Spring NEARC - May 22, 2012 - Smith College

How to Put GIS To Work for Voting Redistricting

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Empowering People with Spatial Solutions

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Agenda

- Background
- Methods
  - Data Prep
  - Create Proposals
  - Street List
- Lessons Learned

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Background

- New 2010 Census data
- New State and US districts
  - State Representative (House)
  - State Senate
  - US Congressional
- Drives new local districts
  - Voting districts/precincts
  - Town Council districts/wards
  - Potentially others (School, Water, Special…)
- Case Studies
  - Lincoln/Cumberland RI
  - West Hartford CT

United States™ Census 2010

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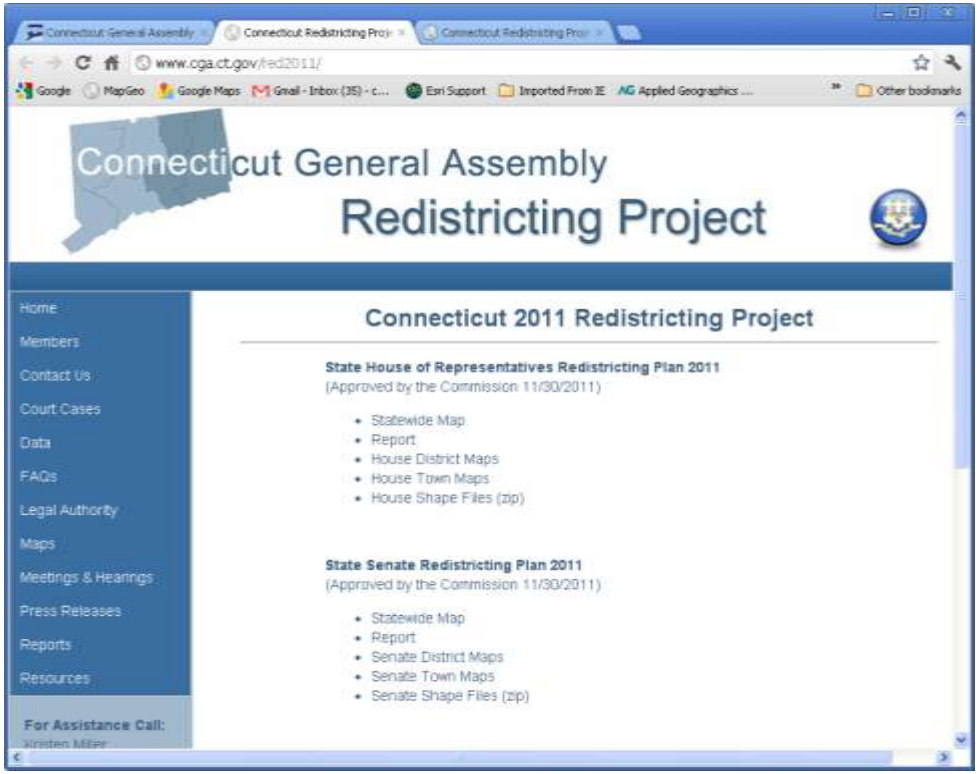
Methods – Data Prep

- **New State/US districts**
  - CT published online for download
  - RI didn't distribute publically – only to towns



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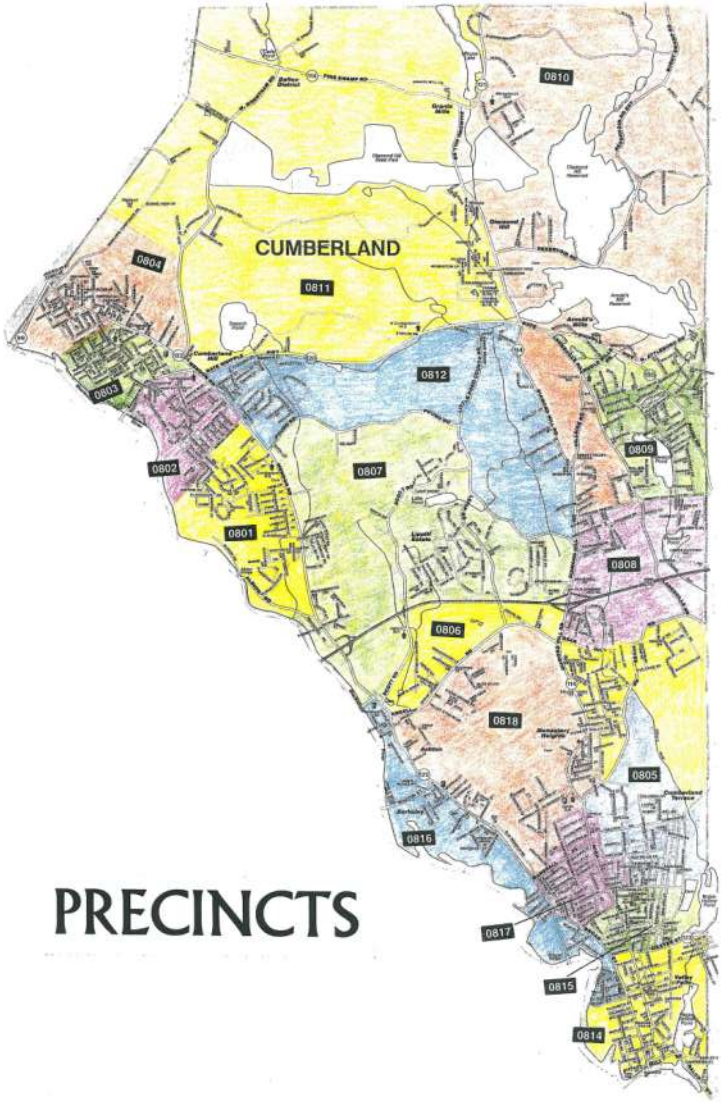
Methods – Data Prep

- **Existing Local Districts**
  - Obtain existing local district layers And/Or
  - Convert existing maps
  - Start by coding census blocks with district numbers



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Methods – Data Prep

- **Geocoding**
  - Obtain list of Registered Voters, Polling Locations, Commissioners/officials
  - Prep into tabular format for geocoding

