

# Impervious Surface Mapping

## City of Pittsburgh

ASPRS Eastern Great Lakes Region | Fall Meeting | November 1, 2019

# Today's Presenter

## Jeremy Jurick

- Moon Township, PA
- GIT Technical Manager

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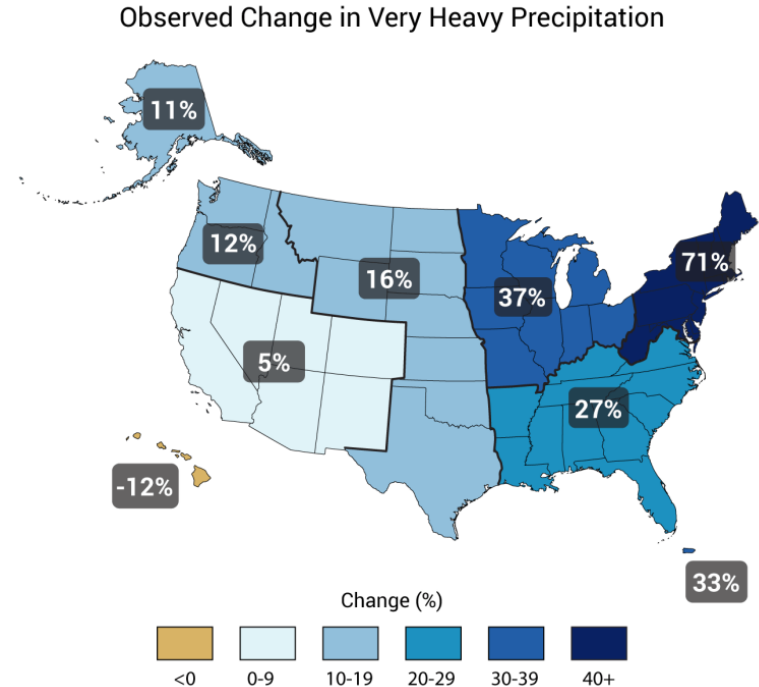
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**Michael Baker**

INTERNATIONAL

# Stormwater Fee Implementation

- Why is it necessary?
  - Increased precipitation
  - Additional funding needed



# Stormwater Fee Implementation

- Current sewer conveyance fee not equitable
- Impervious surface based rate structure:



Residential



Uniform Flat Fee



Non-Residential  
& Condominiums



Equivalent Residential Units  
(ERUs) calculated based on  
Actual Impervious Area



Undeveloped  
& Vacant Non-  
Residential



ERUs calculated based on  
Actual Impervious Area

# Accuracy Matters!

- 2013 Stormwater Rate Structure Feasibility Study
  - Low resolution review
- Stormwater fee planned for inclusion by 2021
  - High accuracy for better program cost distribution
  - Better platform for “challenge” process

