

# Soil Sampling, Risk Mapping & Exposure Prevention

## Second Session of a Three Part Series on Soil Quality/Health

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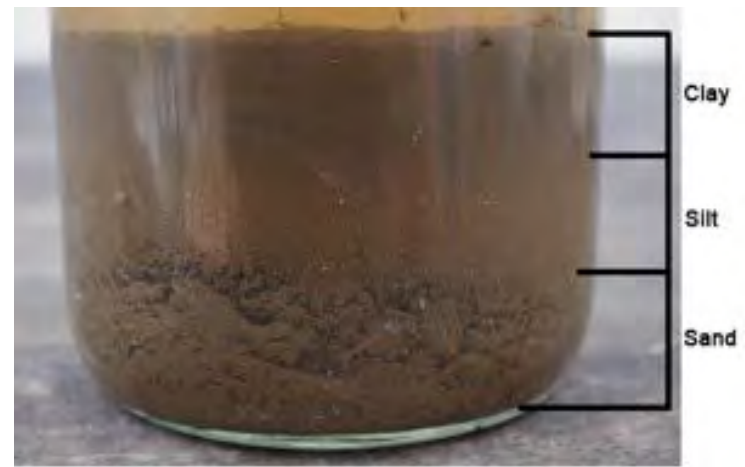
# **Goal:**

## **Understand Soil Quality to Assess Site-Risk & Manage Soils to Grow Food & Family Safely**

# Objective:

**Provide Soil Testing & Best Practice Guidance to ↑ Informed Decision Making that ↓ Risk of Soil Contaminant Exposure**

# Why should you care about your soil?



## Soil Quality

## → How Your Crops Grow!!!



# Some Soils

## Are Easy To Improve:

Plants Grow Best With Proper

Nutrients/Structure/Composition/pH

# Dont Guess!

# Test!!



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# **Some Soils are Harder to Improve: If have Contaminants...**

**Soil Quality Affects Human/Plant Health**

**→ Risk Management: (even in testing)**

**Home Tests versus Lab Test Results**

**DIY Home Tests → Basic Info**

**vs. Lab Tests → Reliability & Precision**



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# Where are Soil Contaminants a Concern?

- **Agricultural Lands - Historical Contaminants can Inhibit Plant Growth/Affect Human Health**
- **Residential Properties - Contaminants could be > Allowable for Human or Plant Health**
- **Urban Ag/Community Garden Sites –  
Based on Site History/Possibly Several Risks**

# ***Common Soil Contaminant Sources***

<b>Source:</b>	<b>Contaminant</b>
Paint (before 1978):	lead
High traffic areas:	lead, zinc, PAHs
Treated lumber:	arsenic, chromium, copper
Burning wastes:	PAHs, dioxins
Manures:	copper, zinc
Coal ash:	molybdenum, sulfur
Sewage sludge:	cadmium, copper, zinc, lead, PBTs
Petroleum spills:	PAHs, benzene, toluene, xylene
Commercial / industrial site use:	PAHs, petroleum products, solvents, lead, other heavy metals
Pesticides:	lead, arsenic, mercury (historical use), chlordane and other chlorinated pesticides



# Why are soil contaminants a concern in urban areas?

## Contaminants Can:

- Inhibit Plant Growth
- Affect Human Health!
- Persist in Soils Long Term
- Persist without Us Knowing

# Sources of Heavy Metal/Lead Exposure

- **Lead paint hazards**
  - lead **dust** in homes;  
from exterior prep work  
& friction of windows
- **Bare soil** in yards with  
lead contamination from  
house paint or previous  
use of leaded gasoline
- **Take-home** lead dust  
from construction work  
or other occupations



# How do we get lead into our body while growing food?

- **Hands contaminated with leaded soil**  
*Contaminated hands touch mouth, food, drink container, cigarette*
- **Hands contaminated with leaded paint**  
*Hands touch damaged lead paint and its dust. Then hands touch mouth, food, drink container, cigarette, etc.*
- **Eating lead-containing soil or paint dust on unwashed produce, or eating produce that has lead uptake**