Table

RegisteredVoters_toGeocode

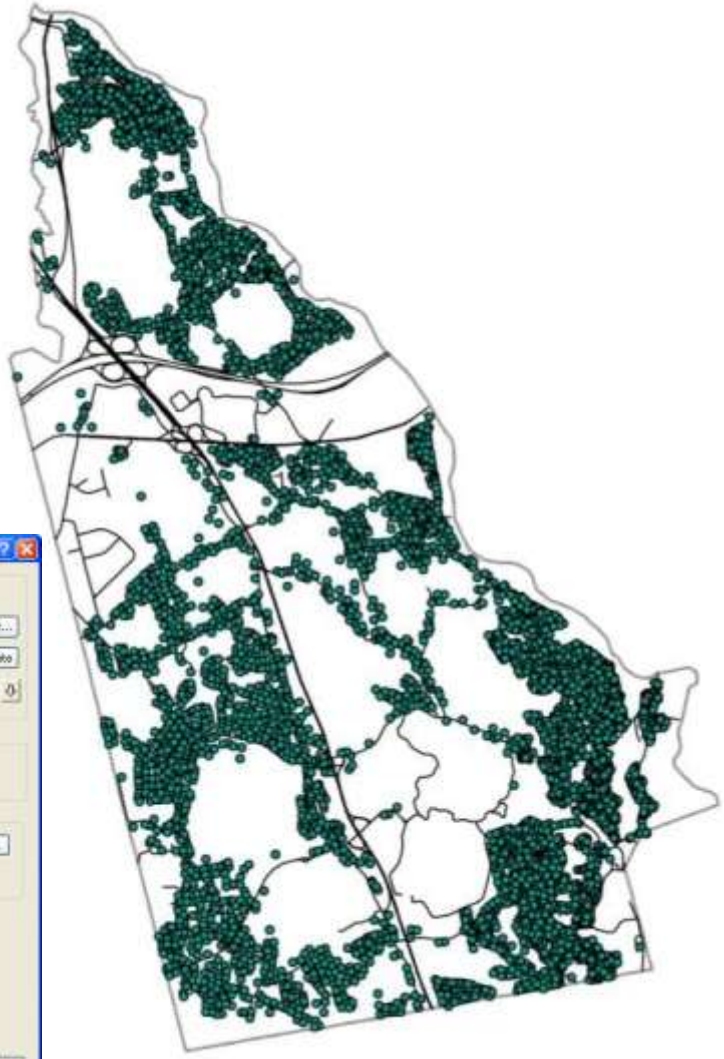
OBJECTID *	VOTER_ID	STREET_NUM	SUF_A	SUF_B	STREET_NAM	UNIT	POSTAL_CIT	ZIP_CODE	PRECINCT	WARD_DISTR	CONGRESSIO	SENATE_DIS	REP_DISTRI	VOTER_STAT	Full_Address	City	ZipCode
1	17001090942	10			FRANKLIN ST	APT 34	LINCOLN	2865	1712	<Null>	1	17	46	A	10 FRANKLIN ST	Lincoln	02865
2	28000724442	10			FRANKLIN ST	APT 105	LINCOLN	2865	1712	<Null>	1	17	46	A	10 FRANKLIN ST	Lincoln	02865
3	28000724443	10			FRANKLIN ST	APT 105	LINCOLN	2865	1712	<Null>	1	17	46	A	10 FRANKLIN ST	Lincoln	02865
4	17000856549	2			KENDALL DR		LINCOLN	28654934	1713	<Null>	1	17	46	A	2 KENDALL DR	Lincoln	02865
5	17000856550	7			ROSEWOOD DR		LINCOLN	28654611	1702	<Null>	1	17	44	A	7 ROSEWOOD DR	Lincoln	02865
6	17000856552	5			BROWNE HILL CT		LINCOLN	28652901	1710	<Null>	1	17	46	A	5 BROWNE HILL CT	Lincoln	02865
7	17000856553	7			ROSEWOOD DR		LINCOLN	28654611	1702	<Null>	1	17	44	A	7 ROSEWOOD DR	Lincoln	02865
8	17000856554	1681			LOUISQUISSET PIKE		LINCOLN	28654505	1701	<Null>	1	17	44	A	1681 LOUISQUISSET PIKE	Lincoln	02865
9	17001227419	6			RIATA DR		LINCOLN	2865	1701	<Null>	1	17	44	A	6 RIATA DR	Lincoln	02865
10	17001054206	6			RIATA DR		LINCOLN	2865	1701	<Null>	1	17	44	A	6 RIATA DR	Lincoln	02865
11	17001030377	6			RIATA DR		LINCOLN	2865	1701	<Null>	1	17	44	A	6 RIATA DR	Lincoln	02865
12	17000856555	6			RIATA DR		LINCOLN	28654958	1701	<Null>	1	17	44	A	6 RIATA DR	Lincoln	02865
13	17001209011	38			WOODLAND CT		LINCOLN	2865	1710	<Null>	1	17	46	A	38 WOODLAND CT	Lincoln	02865
14	17001176802	38			WOODLAND CT		LINCOLN	2865	1710	<Null>	1	17	46	A	38 WOODLAND CT	Lincoln	02865
15	17001182459	38			WOODLAND CT		LINCOLN	2865	1710	<Null>	1	17	46	A	38 WOODLAND CT	Lincoln	02865
16	17000856557	38			WOODLAND CT		LINCOLN	28652811	1710	<Null>	1	17	46	A	38 WOODLAND CT	Lincoln	02865
17	17000856558	17			GREENWOOD LN		LINCOLN	28654725	1702	<Null>	1	17	44	A	17 GREENWOOD LN	Lincoln	02865
18	08000832033	252			CENTRAL ST		MANVILLE	2838	1705	<Null>	1	19	45	A	252 CENTRAL ST	Lincoln	02838
19	17001174363	8			ASHLEY DR		LINCOLN	2865	1715	<Null>	1	19	46	A	8 ASHLEY DR	Lincoln	02865
20	08001029790	19			JASON DR		LINCOLN	2865	1713	<Null>	1	17	46	A	19 JASON DR	Lincoln	02865
21	17001154728	61			SPRING ST	1L	MANVILLE	2838	1705	<Null>	1	19	45	I	61 SPRING ST	Lincoln	02838
22	28000724596	61			SPRING ST	1R	MANVILLE	2838	1705	<Null>	1	19	45	A	61 SPRING ST	Lincoln	02838
23	17001222142	21			PEARL ST		MANVILLE	2838	1705	<Null>	1	19	45	A	21 PEARL ST	Lincoln	02838
24	17000856560	69			BOULEVARD AVE		LINCOLN	28652138	1712	<Null>	1	17	46	A	69 BOULEVARD AVE	Lincoln	02865
25	17000856564	14			HOLIDAY DR		LINCOLN	28652229	1715	<Null>	1	19	46	A	14 HOLIDAY DR	Lincoln	02865

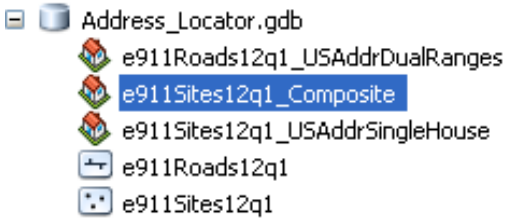
0 (0 out of 16577 Selected)

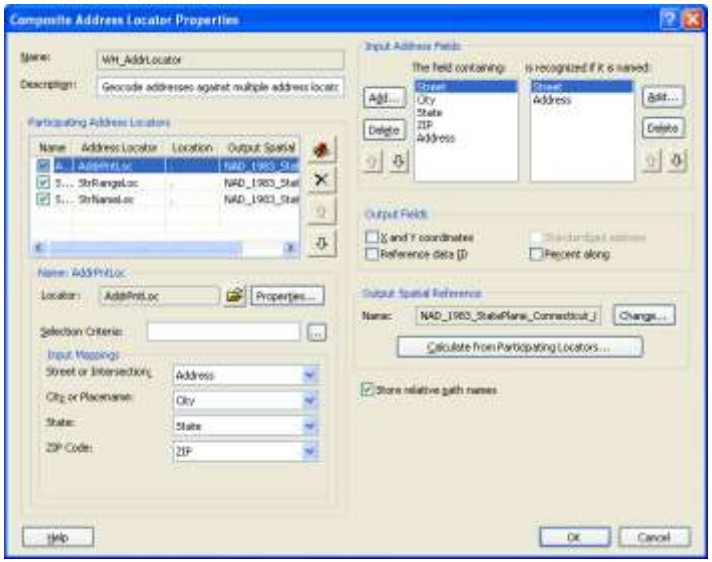
B_2010_44007_edges RegisteredVoters_toGeocode

Methods – Data Prep

- **Geocoding**
  - Composite Address Locators
    - RI: e911 Sites & e911 Roads
    - CT: address points & roads







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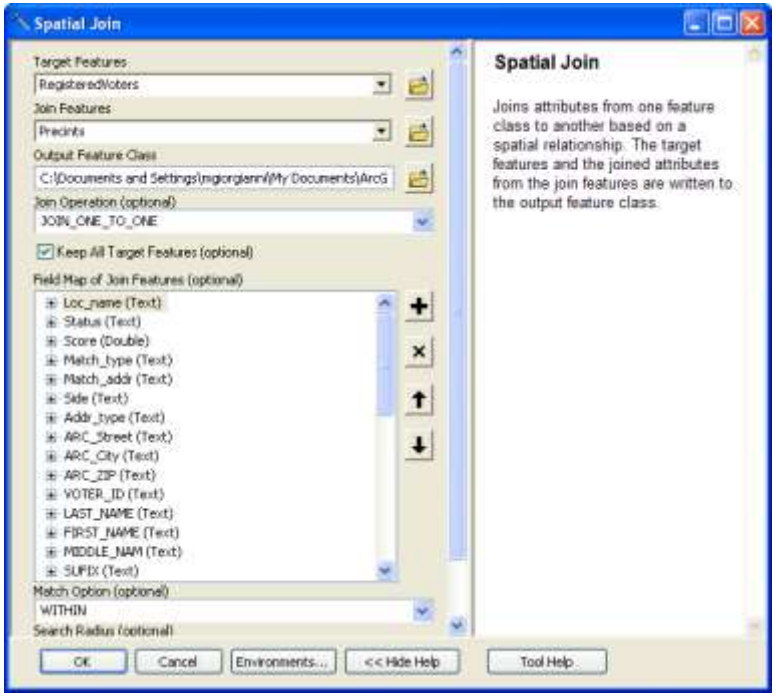
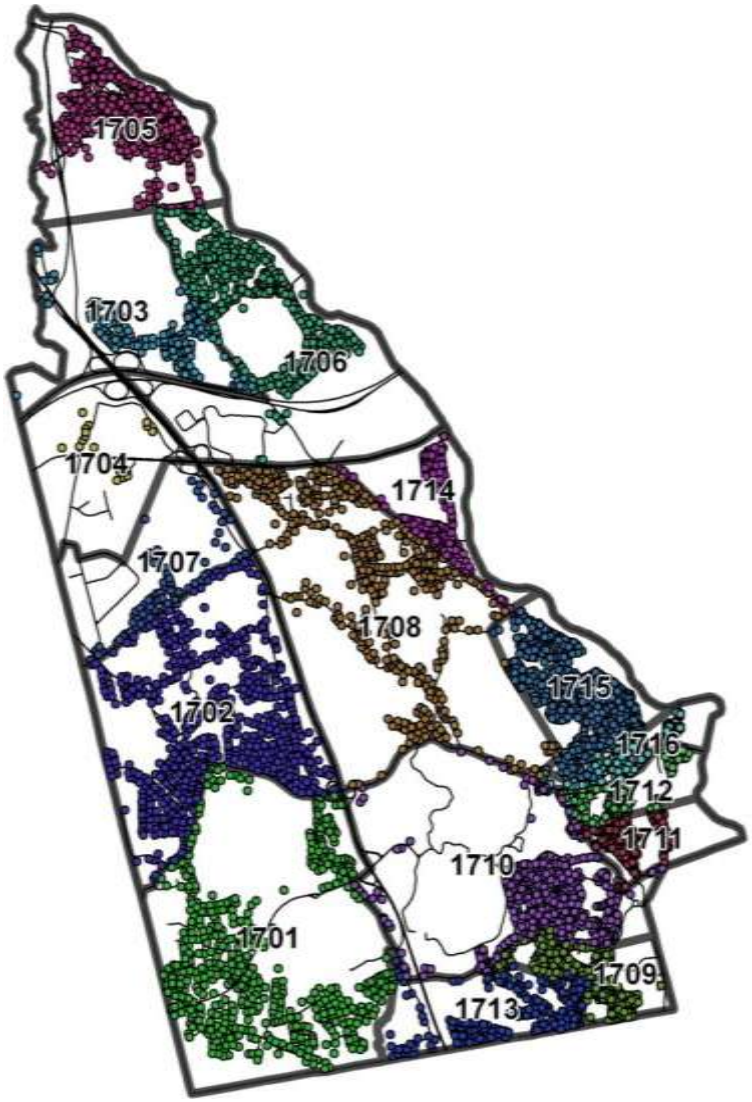
Methods – Data Prep

