

Coal Mining Spatial Infrastructure Prototyping Report

Prototype Goals:

- **Download spatial coal mining data from multiple geodata servers located both inside and outside of OSM WAN**
- **Re-Project the downloaded data into a Lat/Long System**
- **Remap downloaded data attributes to match the national schema for coal mine permit boundaries**
- **Merge all downloaded data into a single dataset**

The Technology

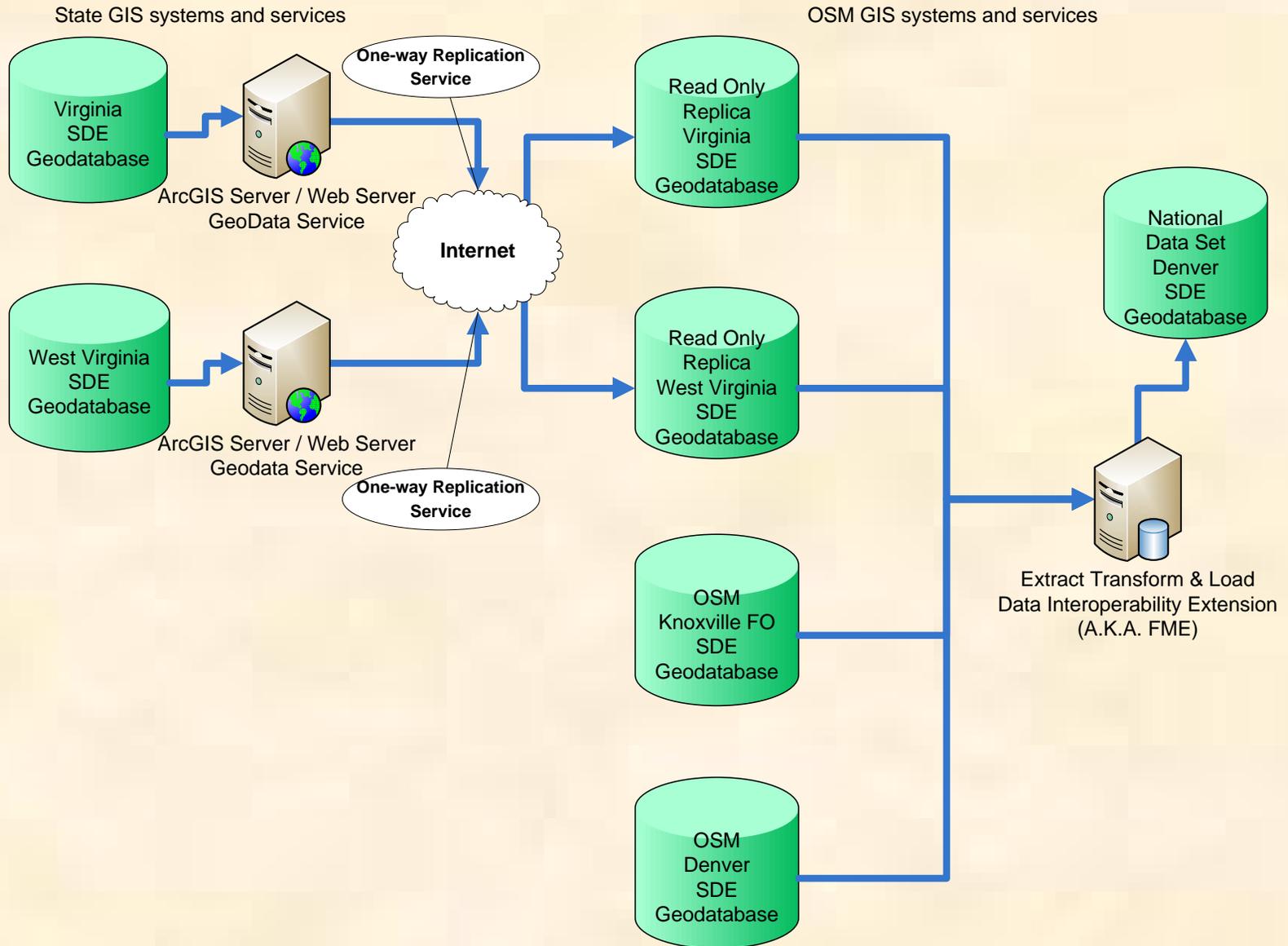
ArcGIS Server 9.2 - Geodata services allow users to publish geographic data for extraction, and replication.

ArcSDE technology is an integrated part of ArcGIS Server and is used to access multiuser geographic databases stored in relational database management systems (RDBMS).