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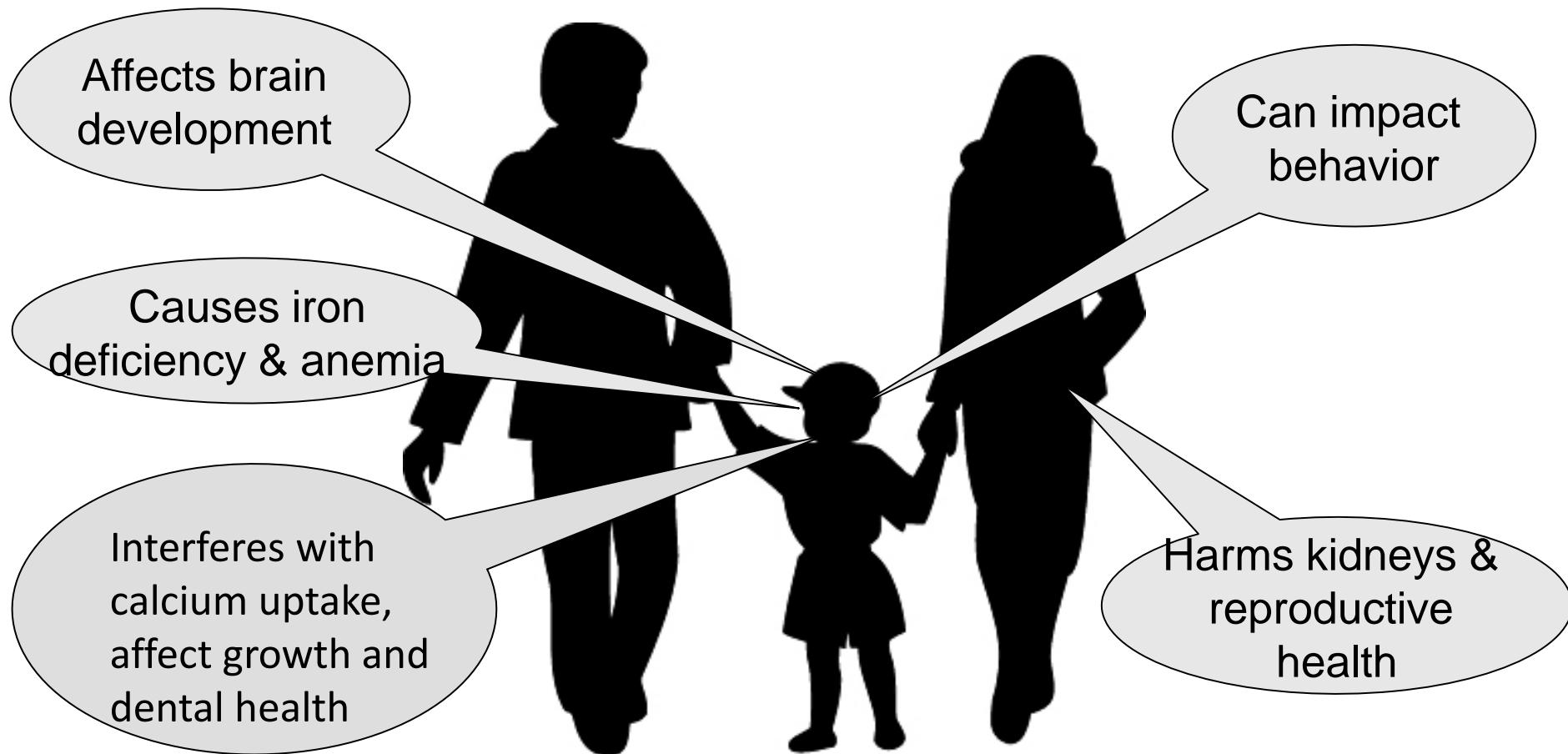


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# How Lead Toxicity Affects Health



**Children at most risk-** their brains & bodies are still developing (& fetus, because lead easily crosses placenta).

# Human Exposure

## Pathways:

→ Soils/Dust Ingestion,

→ Skin/Eye Contact, Inhalation

→ Bare Feet from Garden to Home

Who is impacted?