**Residential Parcels:**

Residential sample: average impervious area = 1,647 ft<sup>2</sup>

**Non-Residential Parcels:**

Impervious Area estimated via GIS Analysis

**Condominiums:**

Impervious Area estimated via GIS Analysis



High Density  
Southside

Moderate Density  
Brookline

Low Density  
Squirrel Hill

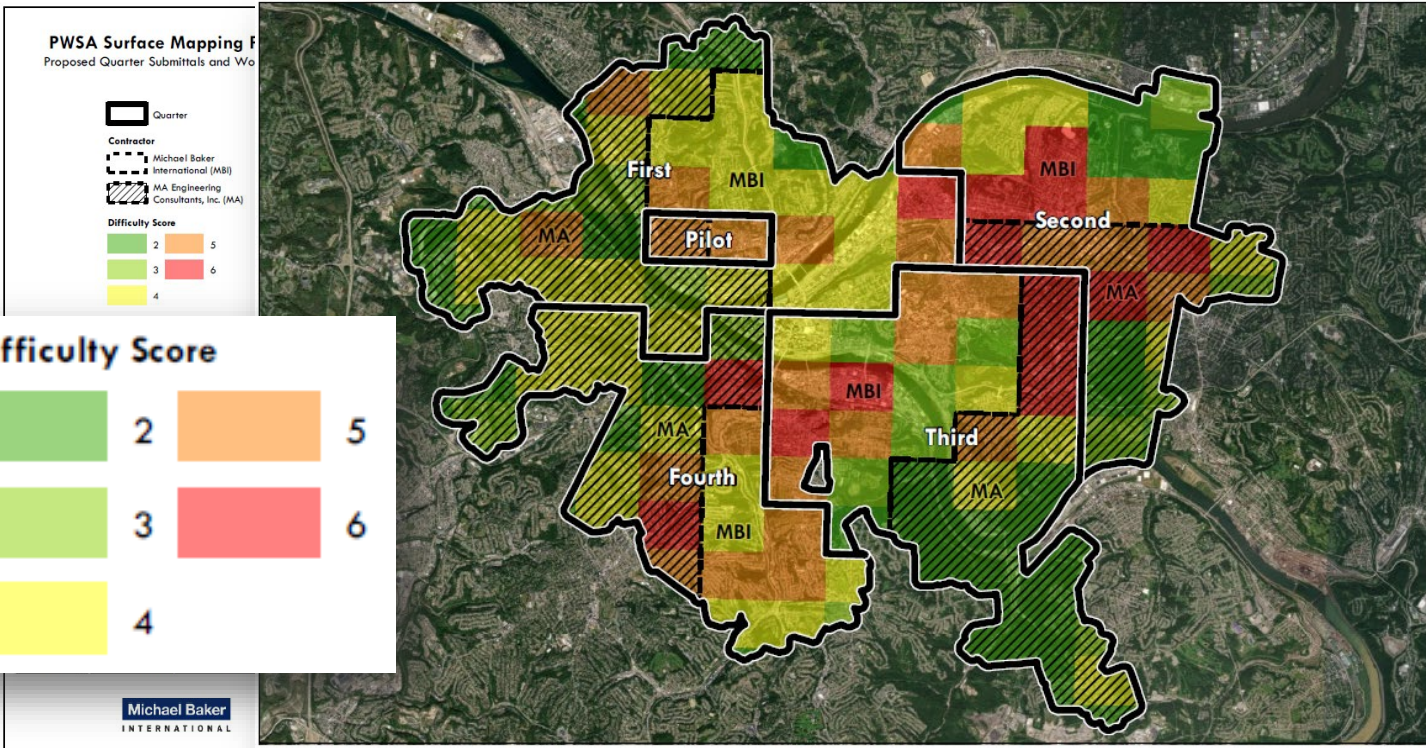
# PWSA Surface Mapping Goal

Develop GIS layers for the purpose of stormwater runoff calculation

- Buildings
- Bridges
- Transportation
- Other Impervious Surfaces
- Major Rivers (Allegheny, Monongahela & Ohio)

1	Roads- Paved
2	Roads- Unpaved
3	Bridges
4	Sidewalks
5	Driveways- Paved
6	Driveways- Unpaved
7	Parking Lots- Paved
8	Parking Lots- Unpaved
9	Buildings
10	Decks/Patios
11	Pools- In Ground
12	Pools- Above Ground
13	Non-motorized bike trails
14	Athletic Facilities (Basketball/ Tennis/ Track/ Baseball & Softball Diamonds)
15	Railroad Tracks
16	Concrete Pads
17	Misc. Structures
18***	Three Rivers Delineation