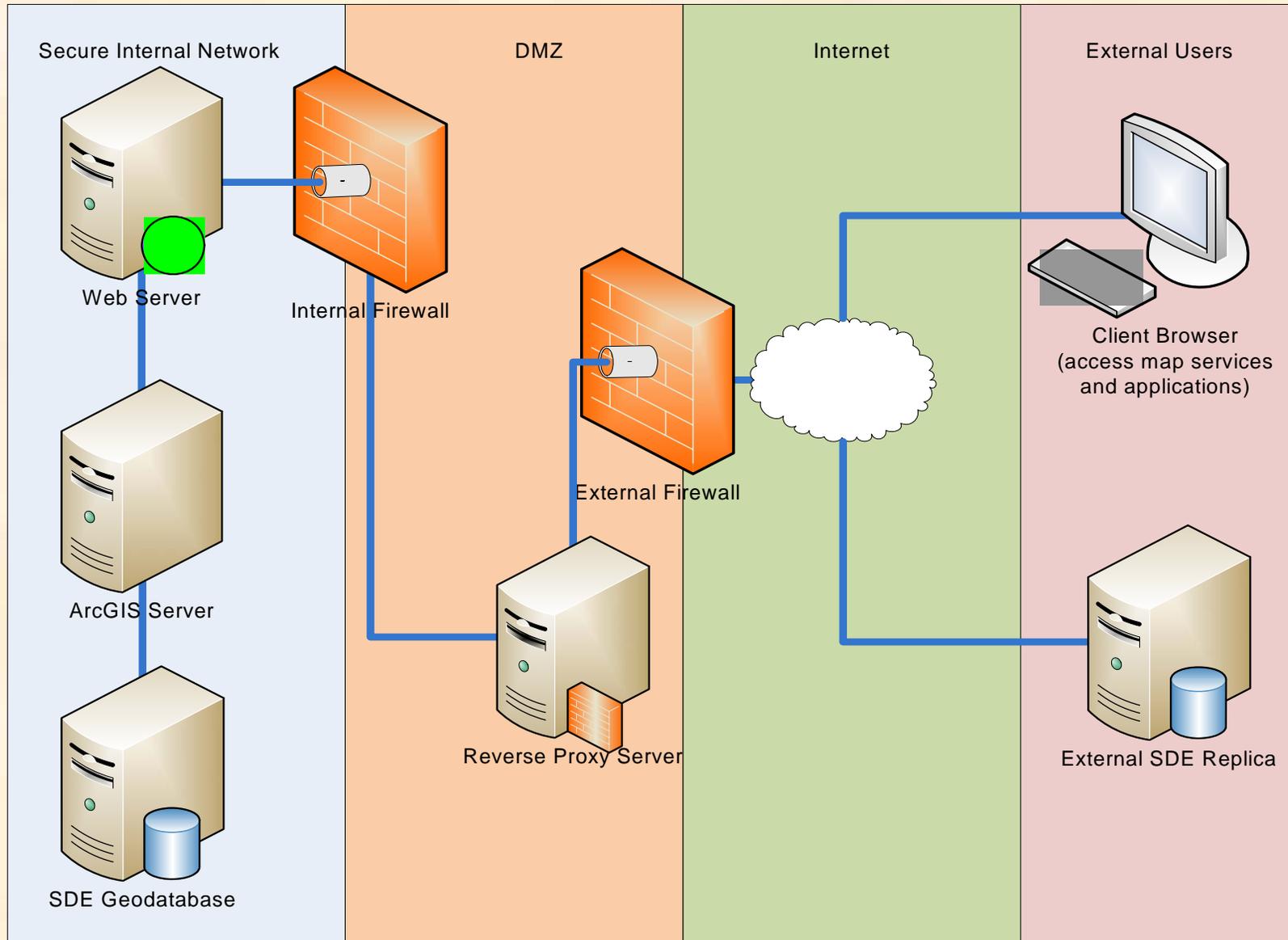
ArcGIS Desktop (ArcInfo 9.2) - gives you the power to manage and integrate your data, perform advanced analysis, model and automate operational processes, and display your results on professional-quality maps

The ArcGIS Data Interoperability is an ArcGIS extension that eliminates barriers to data sharing by providing state-of-the-art direct data access, complex data transformation, and import/export capabilities. This extension uses Safe Software's FME technology. The Feature Manipulation Engine (FME) Suite is an ETL (Extract, Transform, Load) tool for spatial data.

