Army National Guard: Common Installation Picture

Chris Argentieri
Brooks Smith

Agenda

- Introduction
- Goals/Purpose of Common Installation Picture program
  - History of CIP processes
  - Integration with the Regulations/QAP's
- CIP Components
- Processes
- Long Term Results
- Project Milestones and Major Accomplishments
- Benefits of Current Tools/program
  - Customizable- Any rules for any type of GIS data
    - Add additional layers to Rules
    - Minimum requirements for contract submitted data

Introduction

- Common Installation Picture (CIP)
  - ARNG IGI&S Program – ILI/ILE request for EXISTING GIS data
  - Is not just tools, supported process
- Components
  - Program Management
  - Guidance Documentation
  - Data Models
  - Custom Python Scripts/Geoprocessing Tools
  - Real Property Databases

The National Guard Bureau (NGB) manages a set of geospatial data which comprises up to 60 vector layers selected from the SDSFIE v 2.6. This Common Installation Picture (CIP) is used by Army Reserve National Guard (ARNG) States/Territories and Headquarters to visualize information associated with ARNG missions. The following document describes the CIP Quality Assurance Program (QAP) process for the collection, standardization, and maintenance of the CIP geospatial data.

Introduction

- Quality Assurance Plans (QAPs)
  - Defines Feature Classes
  - Defines minimum Attribution
  - Defines Relationship to Environmental Regulation or Real Property Policies
- Data Model
  - Spatial Data Standards for Facilities, Infrastructure, and Environment (SDSFIE)
  - CIP - Subset of 60 Feature Classes
    - ILI datasets - built infrastructure, Real Property
    - ILE datasets - soils, wetlands, environmental hazards
  - Provides Standardized Platform that captures a majority of Real Property assets

Introduction

- CIP as a Process
  - Iterative process by nature (goal is improvement year to year)
  - Four Custom Geoprocessing Tools to automate QA/QC process
    - Tool 1 – Name and geometry checks
    - Tool 2 – Spatial checks; Real Property comparison
    - Tool 3 – Attribute checks
    - Tool 4 – Layer Extraction Tool
  - States utilize tools to produce standardized SDSFIE 2.6 datasets
    - States Run Tools and make corrections based on tool outputs
    - Minimum attribution in compliance with ARNG QAP's
  - Extract data to send to NGB for QA/QC
  - NGB Aggregates all States CIP data into Nationwide dataset

CIP – Regulations and Memos

- IGI&S Regulations
- OSD
  - Defense Installation Spatial Data Infrastructure Group
    - Oversight of DOD IGI&S investment
    - DISIDI CIP
  - ARMY
    - Installation Geospatial Information and Services
      - **AR 115-13 Installations Geospatial Information and Services (IGI&S)**
  - Master Planning
    - NGR 210-20 Real Property Development Planning for ARNG
    - NG PAM 210-20 Real Property Development Planning for ARNG
  - Many other regulations which support Geospatial Data Collection

Goals and Purpose of CIP

- Integration with RP regulations (QAP's based on RP)
- History
- Benefits

Purpose of CIP

- Headquarter Level
  - Support Headquarter Level Data Request
  - Supports Headquarter Analysis
  - Insight into State's Data holdings
- State Level
  - Satisfy SDSFIE Compliance requirement
  - Reduce "ad hoc" data calls
  - Data Development priorities in the absence of local requirements

Goals

- Standardize 54 State and Territory datasets
- Generate one standardized Nationwide dataset
- Assist in Real Property Reconciliation
  - Automates Real Property Validation with GIS data
- Provide Baseline for ISR Reporting on GIS program

History of the CIP

- Started as annual data call
  - NGB requested data annually
  - NGB took data and loaded into SDSFIE 2.6 compliant databases,
  - NGB generated “to-do list” of issues regarding quality for the States
- Weaknesses
  - Ended up with two data sets (State and NGB) that had diverged during the process
  - At best, edits were required in two databases or did not end up in production data
  - Process lacked transparency
  - Elements of the data checks were unclear
  - Lacked flexibility
    - Schedule and data schema

Benefits of New Approach

- Goal - provide value at State while satisfying ARNG-ILI/ILE requirements
- Flexibility
  - Four open windows to deliver data
  - Tools run at installation or state wide level
- Transparency
  - Allows States to utilize tools and understand process
- Customizable
  - State GIS personnel customize layers and attributes to check
  - Work with “CIP+” datasets
- Dual Purpose
  - Provides a systematic data QA for state’s production dataset

CIP Components

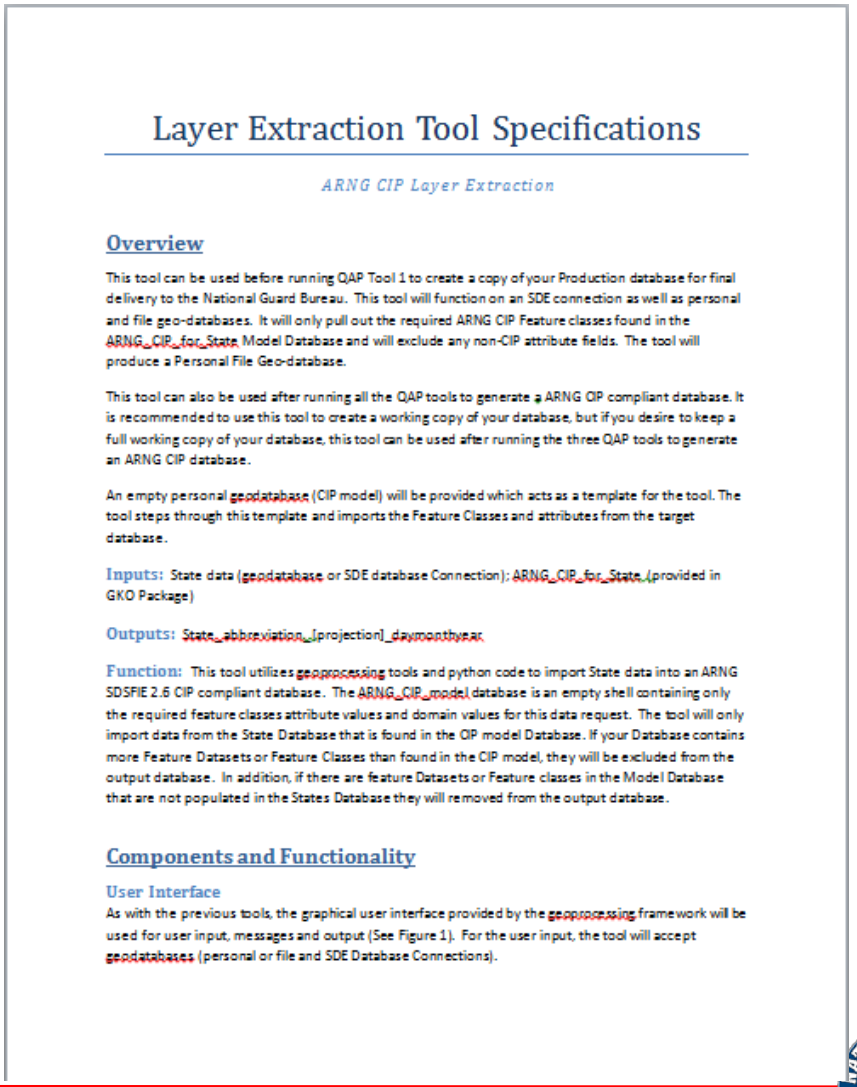
- Program Management
- Guidance Documentation
- Data Model
- Databases
- Custom Geoprocessing Tools