# Project Area



Pittsburgh + 500

er

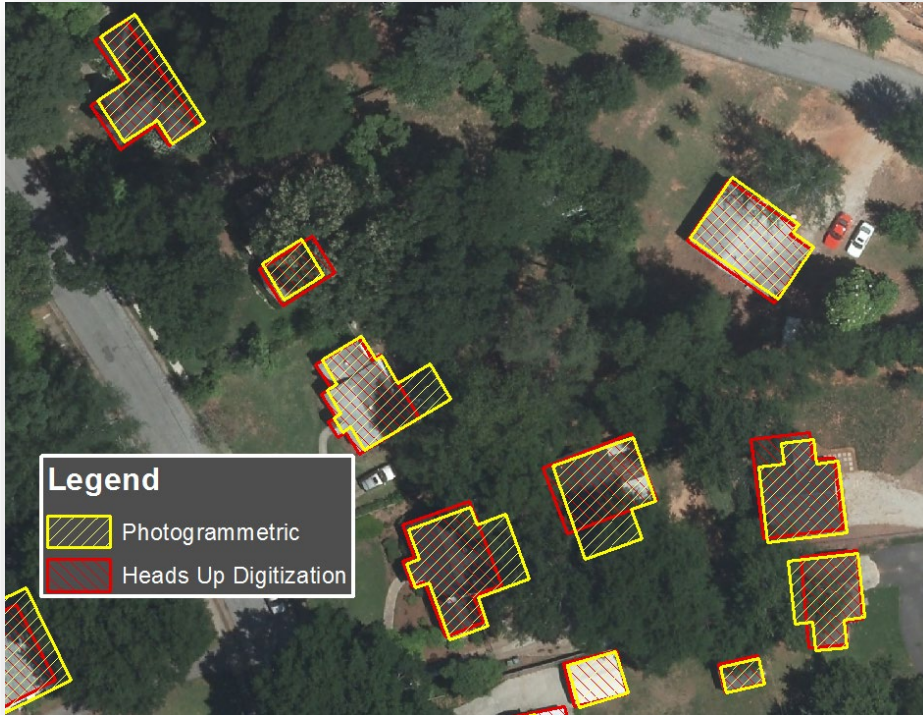
approximately 65 square

acres

County Grid  
used for tiling

= 0.59 Sq Mi

# Photogrammetric Collection vs Heads Up Digitization



**Michael Baker tested both compilation techniques on 60 mixed residential/commercial buildings:**





**Photogrammetric: 166,398 sq ft**

**Heads Up Digitization:  
168,945 sq ft**

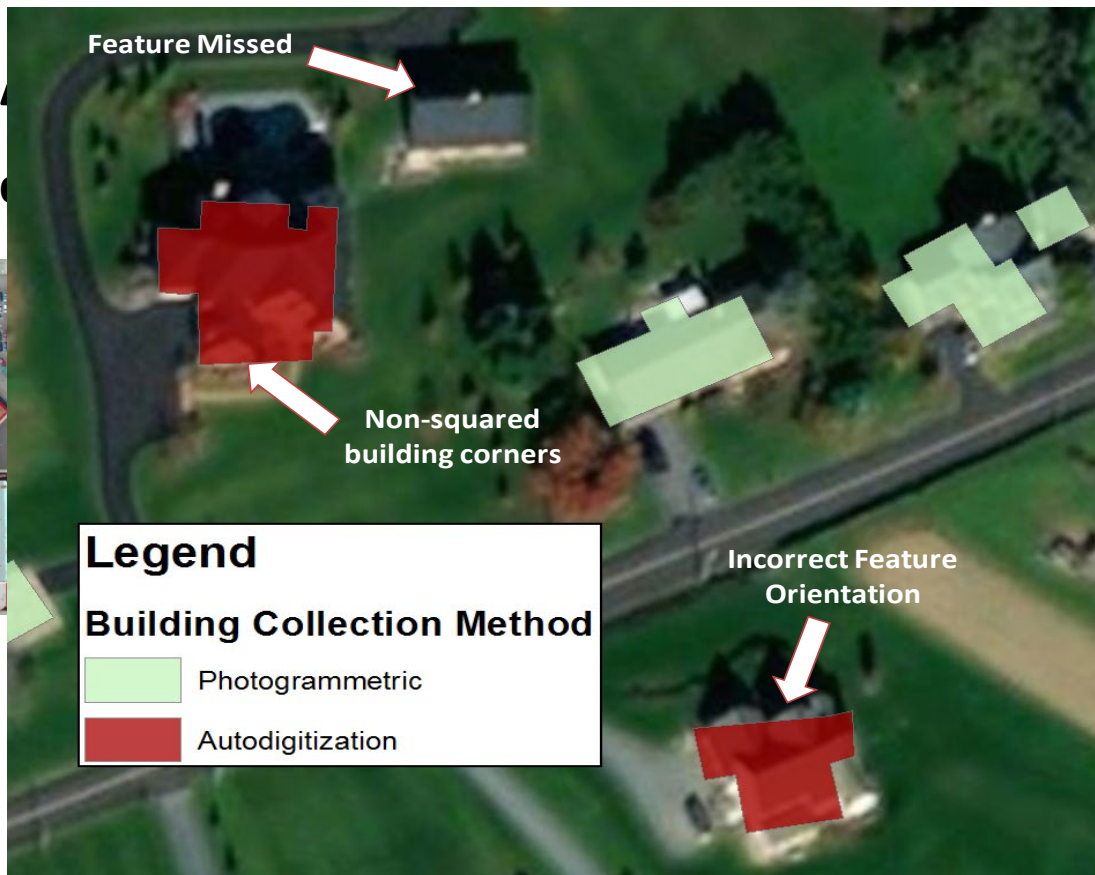
**Difference:  
2,547 more sq ft in Heads Up  
Digitization**



