GEOCOMM

State of North Carolina GIS Managed Services

User Guide

12/22/2020

PUBLIC SAFETY GIS SIMPLIFIED

Revision History

Revision #	Revision Date	Brief Description of Change(s)	Changes Made By
Original	June 2019	Original	Jessica Beierman & Jessica Frye
1	August 2019	Added QC Tips & Tricks appendix, Submitter add-on tool information, updated QC table to include new "outside acceptable values" checks, QC, and link to aggregated dataset	Jessica Beierman & Jessica Frye
2	October 2019	Updated SSAP to RCL exception code to 401. Added CRITICAL to multiple checks.	Jessica Beierman
3	April 2020	Updated which checks are considered critical, added EGDMS submission workflow. General review and refresh of whole document.	Jessica Beierman
4	July 2020	Updated EGDMS dataset and submission process, added link to new i3 maintenance instructional document, updated critical QC check list.	Jessica Beierman
5	December 2020	Changes and additions made: 1. Updated critical QC check list with Route URI acceptable values check and boundary outside of provisioning boundary check (p. 17 and p. 19). No critical errors should be removed using exception codes. 2. Added information about i3 Ready jurisdiction email notification when critical errors are present in data (p. 6). 3. Added information on Google Chrome security change workaround added (p. 2).	Jessica Beierman

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1.0 User Guide Overview

The State of North Carolina GIS (geographic information systems) managed services include the development of project specific workflows, standard operating procedures (SOPs), and informational documentation on operational processes and procedures including tools to facilitate discrepancy resolution and data quality improvements.

The GeoComm GIS Data Hub allows for access to mechanisms to complete the following:

- upload datasets,

- download the statewide dataset,

- download detailed QC results,

- view reports in the Dashboard,

- provision aggregated data to AT&T's EGDMS system for call routing

Software specific procedural instructions and help files are maintained through the specific software's Web Help files.

Ad-hoc summary reports for individual jurisdictions may be downloaded from the GIS Data Hub Dashboard by individual jurisdictions at any time in PDF format. The QC report is also sent to users via email after each data upload is successfully processed. State level reports are also accessed via the GIS Data Hub Dashboard. The statewide summary reports can be downloaded in PDF and Excel formats.

2.0 Application access

The GIS Data Hub is accessed via the following link: *https://gdh.sonc.nc.geo-comm.com/GMS_API/*

To request a new user access account for the GIS Data Hub, please e-mail your jurisdiction's Regional Coordinator and include the NCTeam@geo-comm.com with the following information for each end user in your jurisdiction:

- Name

- Title

- E-mail address

- Phone number

The Regional Coordinator approves every new user request. E-mail addresses are used for user access. An e-mail is sent to the user upon initial account creation and the user generates a password when registering. Registration e-mail invites expire after 24 hours.

A November 2020 Chrome browser update flags GIS Data Hub as possibly insecure content. If the QC results link does not allow you to download the zipped results file, make the following Chrome browser settings changes:

1. Clear browser cache

2. Update settings using this URL-
   chrome://settings/content/siteDetails?site=https://gdh.sonc.nc.geo-comm.com/

3. Ensure 'JavaScript' is set to Allow

4. Ensure 'Pop-ups and redirects' is set to Allow

5. Ensure 'Insecure content' is set to Allow

3.0   Workflows

The workflows that follow are intended to provide guidance through each part of the process, from GIS data maintenance and quality improvement at the local level to submission into the GIS Data Hub by each local source entity, to obtaining a copy of the statewide dataset. Additional information about the QC check results and guidance on improving GIS data is found in subsequent sections.

Local Source Data Preparation and Submission Workflow

The diagram below details the workflow for jurisdiction submission of data for quality control checks and aggregation into the statewide dataset used for call routing.
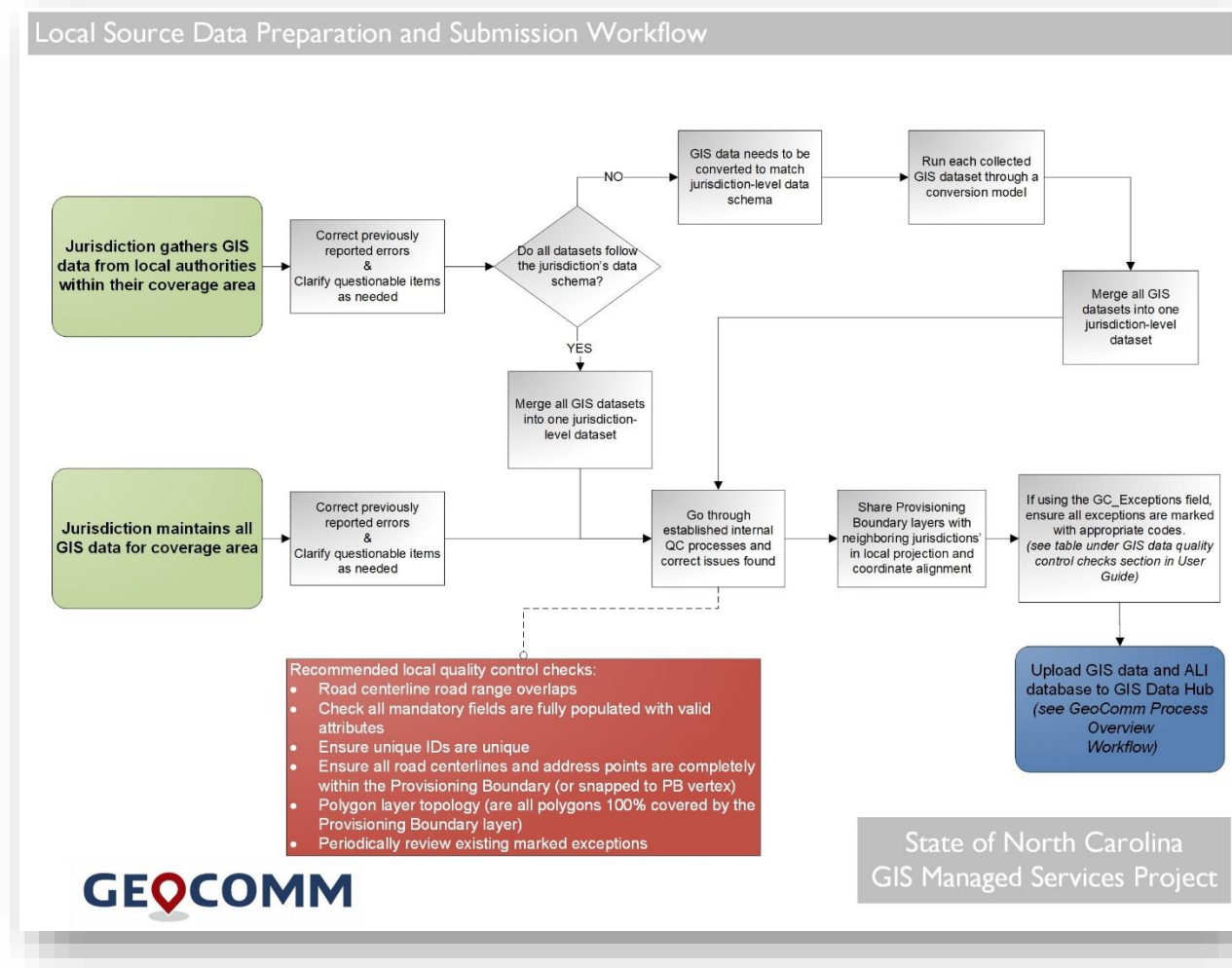
GeoComm Process Overview