-Humans/Children/Seniors -Pets

~ Based on Contaminant Concentrations

# Plant/Crop-Contaminant Exposure Pathways

Through Plants Roots → Plant Root Uptake  
(In Plants=Lab tests) (Plant-Internal/Now what?)

On Plants' Parts/Leaves → Topical  
(ALL Plant/Leaf Surfaces (Plant-External/Wash)  
=Lab Tests/Not Visible to Naked Eye)

If contamination found, how manage soils?

Use Best management practices based on case.



# Best Practices: Recognize Potential Contamination → Know Risks

- **Test Soils: Dont Guess! Research!  
Investigate! Do Soil Tests!!**
- **Buy Organic Materials Review Institute (OMRI)**
- **Test soils to confirm lead is < 80 ppm**
- **Wear Gloves & Practice Good Hygiene/Boots**
- **Don't Let Kids Garden/Play in > 80 ppm Soils**

# Best Practices:

- Raise Beds** → **Import Clean Soils/Make & Use Compost**
- Amend with Compost/OM** → **-to Bind Soil Contaminants With Phosphorous & Dilute Contaminants**
- Mulch** → **-to Prevent Airborne Soil Dust & Prevent Upsplash**
- Sub-Surface Irrigate** → **-to Prevent Upsplash/Spreading Particles**

# Best Practices:

- Adjust pH** → **Neutral pH → Optimal Growth/Nutrition**
- Promote Good Drainage** → **-Soil Contaminants Concentrate @ Slopes-Bottoms/Allow H2O Infiltration**
- Post-Harvest** → **-Soak in Vinegar/Wash Produce & Peel Root Crops**
- Manage Inputs** → **-Avoid Waste-Derived Fertilizers**

# Where to start?

Understand/Interpret:

- Site History
- Soil Test
- Remediation versus

Best Management Practices



Observe Plant Growth/Soil Orgs/Debris

- Dig test, Soil Structure Tests.

# Site History → What to Look For:

- Public Access Maps (Sanborn)
- Walk around, ask neighbors/property owners, identify other homes in neighborhood that show similar potential hazards
- Parking lots, auto repair, junkyards, machine shops, dry cleaners, gas stations, concrete plants, illegal dumping sites!!



# Every site is different, Soils vary too...

## Ask Yourself....:

### Are there plants currently growing?

- Is the soil easy to dig into?
- Are you finding any micro organisms in the soil? (worms, insects, larvae)
- Do you come across any debris or trash?
- Consider a Bean Test: plant in testing site soil, and compare growth with potting soil.

