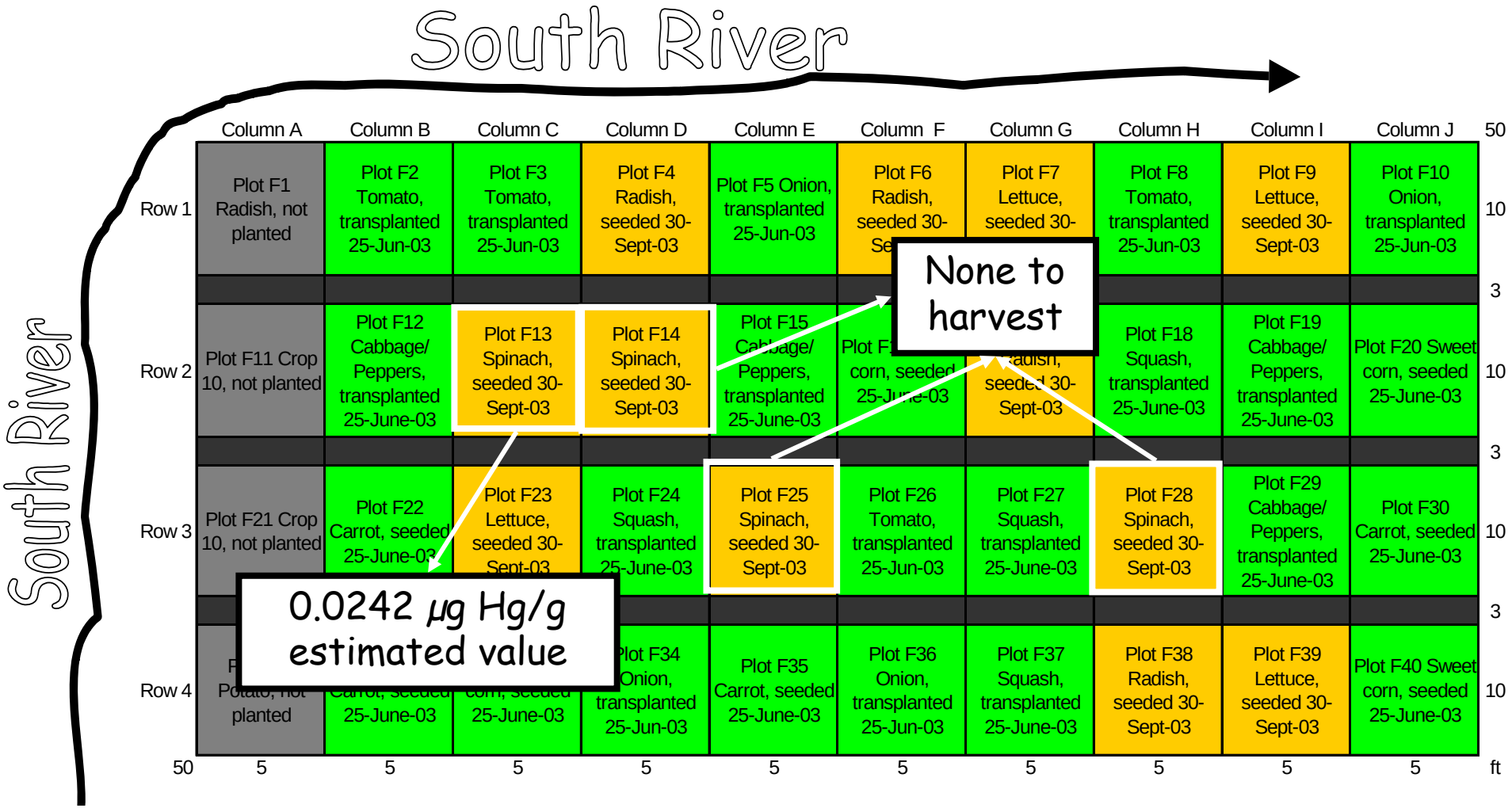
# Floodplain Garden – Small squash harvested 28-Aug-03