Program Management

- Constant Improvements to Process
  - ‘Living Program’ is adaptable - responsive to Stakeholder feedback
  - Tool enhancements and upgrades
  - Direct feedback to Users on how to improve the data
- Training
  - DCO- Individual hands-on training sessions
- CIP Technical Support Center
  - Deal with issues from users
  - Answer Questions/concerns from users

Guidance Documentation

- Quality Assurance Plans
  - Based on OACSIM QAP's
  - Modified for ARNG requirements
  - Defines Geospatial Elements
    - Feature Classes
    - Definitions
    - CATCODES
    - Attributes
- Documentation
  - Tool Specification documents
  - 'How To' documents



Layer Extraction Tool Specifications

ARNG CIP Layer Extraction

Overview

This tool can be used before running QAP Tool 1 to create a copy of your Production database for final delivery to the National Guard Bureau. This tool will function on an SDE connection as well as personal and file geo-databases. It will only pull out the required ARNG CIP Feature classes found in the ARNG_CIP_for_State Model Database and will exclude any non-CIP attribute fields. The tool will produce a Personal File Geo-database.

This tool can also be used after running all the QAP tools to generate a ARNG CIP compliant database. It is recommended to use this tool to create a working copy of your database, but if you desire to keep a full working copy of your database, this tool can be used after running the three QAP tools to generate an ARNG CIP database.

An empty personal geodatabase (CIP model) will be provided which acts as a template for the tool. The tool steps through this template and imports the Feature Classes and attributes from the target database.

Inputs: State data (geodatabase or SDE database Connection); ARNG_CIP_for_State (provided in GKO Package)

Outputs: State_abbreviation_[projection]_daymonthyear

Function: This tool utilizes geoprocessing tools and python code to import State data into an ARNG SDSFIE 2.6 CIP compliant database. The ARNG_CIP_model database is an empty shell containing only the required feature classes attribute values and domain values for this data request. The tool will only import data from the State Database that is found in the CIP model Database. If your Database contains more Feature Datasets or Feature Classes than found in the CIP model, they will be excluded from the output database. In addition, if there are feature Datasets or Feature classes in the Model Database that are not populated in the States Database they will removed from the output database.

Components and Functionality

User Interface

As with the previous tools, the graphical user interface provided by the geoprocessing framework will be used for user input, messages and output (See Figure 1). For the user input, the tool will accept geodatabases (personal or file and SDE Database Connections).

Data Model

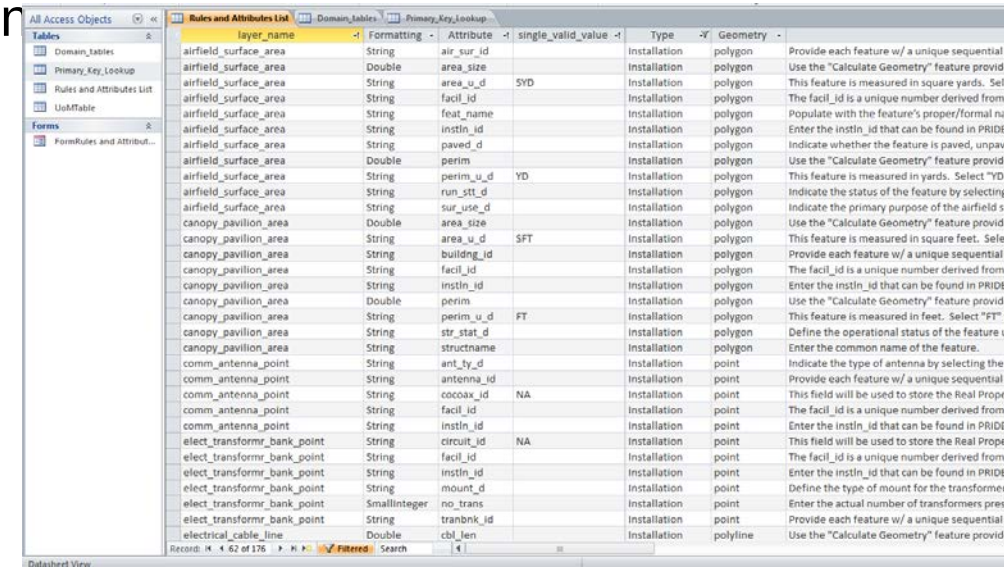
- SDSFIE 2.6

SDSFIE | Spatial Data Standards for Facilities, Infrastructure, and Environment

- CIP is a subset of 60 Feature Classes
  - Representing Real Property and Environmental
  - Standardized subset of ‘Recommended’ Attributes
    - Documented in QAP
    - Rules Database
- Benefits of using a standard data model
  - Provides a unified data structure and organization across the National Guard
  - Provides a standard naming convention for fields and attributes
  - Facilitates sharing of data & development of common GIS tools
  - Simplifies Aggregation of multiple Databases
  - Provides foundation for automated QA/QC process

Databases

- ‘Logic’ Behind the Tools
  - Allows for Modification Without Re-writing the Tools
  - Can be used for Quick Referen
- Rules database
  - Feature Classes
  - ‘Recommended’ Attributes
  - Domain Values
  - Primary Key
  - Error messages for Tools

