Why do They Cut Them Like That?

Utility Arboriculture Explained

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Greetings from Michigan!

Why would anybody do something like this?

Because they are not an arborist.

The trees in this small municipally-owned utility are maintained by linemen (most linemen don’t know much about trees)

How utility engineers see trees

Trees fail with consequences

Trees compete for space with the built environment

Above and below ground

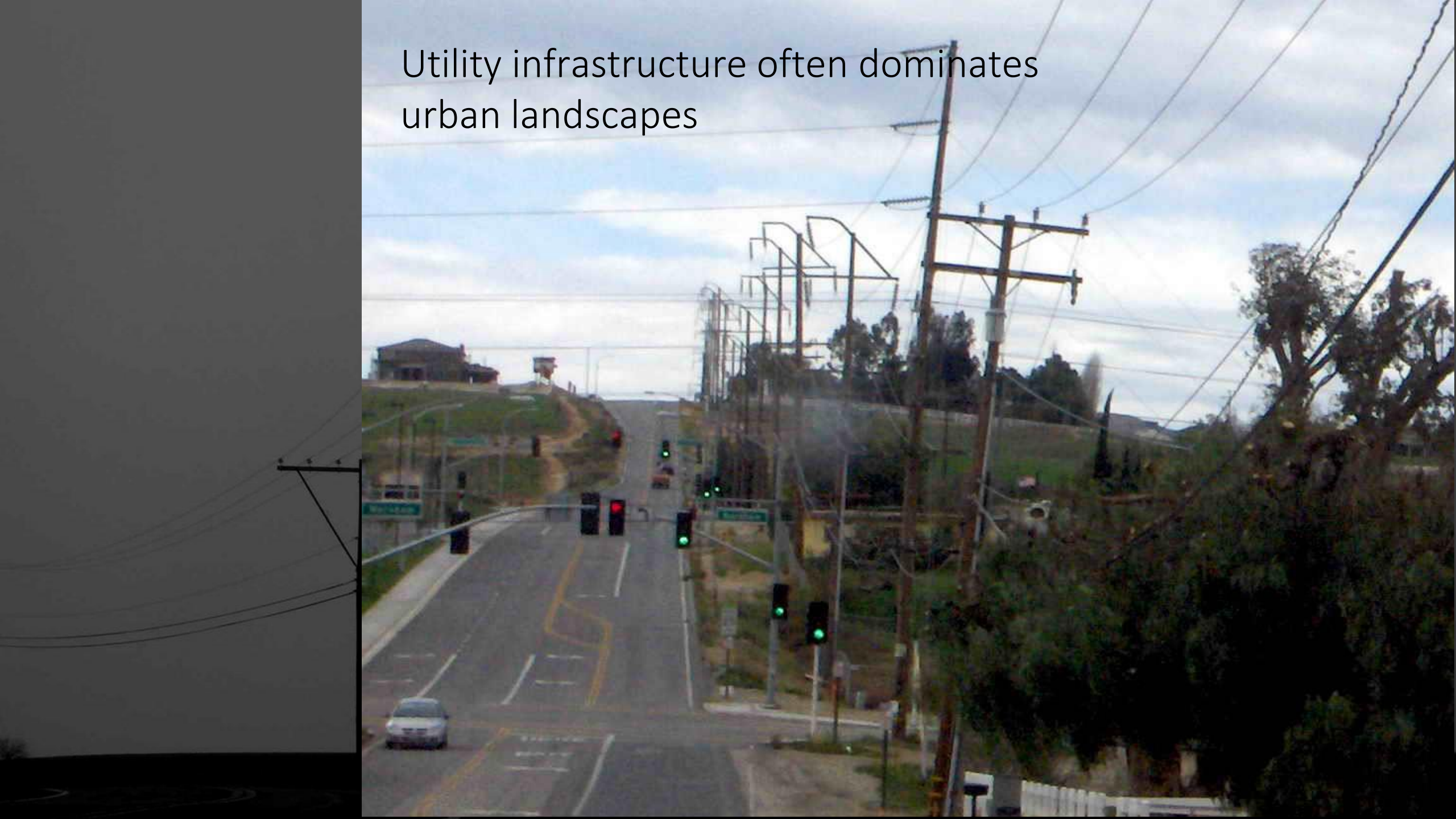
Electric Utilities are Everywhere

Because we all depend on a reliable supply of electricity

- 7 million miles of line in North America
  - (300x around the world!)
- 130 million+ utility poles
- ~3600 individual utilities serving 345 million people
  - Investor owned
  - Municipally owned
  - Cooperatively owned
  - $5 billion + spent annually on vegetation management

➢ *3600 different tree maintenance specifications!*

Utility infrastructure often dominates urban landscapes




Utility infrastructure often dominates
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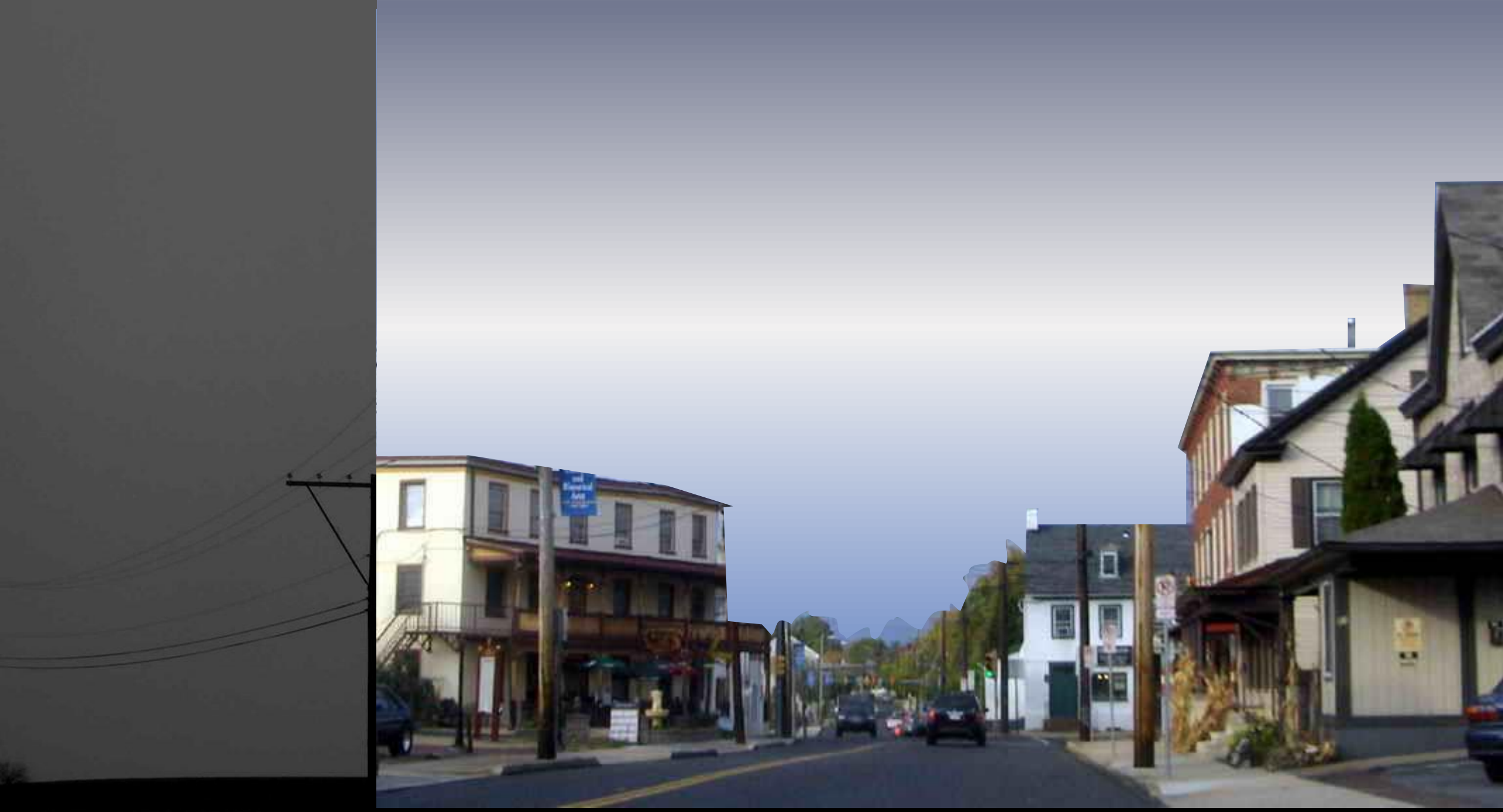


The Effect on Trees is Profound

- in every city in North America

The basic infrastructure – poles supporting wires – has changed little in the past 130 years.

Many ask…

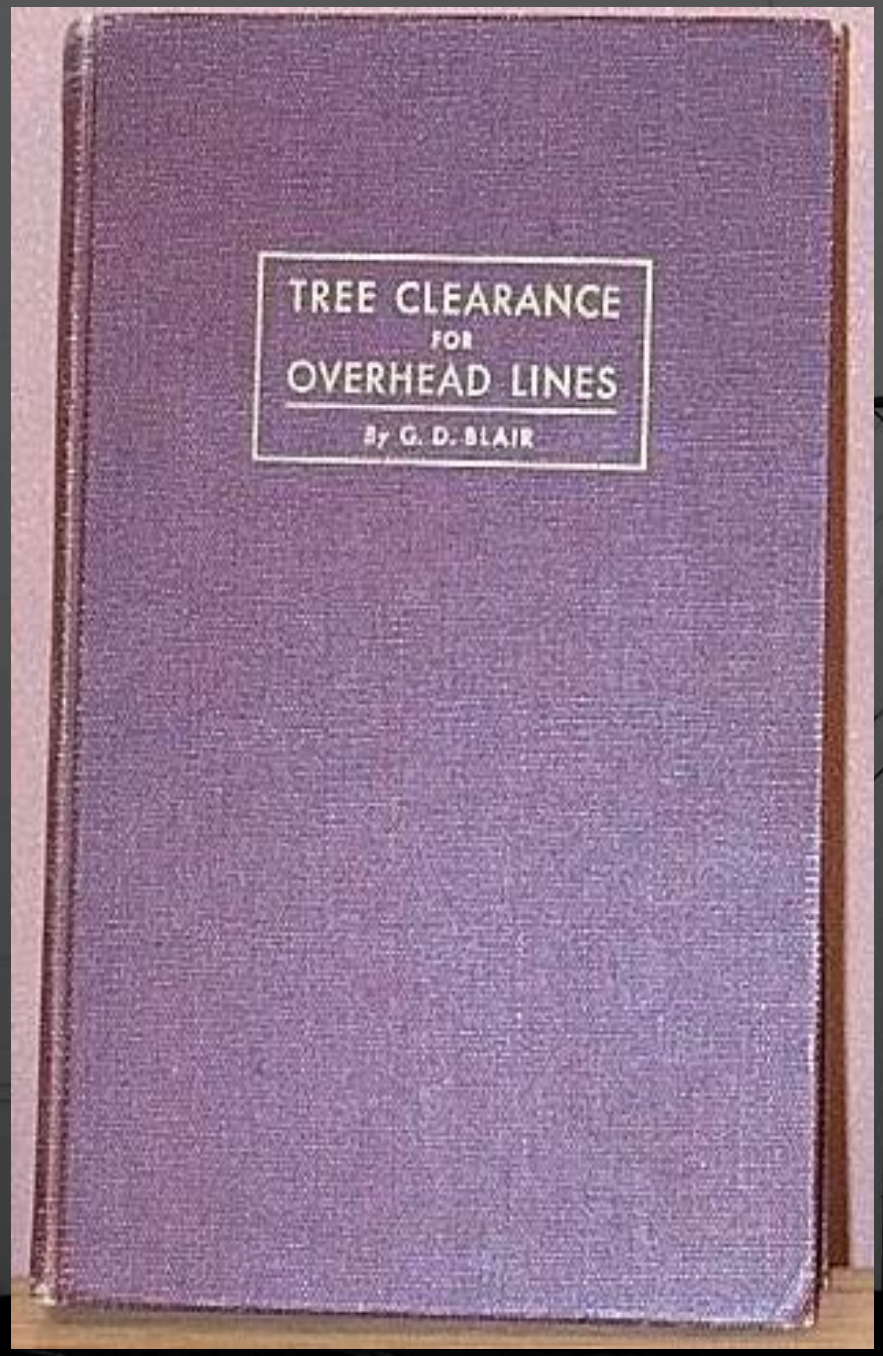
“Why do we put up with this eyesore?”