The diagram below details the managed service process for receiving the GIS datasets submitted by local entities, validation, quality control and aggregation. It also depicts the different mechanisms in which the quality check results are communicated back to the submitting entities.
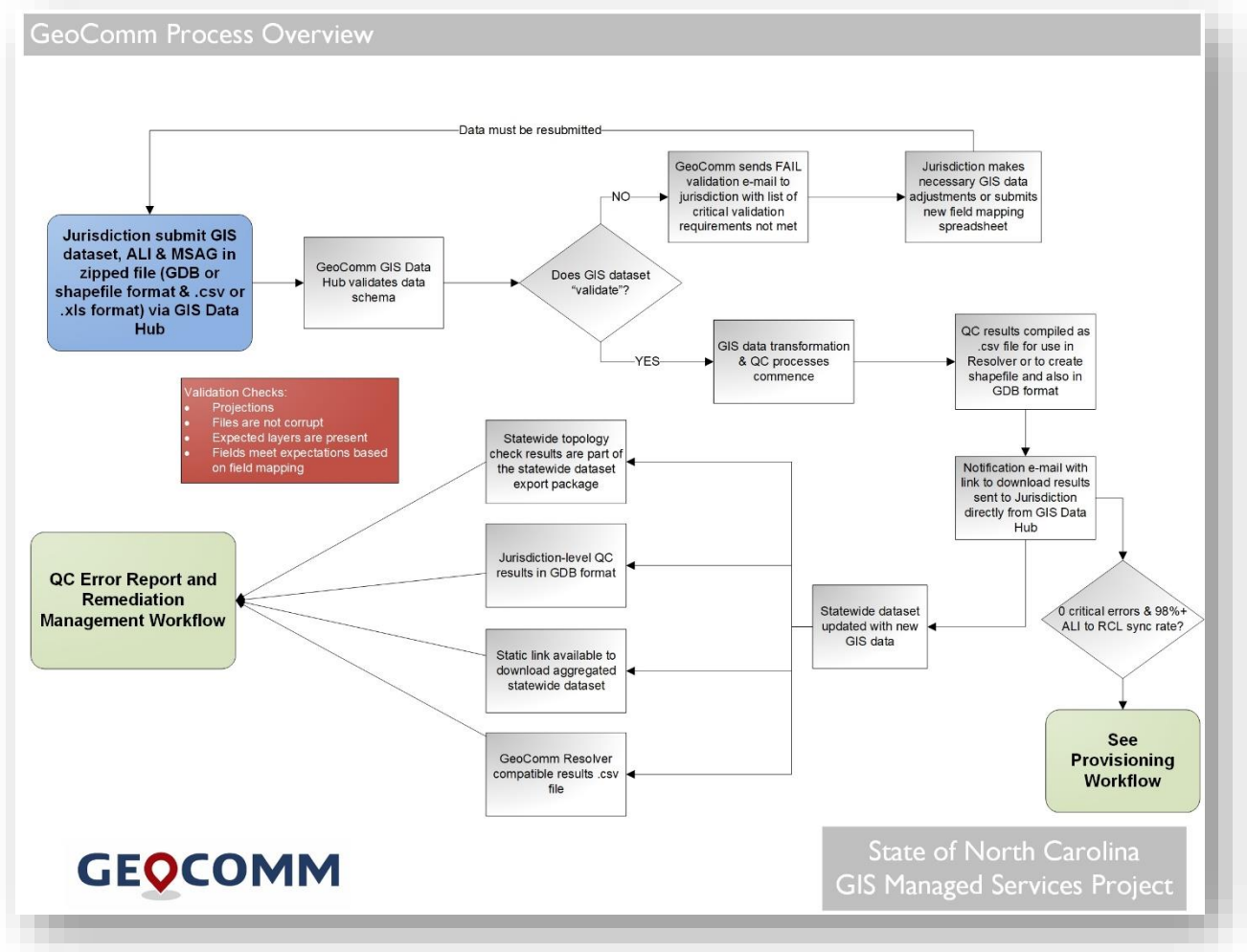
QC Error Report and Remediation Management Workflow

The diagram below details the workflow for retrieval, review, and resolution of quality control discrepancies reported by the GIS Data Hub through a summary of results, GeoComm Resolver, or by loading a .csv file or QC fallouts feature classes into an ArcMap or ArcPro session.

Static link for statewide dataset download: https://gdh.sonc.nc.geo-comm.com/GMS_API/Admin/Download?projectName=NC&fileURL=http%3A%2F%2Fgdh.sonc.nc.geo-comm.com%2FExports%2FNC_NCStatewide%2FNC_Statewide.zip&packageDescription=Statewide+QC+Report&clientName=NCStatewide
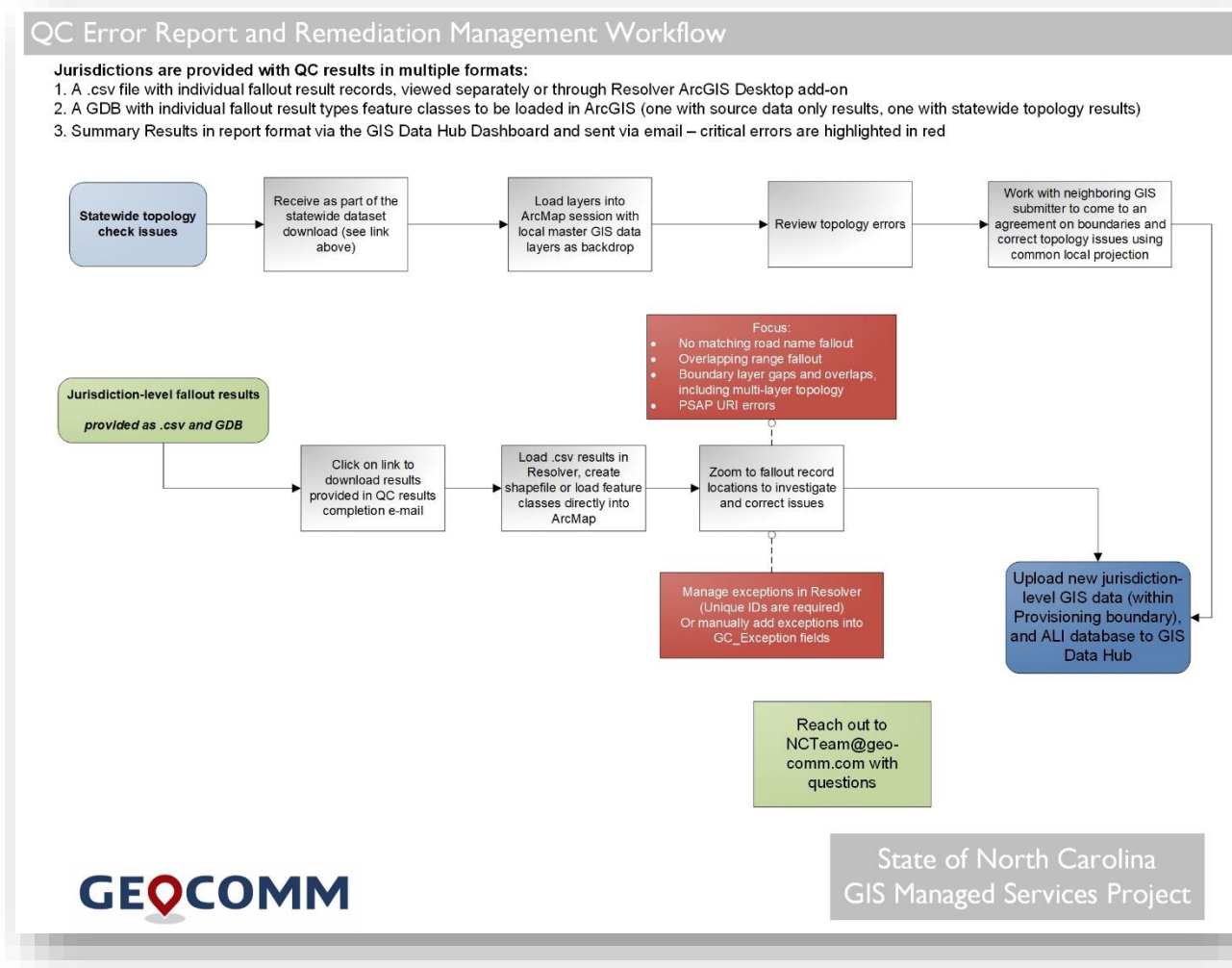
Provisioning of GIS data to EGDMS system for i3 call routing

The diagram below details the workflow each jurisdiction's data goes through to initially be provisioned into the AT&T EGDMS system and subsequent maintenance updates.
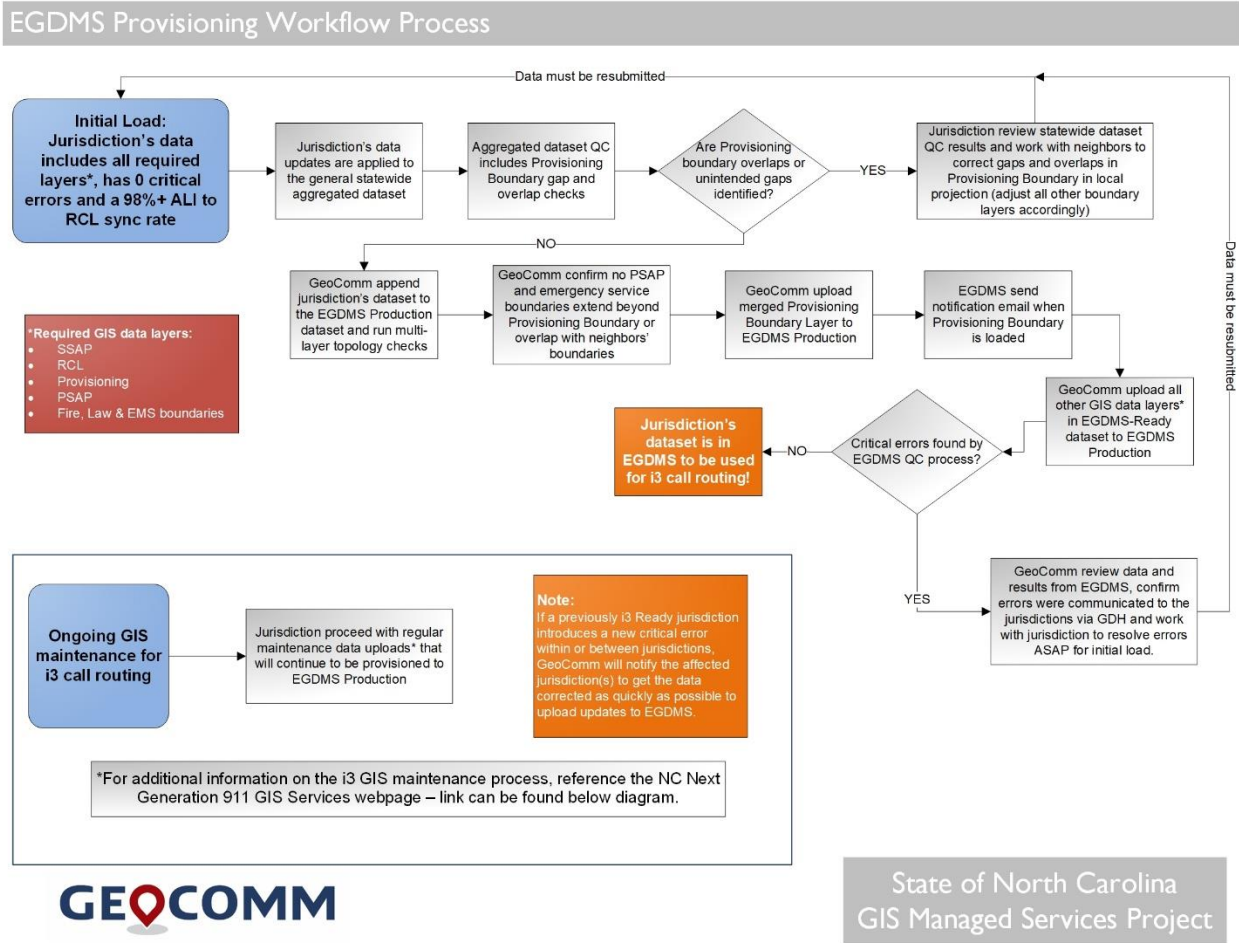
*For additional information on the i3 GIS maintenance process, reference the NC Next Generation 911 GIS Services webpage: https://it.nc.gov/about/boards-commissions/nc-911-board/next-generation-911/next-generation-911-gis-services