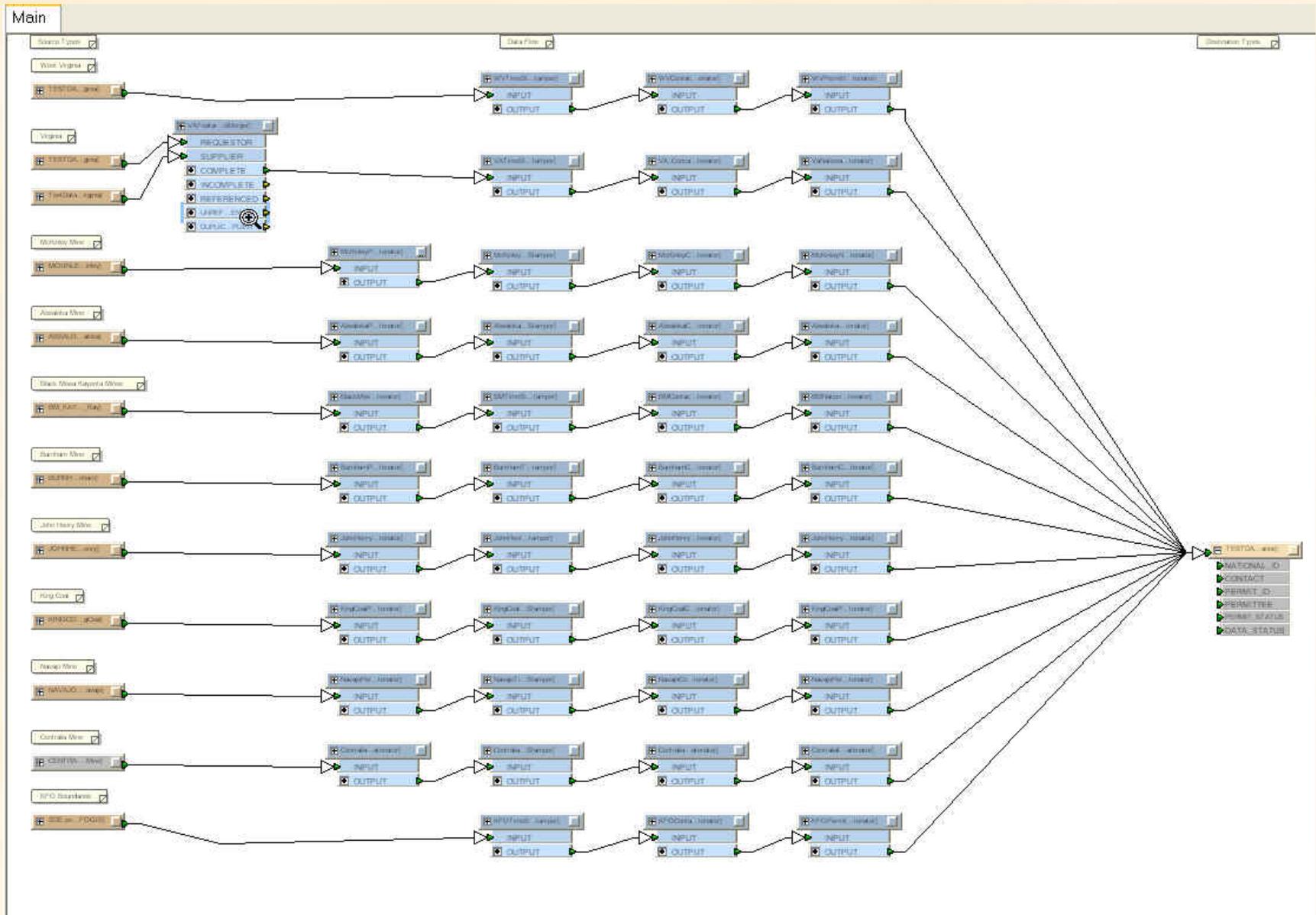
Prototype Configuration



ArcGIS Server Security Considerations



The ETL Tool Designed for Prototype



Connection to VA Replicated SDE Database

The screenshot displays the 'LoadDataToNationalBoundaries' application window. The left pane shows a project tree with the following structure:

- WestVirginia
- Virginia
 - Parameters
 - Source Enterprise Geodatabase: TestNationalGIS2
 - Destination Enterprise Geodatabase Server Name: ismdenfs02
 - Destination Enterprise Geodatabase Instance: port:5153
 - Destination Enterprise Geodatabase User ID: TestDataLoader
 - Destination Enterprise Geodatabase User Password: *****
 - Destination Enterprise Geodatabase Version: SDE.DEFAULT
 - Clip Source to Envelope: no
 - Translate Spatial Data Only: no
 - Resolve Domains: no
 - Resolve Subtype Names: yes
 - Ignore Network Info: no
 - Split Complex Edges: no
 - Use Rich Geometry: no
 - Split at Arcs: no
 - Where Clause: <not set>
 - Search Feature: <not set>
 - Search Order: SPATIAL_FIRST
 - Search Method: GEODB_INTERSECTS
 - Child Version Name: <not set>
 - Advanced
 - Feature Types
 - TESTDATA...Permit_Bnds
 - Parameters
 - Attributes
 - geodb_oid [integer]
 - OBJECTID [integer]
 - Permit [char(10)]
 - SHAPE.area [double]
 - SHAPE.len [double]
 - TestDataLoader.PERMIT_DATA
 - Parameters
 - Attributes
 - CoAmIcode [char(6)]
 - CoCode [char(6)]
 - CoPoolCode [char(6)]
 - geodb_oid [integer]
 - OBJECTID [integer]
 - PeAcidFrequency [char(10)]

The main workspace on the right contains a diagram with the following elements:

 - Three data source boxes: 'TESTDA...ginia]' (top), 'TESTDA...ginia]' (middle), and 'TestData...irginia]' (bottom).
 - Two destination boxes: 'Virginia' (top) and 'McKinley Mine' (bottom).
 - Flow lines connect the data sources to the destination boxes, with a central junction point.
 - Each data source box has a '+' icon and a '...' button.

Merging VA's Permit Polygon Data with Related Attribute Database

The screenshot displays the 'LoadDataToNationalBoundaries' application window. The main workspace shows a data flow diagram with three input boxes on the left: 'Virginia', 'TESTDA...ginia]', and 'TestData...irginia]'. Arrows from these boxes converge into a central junction, which then feeds into a 'VAFeatur...eMerger]' transformer box. Below this transformer, a list of attributes is shown, including 'REQUESTOR', 'SUPPLIER', 'COMPLETE', 'geodb_oid', 'OBJECTID', 'Permit', 'SHAPE.area', 'SHAPE.len', 'PeNo', 'CoCode', 'TbIPsCode', 'PePsDate', and 'PeSitePhone'. A dialog box titled 'Edit FeatureMerger Parameters' is open in the foreground, showing the following settings:

- Transformer Name: VAFeatureMerger
- Group By: (empty)
- Merge Type: Attributes Only
- Requestor Join Attribute: Permit
- Supplier Join Attribute: PeNo
- List Name (Optional): (empty)
- Build Incomplete Requestors: No
- Process Duplicate Suppliers: No

The status bar at the bottom indicates 'Ready' and 'VAFeatureMerger [FeatureMerger]'.

Generating Time Stamp

The screenshot displays the Microsoft SQL Server Data Transformation Services (DTS) interface. The main window shows a Data Flow Task with several input and output components. The 'VATimeStamp [TimeStamper]' transformer is highlighted, and its properties are listed below it:

- _timestamp
- geodb_oid
- OBJECTID
- Permit
- SHAPE.area
- SHAPE.len
- PeNo
- CoCode
- TbIPsCode
- PePsDate
- PeSitePhone

An 'Edit TimeStamper Parameters' dialog box is open, showing the following settings:

- Transformer Name: VATimeStamp
- Time Stamp Format: ^Y^m^d^H^M^S
- Time Stamp Attribute: _timestamp

The dialog box also includes 'Help', 'OK', and 'Cancel' buttons.