“Isn’t there a better way?”

Electricity is a vital service

And trees can have a very negative effect on that service!

- Understand the utility perspective
- Find common ground



"…trees must be vigorous and beautiful; overhead line service must be continuous and dependable. In this measure of quality, each is essential to the happiness of civilized people."
- George Blair, 1939

Understanding the Utility Perspective

- Technology has improved the grid
- Power quality has improved
- Basic method of delivery is largely the same
- The overhead utility grid remains vulnerable to tree failures

Utilities provide a vital service

Extreme example: 2003, 50 million people in the US and Canada were affected by an outage triggered by one tree.

Utilities face daunting challenges from vegetation

The space needed by utilities to deliver this service is perfect for growing valuable tree canopy.

For utilities, trees interfere, and are a significant cost

- Utilities do not own the trees
- Utilities are responsible for maintaining their easements
- Some utilities just remove the tops of trees
  - i.e. the part affecting their easement
- Utilities seldom remove stumps

Private and public entities continue to plant tall-growing trees directly underneath overhead lines

This utility is owned by the same municipality that planted the trees!

Why does this happen?

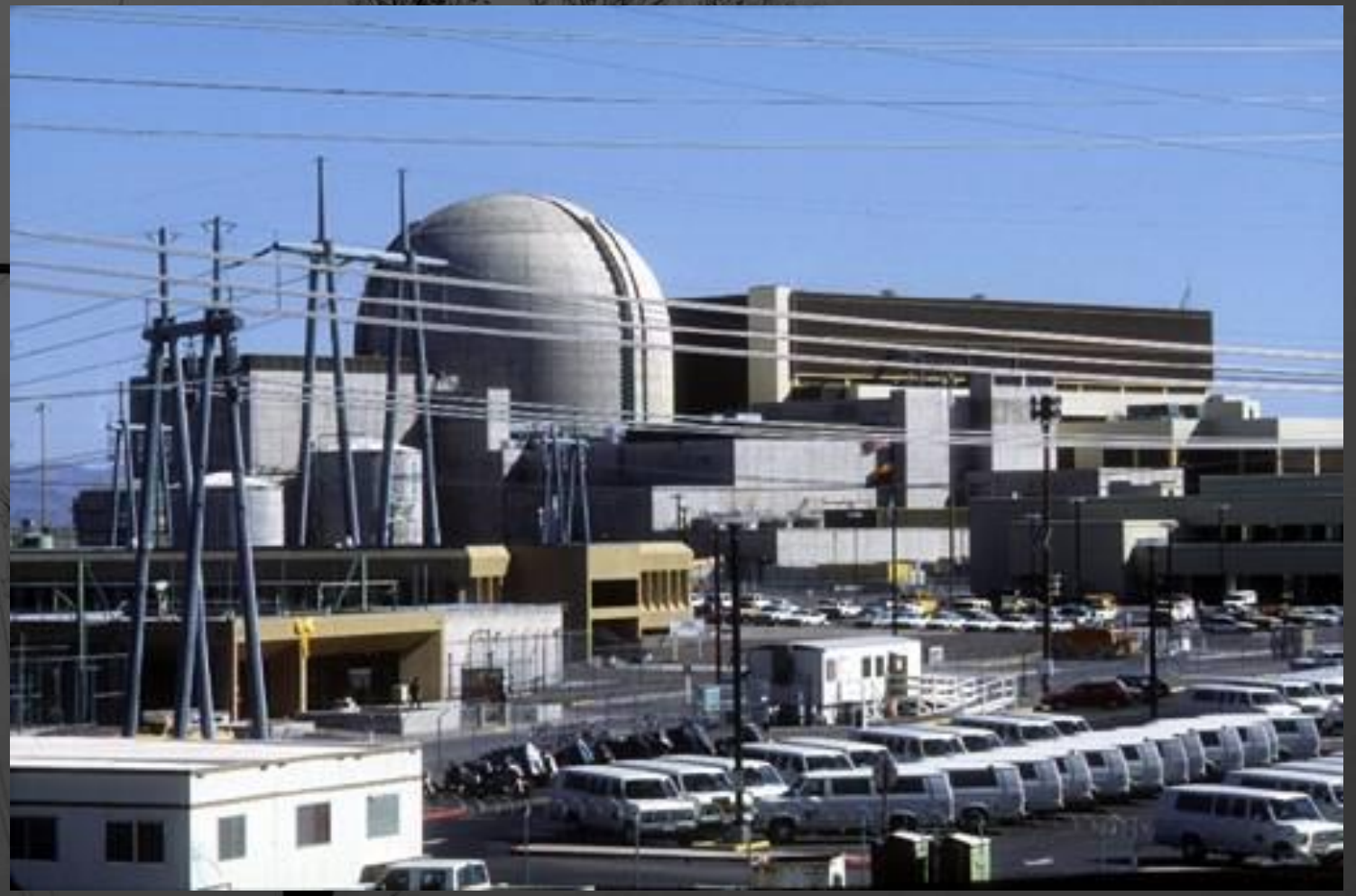
“What we’ve got here is a failure to communicate!”

From *Cool Hand Luke,* 1967
(Played by Paul Newman)

- *Utilities must communicate the benefits of “right tree right place”*
  - *And defining what is meant by “right tree”*
- *Cities and tree advocates must communicate the benefits of trees to utilities*
- *Everyone needs to understand the best way to manage this valuable resource*

Utility Corporate Culture

- Large corporations, regulated by the government
- Conservative, careful, slow to change
- Focused on:
  - Generating and delivering electricity (engineering)
  - Managing accounts, collecting money, maintaining stockholder equity (finance)
- Utility arborists and foresters are make up a very small percentage of utility employees



Utilities and state regulators are very concerned about:

- Public safety
- Service reliability
- Customer relations
- Controlling costs

Guess what…?

Trees have a direct effect on:

- Public safety
- Service reliability
- Customer relations
- Controlling costs

Utilities must deal with trees.

Utility Basics

Electricity 101

Utility Basics: Volts, Amps, Watts, Ohms

They are all mathematically related

Volt – unit of electrical potential

Voltage represents an excess of electrons – the greater the excess, the higher the voltage

Amp – unit of electrical flow rate

Represents the capacity of the conductor, or how much current can pass through

Watt – unit of electrical usage

How much power is consumed

Ohm – unit of electrical resistance

Think of this as friction, or work done

$$\text{Volts} = \frac{\text{Watts}}{\text{Amps}}$$

$$\text{Amps} = \frac{\text{Volts}}{\text{Ohms}}$$

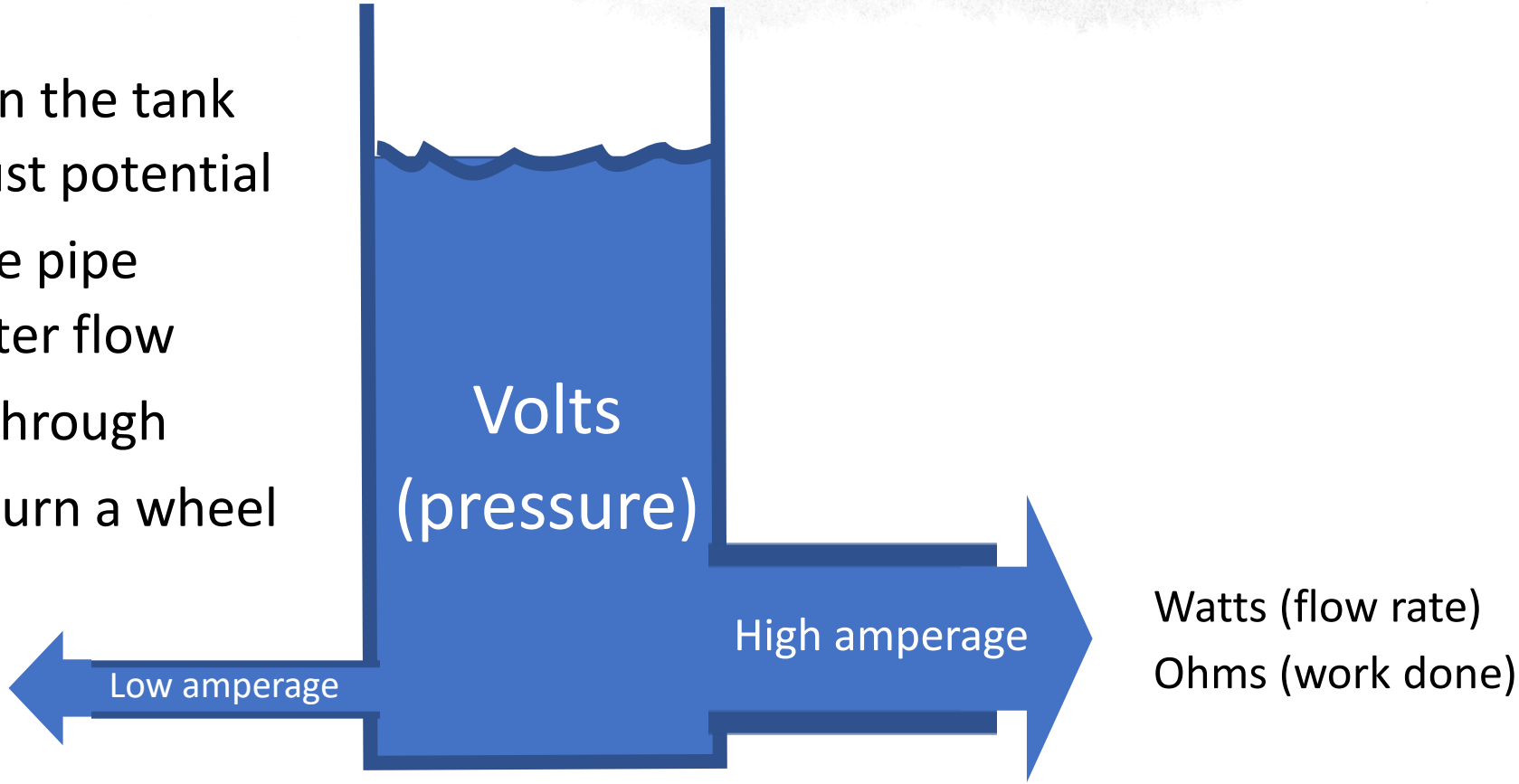
$$\text{Watts} = \text{Amps} \times \text{volts}$$

$$\text{Ohms} = \frac{\text{Volts}}{\text{Amps}}$$

E.g. Increased volts require fewer amps to obtain the same watts.