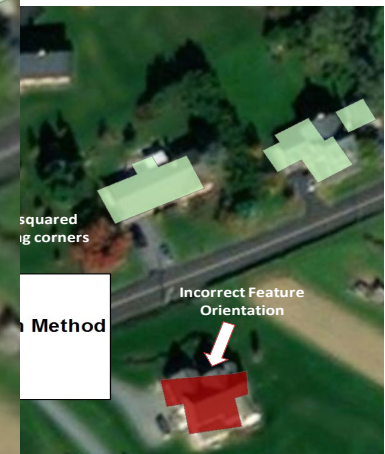
# Approach and Methodology

Imagery	Collection Method	Accuracy	Effort
2016 – 6” Pixels	Photogrammetric		
2017 – 3” Pixels	Heads-up-Digitization		

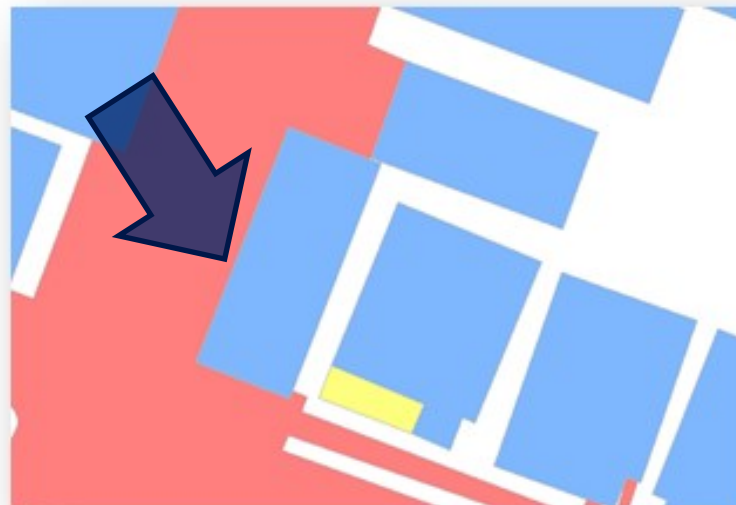
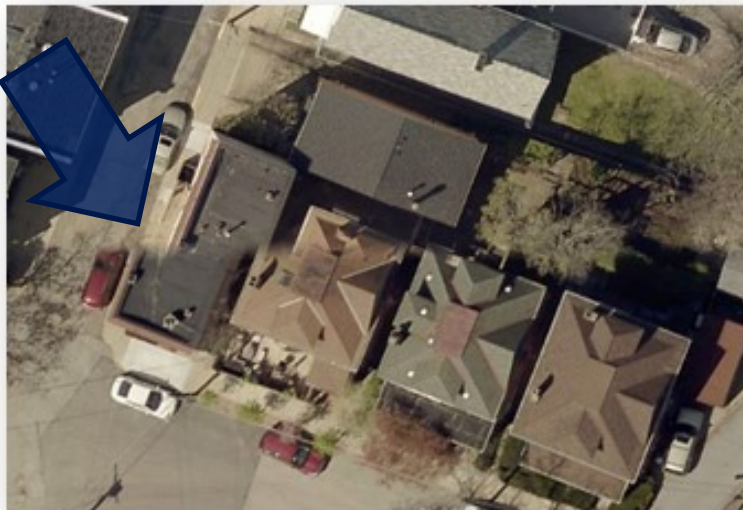
# Photogrammetric Collection