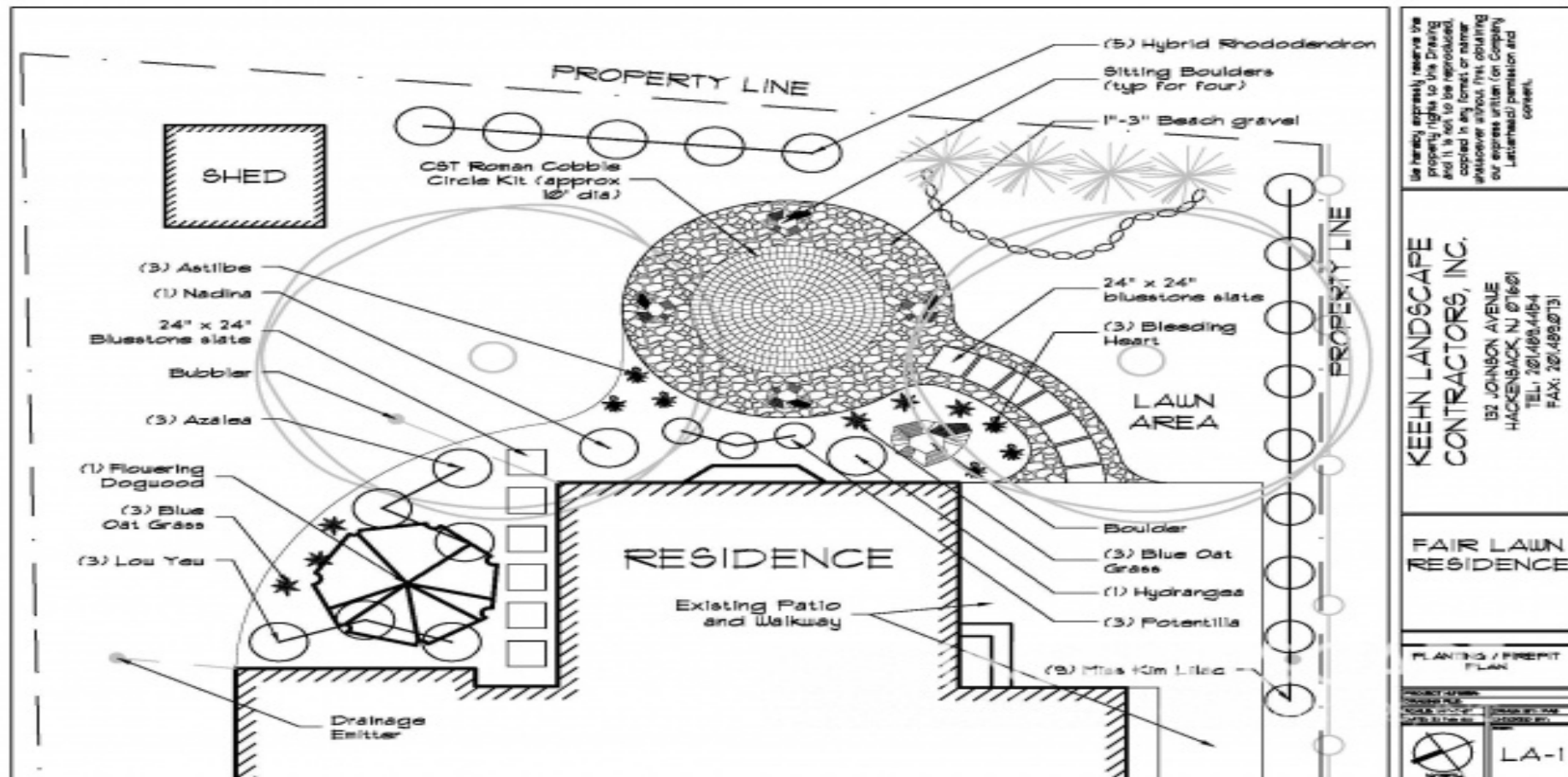


# Mapping Your Food Growing Site

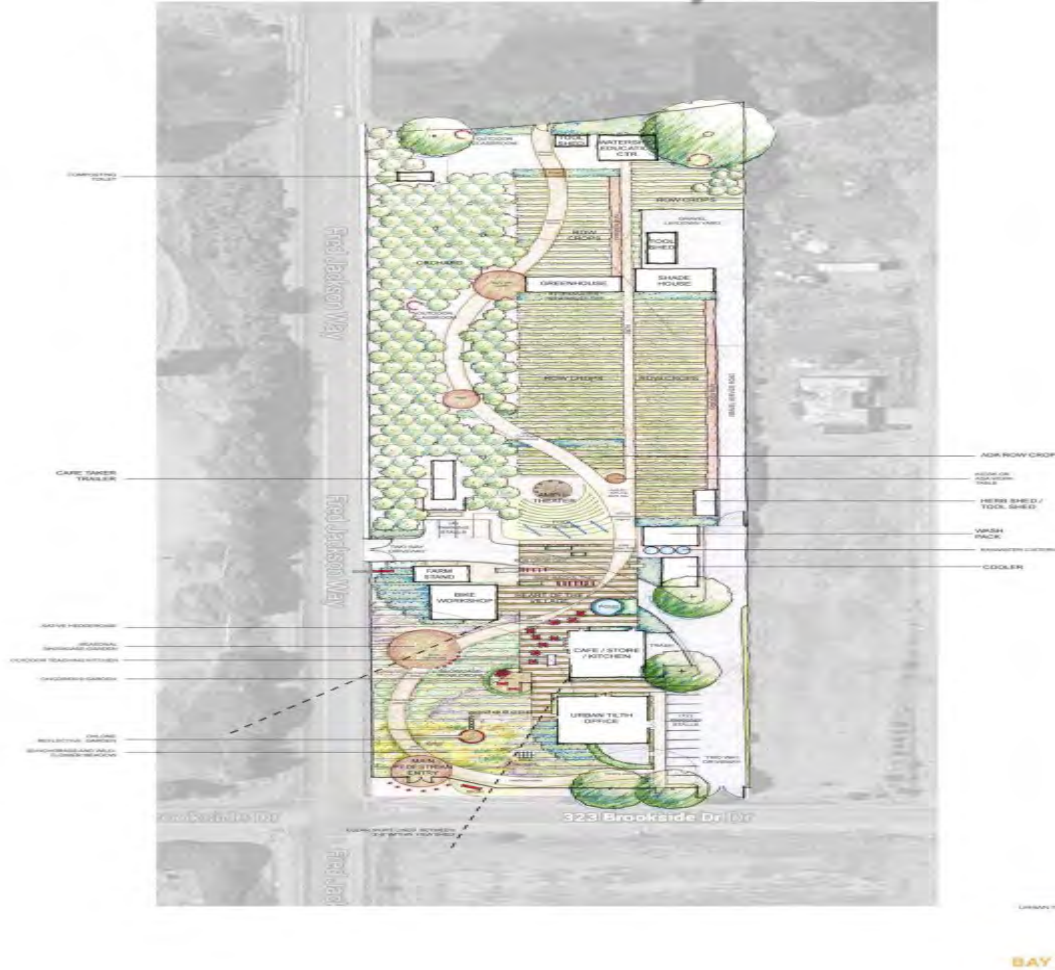
- Areas that show differences in plant growth should be sampled separately
  - Peeling paint, evidence of contamination
- 5-6 samples per area (top 4-6 inches of soil)
  - Decomposing foliage should not be included
  - Keep accurate notations per site-area
  - Each distinct area should be sampled