Water model

- Volts are like the pressure in the tank
  - The pressure alone is just potential
- Amps are like the size of the pipe
  - Larger pipe allows greater flow
- Watts are how much pass through
- Ohms are work done, e.g. turn a wheel



12V

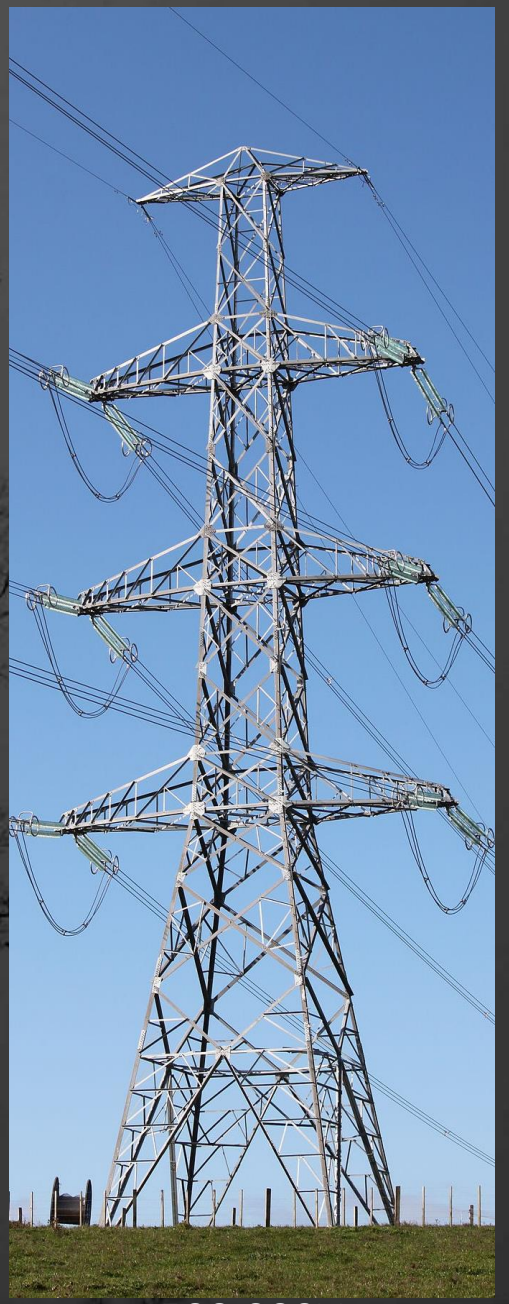
120V

240V

625V

12,000V

46,000v

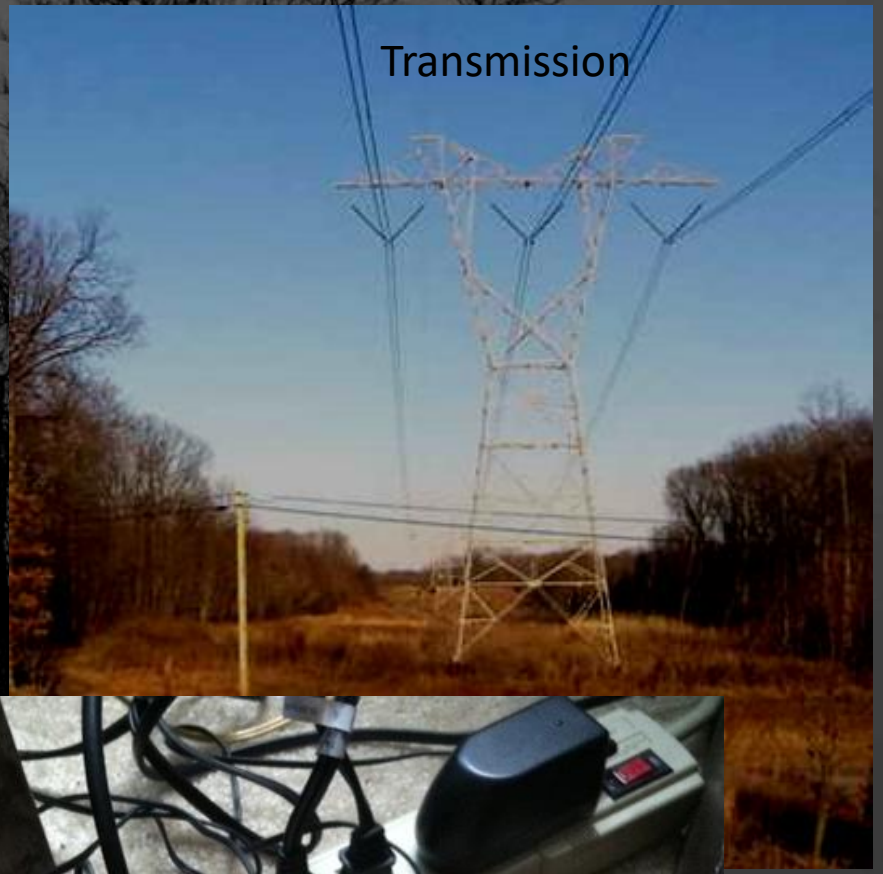


500,000V

Voltage	Example
12	Car battery
120	Regular outlet (10x)
240	Dryer, stove, large AC unit, service from pole to meter (20x)
625	NYC subway system third rail (50x)
3000-32,000	Typical utility primary distribution (neighborhoods) (~1000x)
32,000-120,000	Typical utility subtransmission (10,000x)
120,000-750,000	Transmission (10,000x +)

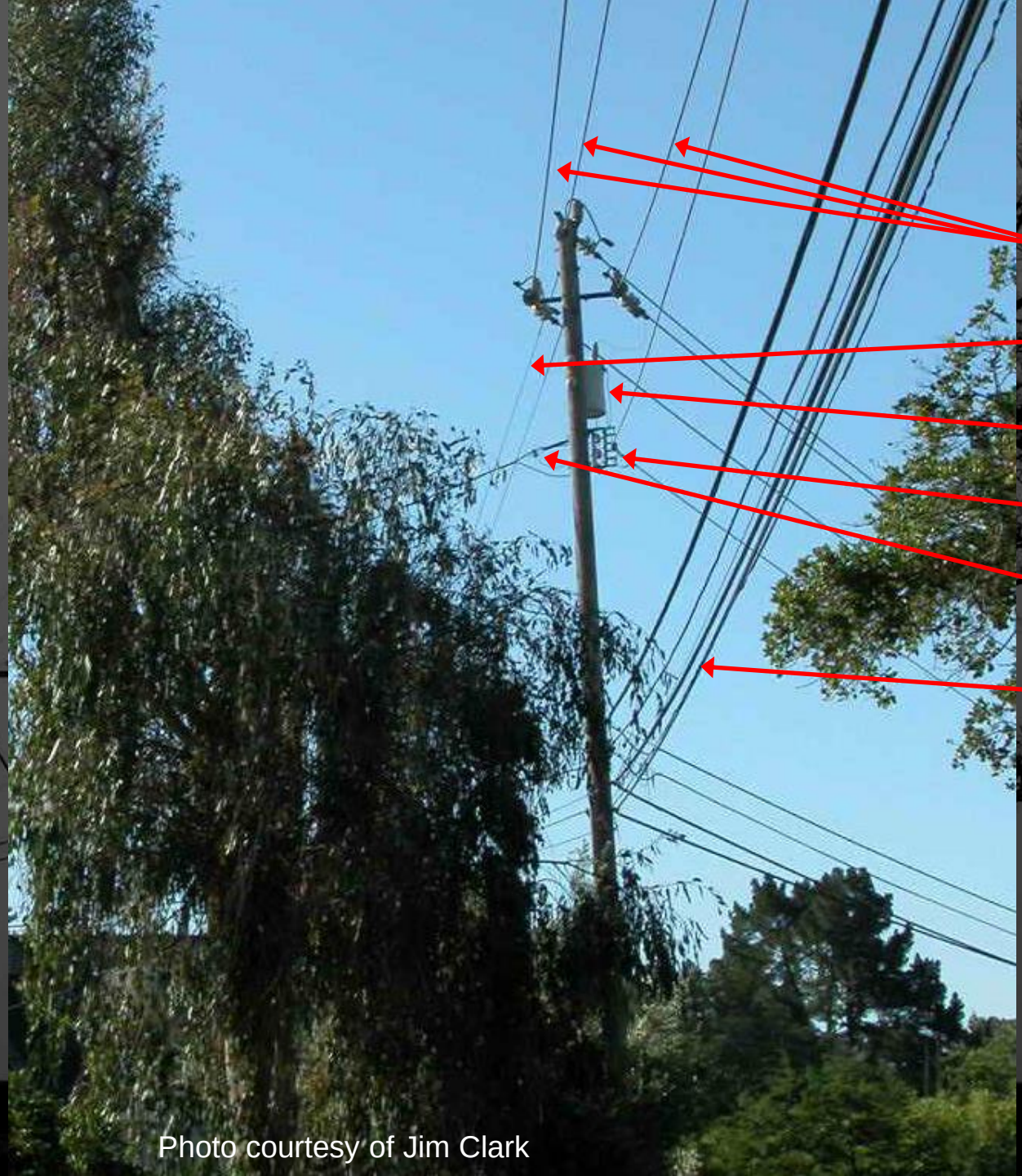
Voltages (V) vary by orders of magnitude

Transmission	65.000 – 765,000 V
Distribution	3,000 – 33,000 V
Secondary	220 – 480 V
Household	110 – 220 V



500,000 Volt Fault


https://www.reddit.com/r/Bellingham/comments/cvg3pm/wildin/



Typical Utility Pole Configuration

- Primary lines (24,000 V)
- Guy wires
- Transformer
- Secondary lines (220 V)
- Service drop (220 V)
- Cable/phone

Note that voltage of primary lines is often 100x greater than household current!