- **Voters**
  - Voter points by precinct
    - Spatial Join





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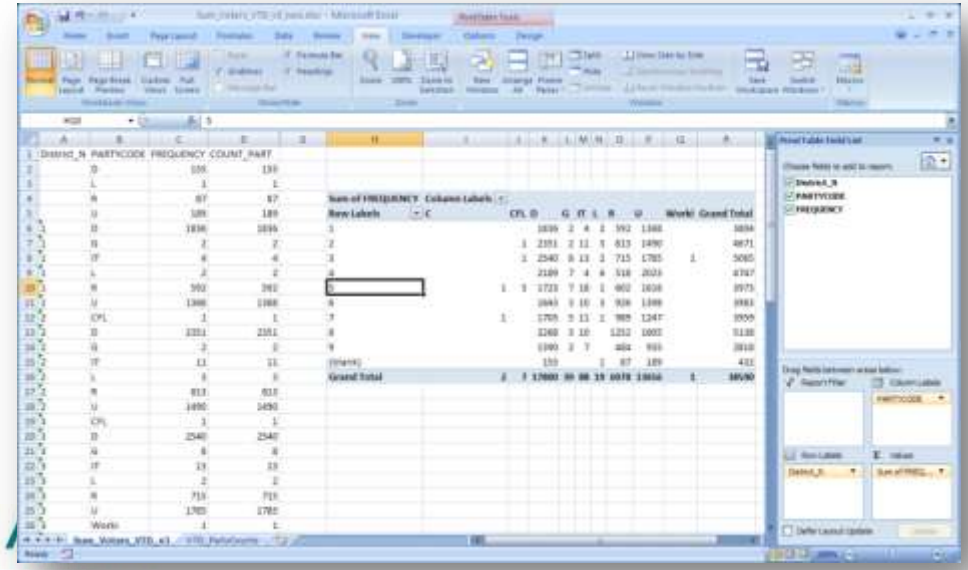
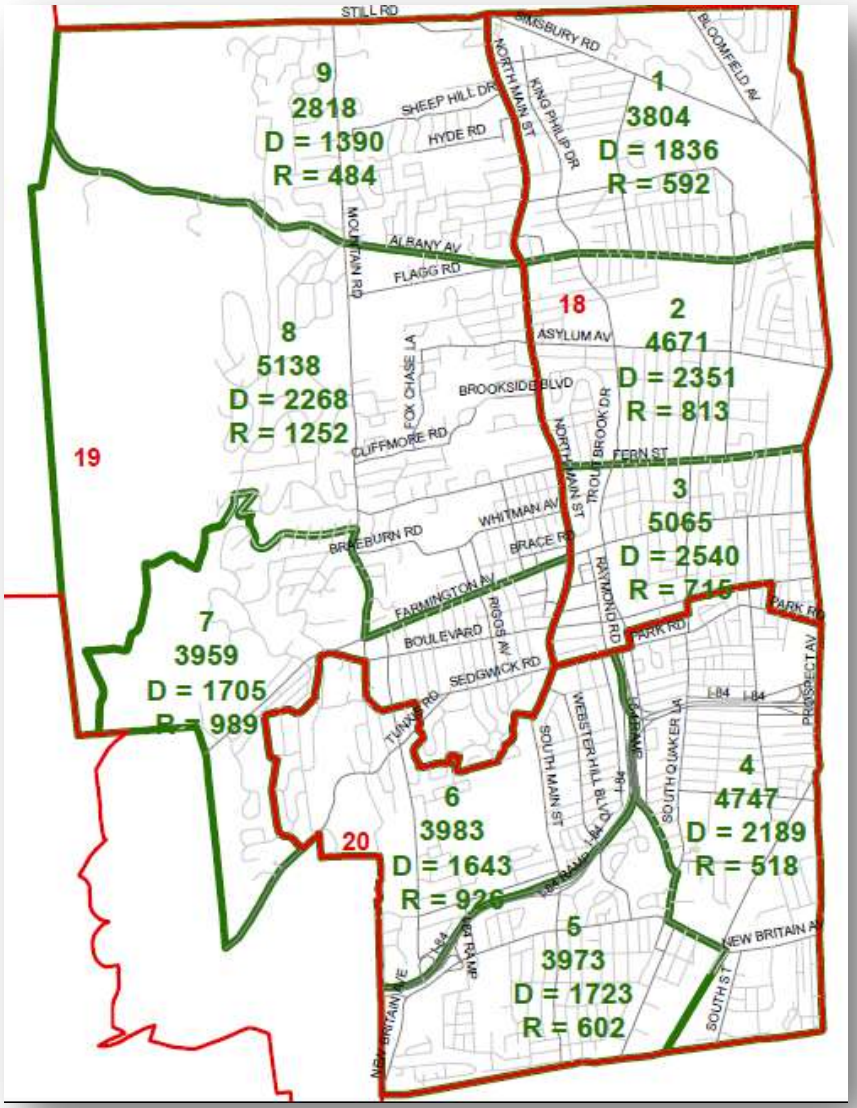
Methods - Data Prep

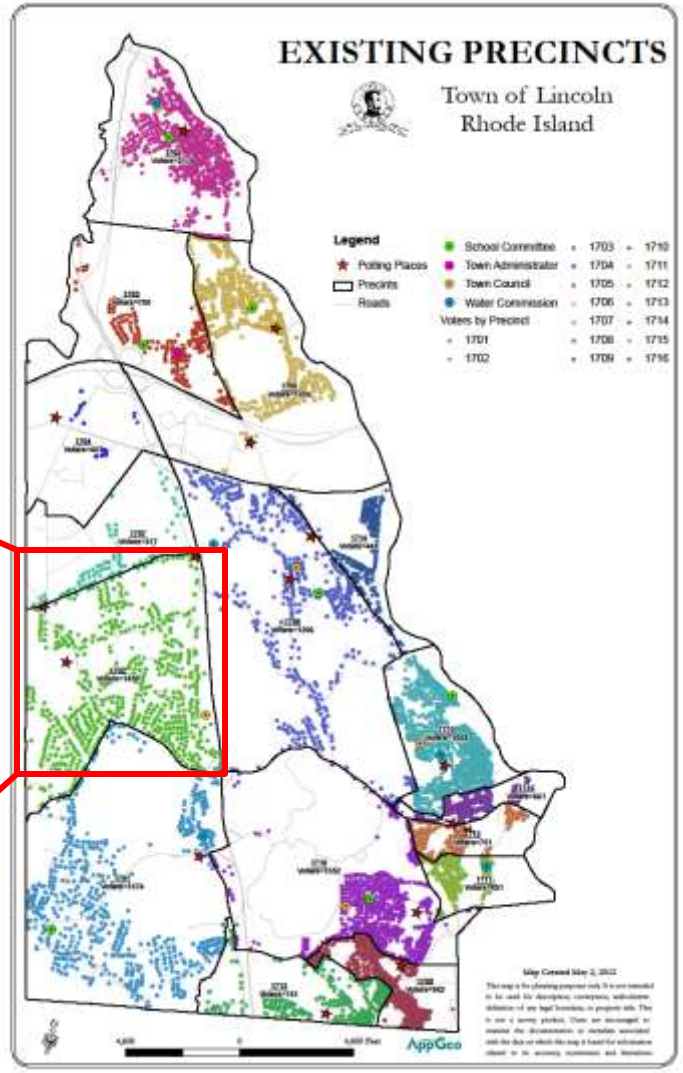
- **Voters**
  - Summary Statistics on district
  - Create pivot table if labeling multiple parameters
  - Join to display voter counts on map