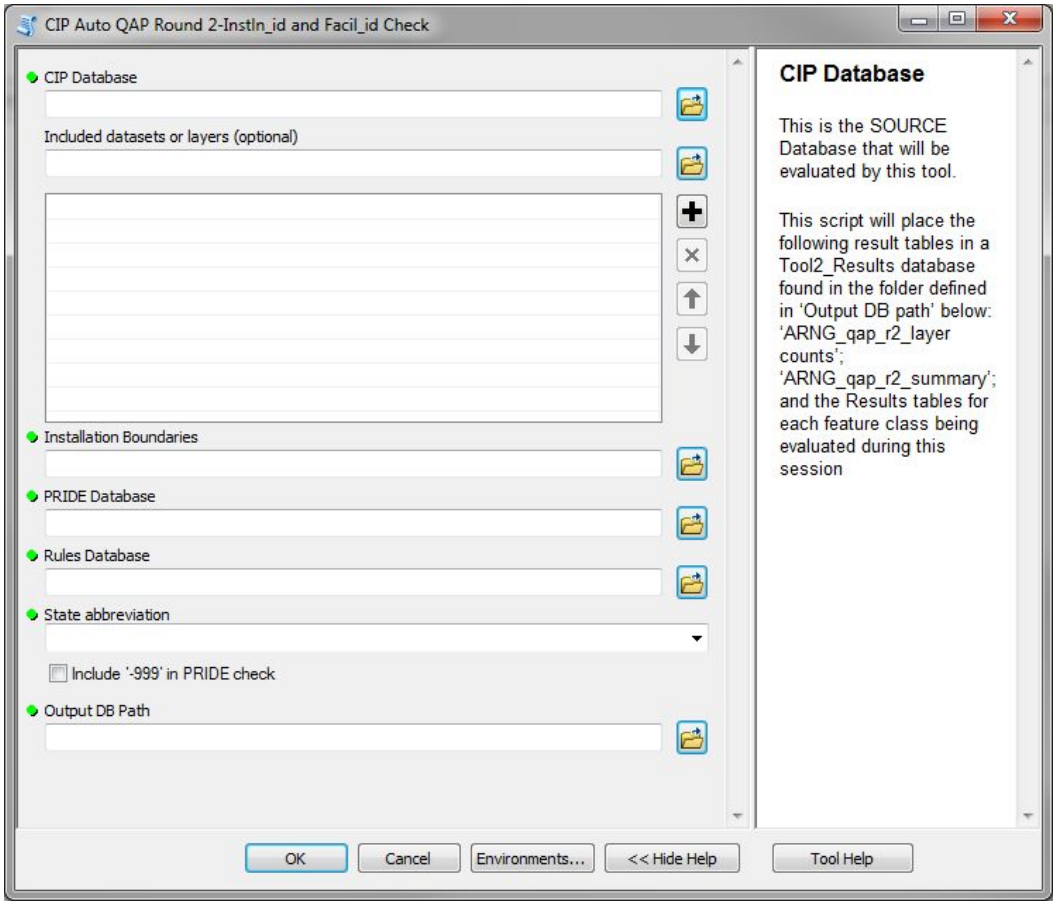


Databases

- PRIDE database
  - Current Real Property Inventory
    - Facility Id provides link from PRIDE to records in GIS
    - Installation Id = Site Code
    - CATCODE
    - Quantity/Unit of Measure
  - CATCODE Cross walk
    - Aligns SDSFIE feature classes to ARMY CATCDs
    - Able to Validate RP Facility is in the Correct FC

Custom Geoprocessing Tools

- Automates QA/QC processes
- Utilizes external databases for rules and logic
- Iterative in Nature
  - State Builds Upon Previous FY CIP Tool Corrections
  - Makes Corrections Manageable- able to run one feature class at a time



Rules and Attributes List

Rules Field Name	Field Definition	Example Input	Required for Tools	Tool 1	Tool 2	Tool 3
ID	Access Auto Populate Field	N/A	None			
analyst_narrative	Descriptive text for what should be populated into the Attribute	This feature is measured in square yards. Select “SYD” from…	None			
Tier	Legacy Data for ‘Tier’ that FC was added to CIP	1,2,3	None			Yes
Type	If the FC is associated with ILI or ILE	Installation or Environmental	Some			Yes
layer_name	SDSFIE 2.6 CIP Feature Class Name	structure_existing_area	All	Yes	Yes	Yes
Geometry	Feature Class Geometry Type	Point, line, polygon	Some	Yes		Yes
Attribute	Feature Attributes to be checked by Tools	instln_id, facil_id, etc.	All	Yes	Yes	Yes
attribute_definition	Definition of Attribute from SDSFIE or QAP	The unit of measure for area.	None			
single_valid_value	Populated if there is only one acceptable value for Attribute	M, FT, SFT	Some		Yes	
can_be_null	Identifies if Field can be Null for Result Message	YES or NO	Some			Yes

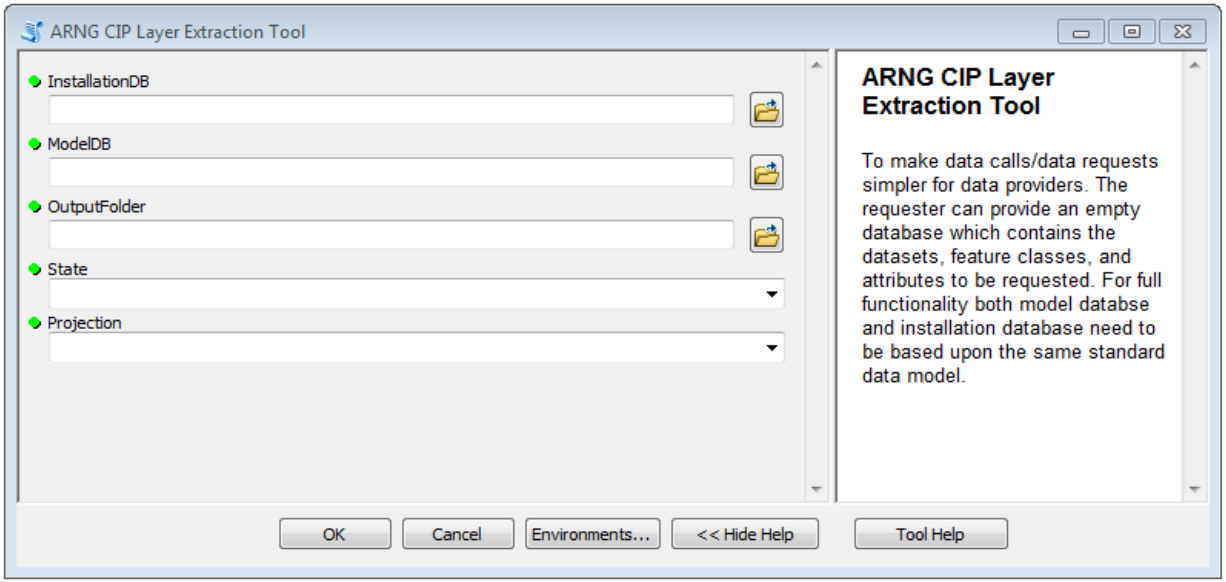
Rules and Attributes List, con't.