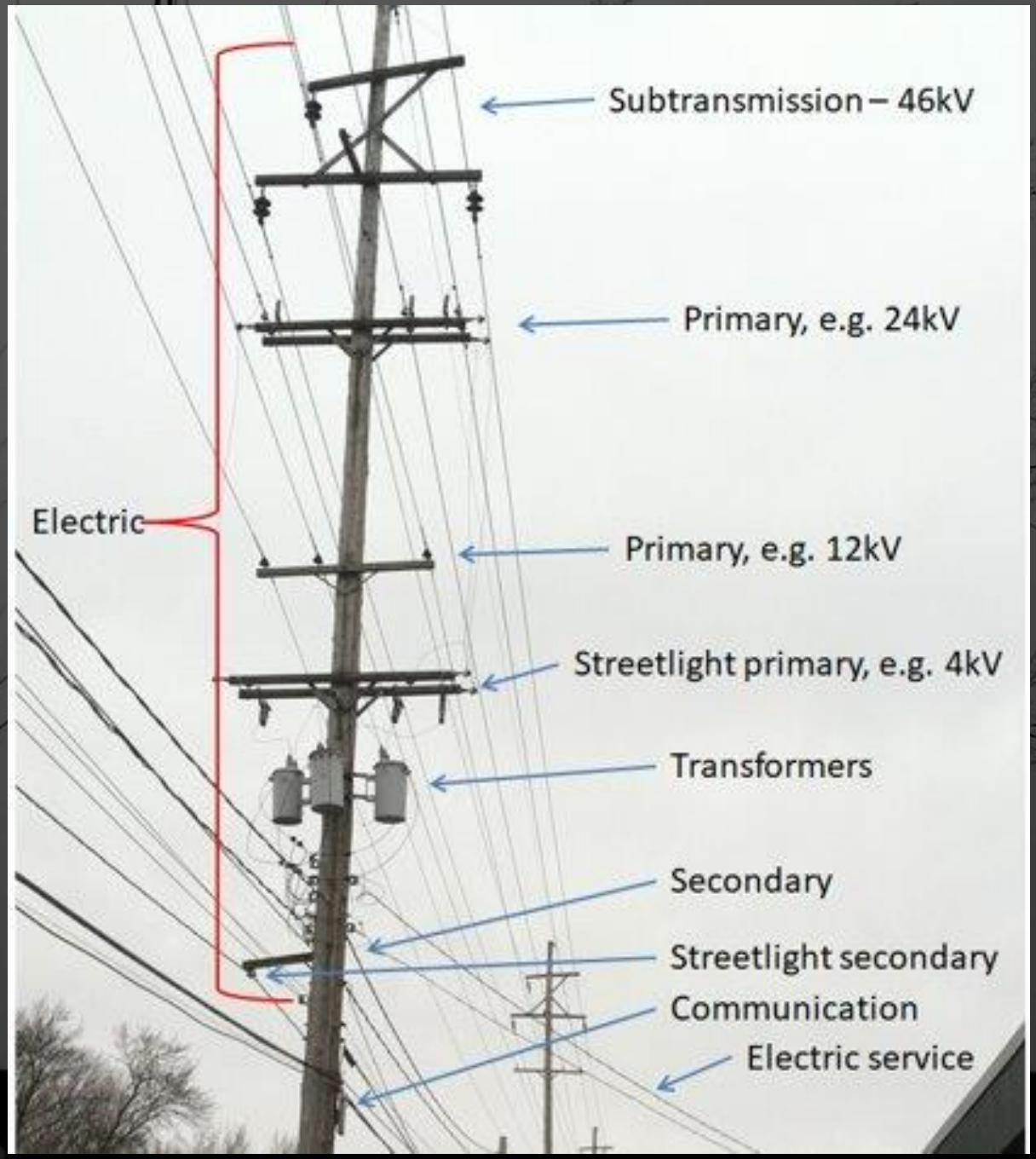
Photo courtesy of Jim Clark

Underbuild

Two sets of primary lines, with transformer, secondaries and communication lines below.

The higher on the pole, the higher the voltage (and the more dangerous)

It can get very complicated.



ANSI Z133.1 Safety Rules (*defacto* OSHA Regulations)

Employees contracted to or working for electric utilities:

- Employers “shall verify” that employees are qualified to work around electrical hazards

Incidental:

- Workers “shall be trained” based on “the voltage level to which they are exposed”

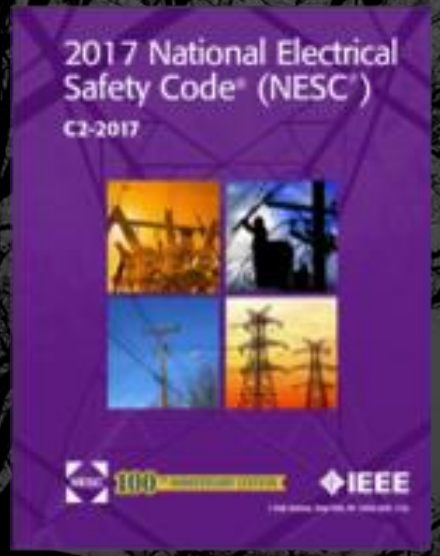
Non-qualified employees

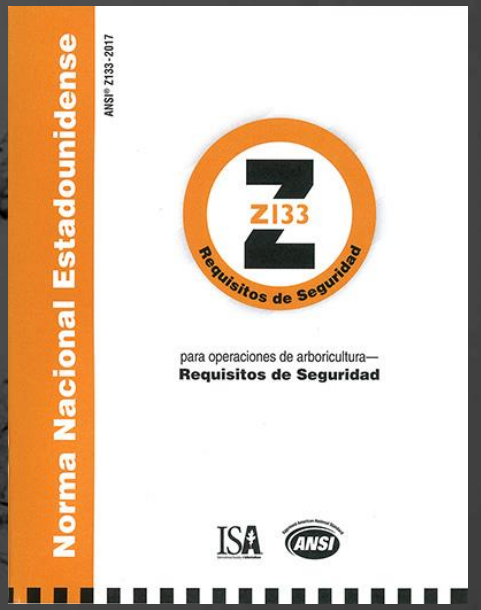
- Must maintain 10’ minimum separation (greater for higher voltages)

These are very different requirements, ***but the electrical hazard these employees face is the same.***

Industry Standards for Utility Arboriculture

- ANSI Z133.1, Safety Requirements
- National Electric Safety Code
- ANSI A300, all parts (some more than others)





Institute of Electrical and Electronics Engineers (IEEE)

National Electric Safety Code (U.S.)

Applies

> "…during the installation, operation, or maintenance of electric supply and communication lines...."

Does not prescribe or suggest clearance distances from trees

Institute of Electrical and Electronics Engineers (IEEE)

National Electric Safety Code (U.S.)

Trim or remove interfering trees, accounting for:

- Tree growth
- Tree and conductor movement under adverse weather conditions
- Voltage
- Conductor sag on hot days

There is no standard clearance distance.

ANSI A300 Tree Care Standards with direct utility application:

- Part 1, Pruning
- Part 5, Site Planning Site Development and Construction
- Part 6, Transplanting
- Part 7, IVM
- Part 9, Tree Risk Assessment

All parts will be combined into one document next year.

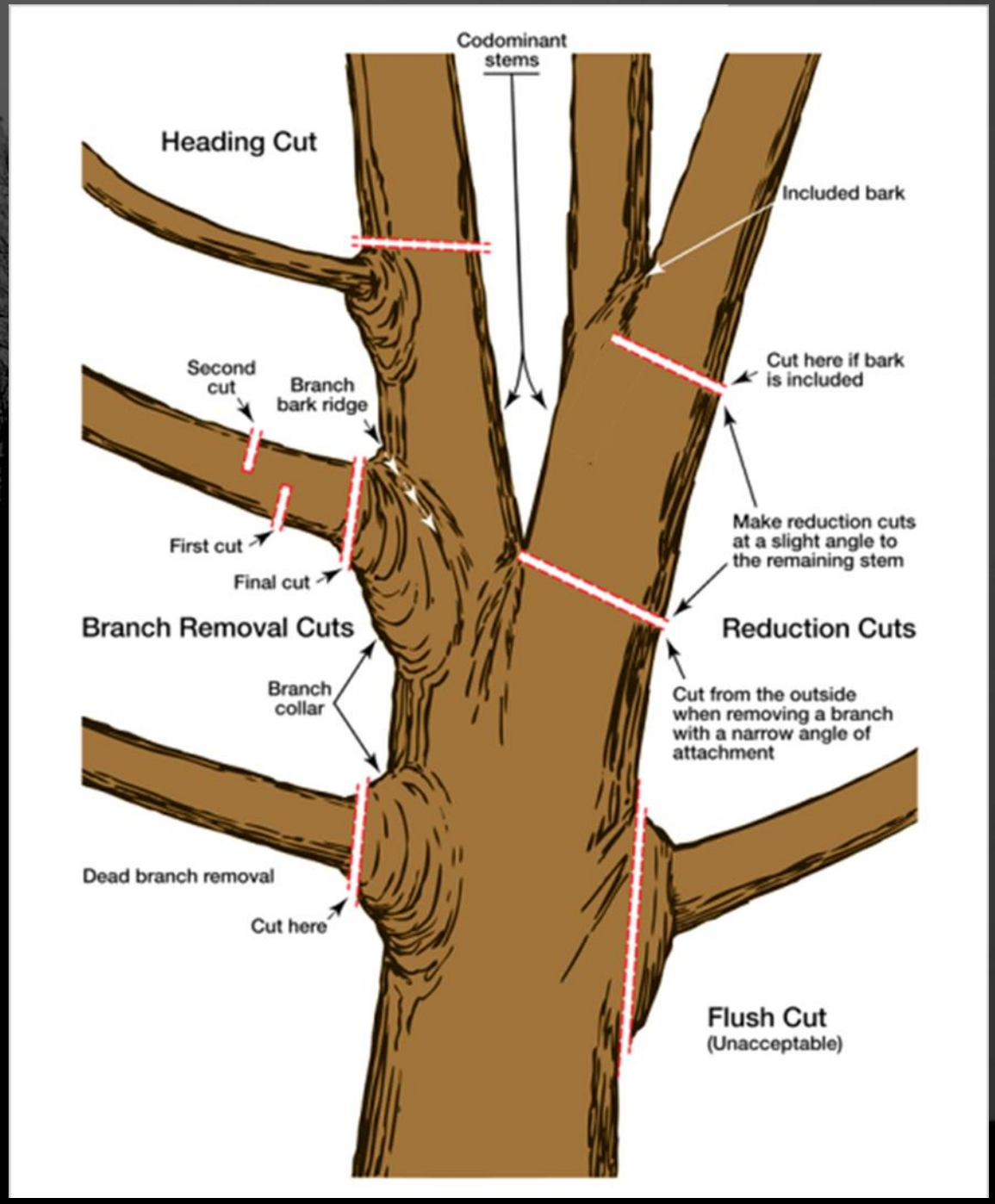
ANSI A300 Tree Care Standards Part 1, Pruning 2017

Applies to all professional arborist, including utility arborists

Utility Arborists are Included in ANSI A300

When pruning, utility arborists must perform as other arborist, e.g. ***shall:***

- Establish objectives
- Make proper cuts:
  - Branch removal cut:
    - "…without cutting into the branch bark ridge…or leaving a stub"
  - Reduction cut:
    - "…to a live lateral branch or codominant stem...typically at least one-third the diameter of the stem or branch being removed."



ANSI A300 Pruning Standard Specifications

Arborists "Should…"

"…remove no more living material that what is necessary to achieve specified objectives."

Arborists "Shall…"

…consider "species, size, age, condition, and site… when specifying the location and amount of live branches to be removed."