Note: Starting in 2021, the QC results notification e-mail will call out if critical errors were introduced once i3 Ready status is reached. It is important to correct these critical errors and reupload to GIS Data Hub as data changes with critical errors are rejected by the EGDMS that provisions to the i3 call routing system.

If critical errors are introduced with a new data upload, please correct these critical errors and reupload new data as soon as possible, at the most within 24 hours of receiving the results.

4.0   Standard operating procedures

This section provides standard operating procedures (SOPs) and instructions on the GIS data, MSAG and ALI database requirements for source entity data submission into the GIS Data Hub, including field mapping instructions.

Data requirements for GIS datasets submitted by source entities

Field mapping and data submission

Initial configuration of the ETL process requires field mapping of the local source data to the State of North Carolina data schema standard.

The following GIS data layers are required (not all layers need to be uploaded initially):

- Road centerlines

- Site/Structure address points

- PSAP boundary

- Law boundary

- Fire response boundary

- EMS response boundary

- Provisioning (Authoritative) boundary

Each individual data layer needs to be field mapped upon initial submission to GIS Data Hub. Data submissions should be made in Esri geodatabase format up to version 10.6.1 or in shapefile format. If schema changes are made that affect a layer name, the old layer will need to be deleted and the new layer field mapped. If field name schema changes are made, the "Pause" option should be chosen. After the new data is ingested into GIS Data Hub, the changed or new fields can be mapped. An email needs to be sent to the GeoComm NCTeam@geo-comm.com to request data processing after field mapping changes are made.

Training for the field mapping process was provided in person at the initial regional training meetings for the jurisdictions ready to begin submitting GIS data at the beginning of the project, in June 2019. Mini-regional sessions were offered to jurisdictions as an additional training option in smaller groups. The North Carolina CGIA and GeoComm teams are available to assist with any questions that arise about quality control check results, the initial field mapping process or field mapping adjustments to accommodate schema changes, layer name changes or layer additions, The GeoComm team can be reached by e-mail at NCTeam@geo-comm.com.

A field mapping spreadsheet is available to download from the State of North Carolina project site. You may also request a copy at any time by e-mailing the GeoComm team (NCTeam@geo-comm.com). This spreadsheet can be used for reference. It includes attribute examples for fields and a column indicating whether an attribute value is mandatory, conditional, or optional (M/C/O) for features.

Please note the following:

- An e-mail should be sent to NCTeam@geo-comm.com after the initial data upload and whenever field mapping changes are made to request that the team initiate data processing. Subsequent uploads without new or changed schema automatically begin processing.

- The names of the feature classes need to remain consistent for each data submission. The fields listed in the field mapping spreadsheet need to be included with every data submission as the GIS Data Hub ETL configuration is set up to expect the same fields. Additional fields beyond the fields listed in the field mapping spreadsheet are disregarded so they are not an issue other than possibly affecting processing efficiency.

- It is also requested that any additional ObjectID fields be removed from the data. Many times, when moving data from location-to-location extra ObjectID fields are created (ObjectID_1, ObjectID_12…). Ensure you are deleting the extra ObjectID fields that are not of the *ObjectID* data type. The true ObjectID field will not allow you to delete it.

Unique identifiers

The initial creation and subsequent maintenance of unique identifiers for all features submitted into the dataset is crucial. The unique identifiers (NGUIDs) need to be maintained at the local level by the person or department maintaining the GIS data that is ultimately fed into the statewide dataset.

Unique identifiers can be created and maintained following more than one method. Manually updating features' unique identifiers as road segments, address points, or polygon layers are added or changed, is not recommended as this method is tedious and error prone. Esri has provided a solution which can be configured to the State of North Carolina's specific naming convention. This solution can be found in the Attribute Assistant tool. The Attribute Assistant tool is part of the Address Management toolset in the ArcGIS for Local Government templates. The following links provide an introduction and overview of Attribute Assistant, as well as details on tool configuration and links to download the tool.

- Address Data Management toolset

- Attribute Assistant add-in overview

Please note that Esri GlobalIDs or ObjectIDs are not appropriate for use as unique identifier attributes in an NG9-1-1 dataset. The reasoning is that ObjectIDs change as features are split, added, and deleted, and GlobalIDs change when feature classes are exported from the SDE database, so they are not retained throughout the submission and aggregation process. Also, GlobalIDs may be unique within a local dataset, but may be found duplicated in an aggregated dataset consisting of many disparately maintained datasets. This is the reason the recommended standard includes an extension indicating the PSAP or county name, along with the State name as part of the unique ID attribute. GlobalIDs or ObjectIDs may be combined with additional attributes to create the NGUID (example: SSAP_ObjectID@county.nc.us). Please see the North Carolina State NG9-1-1 Data Standard field mapping spreadsheet for more details and guidelines.

Unique identifiers are critical for the error reporting loop. Each feature requires a unique identifier that remains persistent through the upload, quality control check and AT&T ECRF provisioning processes. A feature that falls out of quality control checks at any of the process steps is reported back to the local entity using the Discrepancy Agency ID and the unique identifier assigned to the feature. See the field mapping spreadsheet for descriptions of these mandatory fields. It is expected that unique identifiers may occasionally need to be recreated due to unforeseen circumstances or accidental duplication. Please

keep in mind that replacing/overwriting existing unique identifiers should be done after the reporting loop is complete (local entity data upload→GIS Data Hub QC→provisioning to AT&T ECRF→AT&T QC and error notification). Field calculation formulas can be saved on a per layer basis to assist in recalculating the NGUIDs when and as needed.

MSAG and ALI database preparation for submission to GIS Data Hub

It is recommended that each jurisdiction upload the most recent ALI database with each GIS data submission. An MSAG may be uploaded as well to check synchronization between the MSAG and road centerline but is not required for the project.

The ALI database and MSAG may be uploaded in .xls, .xlsx or .csv format. If uploading data in an excel format, it should be noted the automatic system only analyzes the first sheet within the file. If multiple worksheets are present within the table, the extra sheets will need to be deleted. The file names and spreadsheet tab names should consistently be named the same, for example "MSAG" and "ALI", as this information is utilized to configure the field mapping. It is also important that only a single, top row contain headers. A second row with additional header information or a blank row will cause conflicts in the QC results.

The ALI database and/or MSAG should be submitted in the same .zip file as the GIS data.

Upon submission of ALI database and/or MSAG for each source entity, the GIS Data Hub performs synchronization checks using the GIS data included in the zipped file and reports the results back to each source entity for review and correction.

ALI database and MSAG synchronization results are included in the QCFallouts.csv output from GIS data Hub. No separate ALI and MSAG results layers are produced by the synchronization checks.

To reduce the number of false errors, the following records should be removed prior to submission to GIS Data Hub:

- FX Records

- VoIP records

- Wireless records

- Fictitious records: blank to blank, zero to zero

GIS Data Hub Instructions

1. Log onto GIS Data Hub in Google Chrome
    a. 1st Time Log In – An email from GeoComm will be sent with a link for the user to select a password.

Welcome Heidi!
An account has been created for you. Once you complete registration you will be able to log in
to your application.