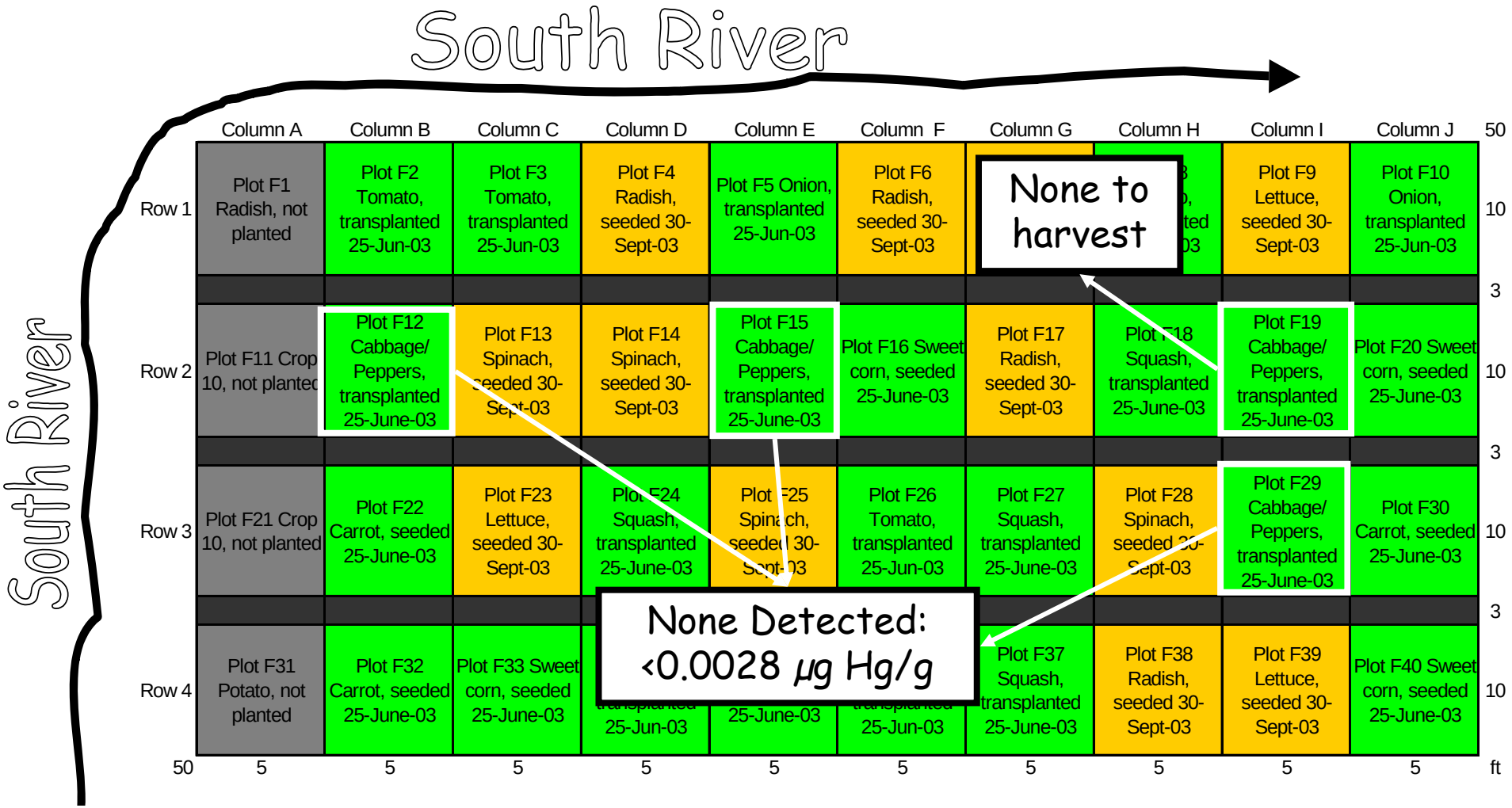
# Floodplain Garden – Large squash harvested 28-Aug-03