Generating "Contact" Information

The screenshot displays the Microsoft SQL Server Data Transformation Services (DTS) interface. The main window, titled "LoadDataToNationalBoundaries", shows a data flow diagram with several Concatenator tasks. The task "VA_Conca...tenator" is selected, and its "Concatenator Settings" dialog box is open. The dialog box contains the following information:

- Parameters:**
 - Transformer name: VA_Concat
 - Destination attribute: _Contact
- Attributes:** A list of attributes including: _timestamp, CoAmlCode, CoCode, CoPoolCode, geodb_oid, OBJECTID, PeAcidFrequency, PeAcidMonitor, PeAcidOb, PeAcidPlan, PeAltSpecs, and PeAnnivAny.
- Concatenated Items:** A list containing the text: "Daniel Kestner, Big Stone Gap, Vi".
- Constants:** An empty text box with "Replace", "Add", "Up", "Down", and "Remove" buttons.
- Buttons:** "Help", "OK", and "Cancel".

The background diagram shows a flow from an "INPUT" to an "OUTPUT" for the "VA_Conca...tenator" task. The output list includes attributes such as _Contact, _timestamp, geodb_oid, OBJECTID, Permit, SHAPE.area, SHAPE.len, PeNo, CoCode, TbIPsCode, and PePsDate. Other Concatenator tasks like "VaNationa...tenator" and "Absaloka...tenator" are also visible in the diagram.

Generating Unique National ID Attribute

The screenshot displays a data transformation tool window titled "LoadDataToNationalBoundaries". The main workspace shows a flow from an "INPUT" to an "OUTPUT" via a transformer named "VaNationalConcatenator". A list of attributes is shown below the output, including "_Contact", "_NationalID", "_timestamp", "geodb_oid", "OBJECTID", "Permit", "SHAPE.area", "SHAPE.len", "PeNo", "CoCode", and "TbIPsCode".

The "Concatenator Settings" dialog box is open, showing the following configuration:

- Parameters:**
 - Transformer name: VaNationalConcat
 - Destination attribute: _NationalID
- Attributes:** A list of attributes including _Contact, _timestamp, CoAmIcode, CoCode, CoPoolCode, geodb_oid, OBJECTID, PeAcidFrequency, PeAcidMonitor, PeAcidOb, PeAcidPlan, and PeAltSnece.
- Concatenated Items:** A list containing "VA" and "PeNo".
- Constants:** An empty text field.
- Buttons:** Add, Replace, Add, Up, Down, Remove, OK, Cancel, and Help.

Merging VA's Data into National Data Set

The screenshot shows a data transformation workflow in a software application titled "LoadDataToNationalBoundaries". The workflow consists of three main components:

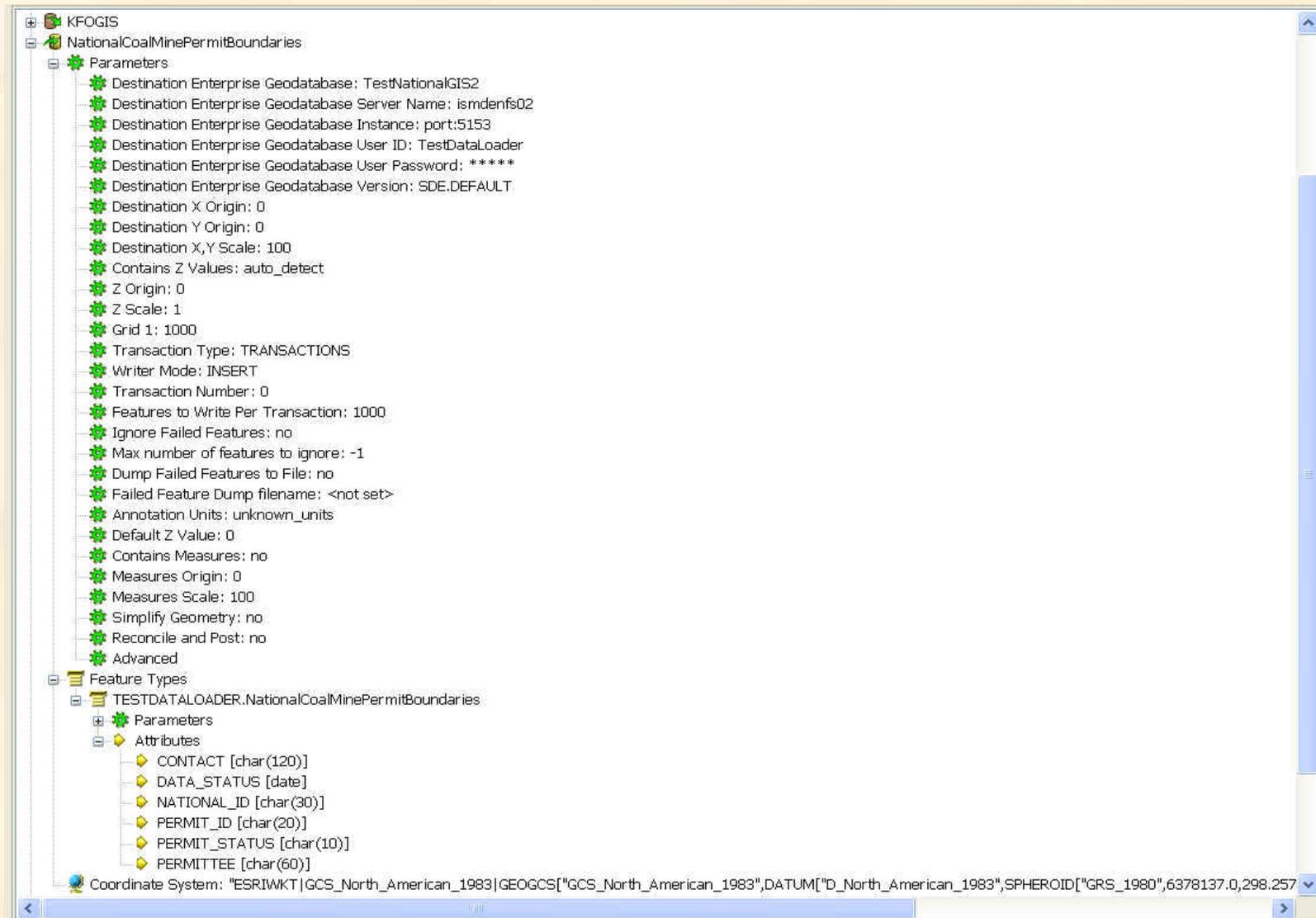
- VA_Conca...tenator**: The source data layer, containing an **INPUT** and an **OUTPUT**.
- VaNationa...tenator**: An intermediate transformation layer, also containing **INPUT** and **OUTPUT**. It lists numerous attributes such as `_Contact`, `_NationalID`, `_timestamp`, `geodb_oid`, `OBJECTID`, `Permit`, `SHAPE.area`, `SHAPE.len`, `PeNo`, `CoCode`, `TbIPsCode`, `PePsDate`, `PeSitePhone`, `PeLien`, `TbArCode`, `TbIDsCode`, `PeOsDate`, `PeAnnivDt`, `TbInCode`, `PeOrgIssueDt`, `PeMidtermDt`, `PeSubmittalDT`, `PeIssueDt`, `PeRenewalDt`, `ReReceiptNo`, `PeOperator`, `PeOperation`, `PeLatitude`, `PeLongitude`, `PeCommunity`, `PeRoad`, `PeLocation`, `PeDisturbed`, `PeRegraded`, `PeReleased`, and `PeTerm`.
- TESTDA...aries**: The destination data layer, containing an **INPUT** and an **OUTPUT**. The output attributes are `NATIONAL_ID`, `CONTACT`, `PERMIT_ID`, `PERMITTEE`, `PERMIT_STATUS`, and `DATA_STATUS`.