Methods – Data Prep

- Create map(s) of existing conditions
- Town can work with it



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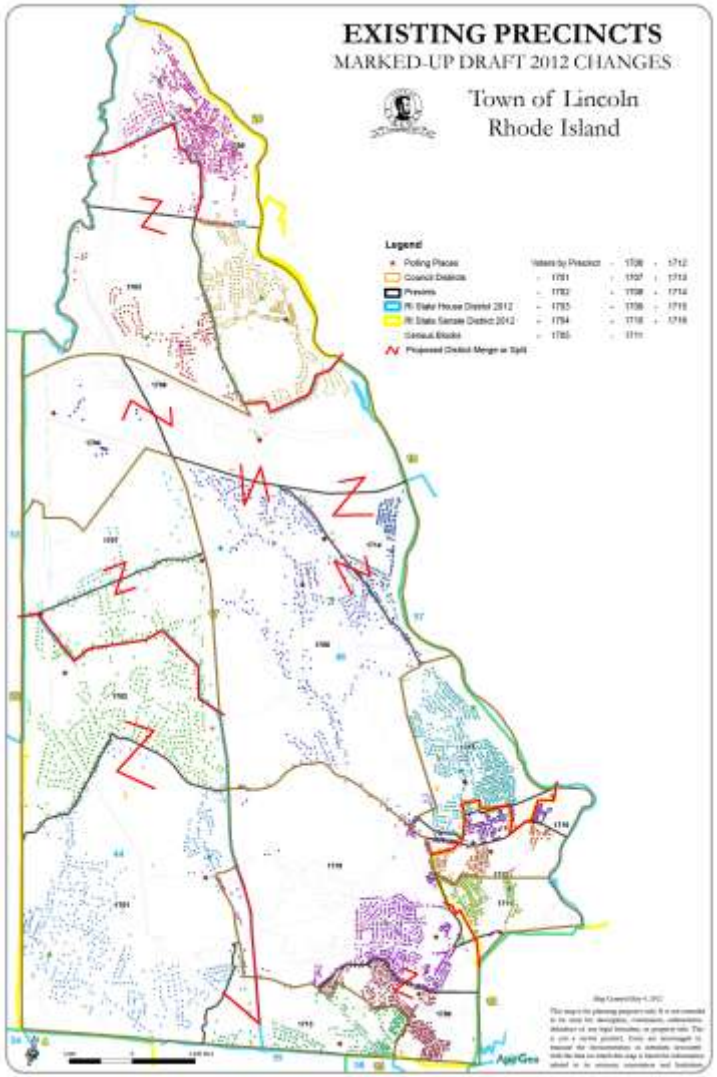
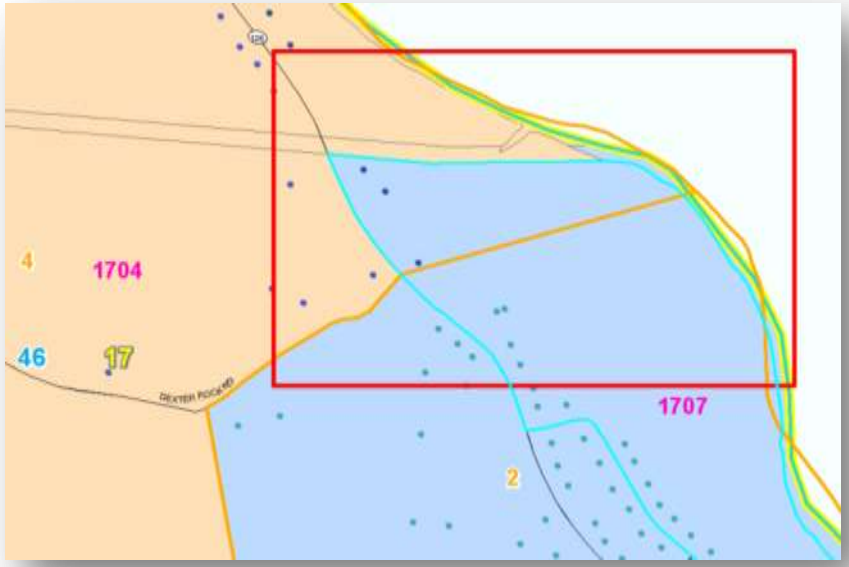
Methods – Create Proposal(s)

- Workshop with Town Staff
  - Mark up maps interactively
    - Pay attention to…
      - New State boundaries
      - Potential to merge districts
      - Keep a polling location in each district
      - Don't move official out of district
      - Registered voter count (ex: RI < 3000)
      - Council district population balanced

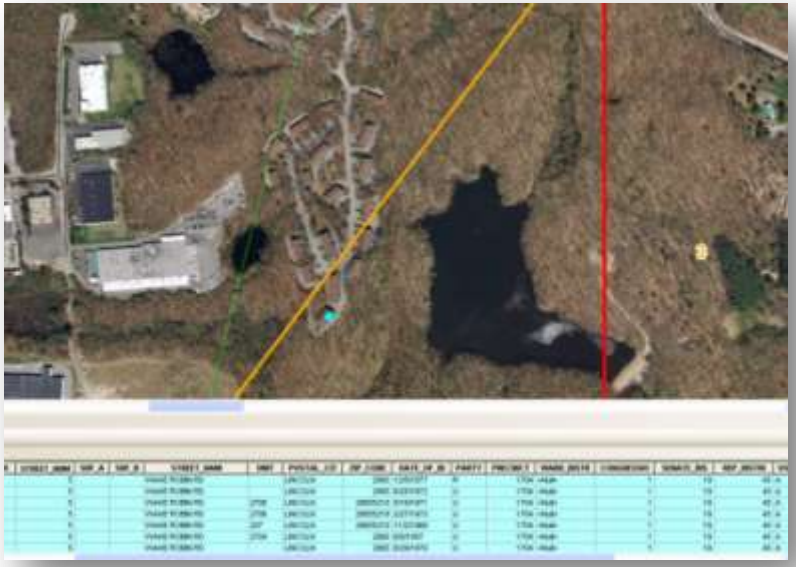


Methods – Create Proposal(s)

- Create proposed layer(s) from Census Blocks
  - Code each block w/ district number(s)
  - Try not to split across blocks if can be avoided



Adjust council boundary to follow block boundaries along the north side



Have to split block to keep Wake Robin Condo Complex voters in council district 4 (north)

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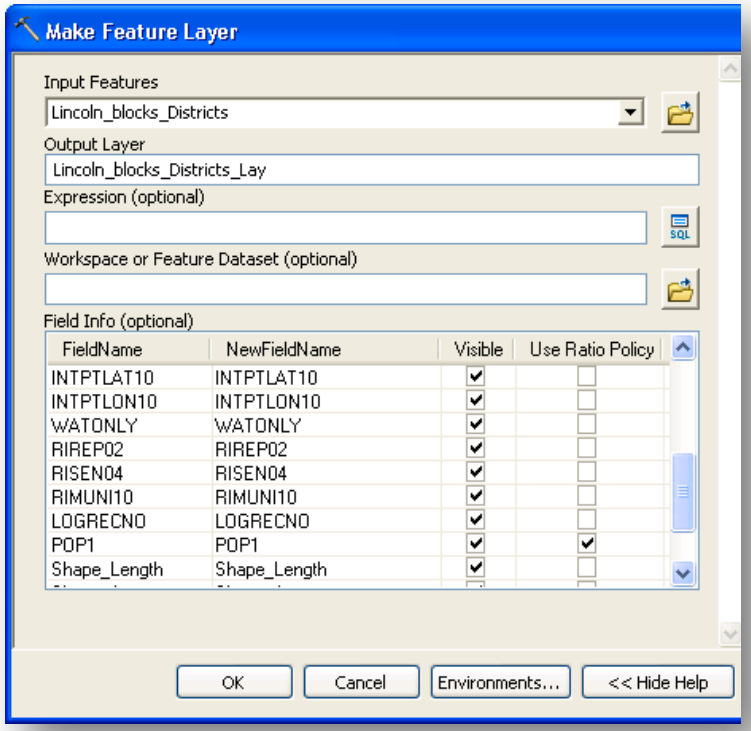
Methods – Create Proposal(s)

- Handling split blocks (only when absolutely necessary)
  - Proportion population
    - Code all whole blocks fully
    - Make feature layer
      - Enable **Ratio Policy** on population field



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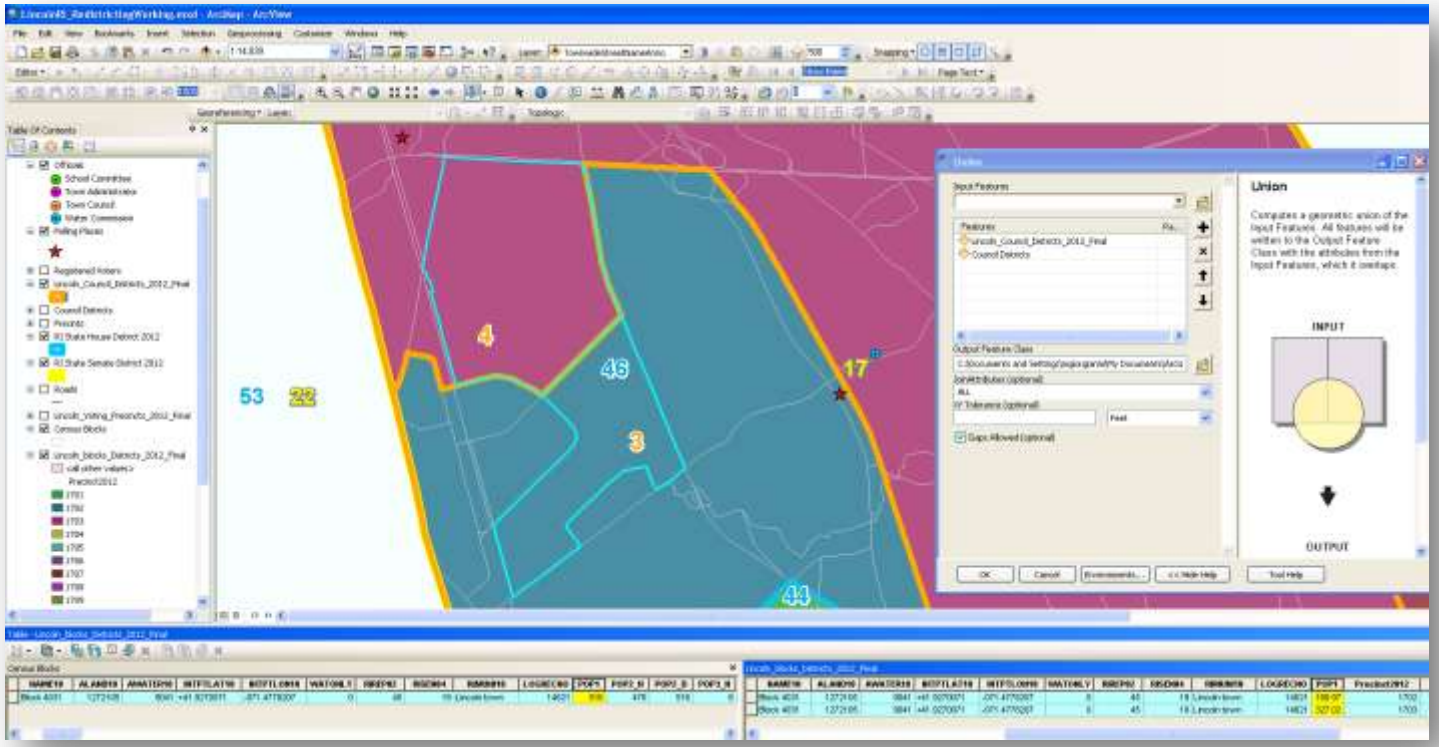
Methods – Create Proposal(s)