This means that some trees require more pruning, some require less.

This requires professional judgment.

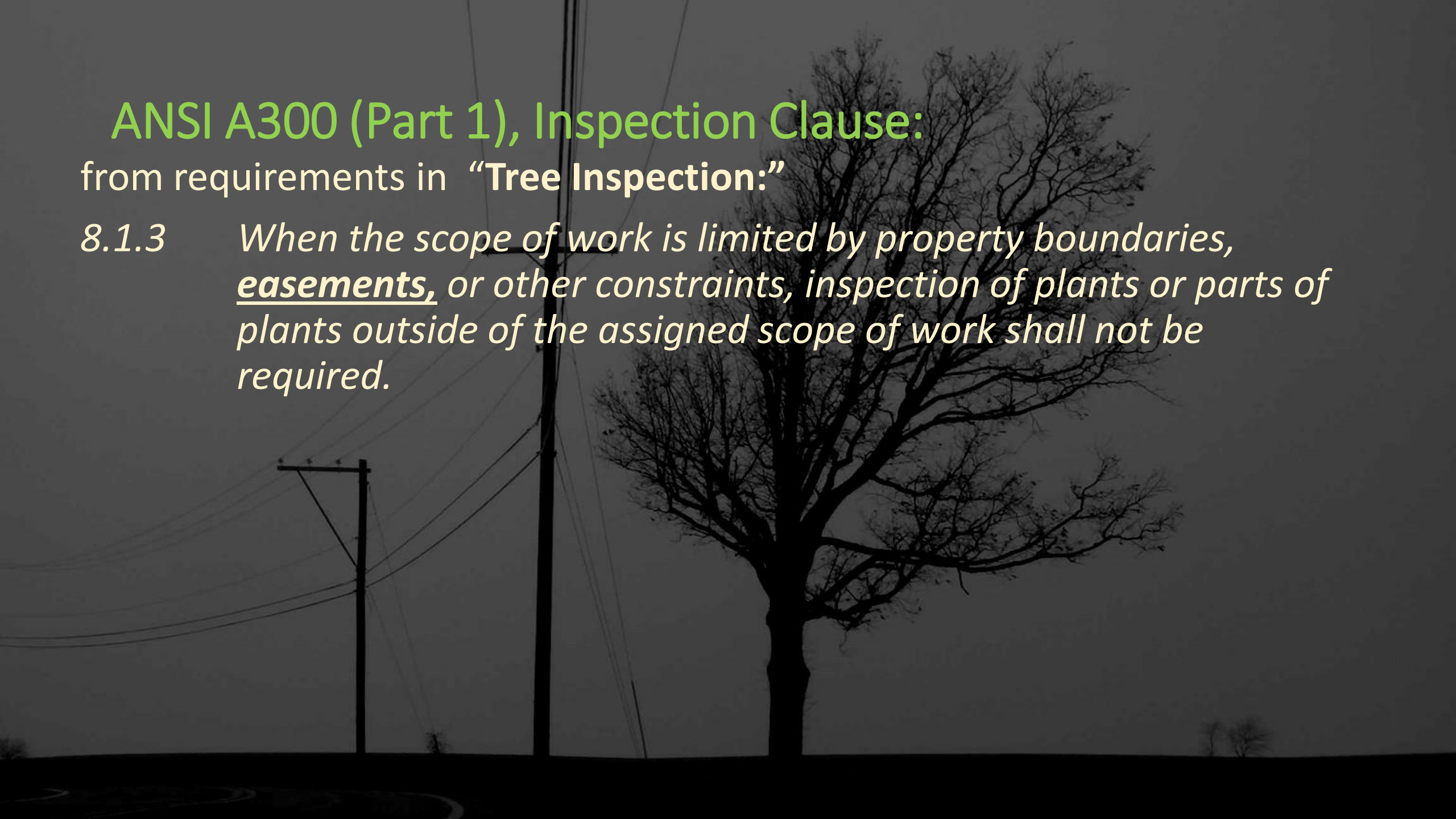
Typical Utility Pruning Objectives (from ANSI A300 Part 1)

"One or more pruning objectives *shall* be specified…"

- Manage risk (A300 Part 9, *Tree Risk Assessment*).
- Develop structure, such as to:
  - Promote or subordinate certain leaders, stems or branches;
  - Promote or discourage growth in a particular direction (directional pruning);
  - Minimize future conflict with traffic or infrastructure;
- Provide clearance, such as to:
  - Ensure safe and reliable utility services;
  - Minimize current interference with infrastructure, buildings or other plants;
  - Ensure lines-of-sight or desired views;
  - Provide access to sites, buildings or other structures; and/or,
- Comply with regulations.
- Manage size or shape.

Utility pruning objectives often overlap with other arborist objectives!

Large trees growing directly under or adjacent to conductors may require extensive pruning to ensure public safety and electric service reliability



ANSI A300 (Part 1), Inspection Clause:

from requirements in "**Tree Inspection:**"

*8.1.3 When the scope of work is limited by property boundaries, **easements,** or other constraints, inspection of plants or parts of plants outside of the assigned scope of work shall not be required.*

Constraints common in utility arboriculture:

Work scope -

Easement includes **only** the portion of the tree near the conductors.

Scale -

Contracts may cover millions of individual trees and individual property owners.

- Impractical to inform owners who are not present or even locatable
- Not reasonable to accept liability for conditions outside of the scope of work

Local regulations are increasing

- California, Oregon – no tree-line contact allowed
  - Fire danger
- Illinois, Maryland, Missouri, Oklahoma – mandatory 4-year tree maintenance cycle
  - Service reliability, impact on communities
- Indiana – mandatory public notification of tree work
  - Limitations on amount of crown removed
- Additional regulations are being considered in other states

Common Regulatory Concerns

- e.g. Minnesota PUC:
  - ”…create and maintain a regulatory environment that ensures safe, reliable and efficient utility services at fair and reasonable rates
- e.g. North Carolina Utility Commission:

  “Promote adequate, reliable, and economical utility service.”
- e.g. Illinois Commerce Commission:
  - “…ensure the provision of adequate, efficient, reliable, safe and least-cost public utility services”

Do you see a trend here?

California PUC:

- "…protecting consumers and ensuring the provision of safe, reliable utility service and infrastructure at reasonable rates, with a commitment to environmental enhancement and a healthy California economy…."

Virginia State Corporation Commission:

- "…to balance the interests of citizens, businesses, and customers in regulating Virginia's business and economic concerns…."

Georgia PUC:

- "…must balance Georgia citizens' need for reliable services and reasonable rates with the need for utilities to earn a reasonable return on investment. The Commission protects consumers' interests while abiding by legal standards in setting rates."

Most Common Regulatory Concerns

- Utility rates
  - High rates drive away business or discourage location by business
  - High rates are hard on individual consumers
- Reliability of service
  - Our economy and way of life depend on electricity
- Public and worker safety
  - Electricity can kill
- Consumer protection
  - Fair treatment by monopolistic service providers
- Fairness to utility owners
  - Utilities must provide a return on investment

It might surprise you to learn that…

State Utility Regulatory Agencies are often driven by politics!

- Political appointees, with inside connections and interests
- Interest groups hire professional lobbyists
- Regulators are under intense pressure to keep rates low
- Citizen groups, community advocates, environmental organizations lobby their interests
- *Relatively few are lobbying for better tree maintenance*

Utilities and their contractors are often caught between the desire for amenity trees and government regulations.

Utilities may want to spend more, e.g. to prune more often, do more removals, etc., but their budgets are constrained by the regulators.

ANSI A300 Tree Pruning Objectives

- Reducing risk
- Improving or maintaining tree health
- Developing desired structure
- Preventing interference with the built environment

Regulatory Requirements

Safe, reliable, economical utility service

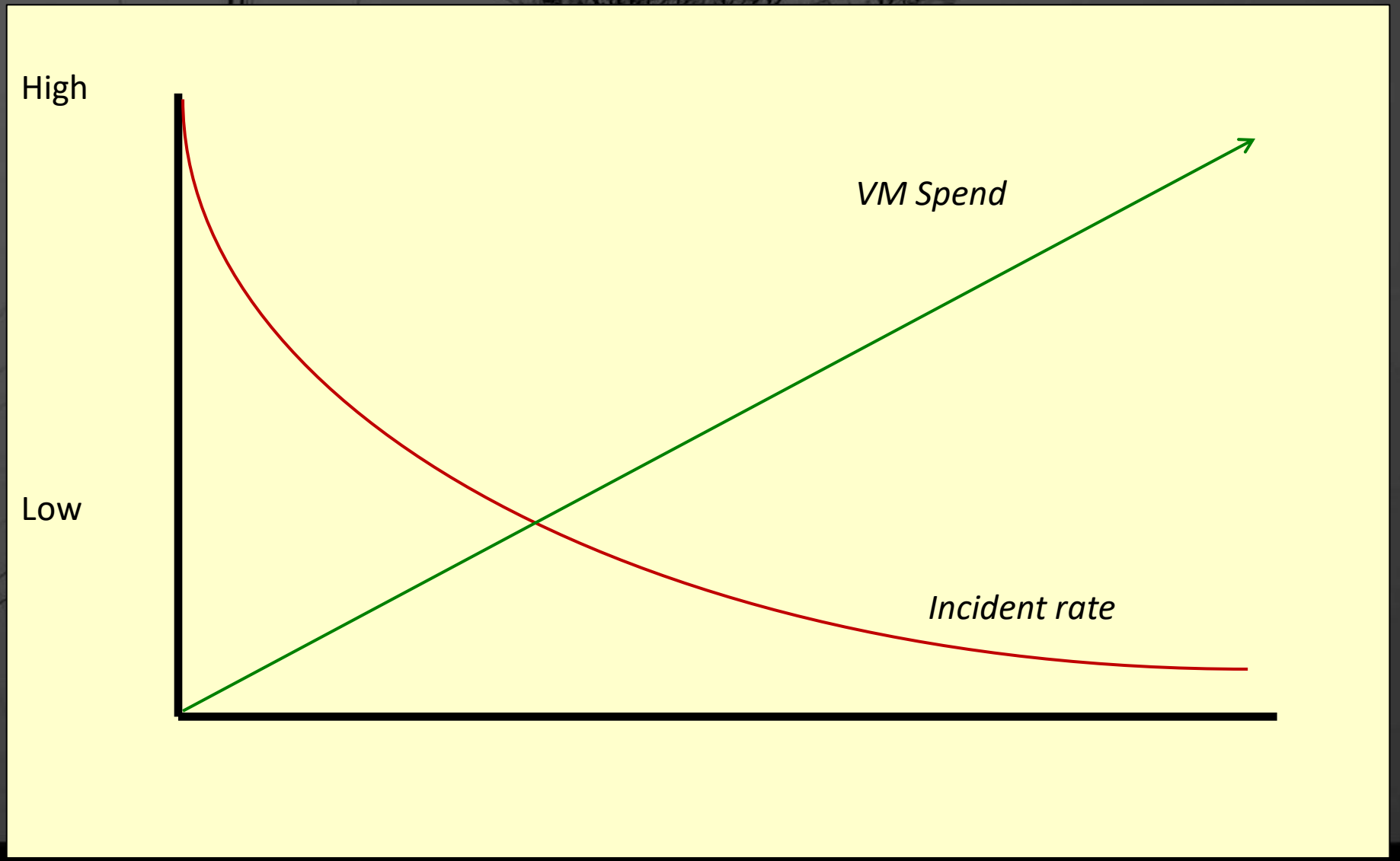
- No rate increases
  - Longer cycles, greater clearances
  - Greater impact on trees
- Reliable service
  - More clearance
  - Greater impact on trees

Challenge: Do more with less. But how?