Complete Your
Registration

For questions about this e-mail, please contact
swsupport@geo-comm.com

For security purposes, you have 24 hours to complete the
registration process before your access expires.
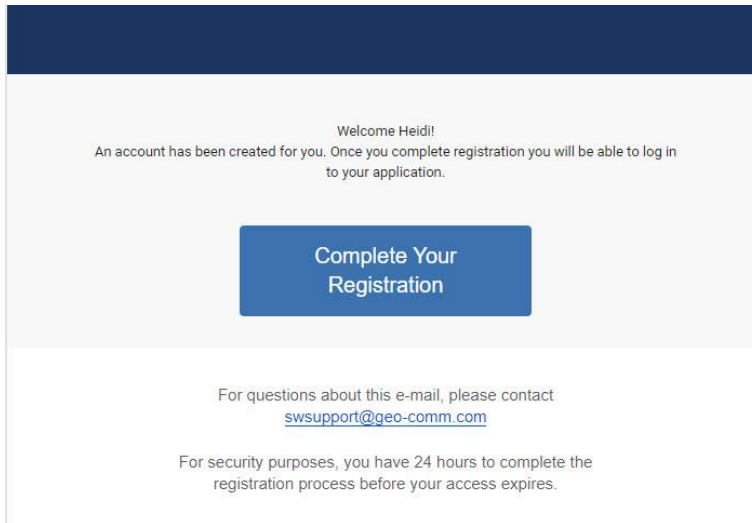
2. Once password is set, navigate to the GIS Data Hub page: https://gdh.sonc.nc.geo-comm.com/GMS_API/

3. Click on "Choose A Project"

GEOCOMM GIS Data Hub

Choose A Project

4. For "My Project" choose the State. For "My Client" choose your jurisdiction's Name. Then click "Start Using This Project"

GEOCOMM GIS Data Hub

Choose Your Project

My Project   My Client
--Choose Your Project--   --Choose Your Client--

Start Using This Project
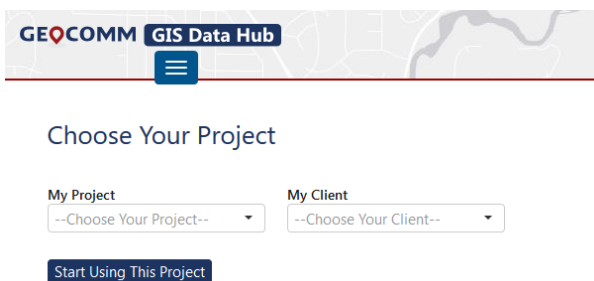
5. Click on "Upload Data"
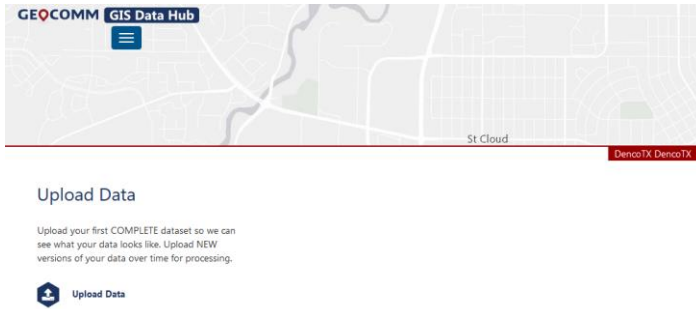
6. Click the "Browse" button and upload a zipped copy of your jurisdiction's GIS data. You can also drag and drop the updated zipped GIS data into the file upload window.

NOTE: If you have added any new layers or made changes to the schema or name of an existing GIS layer since your last submission, choose "Pause! Something changed, I need to update my settings" before uploading your GIS data. Then upload your data and make appropriate changes in the Layer Mapping section of GIS Data Hub. It may take 10-15 minutes for the new layer to show up as an option in the Layer Mapping section. E-mail the NCTeam@geo-comm.com to request QC processing when you have completed the layer and field mapping changes. Also, if any questions arise, send an email to the North Carolina Managed Services Team at NCTeam@geo-comm.com to request assistance.

7. Once the file is listed press the "Upload and Submit" button.

project : Airbus client: Test1

as user: Heidi Ness hness@geo-comm.com

Options

My existing settings work for me.

e! Something changed, I need to update my settings.

To Upload

data for QC checks in a zipped file format.   15.40 Mbit/s | 00:00:05 | 39.83 % | 6.50 MB / 16.32 MB

_E911_20171115NMP.zip   16.32 MB   ⊕ Upload And Submit   Ready For Upload
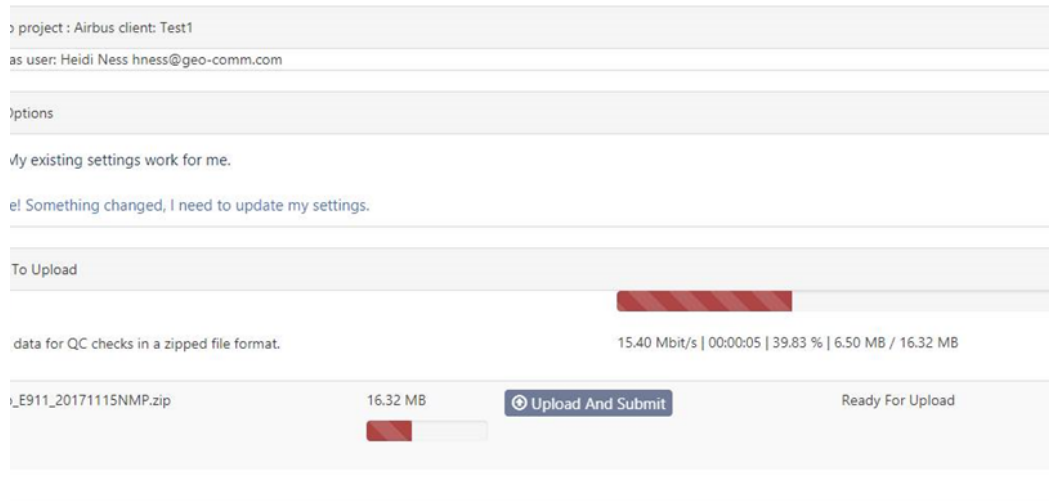
Best Practices for Uploading Data

- All data should be uploaded in a single zipped file

- GIS data can be submitted in shapefile, personal geodatabase, or file geodatabase format up to version 10.6.1

- ALI and MSAG can be submitted as an .xls, .xlsx or .csv file; must be included in the single zip file

- GIS data can be provided in any ArcGIS supported projection with the following exceptions:

    a. Web Mercator Auxiliary Sphere is not supported

    b. County, city, or region-specific custom projections are not supported

- Any GIS data submitted should be free of complex geometry (example: Bezier curves)

    a. Running repair geometry on all shapefiles and/or feature classes can help fix or remove any unwanted geometries and identify missing geometry information.

- Layer name and attribute field names should be free of special characters other than underscores ("_")

- Underscores ('_') or numbers should not be used to start a layer name

- GIS data point layers cannot be multipoint layers

- When submitting data after the first upload:

    - Follow the same layer naming conventions as the originally submitted data

    - Upload all layers when submitting data even if changes were not made to all layers

    Note: If the data is uploaded in a different format than the initial submission you should verify the field names to confirm they have not changed. The conversion between geodatabases and shapefiles can truncate the field names with more than 10 characters.

The Submitter ArcGIS add-on provides an option for jurisdictions to export, zip and upload their GIS data layers directly from within an ArcMap session. The installer, install instructions, and Submitter user guide can be found on the State's NG9-1-1 project landing page at https://it.nc.gov/next-generation-911-gis-services. Please contact NCTeam@geo-comm.com if you have any questions.

5.0 Quality control check reporting

As new GIS datasets are submitted, each feature class, shapefile and table in the dataset is first scanned for validity to be ingested into GIS Data Hub, then processed through pre-determined QC procedures. Once the validity of the data is determined, (i.e., not corrupt, matches documented schema) it is run through an established process to translate the dataset into an internal GeoComm data schema.

Following the translation, the datasets are run through several established automated quality control processes and procedures before translation into the State of North Carolina statewide data schema and incorporation into the statewide dataset. The results of the quality control checks are reported to the local GIS data source entities in multiple ways.

GIS Data Hub Dashboard

The summary report provides a summary of each jurisdiction's latest quality control check results and the latest ALI (Automatic Location Identification) database and MSAG (Master Street Address Guide) to GIS data synchronization check results available at the time the report is generated through the GIS Data Hub Dashboard. All users have access to the Dashboard for their assigned jurisdictions and may pull a current report at any time.

The "Choose Report" dropdown menu has the following options:

- Dashboard – *Results shown in graphs, includes latest resources received*

- Data Quality Analysis Report – *Individual jurisdiction-level summary report (this report is also sent via email after each new GIS Data Hub upload is processed)*

- Summary Report – *State-level summary overview of total errors and critical errors by jurisdiction*

- Resources Received – *Individual jurisdiction-level list of latest resources uploaded to GIS Data Hub*
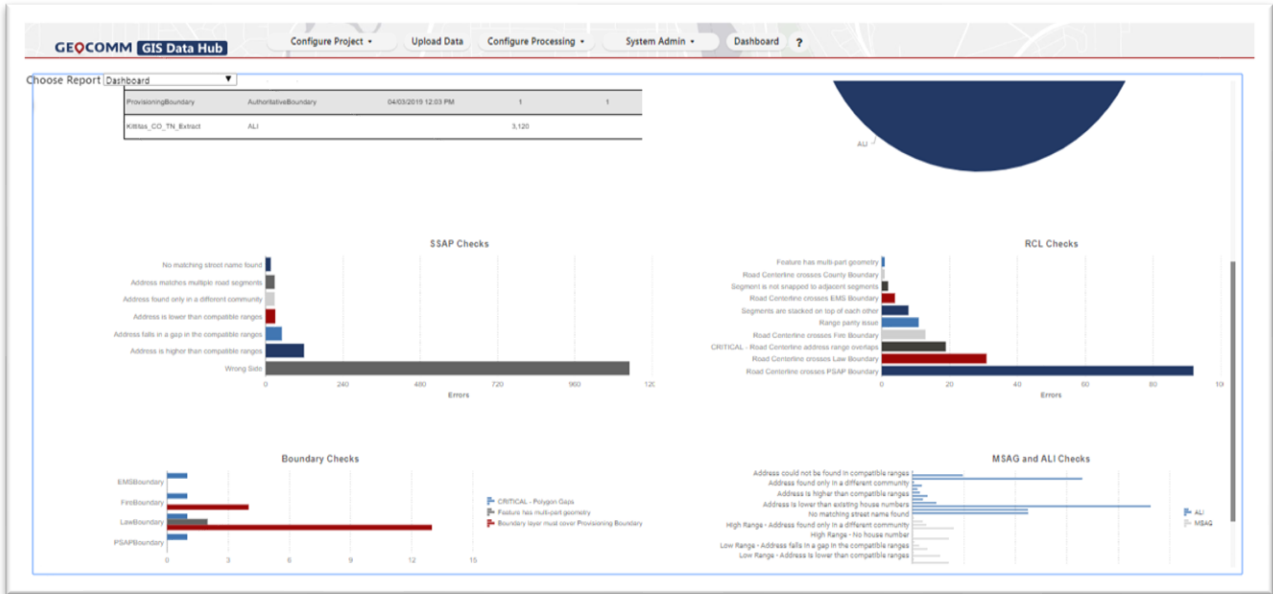
The Dashboard visually depicts the jurisdiction's latest results in graphs by layer type and synchronization checks. The Resources Received table is also included on the Dashboard.