- Split blocks by Union
  - Ex: with council layer from dissolved blocks with cuts already made



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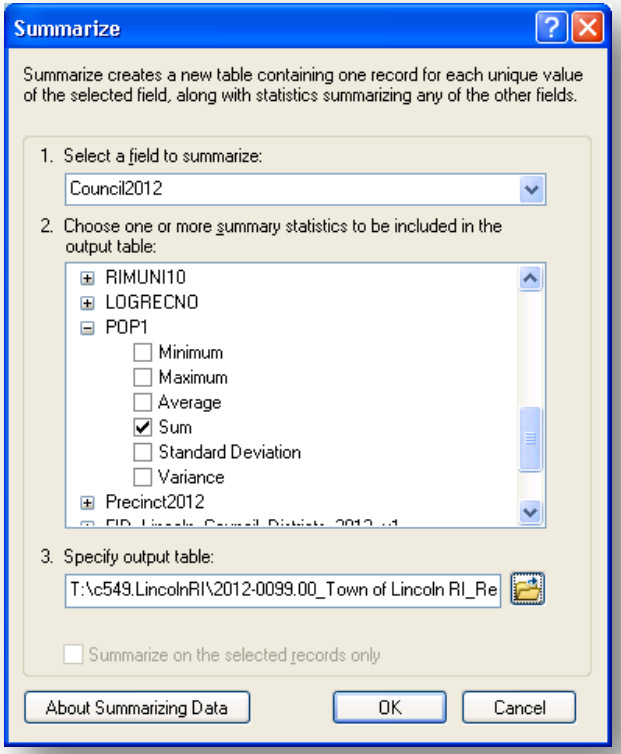
Methods – Create Proposal(s)

- Calculate new counts for proposed districts
  - Voters again (same steps as before)
  - Population (council)
    - Summarize District field for Pop Sum in Unioned block layer



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Methods – Create Proposal(s)

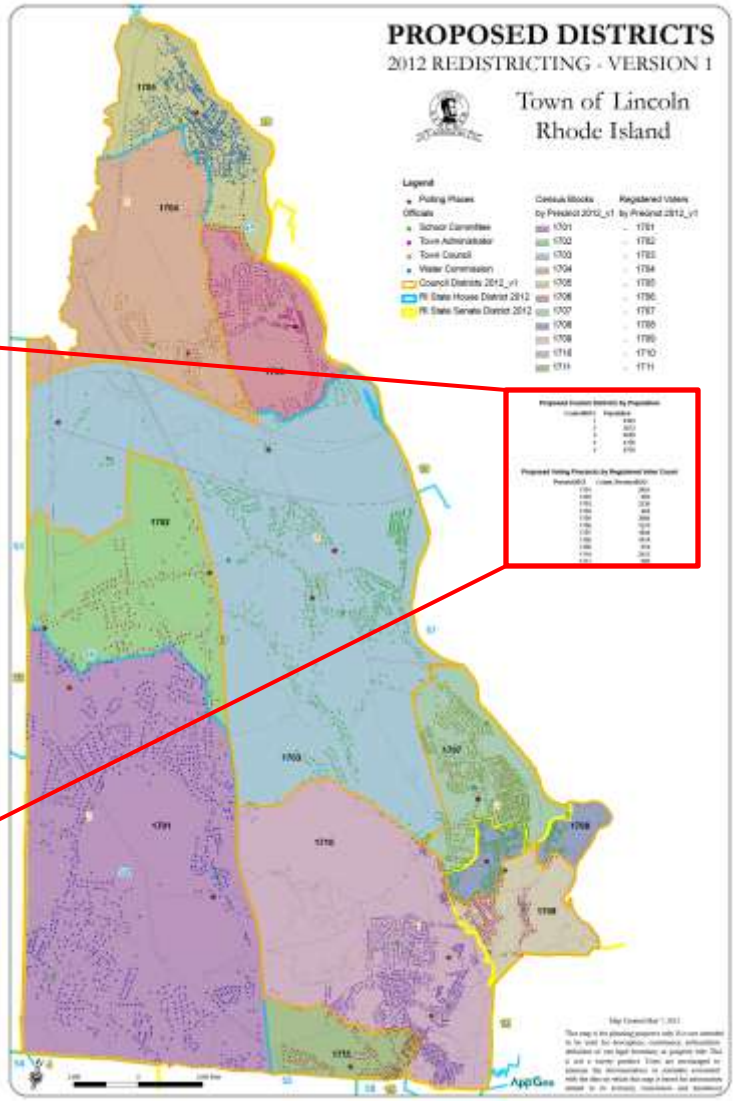
- Display all on proposal map

Proposed Council Districts by Population

Council2012	Population
1	4383
2	3672
3	4656
4	4156
5	4238

Proposed Voting Precincts by Registered Voter Count

Precinct2012	Count_Precinct2012
1701	2681
1702	485
1703	2339
1704	894
1705	2060
1706	1274
1707	1804
1708	1014
1709	919
1710	2512
1711	595



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Methods – Street List

- States require table for import into their database
  - Include all potential addresses, not just voters
  - Address ranges on streets by district

Sample File Layout for Street Files			
Field Name	**Field Type**	**Size**	**Description not part of file**
City Town	Text	30	City or Town
Low Range	Text	6	Low number of the assigned street range
High Range	Text	6	High number of the assigned street range
Side	Text	1	Side of street A=all numbers E=even numbers O=odd numbers
Street Name Pre Direction	Text	1	E= East N= North S= South W= West
Street Name	Text	75	Street name
Street Type	Text	5	AVE=Avenue BLVD=Boulevard CIR=Circle CT=Court CV=COVE DR=Drive HWY=Highway LN=Lane PATH=PATH PKWY=PARKWAY PKY=PARK PL=Place PSG=PASSAGE PT=POINT PTH=P RD=Road RUN=Run ST=Street TER=Terrace TRL=Trail WAY=Way
Street Name Post Direction	Text	1	E= East N= North S= South W= West
Zip Code	Text	5	Zip Code
Zip 4 Code	Text	4	Zip 4 code
Postal City	Text	30	Postal city of the assigned street range
Precinct	Text	5	Assigned precinct of the assigned street range should be city town code and then the rep vote number
Congressional District	Text	5	Congressional District
State Senate District	Text	5	State Senate District
State Rep District	Text	5	State Rep District
Rep Vote	Text	5	Rep vote should be last two digits of precinct
Ward/Council	Text	5	Ward/Council
Ward District	Text	5	Local ward district number
School Committee District	Text	5	School Committee District
Fire district	Text	5	Fire District
Special District	Text	5	Special district if any