Rules Field Name	Field Definition	Example Input	Required for Tools	Tool 1	Tool 2	Tool 3
recommend_QAP_ update	ID's the Attribute that will contain the Primary Key	Primary Key	None			
layer_ name_ error_message	Corrective action if FC Name Does not match the CIP	Incorrect Layer Listed for Attribute				
maximum_data_length	Field Length for Schema Standardization	16, 20, 9999, etc.	Some			Yes
exceeds_max_char_ length_message	Result if attribute does not match value in Max Data Lgth field	exceeds 16 characters	Some			Yes
Formatting	ID's if the Field is a Number or String value	String, Integer, Double	Some			Yes
Incorrect_format_error_m essage	Corrective action message for incorrect 'Formatting' entry identified by Tool	Data Format Type needs to be changed to Character	Some			Yes
formatting_rule	Description of what to populate into the "Formatting" field	Any Alphanumeric combination is Valid	Some			Yes
reference_domain_table	Specific Domain Table name for Attribute	d_uomdis, d_uomvol, d_boolen, etc.	Some			Yes
null_value_message_1	Result message for specific attribute it is associated with	Recommended Primary Key value.	Some			Yes
null_value_message_2	Result message for specific attribute it is associated with	Recommended format…	Some			Yes

Custom Geoprocessing Tools:

Layer Extraction Tool

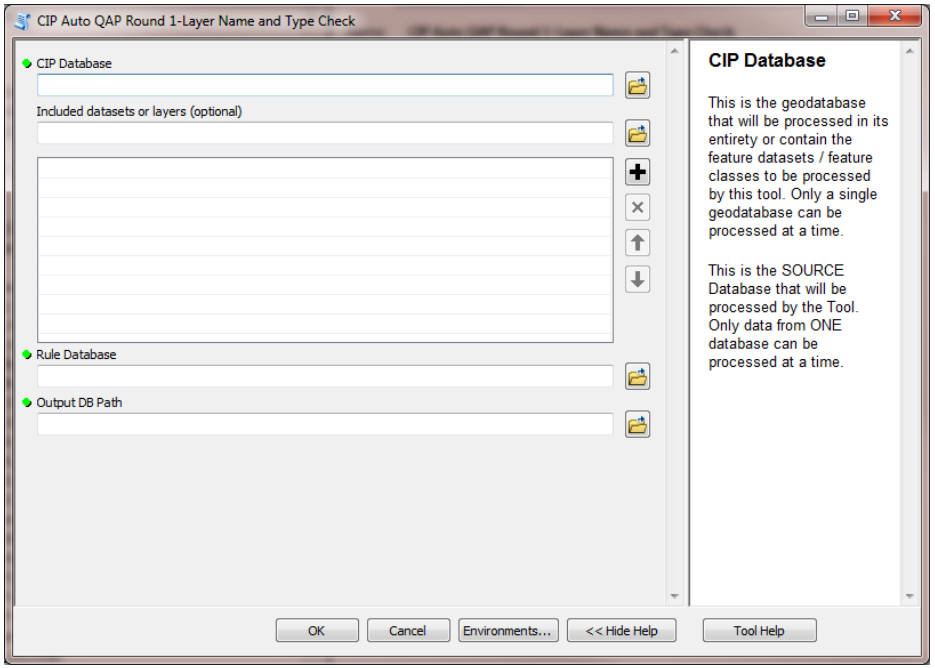
- Extract CIP Data from Larger Database/datasets
- Limits Extraneous Results in QAP tools 2&3
- Provides Easy Process for Deliverables
- Uses an Empty CIP Model to Build New Database



Custom Geoprocessing Tools:

CIP Auto QAP Round 1-Layer Name and Type Check

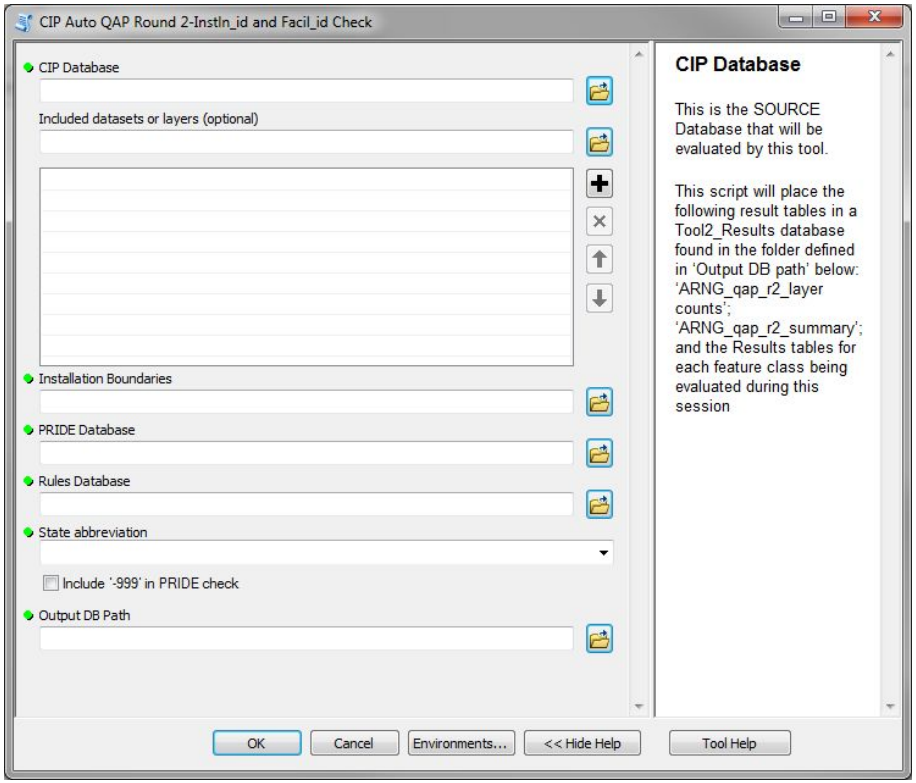
- Validates Database Schema
  - Feature Class Names
  - Geometry Type
- Utilizes Rules Database
  - Feature Classes Can Be Added or Removed
- Performs Geometry Check
  - Self Intersecting Polygons
  - Short Segments
- Provides Standardization For Other Tools