Summary Report - May 2019			
	Total Features	**Errors**	**Sync % / Error Rate**
Adams County			Sync %
ALI_To_RCL	48,556	1,090	97.76%
ALI_To_SSAP	48,556	6,898	85.79%
GIS Data Errors	687,430	14,005	
Critical Errors	687,430	1,308	
Durham County			Sync %
ALI_To_RCL	80,164	1,226	98.47%
ALI_To_SSAP	80,164	5,610	93.00%
GIS Data Errors	827,299	1,371	
Critical Errors	827,299	20	
Richmond County			Sync %
ALI_To_RCL	40,632	233	99.43%
ALI_To_SSAP	40,632	3,692	90.91%
GIS Data Errors	293,085	4,842	
Critical Errors	293,085	8	
Lincoln County			Sync %
ALI_To_RCL	48,131	36,126	24.94%
ALI_To_SSAP	48,131	46,370	3.66%
GIS Data Errors	610,017	46,927	
Critical Errors	610,017	37,303	

The Summary Report shows, by jurisdiction, the number of GIS data features, number of GIS data errors, GIS data critical errors, and ALI database and MSAG to GIS data synchronization results and match rates.

Quality control check detailed results

The GIS data quality control checks and the GIS data to MSAG and ALI database synchronization checks provide detailed results to the individual GIS source entities in Esri file geodatabase and .csv file formats. Upon completion of quality control processes, an e-mail message link to download a zipped file containing the results is sent to registered users for that jurisdiction.

GIS data QC results in .csv and GDB formats

- Upon completion of quality control processes, an e-mail message with a link to download a zipped file containing the following files is sent to registered users for that jurisdiction:

    - a geodatabase with point locations depicting the center of each fallout feature and including quality control check name and description of each fallout feature, split into individual feature classes by QC type. If no QC fallouts were identified by a particular check, no feature class is generated for that QC type.

    - a .csv file with the same information in tabular format plus the ALI and MSAG synchronization results

        - the .csv file can be loaded in the GeoComm Resolver add-on in ArcGIS Desktop for management of the GIS QC results and marking of exceptions – *using Resolver is optional. Additional information provided on the next page.*

        - the ALI database and MSAG to GIS data synchronization results can also be viewed in MS Excel. GeoComm Resolver does not zoom to ALI or MSAG fallout results as there is no location tied to these records.

    - an ETLFallouts.csv file listing feature classes and features that were not accepted and transformed during the ingest process. Features listed in the ETLFallouts.csv are not included in the QC process. ETL fallouts can be caused by field or feature class name changes from upload to upload, corrupt features in the upload, or duplicate SSAPs. If you are unsure of why a feature is reported in the ETLFallouts.csv file, please reach out to the NCTeam@geo-comm.com with questions.

Statewide dataset and topology results

The aggregated statewide dataset along with statewide topology results are provided separately from the individual jurisdiction results. The link to download the most current aggregated dataset and its QC results is as follows:

https://gdh.sonc.nc.geo-comm.com/GMS_API/Admin/Download?projectName=NC&fileURL=http%3A%2F%2Fgdh.sonc.nc.geo-comm.com%2FExports%2FNC_NCStatewide%2FNC_Statewide.zip&packageDescription=Statewide+QC+Report&clientName=NCStatewide

The statewide dataset includes a railroad lines and railroad crossings layer that is updated monthly at the state-level.

The statewide dataset quality control checks include the following:

- Provisioning boundary gaps and overlaps check to identify where neighboring jurisdictions need to coordinate boundary alignment

Note: It is recommended that jurisdictions download these results and the aggregated dataset after each GIS data upload (wait until the following day so latest upload has been aggregated) to confirm their polygon adjustments did not introduce gaps or overlaps with neighboring jurisdictions' data.

The EGDMS aggregated dataset quality control checks include all critical error checks (jurisdiction datasets are added to this as they meet the minimum requirements and are schedule to go live).

See Critical Errors section on page 17 and the QC results table starting on page 19: all QC checks designated as **CRITICAL** in the *QC Settings Description* column are run on the aggregated i3 Ready dataset. These errors need to be resolved as soon as possible after introduction.

The GeoComm team will review these results when a new dataset is added and notify a jurisdiction with reported errors in these categories.

GeoComm Resolver

GeoComm Resolver enables users to interact with GIS data QC results directly in ArcGIS for Desktop.

To install GeoComm Resolver, see Appendix B.

Using GeoComm Resolver, users can view up to 500,000 records within the grid. To view the most current QC process results in the grid, link to the latest downloaded QCFallouts.csv file from the GeoComm Resolver settings.

To configure GeoComm Resolver to read the jurisdiction's data schema and allow marking of exceptions from within the application, these steps need to be followed after installation of the add-in:

1. Download QC results packet

2. Make sure ArcMap and ArcCatalog are closed down

3. Copy the following files from the ResolverFiles folder in the QC results packet:

    a. ResolverSettings.xml

    b. FeatureClassAliases.xml

    c. MappedQCChecks.xml

4. Place these files into the following folder:

    a. C:\ProgramData\GeoComm\Resolver\Settings

    Note: this ProgramData folder may be hidden on your computer. You can navigate to the folder by copying and pasting the above path into a Windows folder.

5. Choose "replace" when prompted

6. Open ArcMap and load Resolver add-in

7. In the Resolver settings, change the file path to the locally saved copy of the results

In addition to viewing the results, depending on individual dataset feature fields and attributes (NGUID and GC_Exception), offending features can be located, and exceptions managed via the GeoComm Resolver grid. See GIS data quality control checks table for QC Check descriptions and associated codes in the GIS data quality control check section of this guide. For more information on managing exceptions, see the Managing exceptions to QC checks section.

Note: To configure GeoComm Resolver to allow you to mark features as exceptions, the NGUID needs to be maintained in the local dataset. This attribute is used to link to the local dataset features.

Emergency Call Routing Function (ECRF)

The ECRF, in conjunction with other components of the ESInet, will utilize the statewide GIS data for routing of 9-1-1 calls.

While not every GIS data QC error must be resolved prior to initial load of an entity's data into the ECRF, there are several GIS data QC errors that are considered critical and need to be completely resolved before initial load. Subsequent data submissions used to keep the ECRF dataset current also may not include any critical errors.

Critical errors

A list of critical errors has been identified and if any critical errors exist in source entity GIS data, loading of GIS updates will be deferred until they are resolved.

The following errors are identified as critical to the ECRF functionality and should be the focus of resolution.

- Invalid value found in PSAP URI field

    - each PSAP has been assigned a URI, which needs to be used to populate the PSAP Route URI field

    Note: Contact the NCTeam@geo-comm.com if you need information about the URI(s) for your jurisdiction(s)

- Invalid value found in the Fire, Law or EMS layers

    - These layers will be used for call transfers in the future. At this time, a temporary URI should be used to populate all features in these layers. This temporary attribute is: tel:1123456789

- Road Centerline address range overlaps (MSAG Community is used for refinement)

- Overlaps of polygons

- Unintended gaps between polygons

- Address Point duplicates

  - The house number prefix, house number, house number suffix, legacy street name components, Unit and Building attributes are used to determine if an address is unique.

  - Any address points that are unique because of Floor, Seat, and/or Additional Location attributes will need to be marked with a '999' exception code as these will be flagged as duplicates by the EGDMS at this time.

- PSAP, Fire, Law and EMS boundary polygons do not completely cover the Provisioning boundary or go beyond Provisioning boundary

- Provisioning Boundary does not cover address points or road centerlines

- Missing values in a mandatory field

- Duplicate or missing NGUID (NG unique IDs)

- Road Centerline Parity Issue

6.0   Understanding GIS data QC results and ALI/MSAG to GIS data synchronization results

As part of the GIS managed services, reports and detailed quality control check results are provided to the source entities for informational purposes, identification of issues, and discrepancy resolution tracking purposes. This section is intended to provide an overview of the checks performed and a description of the intent of the checks. Additional details and logic of the checks are described in the GIS Data Hub Help file.

GIS data quality control checks

This table provides descriptions of each GIS data quality control check result. These values will be reflected in both the jurisdiction summary reports and the detailed results files. Additional details about the logic of each check can be found in the GIS Data Hub Help File.