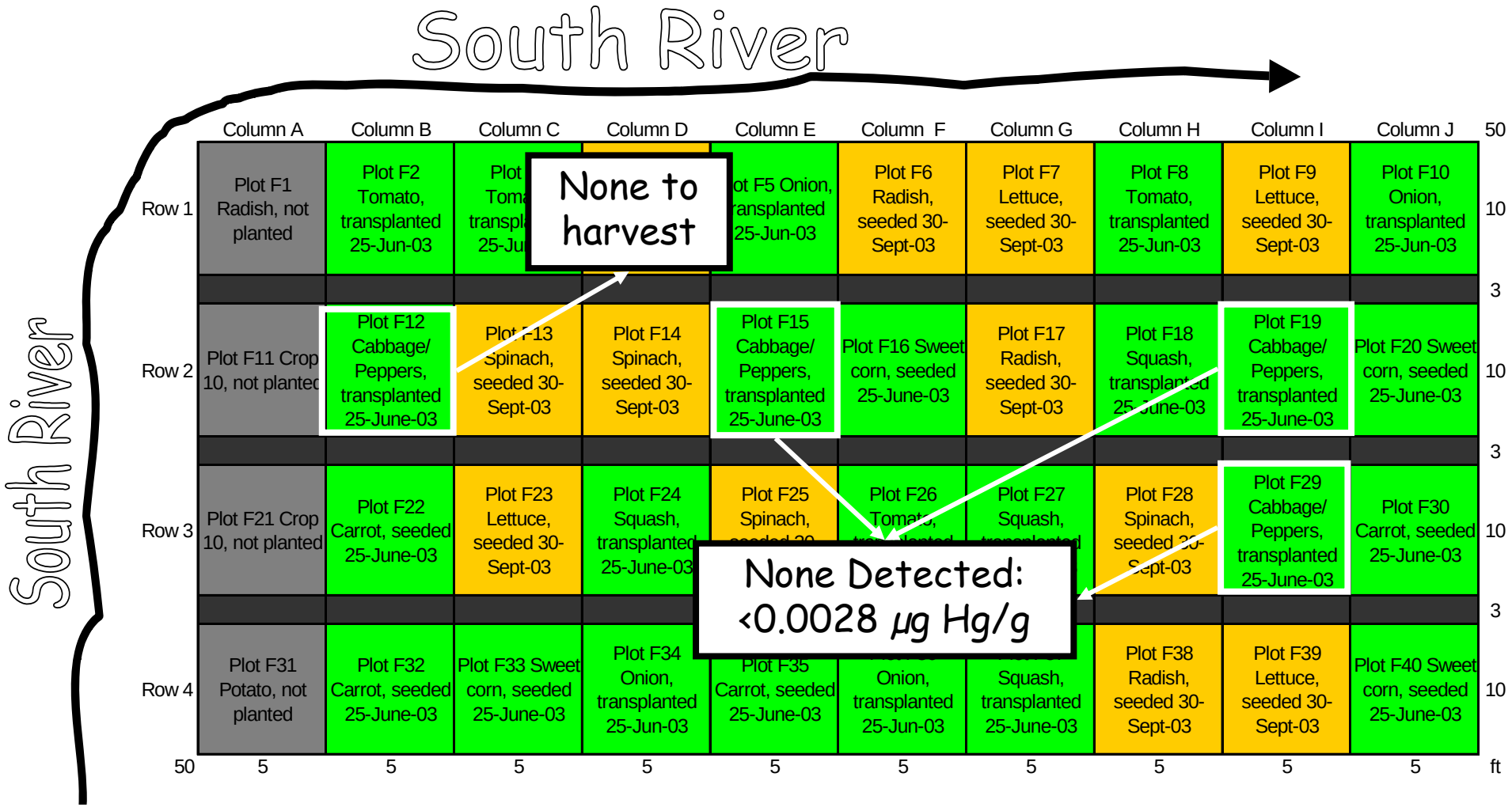
# Floodplain Garden – Spinach harvested 28-Aug-03



# Floodplain Garden – Pepper harvested 28-Aug-03



# Floodplain Garden – Cabbage harvested 28-Aug-03



# Summary

- Total soil Hg, dry-weight basis
  - Control garden; total soil Hg ~0.03 mg/kg (estimated)
  - Floodplain garden; 20 to 55 mg/kg
- Garden vegetables
  - Three of five Carrot samples from floodplain > LOQ and < 0.19 µg/g
  - All other samples < LOQ
  - Hg in most was not detected
    - In 33 samples Hg not detected
    - <0.0028 µg Hg/g

# Path Forward

- Harvest in November, fall crop planted 30-Sept-03
  - Lettuce, radish, spinach
- Check for soil in carrot samples
  - Measure Ti or Al in carrot samples?
- Compare plant analysis on "as is" basis with freeze-dried and oven- dried samples
  - Evaluate detection limits and LOQs on dry-weight basis
  - Evaluate cost

# Path Forward

- Collect soils from plots
  - Once vegetables are harvested
  - Composite sample for soil testing from each plot
    - **Total soil Hg**
    - **pH and plant nutrients**
- Clean-up gardens for winter
- Begin planning for Spring 2004
  - Apply limestone, if recommended by soil test
  - Rototill…

# Acknowledgements


- Lydia Cubbage
- Mike Shifflett
- Don Kain
- Folks at the Augusta Forestry Center
  - Larry Estes
  - Thomas Frazier
  - Carolynn
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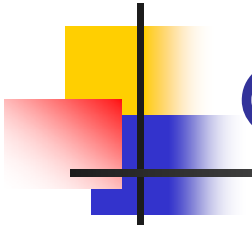
- Barbara Rhodes
- Mike Liberati
- Brenda Kennell
- Barry Wolstenholme



# Questions???