Custom Geoprocessing Tools:

CIP Auto QAP Round 2-Instln_id and Facil_id Check

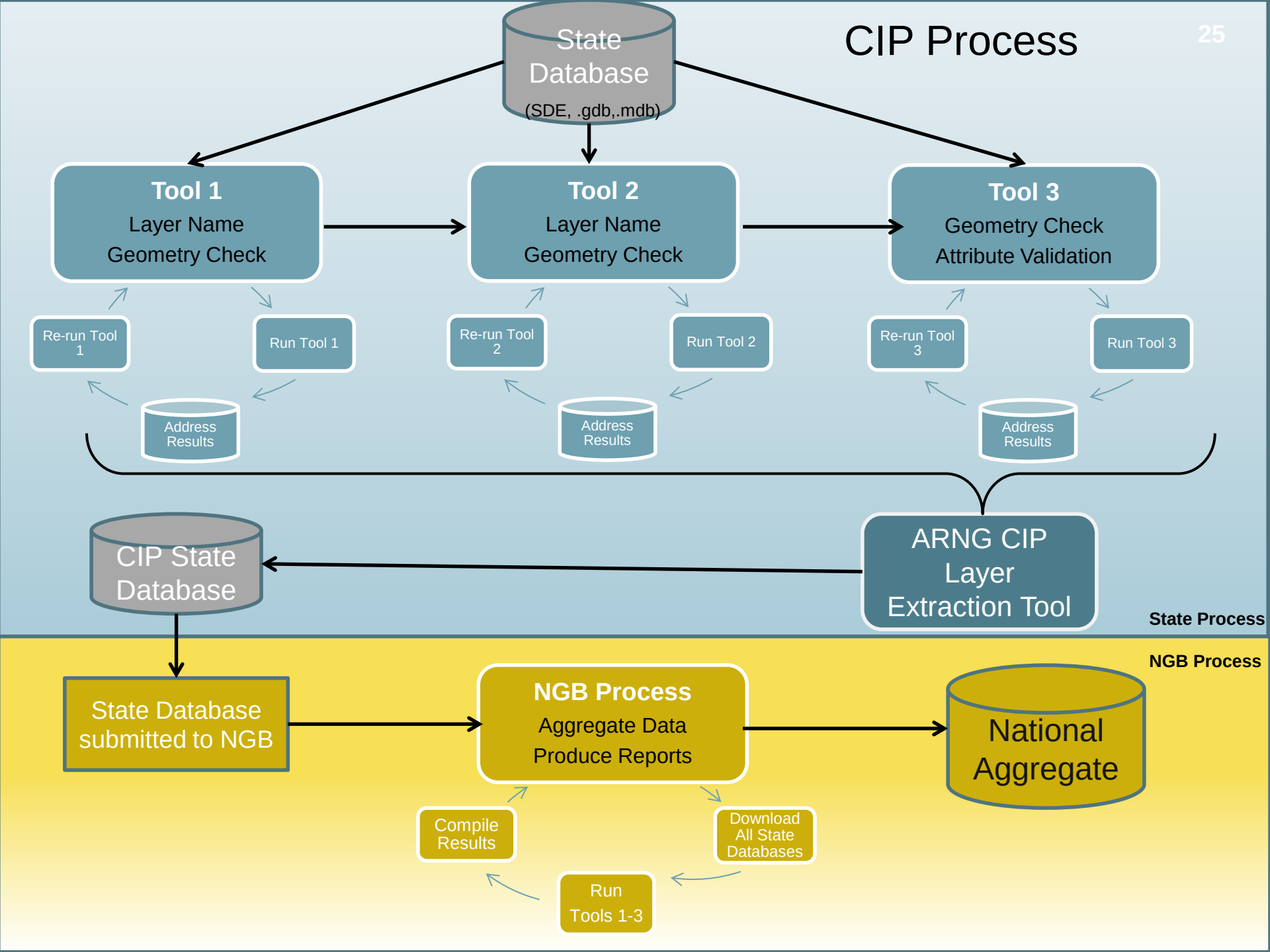
- Compares GIS Data to Real Property Inventory
- Validates Installation Id Attribute
  - Installation ID is in Real Property Inventory
  - Spatial Location of Feature
- Validates Facility ID
  - Exists in Real Property Inventory
    - Provides Result if it Does Not
- Validates Feature is in Correct FC
    - CATCODE of the Facility in RP Inventory