The "Code" column indicates the exception code that can be entered into the local source entity's exception code field if it is determined that a feature's error needs to be treated as an exception. Multiple exception codes can be entered for a single feature if they are divided by a comma and no spaces.

Topology checks are performed after data is transformed to the WGS84 geographic coordinate system. The default Esri tolerance for WGS84, which is 0.000000008983153 degrees, is utilized when checking topology of features. This x, y tolerance is used to determine the minimum distance between coordinates before they are considered equal. The tolerance in GIS Data Hub is configurable for each topology check. Specifics on the tolerance settings are noted in the QC check details column.

Note: To allow for the slight data shifts that occur during data transformation to the WGS84 geographic coordinate system, which may introduce small gaps and overlaps between boundary polygons submitted by neighboring jurisdictions, the AT&T EGDMS system has been configured with a tolerance of 3,600 square meters. This tolerance is applied to the aggregated dataset checks.

Code	QC Check Name	QC Setting Description	Details
N/A	GEN_Duplicate_Source_Unique_Id	CRITICAL - Duplicate unique ID	If a unique ID field is provided, this check identifies where a source unique ID provided by the client is not actually unique.
003	GEN_MultiPart_Geometry	Feature has multi-part geometry	This check is configured for the following layers: PSAP, fire, ems, law, provisioning, and county boundary layers May be marked as an exception
N/A	GEN_MultiPart_Geometry	CRITICAL - RCL MultiPart Geometry Check	Multi-part road centerline segments are generally not intentional. Identifying them will help uncover possible ambiguous geocoding locations
N/A	RCL_No_Value	CRITICAL - RCL Critical Field(s) are Missing Value	All fields designated as "M" mandatory in data schema are checked and features with missing values reported
N/A	GEN_Value_Outside_Acceptable _Values_ValueList	RCL - CLDXF Pre Direction Value Outside Domain	CLDXF fields need to be fully spelled out and attributes stored in the correct fields. See the NENA CLDXF standard for more information.
		RCL - CLDXF Pre Type Value Outside Domain	
		RCL - CLDXF Post Type Value Outside Domain	
		RCL - CLDXF Post Direction Value Outside Domain	
		RCL - Legacy Pre-Direction Value Outside Domain	Fields such as legacy street type and directional indicators should meet NENA standards
		RCL - Legacy Post Type Value Outside Domain	
		RCL - Legacy Post Direction Value Outside Domain	
N/A	GEN_Field_Values_Outside _Acceptable_Value	CRITICAL – PSAP URI value outside acceptable values	Checks values in the statewide PSAP layer against a valid list of PSAP URIs generated by AT&T

Code	QC Check Name	QC Setting Description	Details
N/A	RCL_Range_Overlap	CRITICAL - RCL address range overlaps	Address range overlaps may cause address location ambiguity during a 9-1-1 call. This is a critical error.
N/A	RCL_Range_Parity	CRITICAL - RCL Parity Issue	Inconsistencies in address parity can uncover incorrect ranging.
105	RCL_Range_FROM_Higher	RCL Range FROM value higher than TO	May be marked as an exception
106	RCL_Direction_Check	RCL incorrect directionality - drawn wrong	Segments that run in opposite direction of all the adjacent segments are generally unintentional.
107	RCL_OneWay_Check	RCL OneWay Value Check	Identifies where roads are spatially continuous but one-way values are inconsistent/incorrect.
111	RCL_Zero_Range_Value	RCL has zero in From or To Value	Zero should be in *both* From and To value if parity is zero
112	RCL_StackedSegment	Segments are stacked on top of each other	May mark as exceptions if intentional and needed to represent multiple road names in neighboring jurisdictions.
200	RCL_TopologySnapping	Segment is not snapped to adjacent segment	Roads should create a continuous network, so segments that are not snapped indicate a possible issue.
201	RCL_Topology_BND	RCL crosses County Boundary	
201	RCL_Topology_BND	RCL crosses State Boundary	
201	RCL_Topology_BND	RCL crosses EMS Boundary	Road centerlines should be broken where they cross a polygon boundary to ensure correct geocoding of addresses that fall close to a boundary line.
201	RCL_Topology_BND	RCL crosses Fire Boundary	
201	RCL_Topology_BND	RCL crosses Law Boundary	
201	RCL_Topology_BND	RCL crosses PSAP Boundary	
202	RCL_Segment_Length	RCL does not meet length	Short segments are often unintentional. This check will uncover segments shorter

Code	QC Check Name	QC Setting Description	Details
			than 10 feet and can be marked as exceptions if they are intentional.
N/A	SSAP_No_Value	CRITICAL - SSAP Critical Field(s) are Missing Value	All fields designated as "M" mandatory in data schema are checked.
N/A	GEN_Value_Outside_Acceptable_Values_ValueList	SSAP - CLDXF Pre Direction Value Outside Domain	CLDXF fields need to be fully spelled out and attributes stored in the correct fields. See the NENA CLDXF standard for more information.
		SSAP - CLDXF Pre Type Value Outside Domain	
		SSAP - CLDXF Post Type Value Outside Domain	
		SSAP - CLDXF Post Direction Value Outside Domain	
		SSAP - Legacy Pre-Direction Value Outside Domain	Fields such as legacy street type and directional indicators should meet NENA standards
		SSAP - Legacy Post Type Value Outside Domain	
		SSAP - Legacy Post Direction Value Outside Domain	
N/A	GEN_Value_Outside_Acceptable_Values_ValueList	CRITICAL – Fire, Law or EMS URI value outside acceptable values	The URI field in the Fire, Law and EMS boundaries is checked to ensure it contains the temporary mandatory value of *tel:1123456789*
N/A	GEN_Value_Outside_Acceptable_Values_ValueList	CRITICAL – PSAP URI value outside acceptable values	The URI field in the PSAP boundary polygons is checked to ensure it contains one of the acceptable, official, URI values assigned by AT&T. This value is used to determine to which PSAP a call should be routed.
401	SSAP_to_RCL	Synchronization issues between SSAP and Road Centerline	This check compares SSAPs to Road Centerlines. It identifies addresses that do not have a matching street name or range in the road centerline layer or are spatially located on the wrong side of the

Code	QC Check Name	QC Setting Description	Details
			road based on road centerline address ranging.
N/A	SSAP_Duplicate	CRITICAL - SSAP address found multiple times within GIS data (address duplication)	Parsed out address fields are concatenated and compared to all other SSAPs to determine if a duplicate exists. Unit, Building, Room, Seat and Additional Location differentiation is taken into consideration by GIS Data Hub. EGDMS only takes Unit and Building into consideration.
N/A	Boundary_No_Value	CRITICAL - Missing values in a critical field	All fields designated as "M" mandatory in data schema are checked for attributes. This check is configured for PSAP, Law, Fire, EMS, County boundary layers. The County boundary layer is not mandatory, so missing values in this layer are not reported as critical errors.
N/A	BND_Topology_Gap	Polygon Gaps (non-critical)	County boundary gap check. 8 square foot tolerance configured.
N/A	BND_Topology_Gap	CRITICAL – Polygon Gaps	This check applies to PSAP, Law, Fire and EMS boundary layers. In instances of gaps found by the ECRF, transfer calls will be routed based on closest polygon or default route settings. 8 square foot tolerance configured.
601	BND_Topology_Overlap	Polygons Overlap (non-critical)	County boundary overlap check. 8 square foot tolerance configured.
N/A	BND_Topology_Overlap	CRITICAL – Polygon Overlaps	This check applies to PSAP, Law, Fire and EMS boundary layers. Overlaps may cause ambiguity in call routing and call transfers. 8 square foot tolerance configured.
N/A	BND_DoesNotCoverAuthBndry	CRITICAL - Boundary layer must cover Provisioning Boundary	The PSAP, fire, law and ems boundaries are checked to ensure they fully cover the Provisioning Boundary.

Code	QC Check Name	QC Setting Description	Details
N/A	BND_Overhangs	CRITICAL - Boundary Overhangs Authoritative Boundary	The PSAP, fire, law and ems boundaries are checked to ensure they do not extend beyond the Provisioning Boundary.
N/A	BND_DoesNotCoverFeatures	CRITICAL - Provisioning Boundary does not cover Road Centerline	All submitted road centerlines and address points need to fall within the submitted Provisioning Boundary layer. Any features that fall outside of the Provisioning Boundary are reported as errors unless marked with '999' exception code.
N/A	BND_DoesNotCoverFeatures	CRITICAL - Provisioning Boundary does not cover SSAP	
N/A	ALI_No_Value	Missing values in a critical field	Street address components missing from ALI database record
N/A	ALI_To_SSAP	Synchronization issues between ALI and SSAP	Results directly correlate to landline record validation to GIS data (LVF & ECRF results)
N/A	ALI_To_RCL	Synchronization issues between ALI and Road Centerline	Results directly correlate to landline record validation to GIS data (LVF & ECRF results)
N/A	MSAG_No_Value	MSAG Critical field(s) are missing value	Street address components, ESN or MSAG Community missing from MSAG record
N/A	MSAG_100_BLOCK	Synchronization issues between MSAG and Road Centerline	MSAG low and high range addresses are compared to the road centerline to find an address, ESN and MSAG community match for each record.

Additional exception codes

This table provides the list of additional exception code options to be utilized for features that should be removed or modified prior to quality control due to special circumstances.