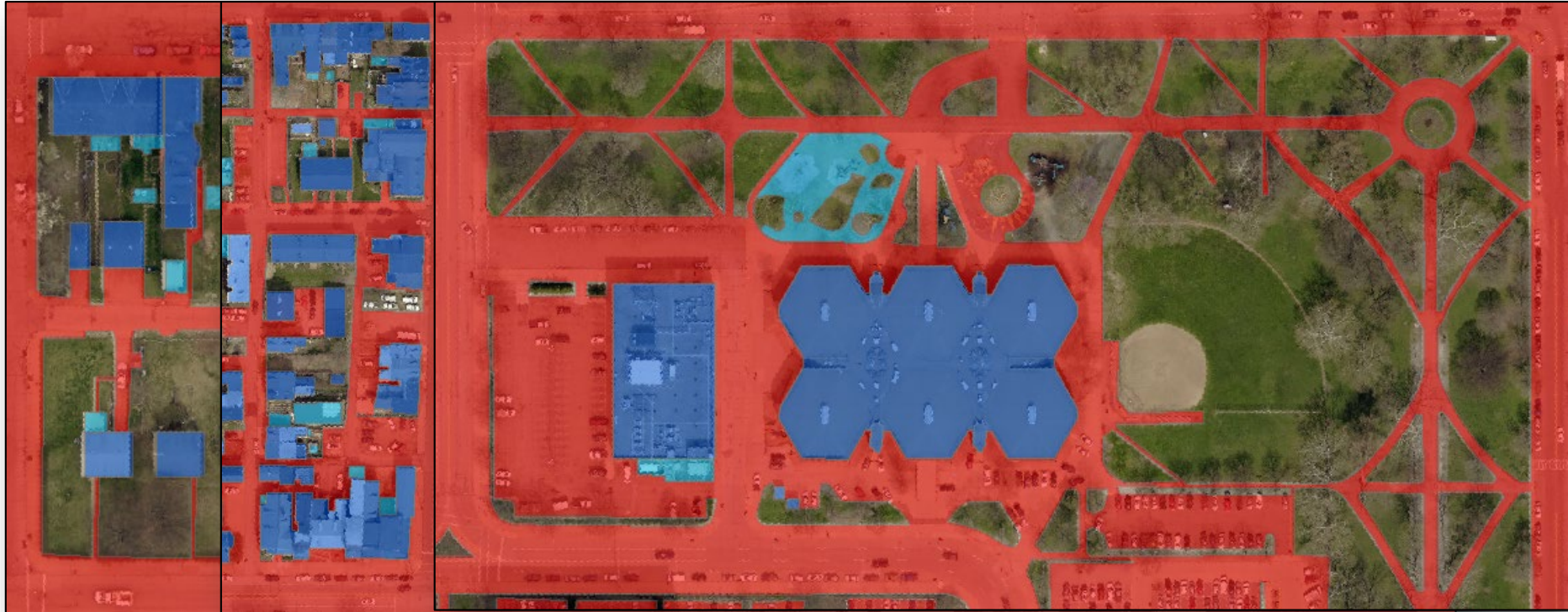
# ~~Automation~~



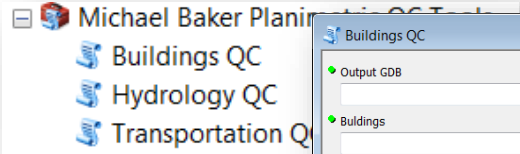
# Approach and Methodology



# Mapping Results



# Automated GIS Quality Control



**Buildings QC**

- Output GDB
- Buildings
- Source Query Expression (optional)
- Previous Buildings
- Other Overlap (optional)
- Minimum Z Value: 0
- Maximum Z Value: 1000
- Selected Tiles

OK Cancel Environments... Show Help >>

**Hydrology QC**

- Output GDB
- Hydrology Lines
- Hydrology Lines Source Query Expression (optional)
- Hydrology Polygons
- Hydrology Polygon Source Query Expression (optional)
- Selected Tiles
- Dangle Tolerance (feet): 5 Feet
- Minimum Z Value: 0
- Maximum Z Value: 1000