A **Feature Type Properties** dialog box is open, showing the configuration for the destination layer. The dialog has tabs for **General**, **User Attributes**, **Format Attributes**, and **Parameters**. The **General** tab is active, displaying a table of attributes:

Attribute Name	Data Type	Width	Dec.
NATIONAL_ID	char	30	
CONTACT	char	120	
PERMIT_ID	char	20	
PERMITTEE	char	60	
PERMIT_STATUS	char	10	
DATA_STATUS	date		

Buttons at the bottom of the dialog include **Move Up**, **Move Down**, **Sort**, **Delete**, **Help**, **Apply to All...**, **OK**, and **Cancel**.

Setting the National Data Set's Attributes and Coordinate System

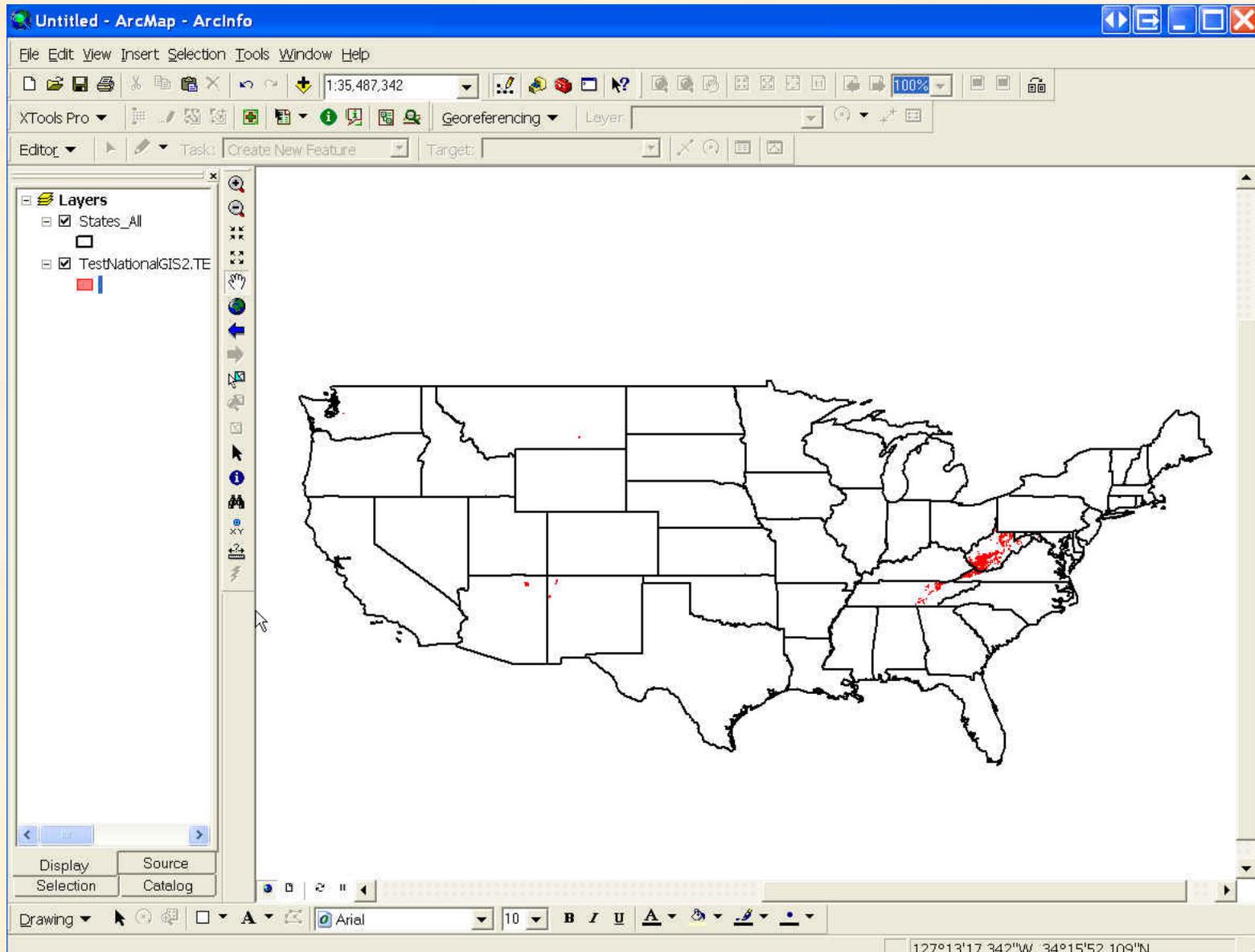


KFOGIS

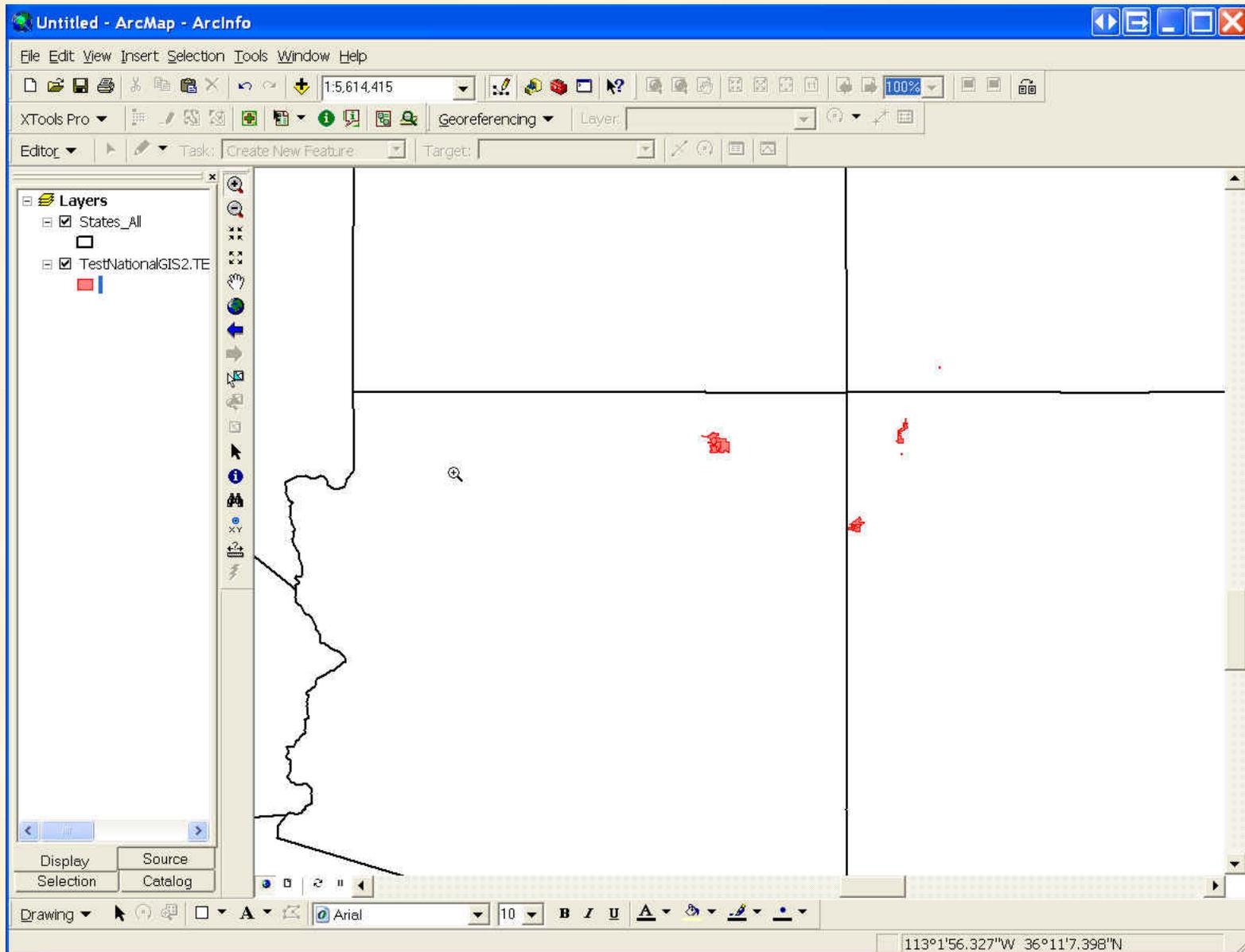
- NationalCoalMinePermitBoundaries
 - Parameters
 - Destination Enterprise Geodatabase: TestNationalGIS2
 - Destination Enterprise Geodatabase Server Name: ismdenfs02
 - Destination Enterprise Geodatabase Instance: port:5153
 - Destination Enterprise Geodatabase User ID: TestDataLoader