Trees are pruned to minimize “incidents,” e.g.

- Safety (injuries, electrocutions)
- Service interruptions
- Infrastructure damage
- Poor storm performance
- Negative public relations

Diminishing returns on VM spend



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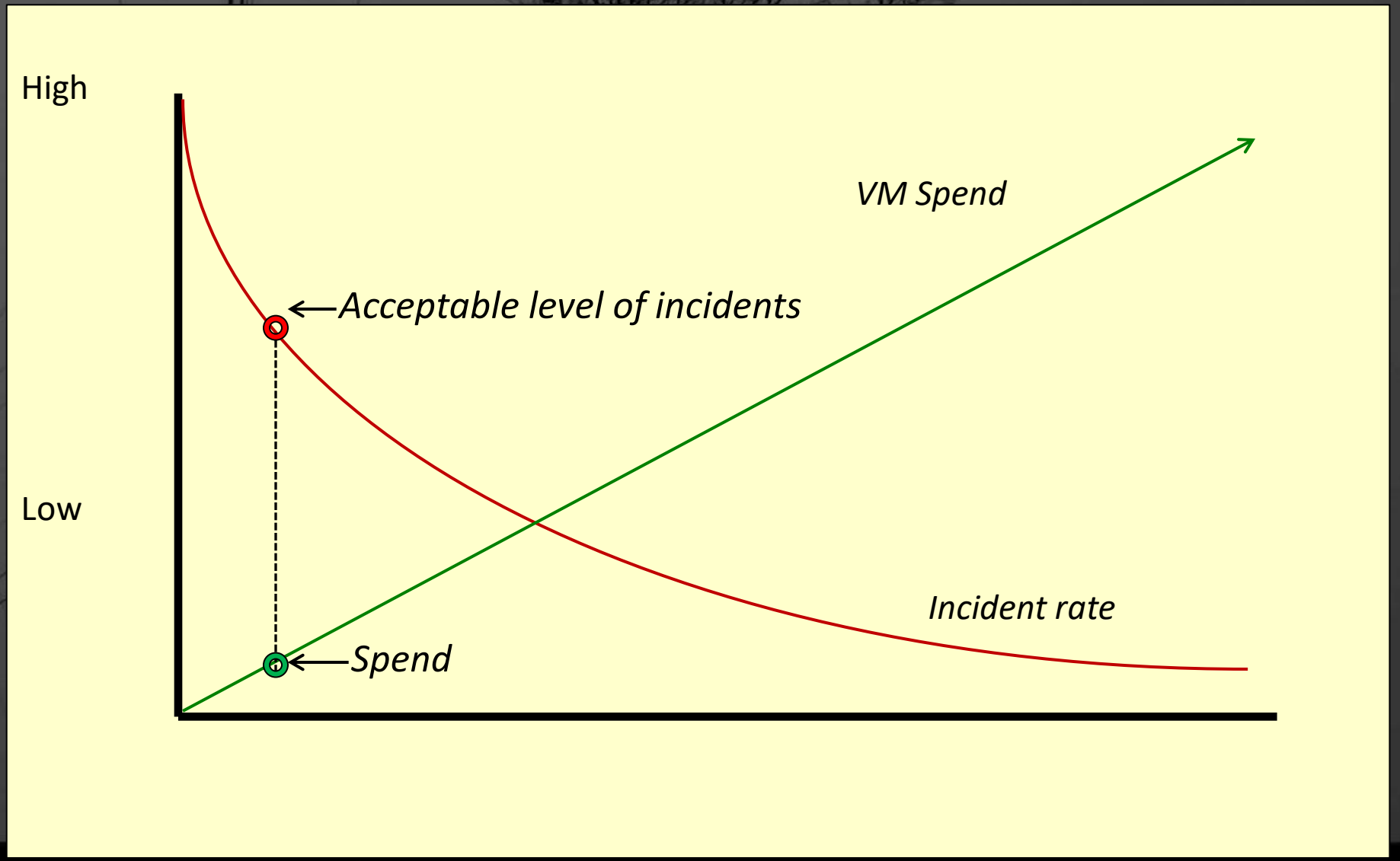

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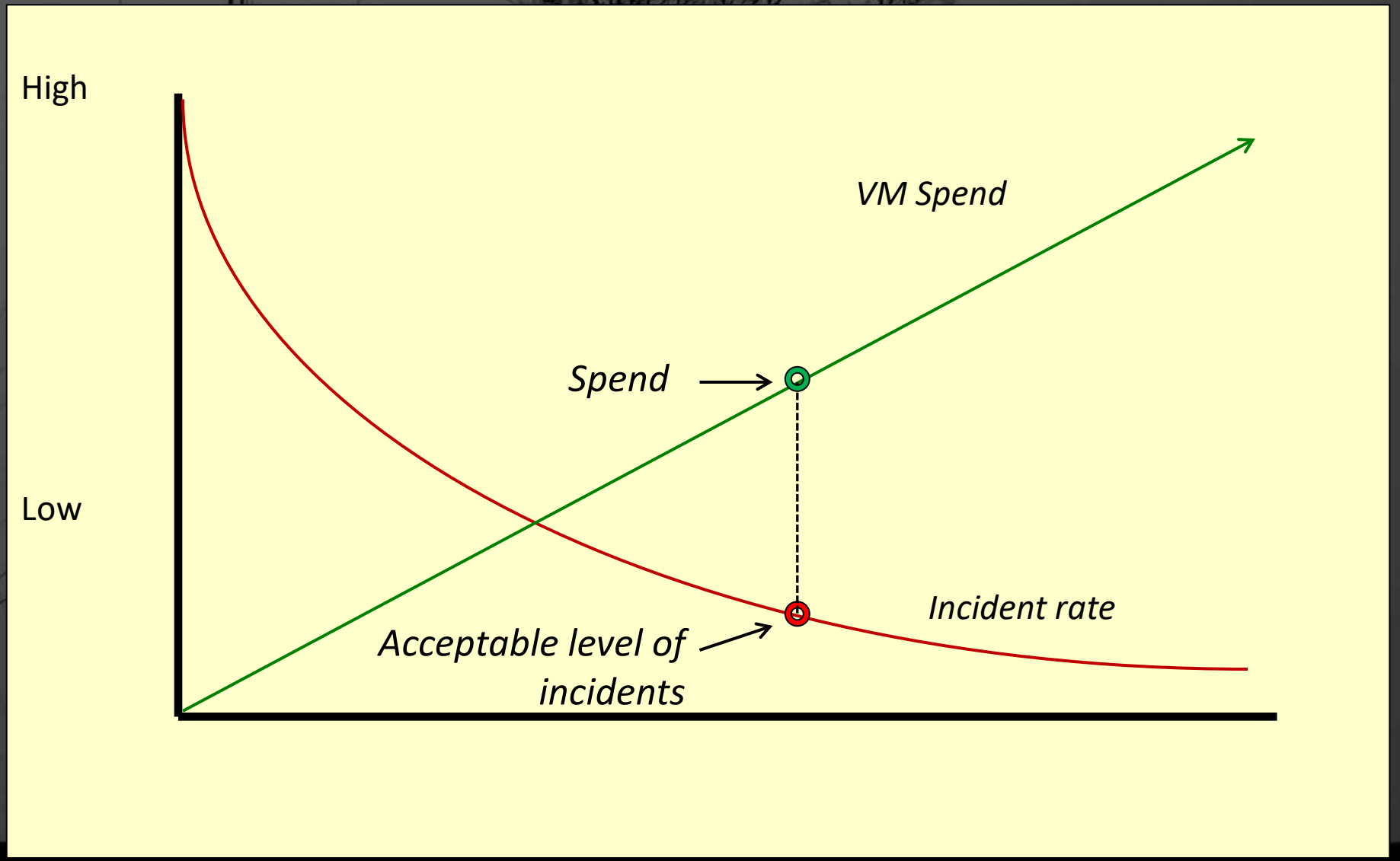
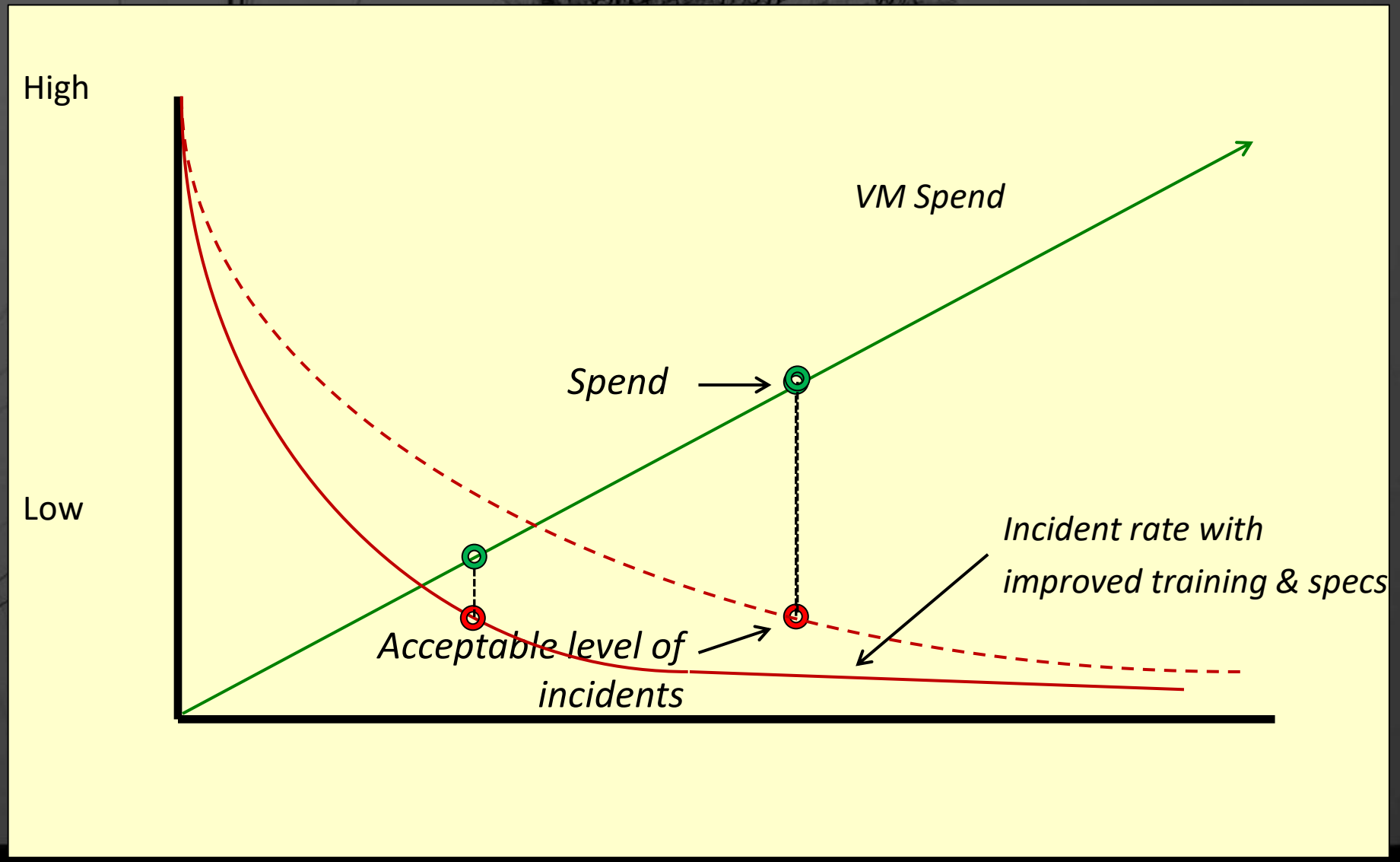
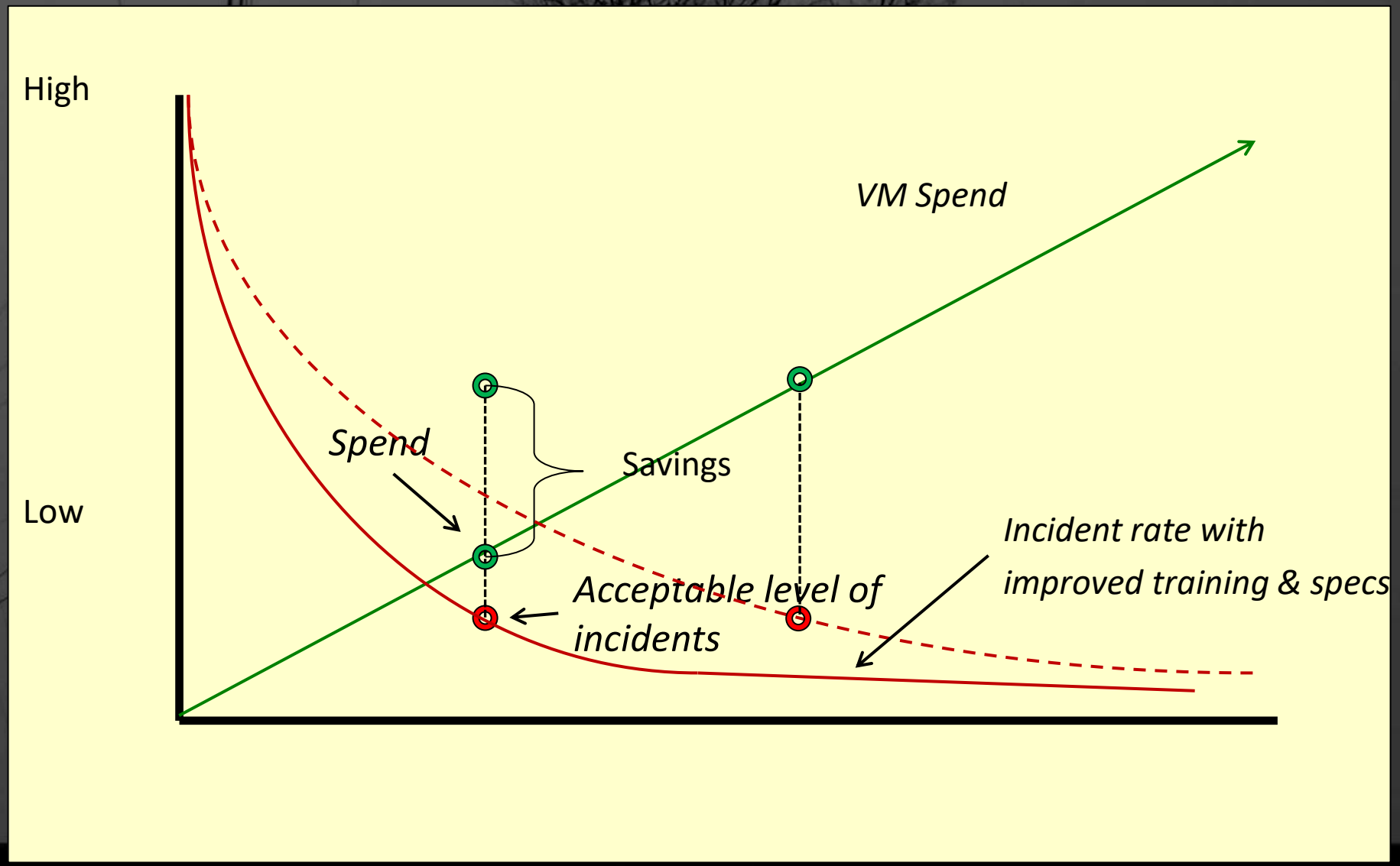