OK Cancel Environments... Show Help >>

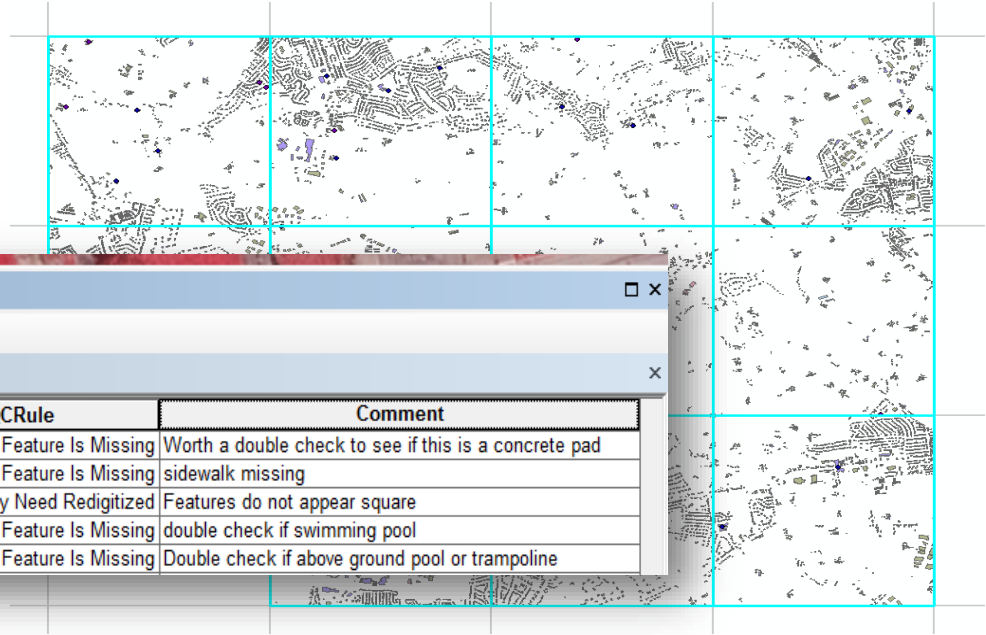
**Transportation QC**

- Output GDB
- Transportation Lines
- Transportation Lines Source Query Expression (optional): SOURCE\_CODE = 6
- Transportation Lines Feature Query Expression (Road Centerline) (optional): FEATURE\_CODE = 1104
- Transportation Polygons
- Transportation Polygons Source Query Expression (optional): SOURCE\_CODE = 6
- Transportation Polygons Feature Query Expression (Roads) (optional): FEATURE\_CODE = 1201
- Transportation Polygons Feature Query Expression (features not in overlap check) (optional): FEATURE\_CODE = 1206 OR FEATURE\_CODE = 1208
- Selected Tiles
- Minimum Z Value: 0
- Maximum Z Value: 1000
- Old Transportation Lines (optional)
- Old Transportation Polygons (optional)

OK Cancel Environments... Show Help >>

# Visual GIS Quality Control

- Grid system set up with checklist to verify guidelines were followed
- Verify no areas were missed



- Layers**
- VisualQAQC
  - DeliveryAreas
  - Street\_Centerline
  - Surface Features to QC
    - Buildings
    - PoolsAboveGround
    - PoolsInGround
    - Sidewalks

OBJECTID	SHAPE *	QCRule	Comment
6	Point	Feature Is Missing	Worth a double check to see if this is a concrete pad
11	Point	Feature Is Missing	sidewalk missing
5	Point	Feature May Need Redigitized	Features do not appear square
9	Point	Feature Is Missing	double check if swimming pool
8	Point	Feature Is Missing	Double check if above ground pool or trampoline

# PWSA QC Process

Table I—Sample size code letters

Lot or batch size			Special inspection levels			
			S-1	S-2	S-3	S-4
2	to	8	A	A	A	A
9	to	15	A	A	A	A
16	to	25	A	A	B	B
26	to	50	A	B	B	C
51	to	90	B	B	C	C
91	to	150	B	B	C	D
151	to	280	B	C	D	E
281	to	500	B	C	D	E
501	to	1200	C	C	E	F
1201	to	3200	C	D	E	G
3201	to	10000	C	D	F	G
10001	to	35000	C	D	F	H
35001	to	150000	D	E	G	J
150001	to	500000	D	E	G	J
500001	and over		D	E	H	K

Table II-A—Single sampling plans for normal inspection (Master table)

(See 9.4 and 9.5)

Sample size code letter	Sample size	Acceptance Quality Limits, AQLs, in Percent Nonconforming Items and Nonconformities per 100 Items (Normal Inspection)																											
		0.010	0.015	0.025	0.040	0.065	0.10	0.15	0.25	0.40	0.65	1.0	1.5	2.5	4.0	6.5	10	15	25	40	65	100	150	250	400	650	1000		
		Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	
A	2																												
B	3																												
C	5																												
D	8																												
E	13																												
F	20																												
G	32																												
J	80																												
K	125																												
L	200																												
M	315																												
N	500																												
P	800																												
Q	1250																												
R	2000																												

↓ = Use the first sampling plan below the arrow. If sample size equals, or exceeds, lot size, carry out 100 percent inspection.  
 ↑ = Use the first sampling plan above the arrow.  
 Ac = Acceptance number.  
 Re = Rejection number.





# Other Uses

- High accuracy surface data
  - Cartographic Mapping
  - Sewershed Modeling
  - Stormwater BMP effectiveness



# Thank you!

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