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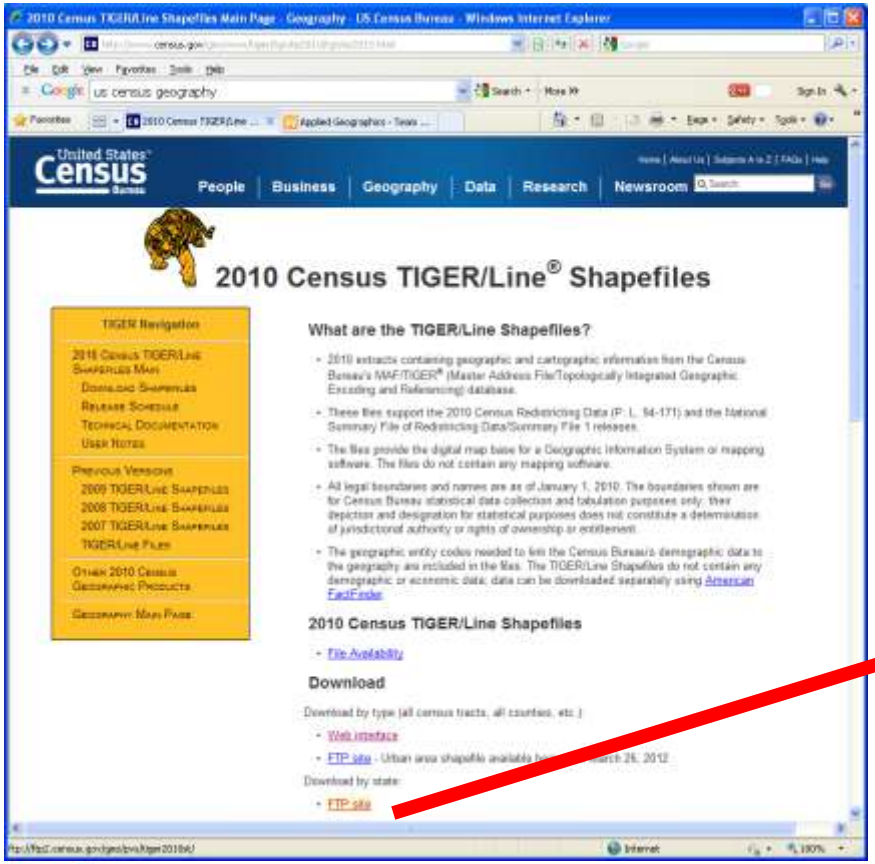
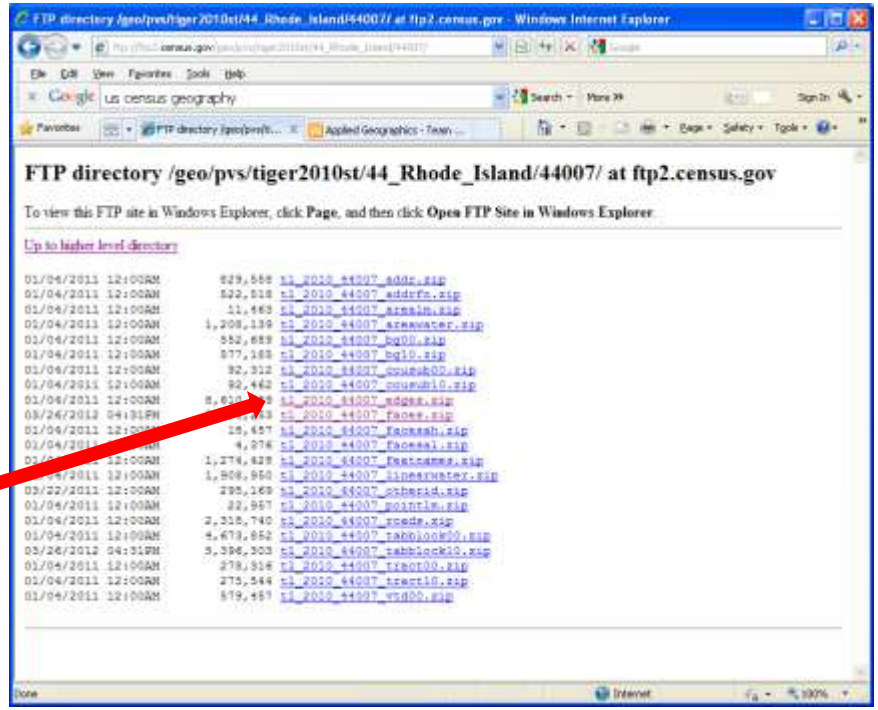
Methods – Street List

- Need Census Geography – **Faces** and **Edges**





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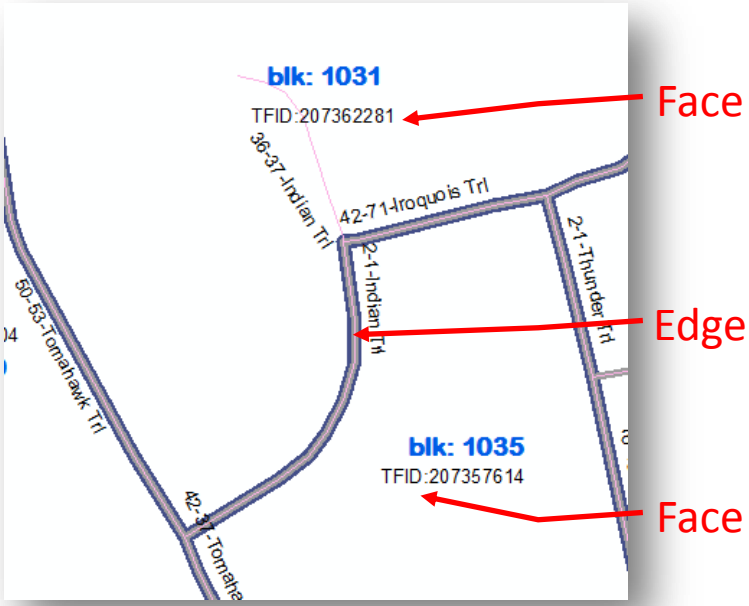
Methods – Street List

- Census **Faces** and **Edges**
  - A census block may consist of one or more faces
- Faces:
  - Unique identifier: TFID
- Edges:
  - Unique identifier: TLID
  - Order of the nodes defines the From-To orientation and left/right sides of the edge
- Each Edge specifies which face (identified by TFID) is on its…
  - right with the TFID**R** field
  - left with the TFID**L** field
- With this knowledge we can now…
  - Code the Faces with the districts (union)
  - Code the Edges with left/right districts



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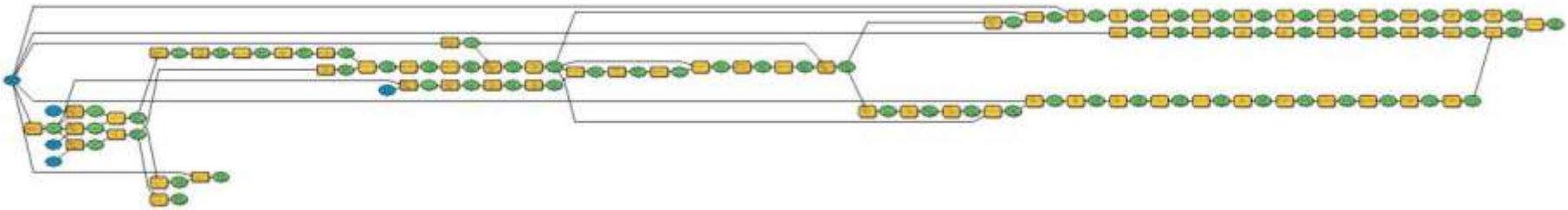
Methods – Street List

- Use model builder and/or python scripting
  - West Hartford – just model builder
    - Didn't aggregate down to the "All"
      - Left each segment as a record in final output table – each Even and Odd
    - Didn't aggregate consecutive segments ranges to single high-low range



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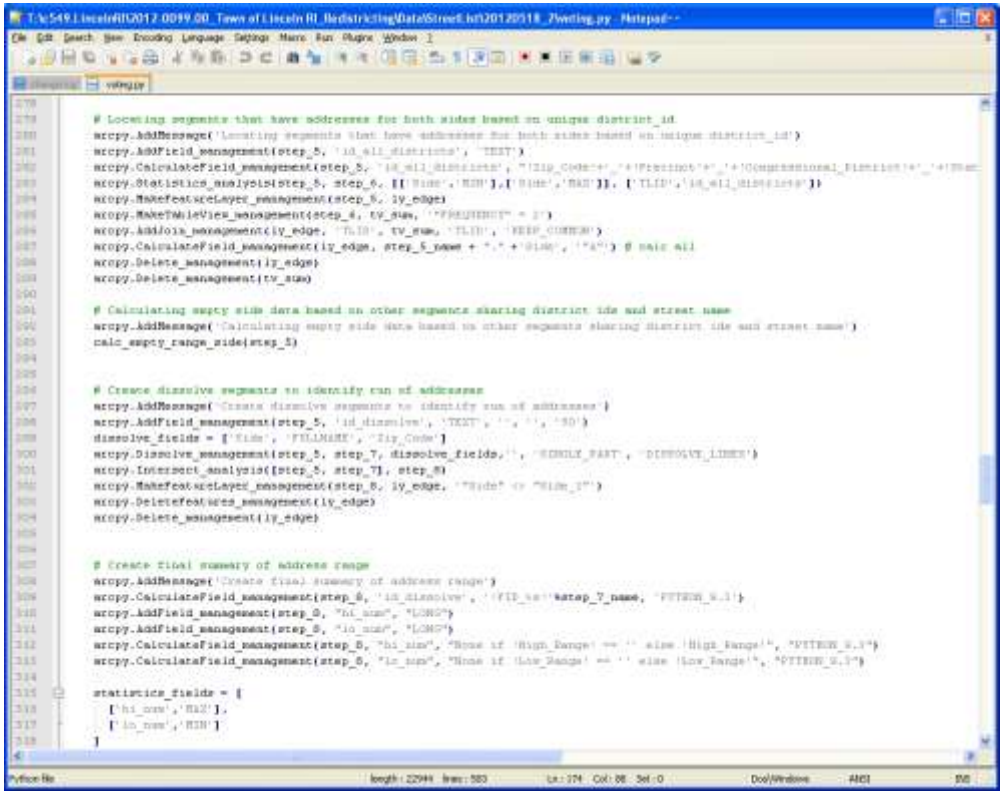
Methods – Street List

- Python scripting handled aggregations
  - RI: started w/ model, moved to python after many crashes
    - Final output table has roads aggregated as much as possible, but still not perfect