Code:	Use:
999	Road centerline feature and SSAP features to be completely removed from submitted dataset prior to quality control process. These features will not be provisioned to the statewide dataset.
701	Left ranges in road centerline feature will be zeroed out before starting QC (for dual carriageways)
702	Right ranges in road centerline feature will be zeroed out before starting QC (for dual carriageways)

Code:	Use:
703	Only first point found with this address will be retained, and duplicates removed. To ensure that these duplicates are truly in the same location on the map (not true duplication errors of addresses in different locations), before removing the ones marked with this code, they are checked to make sure they are in the same physical location.

ALI database and MSAG to GIS data synchronization check results

Result	QC Setting Description	Details
MSAG No value	Missing values in critical field	Low range, high range, street name, ESN and MSAG community are checked.
ALI No value	Missing values in critical field	House number, street name, ESN and MSAG community are checked.
ALI to Road Centerline and ALI to SSAP synchronization checks		
Fail on Full Street Name	No matching street name found	ALI record full street name not found in RCL or SSAP dataset.
Fail on Zone	Address found only in a different community and/or ESN	ALI address number and full street name matches, but record is found in a different zone (community or ESN) than RCL or SSAP
Found multiple times	Address found multiple times	ALI address is found multiple times either in SSAP or road centerline record.
Fail on Address Range	Address falls in gap in the compatible ranges or could not be found in compatible ranges	ALI full street name and zone matches RCL, but address number falls outside of road centerline ranges.
	Address is higher than compatible ranges	
	Address is lower than compatible ranges	
Fail on Address Number	Address lies between existing house numbers	ALI full street name and zone matches SSAP, but no exact address number match can be made.
	Address is lower than existing house numbers	
	Address is higher than existing house numbers	

Result	QC Setting Description	Details
Fail on Address Number Suffix	Address found with different house number suffix	ALI address number, full street name and zone matches SSAP, but not exact address number suffix match can be made.
MSAG to Road Centerline synchronization check		
MSAG_100_BLOCK	High Range - No house number	High or low range not populated in MSAG record
	Low Range - No house number	
MSAG_100_BLOCK	No matching street name found	The street name in the MSAG was not found in the roads file.
MSAG_100_BLOCK	Address is higher than compatible ranges	The street name exists in the road centerline layer, but the low or high range number of the MSAG record cannot be found in the road centerline ranges.
	Address is lower than compatible ranges	
	Address could not be found in compatible ranges	
	Address falls in a Gap in the compatible ranges	
MSAG_100_BLOCK	Address found only in a different community and/or ESN	The street name exists in the roads file, but the MSAG address is found in a different boundary.
MSAG_100_BLOCK	Fail – Address found multiple times	The street name and range were found multiple times in the roads file.

Correcting and managing quality control check results

The GIS Data Hub help file is a great resource to help get a better understanding of the QC check logic. It provides examples of different types of errors.

The GIS Data Hub help file is accessible from within GIS Data Hub. It opens a separate window with this link: https://gdh.sonc.nc.geo-comm.com/GMS_WebHelp/GIS%20Platform%20-%20User/Content/Home%20Links.htm

Managing exceptions to QC checks

Marking certain features as QC exceptions is an option but should be used sparingly. To utilize exception codes, a field specifically for exception codes needs to be added to the source entity GIS data layers. The *GC_Exception* field may be included for each feature class as outlined in the field mapping spreadsheet.

The purpose of utilizing the *GC_Exception* field in one or more layers is to provide a mechanism to report GIS data features as exceptions to specific types of fallout results. In subsequent QC reports, the same GIS data feature will not be reported as a discrepancy. The unique ID fields also need to be maintained and populated to manage exceptions using the GeoComm Resolver add-on tool.

For more information on managing exceptions using GeoComm Resolver, see the GeoComm Resolver help.

To manually maintain the *GC_Exception* field, rather than through GeoComm Resolver, the *Codes* in the GIS data quality control checks table should be referenced by the entity managing the GIS dataset and should be added and separated by commas, no spaces (i.e.,105,200,201).

Note: polygon gaps cannot be marked as exceptions because they are not tied to a specific feature.

ALI and MSAG to GIS data synchronization check results

The purpose of the ALI to GIS data comparison check is to identify records that are not synchronized. Keeping the databases in sync will be an on-going process until the MSAG is replaced with the LVF, which will utilize the statewide GIS data created through aggregation of the GIS data submitted by the local entities.

7.0 Seamless statewide dataset

In order to achieve a seamless statewide dataset, as desired for NG9-1-1, several guidelines and quality control mechanisms need to be put in place and followed. The information in this section provides an overview of guidelines and mechanisms needed to achieve a seamless statewide dataset.

Border points for road centerlines meeting at boundaries

Another important aspect of a seamless dataset is the road centerline and boundary layer topology. As GIS data is maintained by several different entities in disparate systems, the exact geographic location road centerline segment endpoints or boundary vertices meet at borders between the GIS data source entities is impossible to match without a reference layer to indicate the exact location to both entities. *Border points (aka stitch points)* will be created by GeoComm as multiple neighboring dataset submission are received to assist in the effort of creating a topologically accurate seamless, statewide dataset.

The border points layer will be made available at a future date on the State of North Carolina project site.

The points will be placed at each vertex location along a provisioning boundary's border (identical to outside PSAP boundary) and at road endpoints for roads that cross the boundary. Two points will be placed if points between neighboring counties do not match. The local GIS source entities should work together to agree to the exact locations and snap the endpoints of their road centerline segments and add a vertex to the boundary polygons at each border point location along a boundary polygon. In addition to a seamless road centerline layer, this will reduce boundary polygon overlaps and gaps in the statewide

dataset. Once the border points have been established between jurisdictions, they should be used for reference any time GIS data edits are made on border roads.

An accurate, fully developed border point layer, with established guidelines that is understood and agreed upon by all entities, assists in the assurance of a continuous seamless dataset.

Note that exception code "999" may be used for road centerline segments present in a local dataset that fall outside that GIS source entity's jurisdiction.

Mutual aid coverage areas extending beyond county boundaries

Most PSAP boundaries coincide with the county boundary, but in some areas, mutual aid agreements dictate that a PSAP's boundary extends beyond the county boundary. It is important to keep in mind that the PSAP boundary coverage area and underlying GIS data boundary polygons, road centerlines and address points should be maintained and submitted into the NG9-1-1 system by the jurisdiction responsible for that PSAP. The PSAP boundary coverage area corresponds to the MSAG for that PSAP.

In cases where the PSAP boundary extends beyond a county boundary, the neighboring jurisdictions need to coordinate submittal of the associated GIS data to avoid overlapping data submissions. If both jurisdictions wish to maintain the same coverage area for display purposes in the dispatch mapping system, adding the "999" exception code to the features within this overlapping area will ensure they are removed from one jurisdiction's data submission before aggregation and thus will not create duplication in the aggregated dataset.

8.0   GeoComm Services Bureau support information

GeoComm is available to provide support if needed. Regular office hours are Monday through Friday, 9:00 a.m. – 5:30 p.m. Eastern Time. After-hours emergency support is best reached by calling 1.866.837.7379.

State of North Carolina Managed Services team contact information is below followed by GeoComm's response time commitment.

Phone	**E-mail**
1.844.282.4507 (direct line to GIS team)	NCTeam@geo-comm.com
9:00 a.m. – 5:30 p.m. M–F	9:00 a.m. – 5:30 p.m. M–F

When calling in for support, ask for the *State of North Carolina team*. If routed to the automated answering service during regular business hours, choose the "GIS" option, then ask for the State of North Carolina team.

If calling for assistance with critical or major impact to the system after regular business hours and on weekends, choose the "Tech Support" option.

Priority:	Description:	Response time:
Critical Impact – Service Not Available	• Service is unavailable or halted • Data is unavailable or nonfunctional • Service productivity or functionality is severely compromised • There is a complete loss of service for all End users and there is no ability to avoid or reduce the incident via a workaround.	Less than two clock hours 24 x 7
Major Impact – Severely Impaired	• Service performance/functionality for all End users is seriously impaired or degraded • Data accuracy is seriously impaired • There is no ability to avoid or reduce the effect of the incident via a workaround.	Less than four clock hours 24 x 7
Minor Impact – Minimal Degraded Performance or Functionality; Single User Issues	• Service has encountered a non-critical issue with minimal loss of performance/functionality • Data accuracy is minimally degraded • May be identified as a functional defect • Complete stoppage of a single End User • A partial loss of service for an End User and there is a way to reduce the effect or completely avoid the impact of the incident via a workaround at a reasonable cost	Less than 16 business hours Monday through Friday 8 a.m. to 5 p.m. Central Standard Time
Low Impact – Single User Application	• Service is unavailable or degraded (not a complete work stoppage) for a Single End User.	Less than 24 business hours Monday through Friday

9.0   Appendix A | USPS Publication 28 and CLDXF Street Name Values

Legacy Street Suffixes

GIS data attributes in the legacy street suffix fields should follow these NENA USPS street suffixes publication standards.