# Map Your Growing Site



# Urban Tilth's North Richmond Farm, Richmond, CA

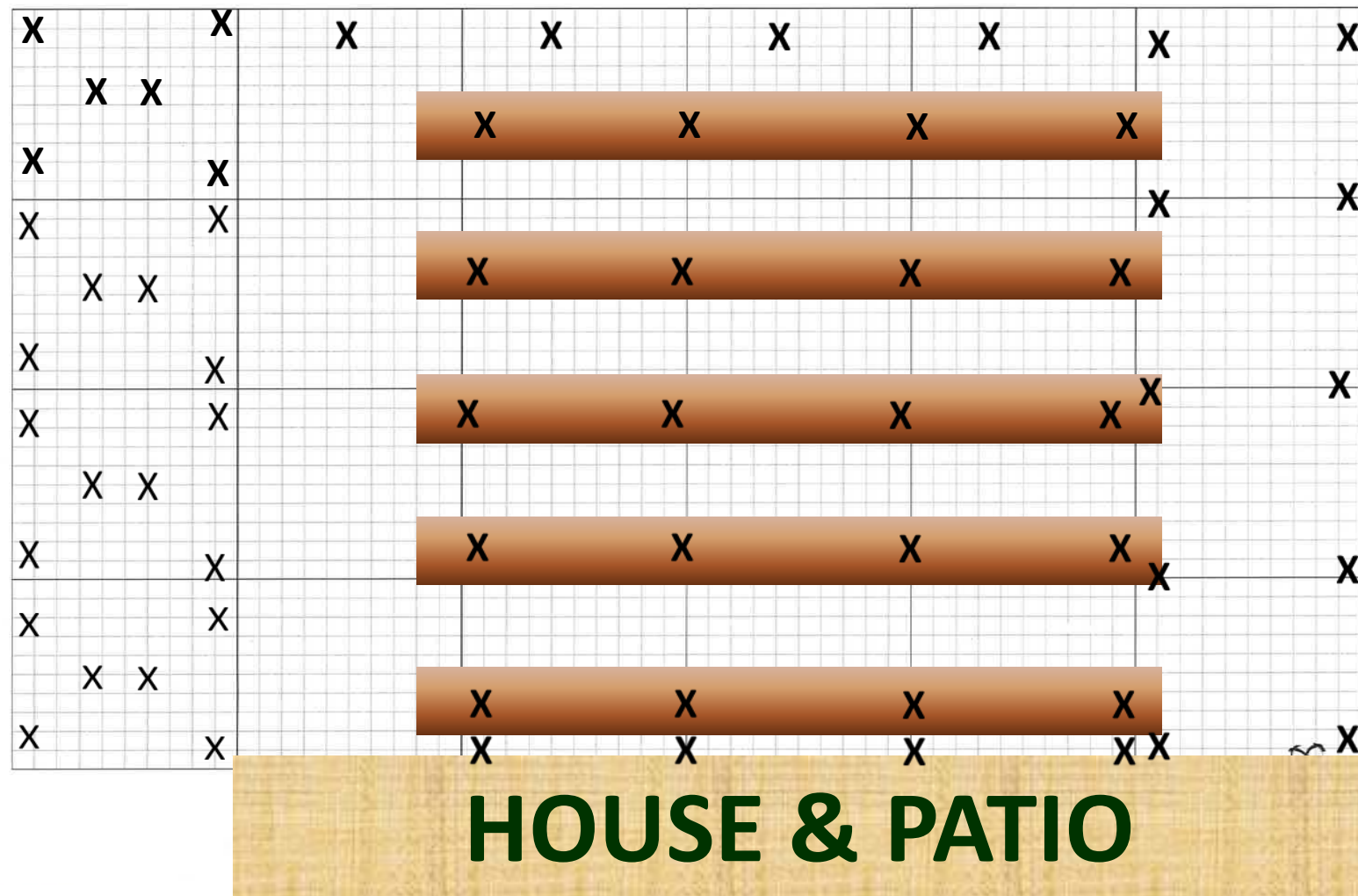




# City Slicker Farms' West Oakland Farm Park, Oakland, CA:



# Example of Soils Sampling Map





# Soil Testing

See UCCE Contra Costa/Alameda Master Gardeners  
**Growing Your Own Food Web Page(s)**  
for Analytical Laboratories for Soil Testing

**EPA Suggests Urban Garden Soils should Be Tested  
for: -pH    -% organic matter**

**-Nutrients      -Heavy Metals/Petro-/Dioxins  
(based on site history including lead)**

# How Should Samples Be Collected?

## Sampling Strategy ~ Site Conditions

- Sampling Soil Surface? Top 2"
- Sampling Food Growing Site? Top 6-12"
- For Both, Make a Composite Sample.
- Mix/Remove Sub-Sampled for Testing.

# Sample Preparation

- Map Sample Spots
- Collect/Mix Composite Sample
- Dry
- Sift
- Remove and Bag Test Sample
- Send/Deliver

# Sampling Your Soil



- Use clean equipment!
- If toxins found, test sub-samples by sample area **AGAIN!!!**
- Sample depth based on plant material
  - Veggies 1-12 inches
  - Turf 1-6 inches
  - Shrubs, roses 1-12 inches
  - Small Trees 6-18 inches
  - Deep rooted trees 6 to 24-36 inches

# Soil Sampling

- Do not sample under wet conditions/bad for soil structure
- Depending on case, may discard top inch of subsamples
- Remove non-soil materials/Rocks
- Mix subsamples, Send sample in plastic zip-type bag (6-8 cups)
- Label completely! Date, time, weather, slope, vegetation, GPS







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Caption: 8-22-2015  
Workshop at the Gill Tract



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**Caption: 8-22-2015 Workshop at the Gill Tract**



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