Diminishing returns on VM spend



Diminishing returns on VM spend

Improving specifications and training makes better use of available funds.



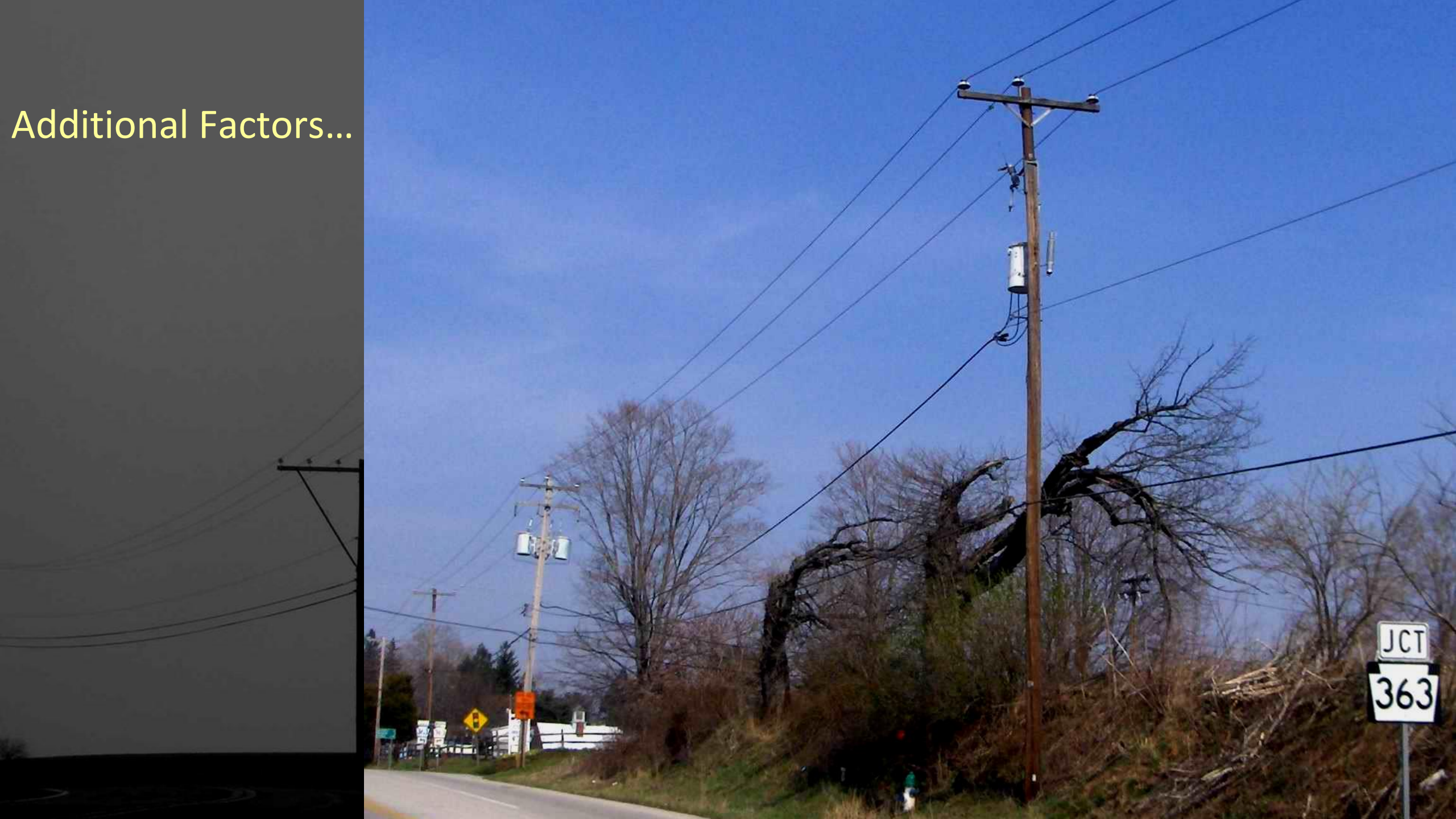
For example:

This was a waste of resources

- The trees were overpruned, and now provide reduced benefits
- The money used to overprune was wasted

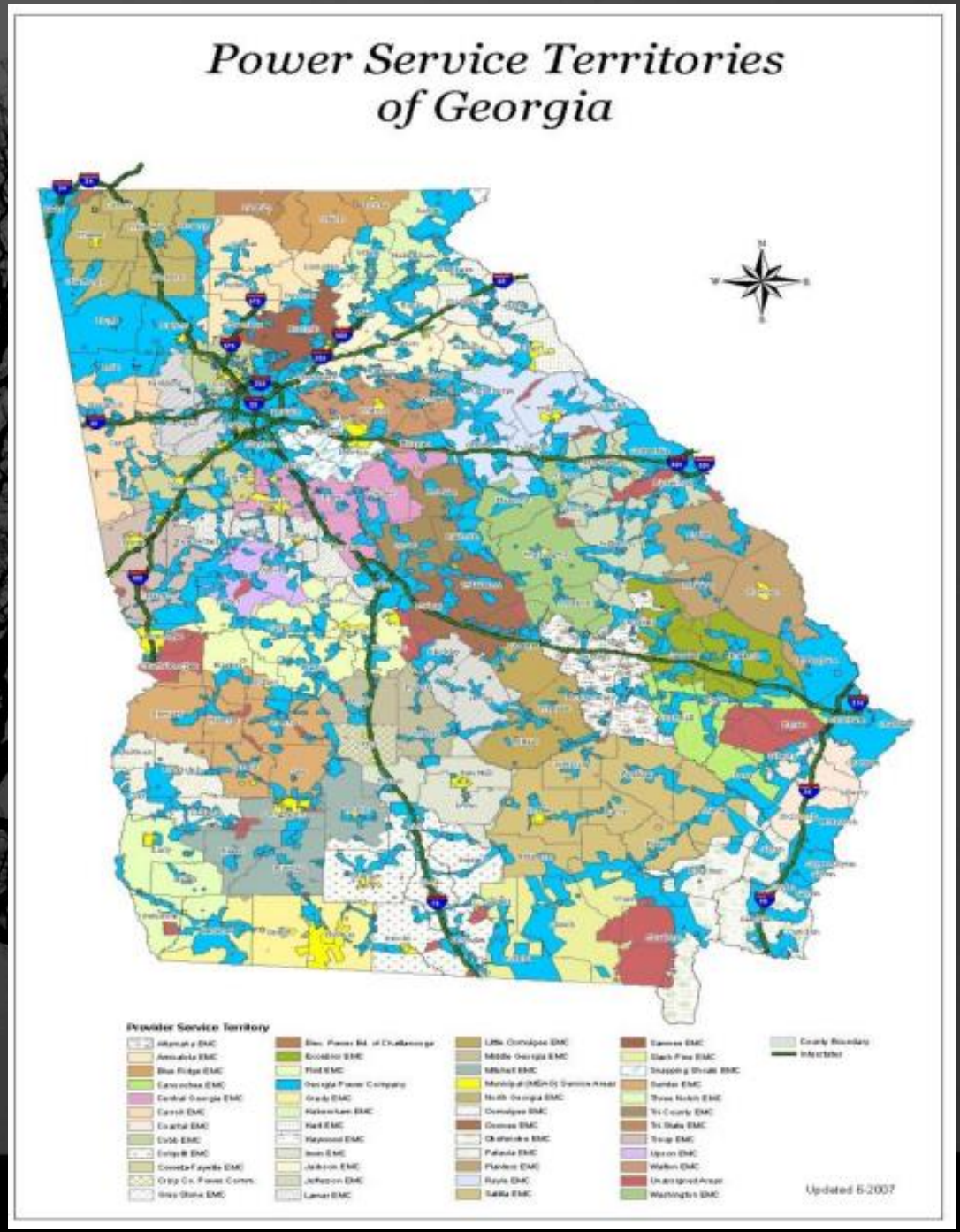
Better planning and personnel training will yield better results