 - Destination Enterprise Geodatabase User Password: *****
 - Destination Enterprise Geodatabase Version: SDE.DEFAULT
 - Destination X Origin: 0
 - Destination Y Origin: 0
 - Destination X,Y Scale: 100
 - Contains Z Values: auto_detect
 - Z Origin: 0
 - Z Scale: 1
 - Grid 1: 1000
 - Transaction Type: TRANSACTIONS
 - Writer Mode: INSERT
 - Transaction Number: 0
 - Features to Write Per Transaction: 1000
 - Ignore Failed Features: no
 - Max number of features to ignore: -1
 - Dump Failed Features to File: no
 - Failed Feature Dump filename: <not set>
 - Annotation Units: unknown_units
 - Default Z Value: 0
 - Contains Measures: no
 - Measures Origin: 0
 - Measures Scale: 100
 - Simplify Geometry: no
 - Reconcile and Post: no
 - Advanced
 - Feature Types
 - TESTDATALOADER.NationalCoalMinePermitBoundaries
 - Parameters
 - Attributes
 - CONTACT [char(120)]
 - DATA_STATUS [date]
 - NATIONAL_ID [char(30)]
 - PERMIT_ID [char(20)]
 - PERMIT_STATUS [char(10)]
 - PERMITTEE [char(60)]