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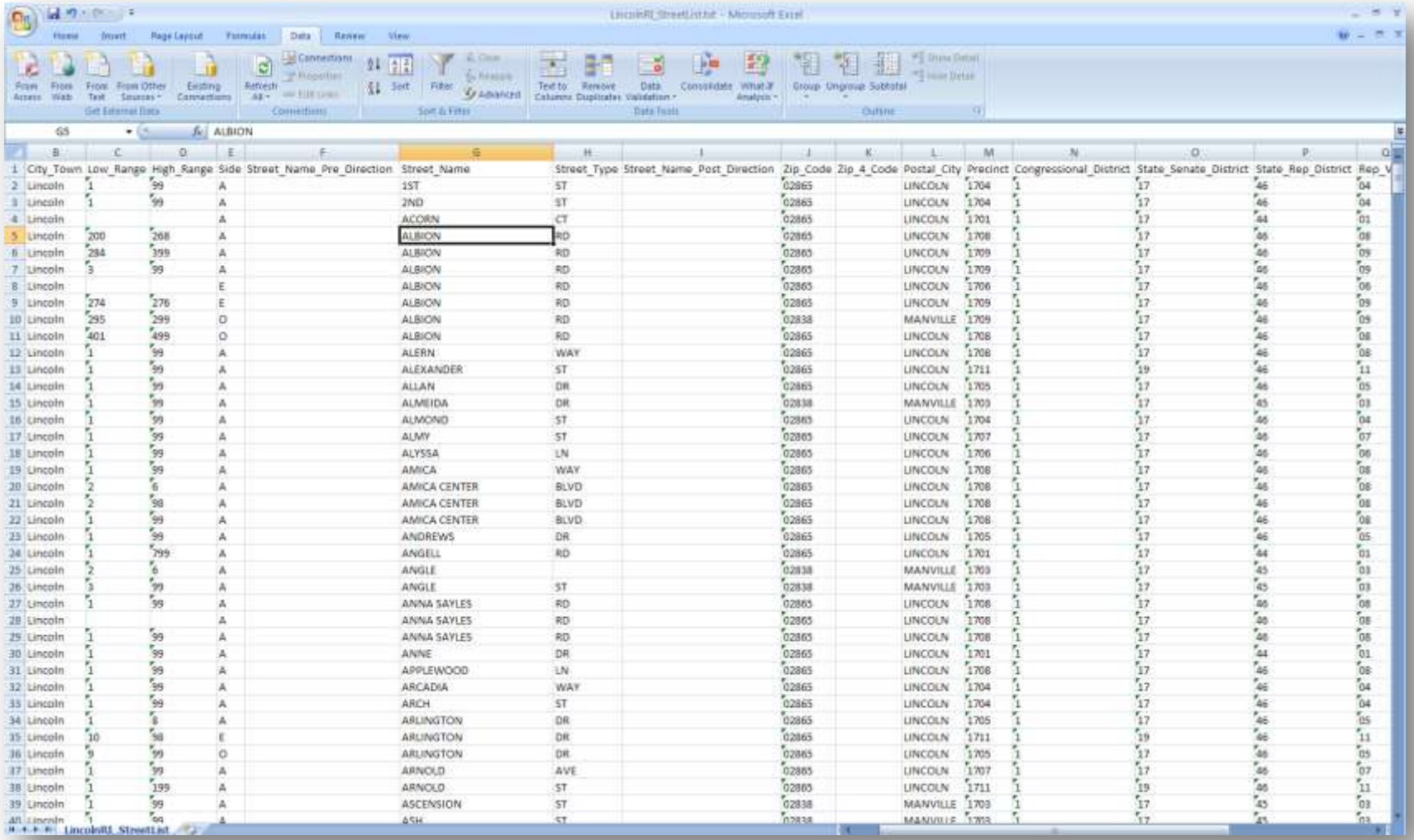
Methods – Street List



City_Town	Low_Range	High_Range	Side	Street_Name_Pre_Direction	Street_Name	Street_Type	Street_Name_Post_Direction	Zip_Code	Zip_4_Code	Postal_City	Precinct	Congressional_District	State_Senate_District	State_Rep_District	Rep_V
Lincoln	1	99	A		1ST	ST		02865		LINCOLN	1704	1	17	46	04
Lincoln	1	99	A		2ND	ST		02865		LINCOLN	1704	1	17	46	04
Lincoln			A		ACORN	CT		02865		LINCOLN	1701	1	17	44	01
Lincoln	200	268	A		ALBION	RD		02865		LINCOLN	1708	1	17	46	08
Lincoln	284	399	A		ALBION	RD		02865		LINCOLN	1709	1	17	46	09
Lincoln	3	99	A		ALBION	RD		02865		LINCOLN	1709	1	17	46	09
Lincoln			E		ALBION	RD		02865		LINCOLN	1708	1	17	46	08
Lincoln	274	276	E		ALBION	RD		02865		LINCOLN	1709	1	17	46	09
Lincoln	295	299	O		ALBION	RD		02838		MANVILLE	1709	1	17	46	09
Lincoln	401	499	O		ALBION	RD		02865		LINCOLN	1708	1	17	46	08
Lincoln	1	99	A		ALERN	WAY		02865		LINCOLN	1708	1	17	46	08
Lincoln	1	99	A		ALEXANDER	ST		02865		LINCOLN	1711	1	19	46	11
Lincoln	1	99	A		ALLAN	DR		02865		LINCOLN	1705	1	17	46	05
Lincoln	1	99	A		ALMEIDA	DR		02838		MANVILLE	1703	1	17	45	03
Lincoln	1	99	A		ALMOND	ST		02865		LINCOLN	1704	1	17	46	04
Lincoln	1	99	A		ALMY	ST		02865		LINCOLN	1707	1	17	46	07
Lincoln	1	99	A		ALYSSA	LN		02865		LINCOLN	1706	1	17	46	06
Lincoln	1	99	A		AMICA	WAY		02865		LINCOLN	1708	1	17	46	08
Lincoln	2	6	A		AMICA CENTER	BLVD		02865		LINCOLN	1708	1	17	46	08
Lincoln	2	98	A		AMICA CENTER	BLVD		02865		LINCOLN	1708	1	17	46	08
Lincoln	1	99	A		AMICA CENTER	BLVD		02865		LINCOLN	1708	1	17	46	08
Lincoln	1	99	A		ANDREWS	DR		02865		LINCOLN	1705	1	17	46	05
Lincoln	1	799	A		ANGELL	RD		02865		LINCOLN	1701	1	17	44	01
Lincoln	2	6	A		ANGLE			02838		MANVILLE	1703	1	17	45	03
Lincoln	3	99	A		ANGLE	ST		02838		MANVILLE	1703	1	17	45	03
Lincoln	1	99	A		ANNA SAYLES	RD		02865		LINCOLN	1708	1	17	46	08
Lincoln			A		ANNA SAYLES	RD		02865		LINCOLN	1708	1	17	46	08
Lincoln	1	99	A		ANNA SAYLES	RD		02865		LINCOLN	1708	1	17	46	08
Lincoln	1	99	A		ANNE	DR		02865		LINCOLN	1701	1	17	44	01
Lincoln	1	99	A		APPLEWOOD	LN		02865		LINCOLN	1708	1	17	46	08
Lincoln	1	99	A		ARCADIA	WAY		02865		LINCOLN	1704	1	17	46	04
Lincoln	1	99	A		ARCH	ST		02865		LINCOLN	1704	1	17	46	04
Lincoln	1	8	A		ARLINGTON	DR		02865		LINCOLN	1705	1	17	46	05
Lincoln	10	98	E		ARLINGTON	DR		02865		LINCOLN	1711	1	19	46	11
Lincoln	9	99	O		ARLINGTON	DR		02865		LINCOLN	1705	1	17	46	05
Lincoln	1	99	A		ARNOLD	AVE		02865		LINCOLN	1707	1	17	46	07
Lincoln	1	199	A		ARNOLD	ST		02865		LINCOLN	1711	1	19	46	11
Lincoln	1	99	A		ASCENSION	ST		02838		MANVILLE	1703	1	17	45	03
Lincoln	1	99	A		ASH	ST		02838		MANVILLE	1703	1	17	45	03

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Lessons Learned

- Geocoding
  - Need good reference data
  - Need clean source address table
  - Can spend a lot of time reviewing/placing unmatched
- Census Data
  - Street Names
    - Some are just missing
    - Some are just wrong
    - Check: join voter list & local road layer street names to census streets names (both directions) – identify/fix mismatches
  - Missing address ranges
  - Edges missing zip codes if no range
    - Populate from associated faces