Additional Factors…



Intermingling of Utility Service Territories

- Service territories were assigned decades ago
- Convoluted service territory boundaries are not always the most efficient design.



Georgia Public Service Commission

Two utilities operating separate distribution systems on the same street!

Poor Communication

- Answering Common Questions
  - From the public
  - From other green industry professionals
  - From within our own industry

➢ *The message needs to be customized depending on who is asking the question!*

Frequently Asked Questions:

My tree now out of balance and it's going to kill me. Why do you have to leave all that weight on one side?

- If we took more it would further damage the health of the tree
- The roots are still in place and are holding the tree up.
- The tree is posing far less risk now that it's clear of the powerlines.
- The people who park here are probably not concerned about the risk from the "unbalanced" trees

Frequently Asked Questions:

Why can't utilities remove more trees that must be repeatedly pruned?

- Tree removals are part of the strategy, however, the primary goal is to prevent outages by protecting the utility easement.
  - For the cost of one tree removal, many trees that also threaten safety and reliability could be pruned
  - Real savings on tree removal projects are very long-term
- Strategic tree removals are an opportunity for municipalities and utilities to cooperate

Frequently Asked Questions:

Are utilities required to obtain permission prior to pruning?

- Utility easements usually allow access for pruning without permission. This varies by state. Some utilities obtain permission as a courtesy.
- Many utilities prefer to use the term “notification” rather than “permission”
- Most utilities obtain permission before **removing** trees.

Frequently Asked Questions:

Can property owners refuse to allow utility tree pruning?

- Most easements or rights-of-way give utilities a legal right (or even obligation) to cross private property to prune trees.
- If no easement, courts may decide
  - *But generally, utilities MUST maintain this vital public service*

Arboriculture & THE LAW

Book by
Victor Merullo
Michael Valentine

"A landowner's interest in trees is subservient to the utility's...."

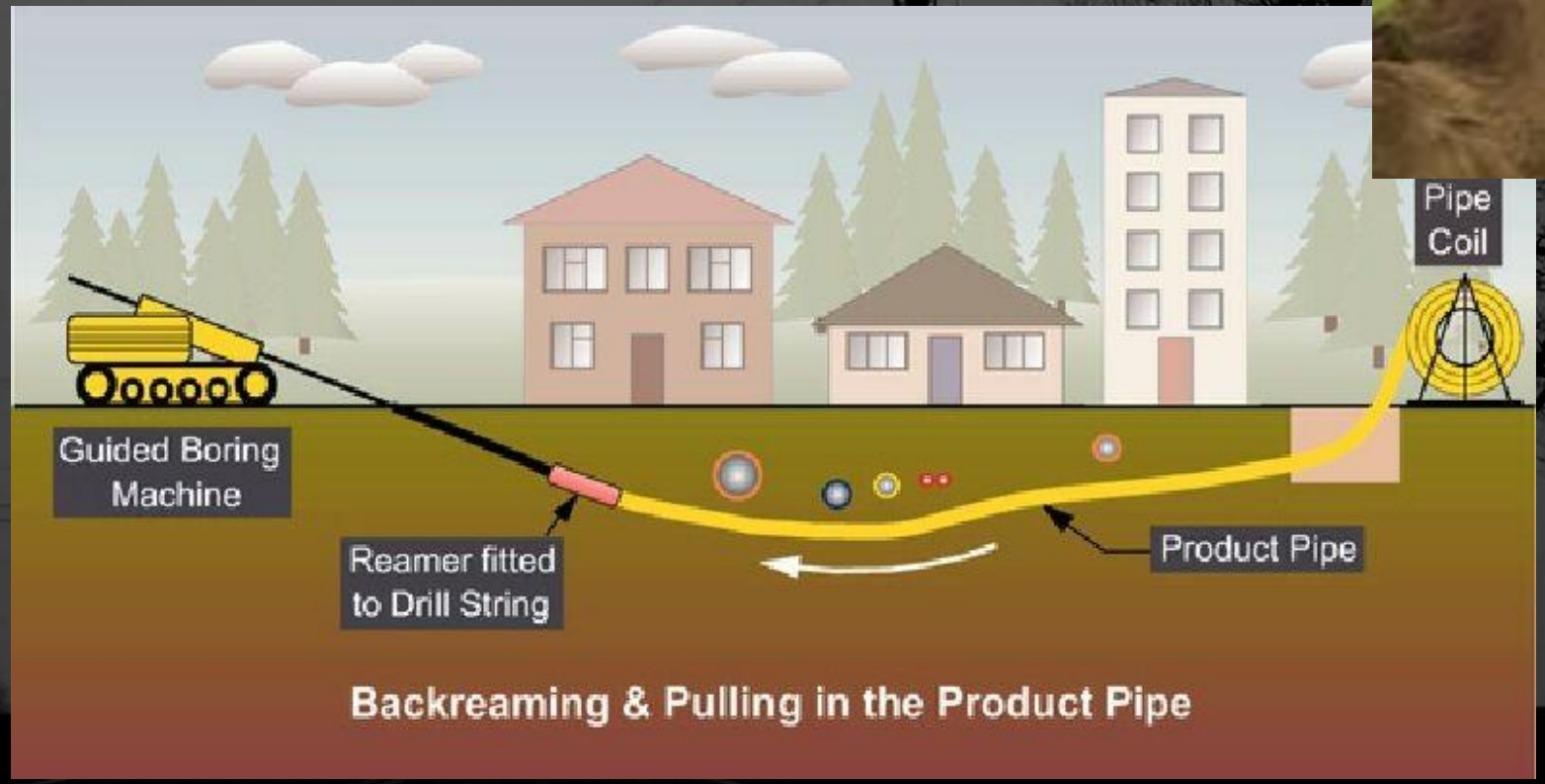

Engineered Solutions

Underground

- Common in
  - new developments
  - high-density urban areas
- Extremely costly to retrofit
- Requires trenching and potential destruction of tree roots

Underground Installation

- Messy, damages tree roots
- There's already stuff under there



Austin Electric, Austin, TX

Municipally owned electric system, 400,000 meters

- Recent estimate to replace existing overhead lines with underground lines:

  $3 Billion

  - Or $7500 per customer
  - Or $62.50/month/customer for 10 years
- Austin may use taller poles on some of its heavily treed areas

Taller Poles

- Allow canopy below power lines
- More expensive to install
- Must have taller maintenance equipment
- Must plant compatible trees
- Not the best option in hurricane areas

Taller Poles

Taller Poles

- Compatible trees may be taller
- Some trees are still not compatible

Alley Arms

- Partially effective
- Trees will catch up eventually

Alley Arms

Ten years later…

Other Considerations

Removal / replacement

Replace old, heavily pruned trees with compatible trees

- Programs are costly
- Public response is often negative
  - *Perception is often the loss of big old shade trees, replaced with puny trees*

Strategic Tree Planting

Sacramento Tree Foundation and Sacramento Municipal Utility District (SMUD)

- Strategically plant trees to conserve energy
- Trees are free, but must be cared for by property owners
- SMUD has offset costs for added generation with this program

We often hear the question:

"Do we want canopy trees or reliable power?"

- *I believe that it is possible to have both, AND*
- *Utilities can use the expertise of arborists and foresters to get it done.*

Tree benefits have quantifiable value

Tree benefits have quantifiable value

- Property values
- Air quality
- Carbon sequestration
- Energy conservation
- Stormwater management
- Quality of life

Some of these benefits accrue to the utility:

- Urban heat island reduction lowers expensive peak demand
- Filtration reduces particulates emitted from coal generation
- Larger trees capture and store more carbon
- Utility can demonstrate environmental stewardship

Shaded utility corridor with three-phase lines


Compatible tree shadow

If this is what people want, how can we provide it?

What should be done?

- Take good care of the trees – utilities and municipalities
  - Assess for risk
  - Prune for good structure
  - Remove and replace as necessary
- Fund research – support the TREE Fund
- Educate and inform to increase support
  - The public
  - Utility regulators and executives
  - State and local governments
- Develop a cost sharing arrangement between utilities and municipalities
  - Risk assessment and mitigation

What else should be done?

- Harden utility systems
  - Tree wire/spacer cable
  - Underground certain key sections of circuits
  - Generally stronger, more resilient systems
- Install “compatible” canopy trees
  - Decurrent, mature height < 40’
  - Minimal clearance pruning required

What else should be done?

- Stop abusing trees
  - Cutting roots
  - Poor pruning
  - Long maintenance cycles
    - Utility and Municipal

If urban trees are so beneficial…

We should work together to preserve and enhance this resource

Who benefits?

- Utilities
  - Reduced costs, enhanced green image
- Municipalities
  - Healthier trees, higher tax base
- Arborists
  - With the expertise to manage the resource
- Citizens
  - Improved quality of life, lower energy bills, higher property values, reduced crime….

Trends…

- Utilities want greater value for their VM spend
- Communities want maximum benefits from trees
- Greater emphasis on reliability and safety
- Professional training and credentials for all arborists

Emphasize *arboriculture* in utility arboriculture

- Tree risk assessment
- Remove branches and trees most likely to fail and cause significant consequences
  - On and off the ROW
- More accurate models of tree benefits
- Greater cooperation between utilities, cities, and community groups

Greater cooperation will benefit all arborists and our communities

- Improved bottom lines for our companies
- Cleaner, healthier environment
- Better quality of life in our communities.

This is our opportunity!

Support Research

Support a Tour des Trees rider

Thanks!

Geoff Kempter
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