Coordinate System: "ESRIWKT|GCS_North_American_1983|GEOGCS["GCS_North_American_1983",DATUM["D_North_American_1983",SPHEROID["GRS_1980",6378137.0,298.257]

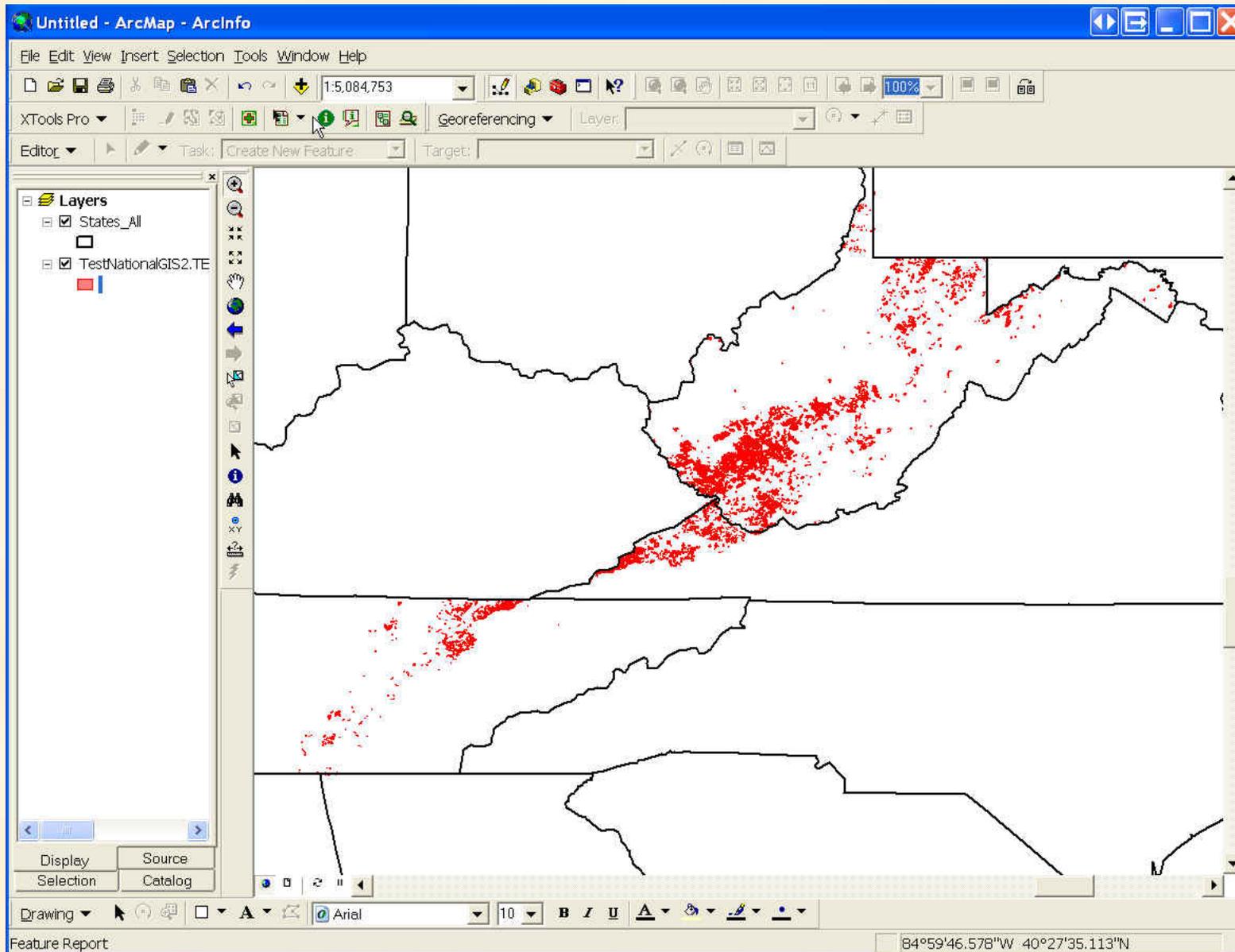
National Data Set Results – National View