ALY,ANX,ARC,AVE,AV,BYU,BCH,BND,BLF,BLFS,BTM,BLVD,BR,BRG,BRK,BRKS,BG,BGS,BYP,CP,CYN,CPE,CSWY,CTR,CTRS,CIR,CIRS,CLF,CLFS,CLB,CMN,CMNS,COR,CORS,CRSE,CT,CTS,CV,CVS,CRK,CRES,CRST,XING,XRD,XRDS,CURV,DL,DM,DV,DR,DRS,EST,ESTS,EXPY,EXT,EXTS,FALL,FLS,FRY,FLD,FLDS,FLT,FLTS,FRD,FRDS,FRST,FRG,FRGS,FRK,FRKS,FT,FWYGDN,GDNS,GTWY,GLN,GLNS,GRN,GRNS,GRV,GRVS,HBR,HBRS,HVN,HTS,HWY,HL,HLS,HOLW,INLT,IS,ISS,ISLE,JCT,JCTS,KY,KYS,KNL,KNLS,LK,LKS,LAND,LNDG,LN,LGT,LGTS,LF,LCK,LCKS,LDG,LOOP,MALL,MNR,MNRS,MDW,MDWS,MEWS,ML,MLS,MSN,MTWY,MT,MTN,MTNS,NCK,ORCH,OVAL,OPAS,PARK,PKWY,PASS,PSGE,PATH,PIKE,PNE,PNES,PL,PLN,PLNS,PLZ,PT,PTS,PRT,PRTS,PR,RADL,RAMP,RNCH,RPD,RPDS,RST,RDG,RDGS,RIV,RD,RDS,RTE,ROW,RUE,RUN,SHL,SHLS,SHR,SHRS,SKWY,SPG,SPGS,SPUR,SQ,SQS,STA,STRA,STRM,ST,STS,SMT,TER,TRWY,TRCE,TRAK,TRFY,TRL,TRLR,TUNL,TPKE,UPAS,UN,UNS,VLY,VLYS,VIA,VW,VWS,VLG,VLGS,VL,VIS,WALK,WALL,WAY,WAYS,WL,WLS

CLDXF Street Name Pre and Post Types

NENA Registry System | Street Name Pre-Types and Street name Post Types

http://technet.nena.org/nrs/registry/StreetNamePreTypesAndStreetNamePostTypes.xml

CLDXF Street Name Pre-Type Separators

 NENA Registry System | Street Name Pre-Type Separators

http://technet.nena.org/nrs/registry/StreetNamePreTypeSeparators.xml

Street Directionals – Legacy and CLDXF

Legacy	CLDXF		Legacy	CLDXF
N	North		NE	Northeast
E	East		SE	Southeast
S	South		NW	Northwest
W	West		SW	Southwest

10.0 Appendix B | GeoComm Resolver – Installing, setting up, and help documentation

The information below provides high-level instructions for installing and setting up GeoComm Resolver and accessing its help documentation. Please contact the NCTeam@geo-comm.com to request the GeoComm Resolver installer for ArcGIS Desktop versions 10.5 and 10.6.

- The GeoComm Resolver package includes a zip file with the GeoComm Resolver installer and installation instructions.

- After installation, help documentation to assist in setting up and using GeoComm Resolver is provided within the product.

When setting up the link to the QCFallouts.csv file, reference the local, downloaded copy of the latest QC results. Note: A suggested method for keeping the view in the grid current is to overwrite the local, linked copy of the QCFallouts.csv file each time new results are available for download from the GIS Data Hub.

11.0 Appendix C | QC corrections tips & tricks

Priorities

The first priority should be to add and populate all mandatory fields. The errors associated with unpopulated mandatory fields are named "critical fields missing values". Populating these fields can greatly reduce the error count.

GeoComm's recommendation for error resolution in order of priority and efficiency is as follows:

1. Populate mandatory fields

2. Ensure unique IDs in every layer are globally unique

3. Correct boundary gaps and overlaps

4. Correct road range overlaps

5. Resolve Site/Structure address point duplicates

6. Manage multi-unit locations

7. Correct Site/Structure address point to road centerline fallout

8. Correct ALI database to road centerline fallout

9. Split road centerlines at every intersection and where roads cross any boundary polygon

10. Ongoing coordination with neighboring jurisdictions to ensure boundary alignment

Instructions

Populate mandatory fields

List of mandatory fields

Road Centerlines		
Discrepancy Agency ID	CLDXF Street Name component (i.e., "Main" in "Main Street")	Left/Right State^
Date Updated	Legacy Street Name component (i.e., "Main" in "Main St")	Left/Right Incorporated Municipality*
Unique ID (NGUID)	Parity Left/Right – a script is available to assist with this process, see landing page	Left/Right MSAG Community
From/To Left/Right ranges	Left/Right County	Left/Right Country^

*populate with "UNINCORPORATED" for areas outside municipalities

Site/Structure Address Points		
Discrepancy Agency ID	CLDXF Street Name component (i.e., "Main" in "Main Street")	State^
Date Updated	Legacy Street Name component (i.e., "Main" in "Main St")	Incorporated Municipality#
Unique ID (NGUID)	County^ & Country^	MSAG Community

#populate with "UNINCORPORATED" for areas outside municipalities

PSAP Boundary		
Discrepancy Agency ID^	State^	Display Name
Date Updated	Agency ID*	Service URI
Unique ID (NGUID)	Service URN^	Agency vCardURI*

Emergency Service Boundary Layers (Fire, Law, EMS)		
Discrepancy Agency ID^	State^	Display Name

Date Updated	Agency ID*	Service URI*
Unique ID (NGUID)	Service URN^	Agency vCardURI*

Provisioning Boundary
Discrepancy Agency ID^
Date Updated
Unique ID (NGUID)

County Boundary	
Discrepancy Agency ID^	State^
Date Updated	County^
Unique ID (NGUID)	Country

Incorporated Municipality Boundary		
Discrepancy Agency ID^	State^	Incorporated Municipality Name
Date Updated	County^	
Unique ID (NGUID)	Country^	

^field can be set to auto-populate in GIS Data Hub, instead of having to be maintained locally

*mandatory fields for which instruction has not yet been provided. No need to populate at this time.

Ensure unique IDs in every layer are globally unique

- For NGUID (NG9-1-1 Unique ID) management, we suggest using Esri's Attribute Assistant toolset or append your jurisdiction's name or your jurisdiction's *Discrepancy Agency ID* to an existing GlobalID (if available)

- It is suggested to include a layer name designation as part of the NGUID to avoid duplication between layers

    - RCL_1@bertncso1.bertie.nc.us

    - SSAP_1@rcmdncec1.richmond.nc.us

- To confirm IDs are unique prior to submission to GIS Data Hub, run a summarize of the NGUID field in each layer before submitting

Correct boundary gaps and overlaps

- Begin with defining PSAP boundary(ies)*

- Create the Provisioning boundary which is required to be 100% covered by the emergency service boundaries, including PSAP

- Align all other emergency service boundaries to match the defined outer edge of the Provisioning boundary

*During the transitional period, your PSAP boundary must match your MSAG coverage. In a full NG9-1-1 system, PSAP boundaries can be defined based on desired call routing. Associated GIS provisioning coverage must be coordinated with neighboring GIS submitters to ensure no overlap or duplication is introduced into the aggregated statewide dataset.

Correct road range overlaps

- Investigate reported road range overlaps and determine how to fix. Common issues include:

  - Mixed parity on one side of the road range (i.e., 1-99 and 1-98).

  - Typo in range field causing multiple overlaps with one segment (i.e., three adjacent segments are ranged: 2-48/1-49, 50-98/51-99 and 10-198/101-199 so all lower ranged blocks will overlap until the range on the third segment is updated to 100-198).

  - Road segments are split or copied without ranges being updated.

- Resolving road range overlaps also resolves SSAP and ALI database synchronization issues that are reported as "address found multiple times".

Manage multi-unit locations

- Add one master address point without unit information for each multi-unit building to the Site/Structure address point layer. The Location column in the ALI database is not utilized for the synchronization check due to non-standardized ALI location information, so a master/main address point is needed for ALI database record match.

Correct Site/Structure address point to road centerline fallout

- Start correcting no matching street name errors.

- Compare and fix any MSAG community differences.

- Resolve house numbers that do not match road centerline ranges (either correct ranges or update address points if the address point house number is invalid).

Note: Upload corrected GIS data layers before proceeding to the ALI database to road centerline corrections as road centerline changes may have introduced new errors or resolved previous ALI database to road centerline mismatches. During the next step, keep in mind that any street name and

MSAG community variations need to be reconciled between the ALI database, MSAG, road centerline and Site/Structure address point attributes.

Correct ALI database to road centerline fallout

- Start correcting no matching street name errors. If the correction is needed in the road centerline, then this can potentially resolve many ALI database fallout records and also uncover new MSAG community mismatches.

- Once all no matching street name errors are resolved, begin working through ALI database records with house numbers that are *higher than or lower than compatible ranges, could not be found in compatible ranges*, or *falls in a gap in the compatible ranges*.

- The remaining error type is *address found only in a different community*. Investigate these errors to determine if the GIS data is correct or the ALI database is correct. If the GIS data is correct, request MSAG modifications to correct the ALI database.

Split road centerlines at every intersection and where roads cross any boundary polygon

- Road centerlines need to be split at every intersection to ensure calls plot on the correct side of an intersection.

- Road centerlines need to be split and snapped to a boundary vertex where roads cross a boundary to ensure a call plots in the correct boundary.

- When splitting roads at intersections or when crossing ESN boundaries (Medical, Fire, Law), ensure that the road ranges are adjusted to account for these changes. Using the split tool in the Esri standard editing tools does not adjust the road ranges automatically. In fact, this creates duplicate road ranges which in turn will be flagged as critical errors in the GIS Data Hub quality control check results.