CIP Processes

- State Processes
- NGB Processes

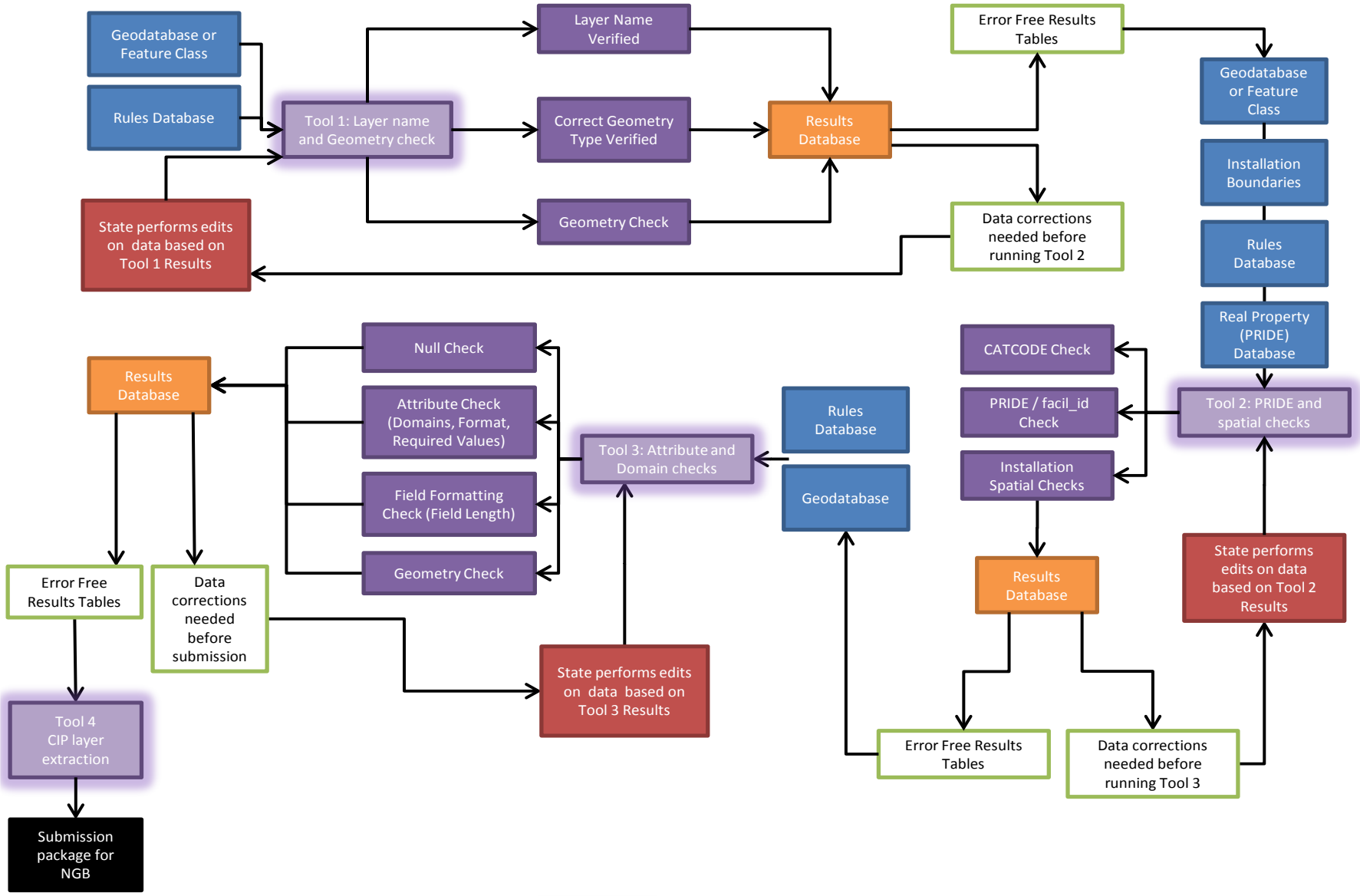
CIP Process

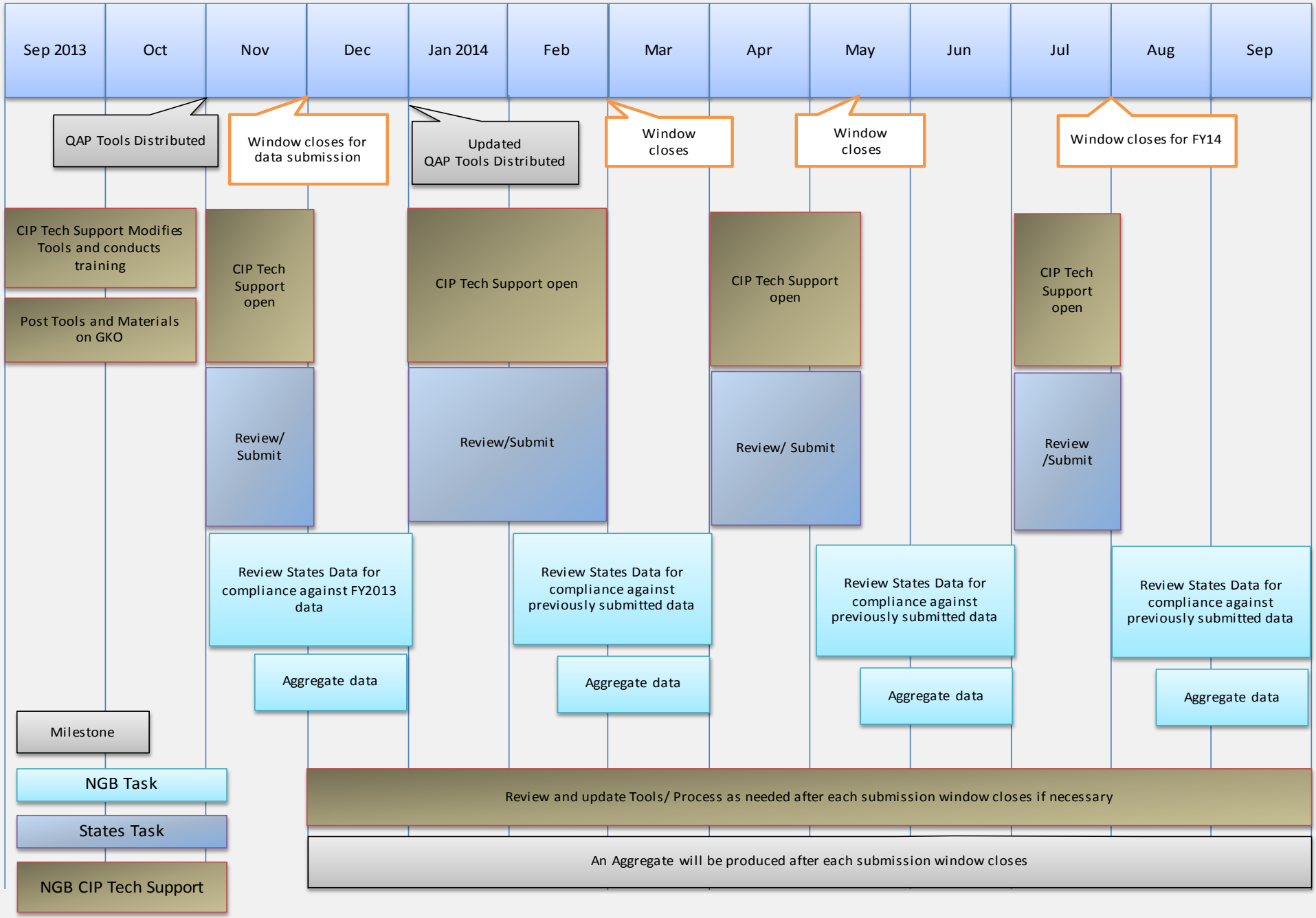

State Database
(SDE, .gdb,.mdb)
Tool 1
Layer Name
Geometry Check
Tool 2
Layer Name
Geometry Check
Tool 3
Geometry Check
Attribute Validation
Re-run Tool 1
Run Tool 1
Re-run Tool 2
Run Tool 2
Re-run Tool 3
Run Tool 3
Address Results
Address Results
Address Results
CIP State Database
ARNG CIP Layer Extraction Tool
State Process
NGB Process
State Database submitted to NGB
NGB Process
Aggregate Data
Produce Reports
National Aggregate
Compile Results
Download All State Databases
Run Tools 1-3