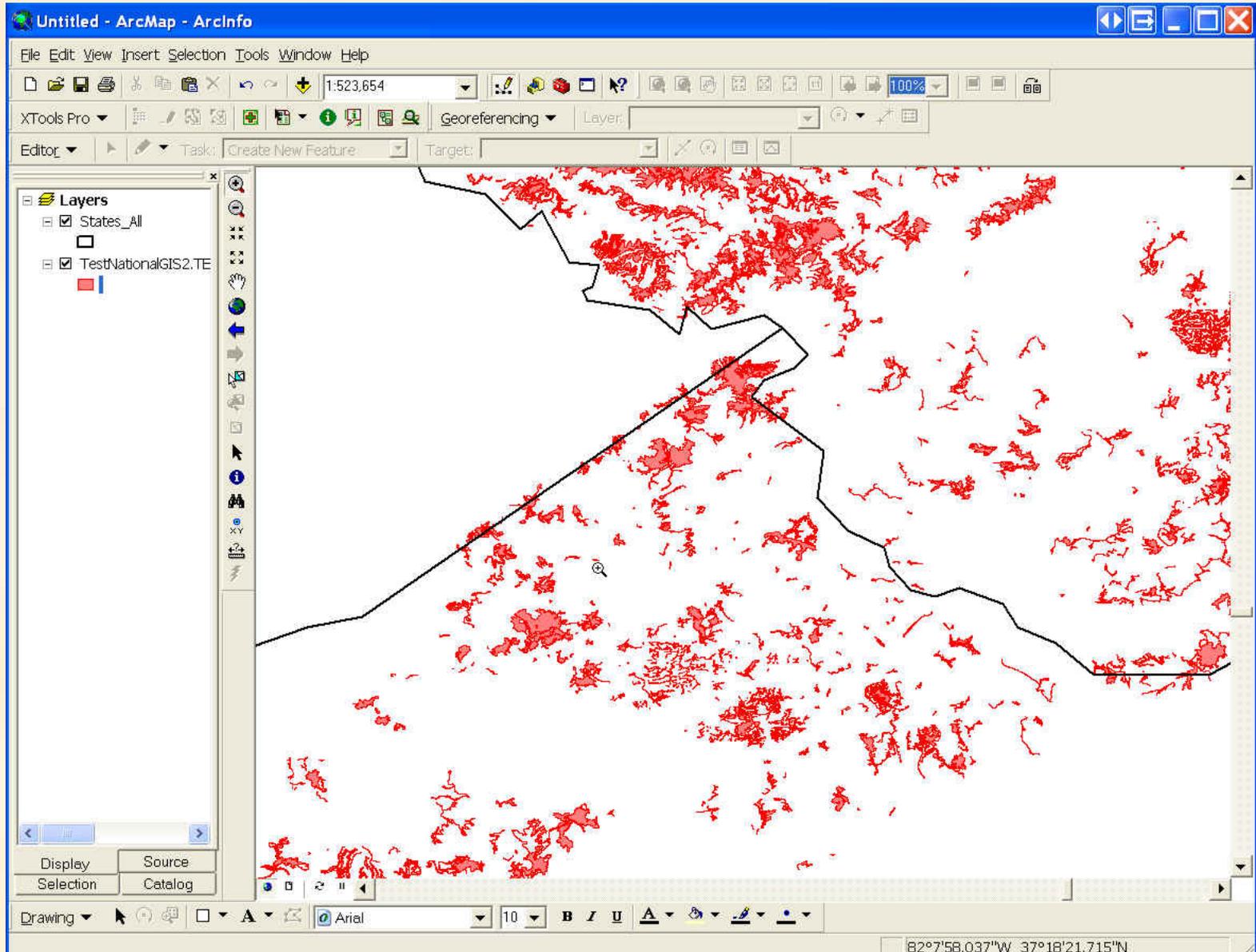
National Data Set Results – Western View



National Data Set Results – Eastern View – TN, VA & WA



National Data Set – Zoom in View of VA & WV Border



Permit Attributes

The screenshot displays the ArcMap interface. The main map area shows a red-shaded polygon representing a permit boundary. An 'Identify' window is open, showing the following attributes for the selected feature:

Field	Value
NATIONAL_ID	VA1101966
CONTACT	Daniel Kestner, Big Stone Gap, Virginia
PERMIT_ID	1101966
PERMITTEE	GREGORY S. BLANKENSHIP
PERMIT_STATUS	PP
DATA_STATUS	2/12/2008 10:03:09 AM
OBJECTID	7628
SHAPE	Polygon
SHAPE.area	0.000482
SHAPE.perim	0.340694

A yellow arrow points from the 'SHAPE' field in the Identify window to the red-shaded polygon on the map. The map also shows a 'Layers' panel on the left with 'States_All' and 'TestNationalGIS2.TE' layers. The status bar at the bottom indicates coordinates: 82°4'36.614"W 37°31'27.911"N.

Some Interesting Statistics

Total Permits Processed = 7966

Total Time to Run ETL Tool = 5.5 minutes

Equipment Specs:

Dell Precision

Xeon CPU 3.0GHz

3.0 GB RAM

XP Professional SP2 Operating System

WV Lessons Learned

- **Test Small / Test Local**
 - **pilot geographic area**
 - **simplified single-purpose map service**
 - **simple geodatabase structures**
- **Scale up one step at a time**
- **Keep security as open as possible as long as possible**
- **IT relationships and infrastructure both critical factors (in both a positive and negative sense)**

As per Sarah Claphan

VA Lessons Learned

- **Permission - Access through firewall - could take awhile to get approval**
- **If using relationship class for attribution, make sure to have the sql tables published to same machine SDE resides on.**

- **Change any local machine name references for services to replicate outside of firewall**

As per Daniel Kestner

OSM Lessons Learned

- **When trying to troubleshoot replication, the error messages from ArcGIS are not good. The replication toolbar in ArcMap gives better error messages for troubleshooting.**
- **The sender and the receiver for replication should agree on the name of the replica since a replica with a duplicate name cannot be made and the error messages generated are not helpful. If one or the other party removes the replica registration from their system, they should inform the other party since there is no automated cleanup and the replication will fail.**

As per Greg Morlock

Acknowledgements

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Questions ???