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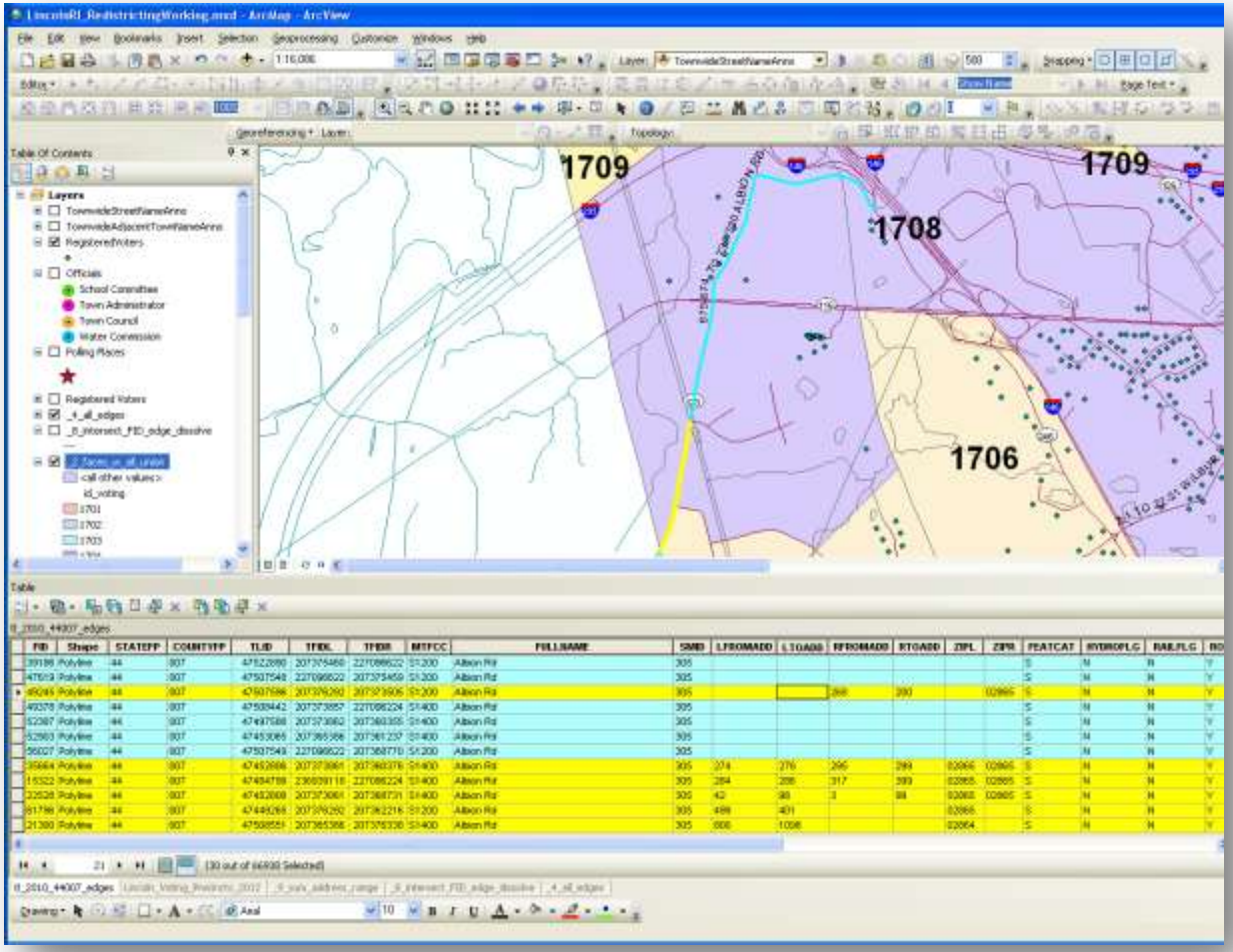
Lessons Learned

- Example: Missing Address Ranges



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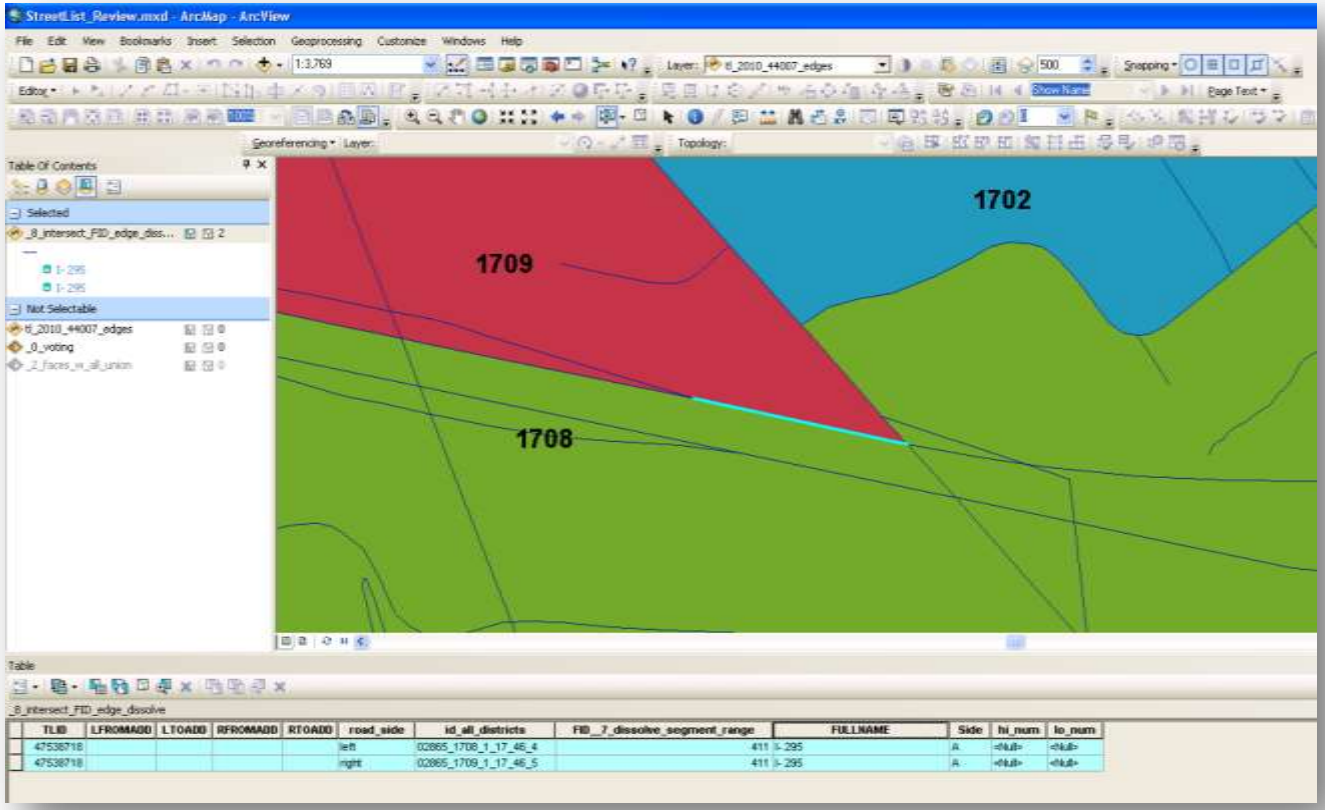
Lessons Learned

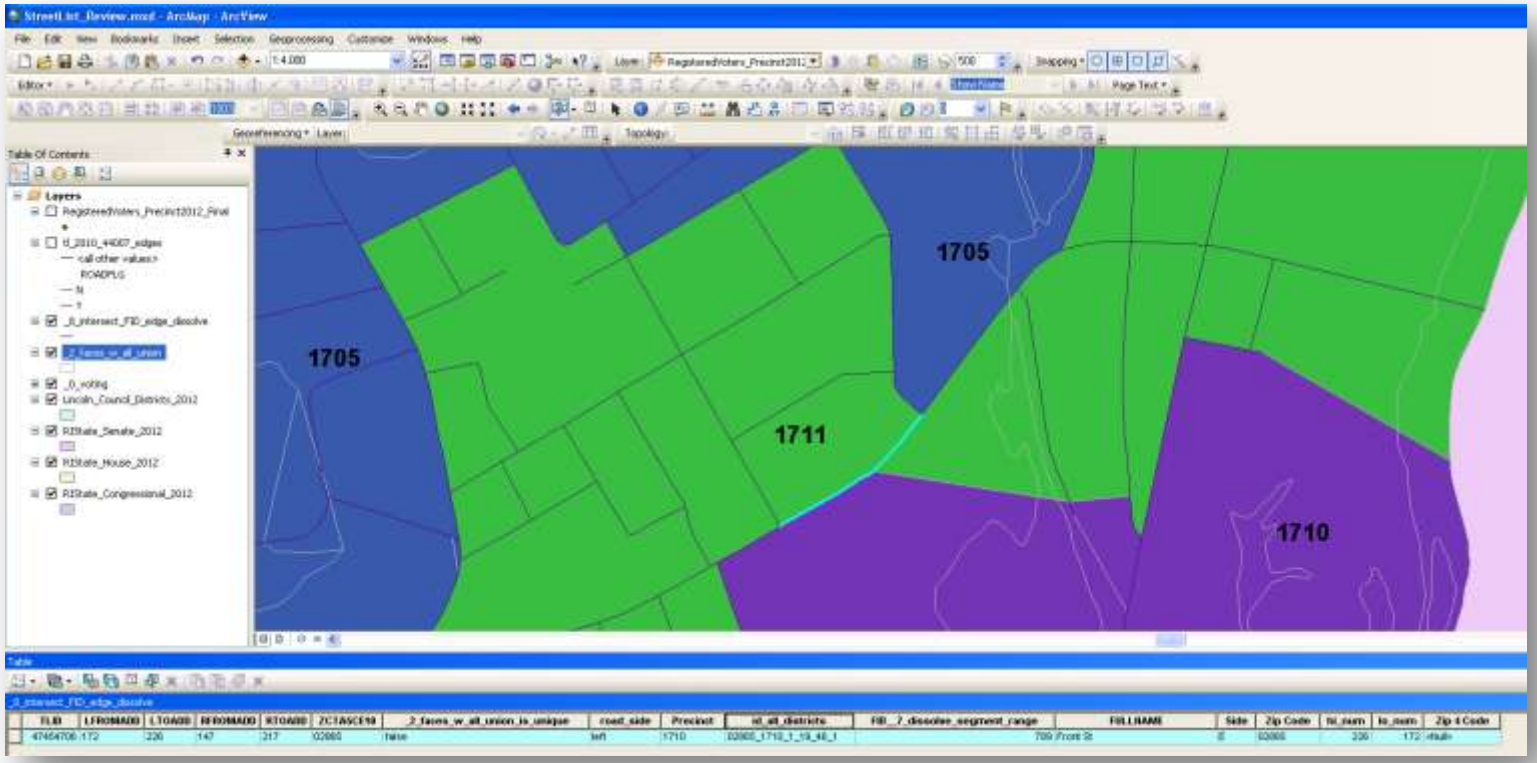
- Example: What side is District on if no range?



AppGeo

Lessons Learned

- Example: Dealing with edges at split blocks = headache



Thank You

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