State Processes

- Download latest package/Tools from GKO

- Run Tools on production data
- Make any modifications to data identified by tool results
- Extract Data from production database
- Send complete CIP database to NGB


Geodatabase or Feature Class
Rules Database
Tool 1: Layer name and Geometry check
Layer Name Verified
Correct Geometry Type Verified
Geometry Check
Results Database
Error Free Results Tables
Data corrections needed before running Tool 2
State performs edits on data based on Tool 1 Results
Geodatabase or Feature Class
Installation Boundaries
Rules Database
Real Property (PRIDE) Database
Tool 2: PRIDE and spatial checks
CATCODE Check
PRIDE / facil_id Check
Installation Spatial Checks
Results Database
Error Free Results Tables
Data corrections needed before running Tool 3
State performs edits on data based on Tool 2 Results
Results Database
Null Check
Attribute Check (Domains, Format, Required Values)
Field Formatting Check (Field Length)
Geometry Check
Tool 3: Attribute and Domain checks
Rules Database
Geodatabase
Error Free Results Tables
Data corrections needed before submission
State performs edits on data based on Tool 3 Results
Tool 4 CIP layer extraction
Submission package for NGB
Key:
Tool Inputs
CIP Tool
Tool Function
Results /Error Report
Data Validation Step
Data Corrections Edits Needed
Final Deliverable


Sep 2013
Oct
Nov
Dec
Jan 2014
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
QAP Tools Distributed
Window closes for data submission
Updated QAP Tools Distributed
Window closes
Window closes
Window closes for FY14
CIP Tech Support Modifies Tools and conducts training
Post Tools and Materials on GKO
CIP Tech Support open
CIP Tech Support open
CIP Tech Support open
CIP Tech Support open
Review/ Submit
Review/Submit
Review/ Submit
Review /Submit
Review States Data for compliance against FY2013 data
Review States Data for compliance against previously submitted data
Review States Data for compliance against previously submitted data
Review States Data for compliance against previously submitted data
Aggregate data
Aggregate data
Aggregate data
Aggregate data
Milestone
NGB Task
States Task
NGB CIP Tech Support
Review and update Tools/ Process as needed after each submission window closes if necessary
An Aggregate will be produced after each submission window closes

NGB Processes

- Download State Submitted data from GKO portal
- Run QAP Tools to identify any outstanding issues
- Make modifications to State data if necessary
  - Standardize UOM fields
  - Populate any NULL values if possible
  - Populate domains fields with coded values if needed
- Generate Reports for States to review
  - Spreadsheets for each tool and how to correct remaining issues
  - Post Reports and Data edits to back to GKO for States to review
- Once submission window closes, generate Aggregate from States that submitted

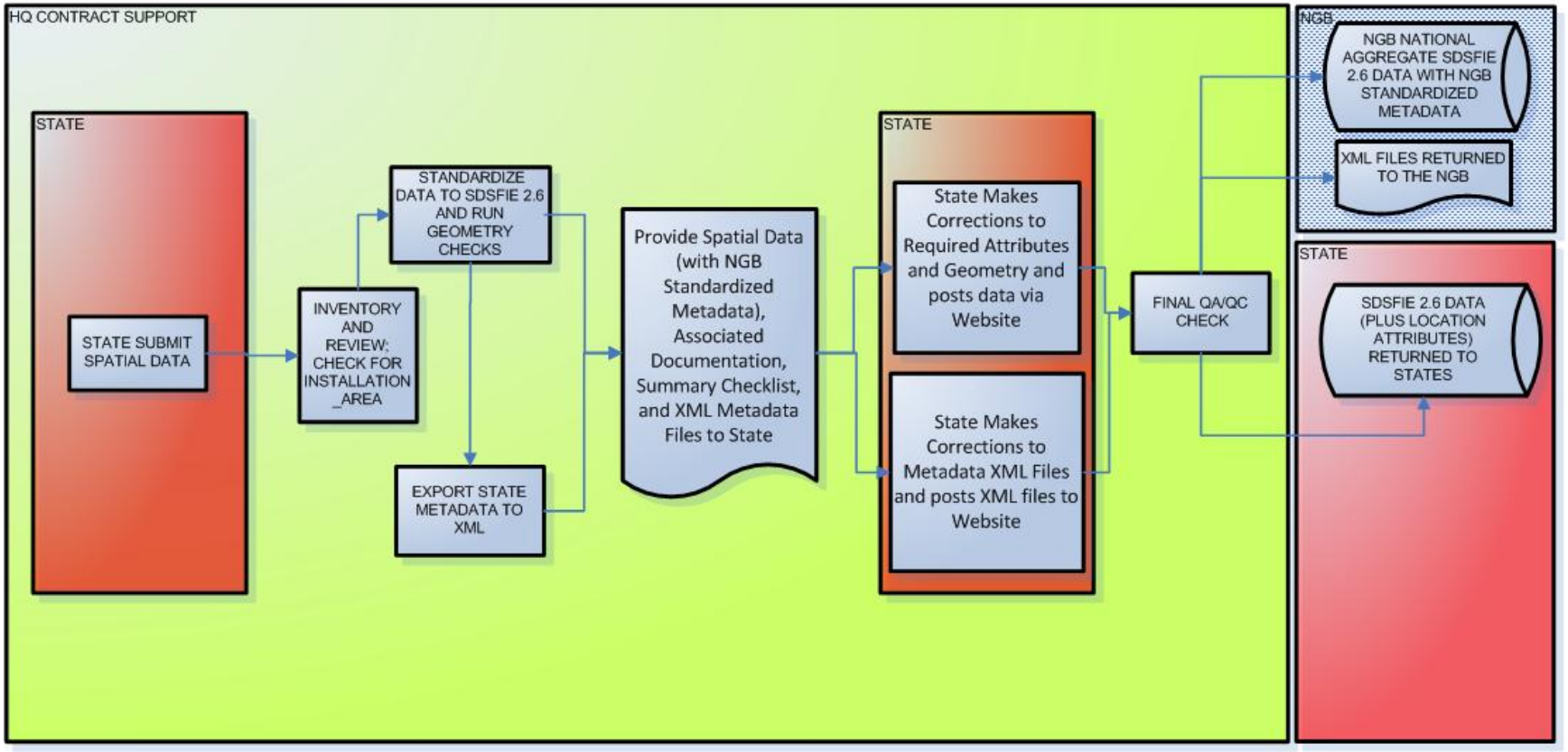
CIP Evolution
Advantages and Benefits

- Historical Approach
- Legacy Processes Limitations
- Current Program
- Advantages/benefits

Historical Approach

Army National Guard

Tier 4 CIP Process



Historical Approach

- Strengths
  - Data was standardized
  - Second pair of eyes on Data for QA/QC
- Limitations
  - Lack of flexibility with schedule
  - Inter dependencies on other parties
  - Black box of rules that generated checklist

Current Program

- Strengths/Advantages
  - Streamline CIP process with tools and program modifications
  - Real Property Reconciliation built into CIP workflow
    - RP reconciliation at state level- users know data best
  - Incorporate CIP process into current workflows
  - Customizable- Additional rules for any non CIP feature classes
  - Adaptable- feedback from States-able to modify processes and tools based on users needs
- Benefits of QAP Python Tools
  - Customizable
  - Rules are the business logic behind tools and are changeable
  - RP reconciliation- tools identify GIS features that are not in PRIDE
    - New tool will identify GIS not in PRIDE and PRIDE not in GIS

Inherent Value Added

- States can incorporate CIP process into current workflows
  - Minimum requirements for contractor submitted data
  - Run QAP tools as new features are added to database

- Less data gaps due to quarterly submissions
  - Multiple submission windows allow states to work on CIP data when most feasible for them
  - States have direct input to what edits are made to the data
  - Streamline process which empowers States to maintain data per NGB guidelines

Additional Benefits: Customized Rules

- CIP QAP Tools can be run on non-CIP feature classes
- Stand-alone database/tool format allows database modification
- Allows States to conduct QA/QC on any SDSFIE feature classes
- Allows for standardization of additional State feature classes and databases

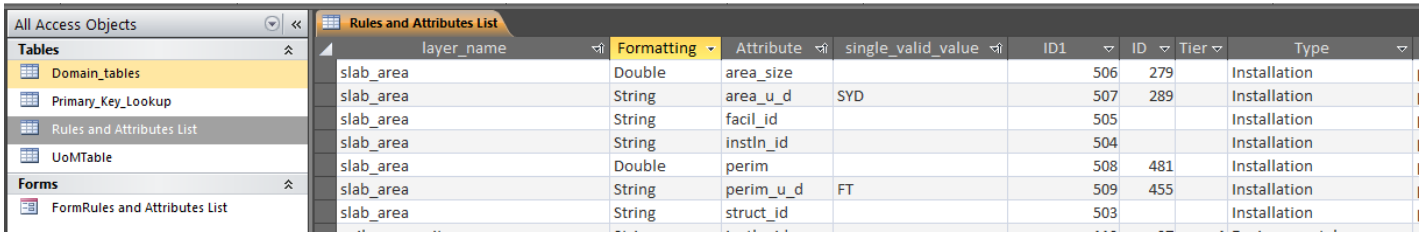
IGI&S Program Geospatial Data Layer QAP – Slab and Pad

Table 4 - Required Populated Attributes

Common Name	Attribute		Definition	SDSFIE 3.1 Army Adaptation Acceptable Values[2]	Attributed Example
	SDSFIE 2.610	SDSFIE 3.1 Army Adaptation[2]			
IGI&S GENERATED					
Facility Number	n/a[1]	facilityNumber	A locally developed asset identification that is normally visible, either painted or by signage on the exterior of a real property facility, used for visual identification of the facility.	HQIIS FCLTY_NMBR Value	02459
Installation Code	instln_id	installationID	The code assigned by the Military Service or Agency used to identify the site or group of sites that make up an installation.	HQIIS PRNT_INSTL_CD Value	51105
Real Property Asset Unique Identifier	facil_id	realPropertyUniqueIdentifier	The real property unique identifier (RPUID) is a non-intelligent code used to permanently and uniquely identify a real property asset.	HQIIS RPA_UID Value	611409
Real Property Site Unique Identifier	n/a[1]	realPropertySiteUniqueID	The unique identifier (UID) used to permanently identify a Site.	HQIIS SITE_UID Value	4980
Slab or Pad Identifier	struct_id	structureIDPK	Primary Key. A unique, user-defined identifier for each record or instance of an entity.	<Site Identifier> plus <HQIIS FCLTY_NMBR Value>	498002459

Additional Benefits: Customized Rules

- Creation of duplicate Rules and PRIDE databases recommended
  - Required attributes need to be identified
  - Required attributes should be added into latest CIP_Rules database
  - PRIDE database should be cross referenced with feature class Army QAP, CATCODES may need to be added



layer_name	Formatting	Attribute	single_valid_value	ID1	ID	Tier	Type
slab_area	Double	area_size		506	279		Installation
slab_area	String	area_u_d	SYD	507	289		Installation
slab_area	String	facil_id		505			Installation
slab_area	String	instln_id		504			Installation
slab_area	Double	perim		508	481		Installation
slab_area	String	perim_u_d	FT	509	455		Installation
slab_area	String	struct_id		503			Installation

- Tool results format will be unchanged allowing States to ensure all feature classes match CIP requirements

Milestones and Major Accomplishments

- Data Quality Improvement
- Most complete Aggregate

Data Improvements

- Feature Count for all Feature Classes has increased
  - 2009* – 203,009 Features
  - 2010* – 303,998 Features
  - 2013* – 318,749 Features
- Installation Area Feature Count
  - 2009 – 190
  - 2010 – 1,385
  - 2013 – 2,174
- Structure_existing_area Feature Count
  - 2009 – 11,672
  - 2010 – 29,168
  - 2013 – 29,421

*Minus road_centerline features. Previous submissions did not clip roads to a 1mile radius around installations as in 2013

Questions?