Pipeline Stream Quality Management (PSQM)

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Discussion Topics

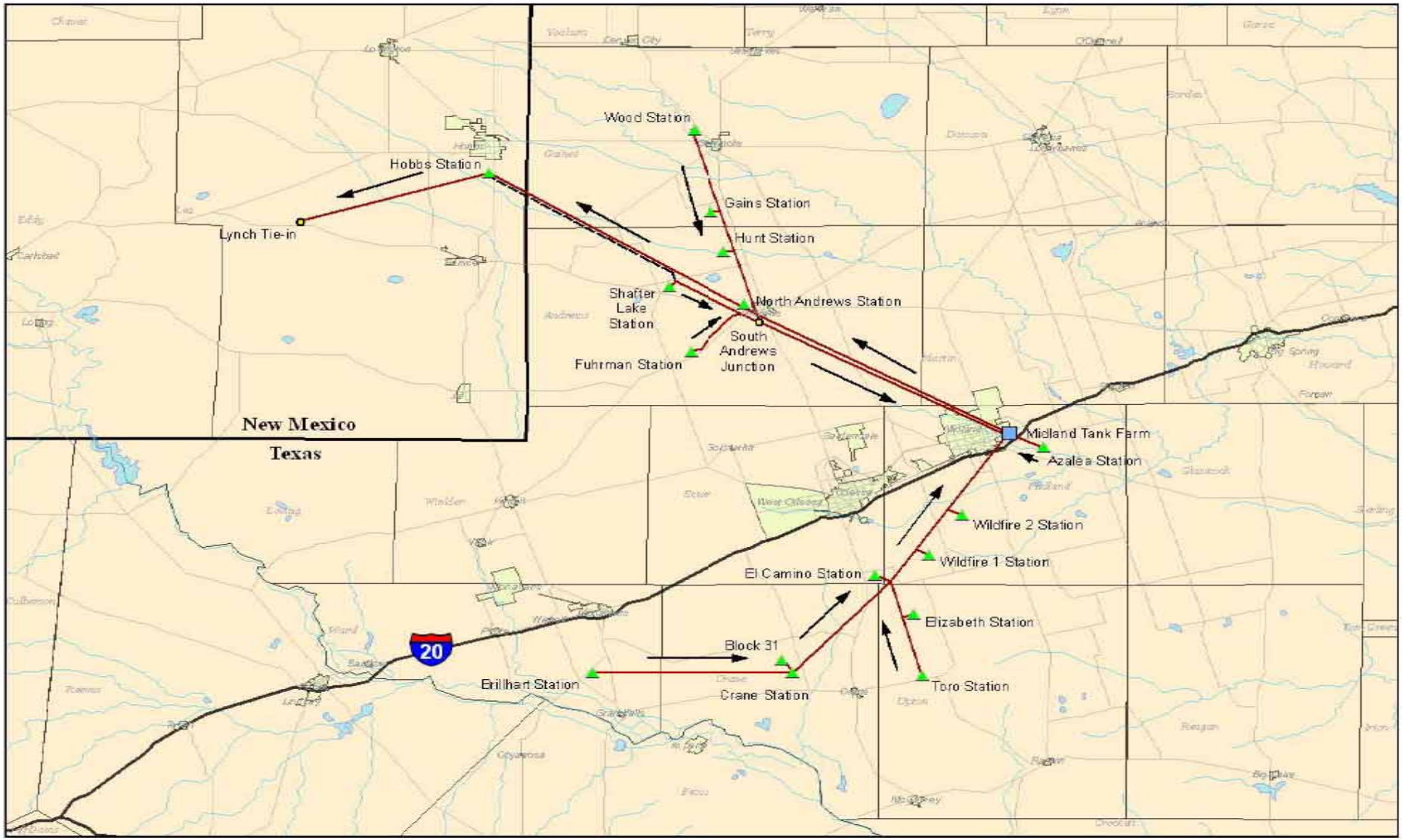
- What is PSQM?
- System Evaluation & Mapping
- Data Collection
- Data Analysis
- Corrective Action Strategies
- Documentation
- Success Metrics

What is PSQM?

- PSQM: Pipeline Stream Quality Management
- A program developed to identify, manage, and document potentially corrosive product streams entering a pipeline system

System Evaluation & Mapping

- Analyze the pipeline system configuration
- Analyze pipeline system characteristics and operating parameters
- Identify **ALL** incoming product streams
- Identify existing and required data sources pertaining to incoming products
- Establish product quality limits



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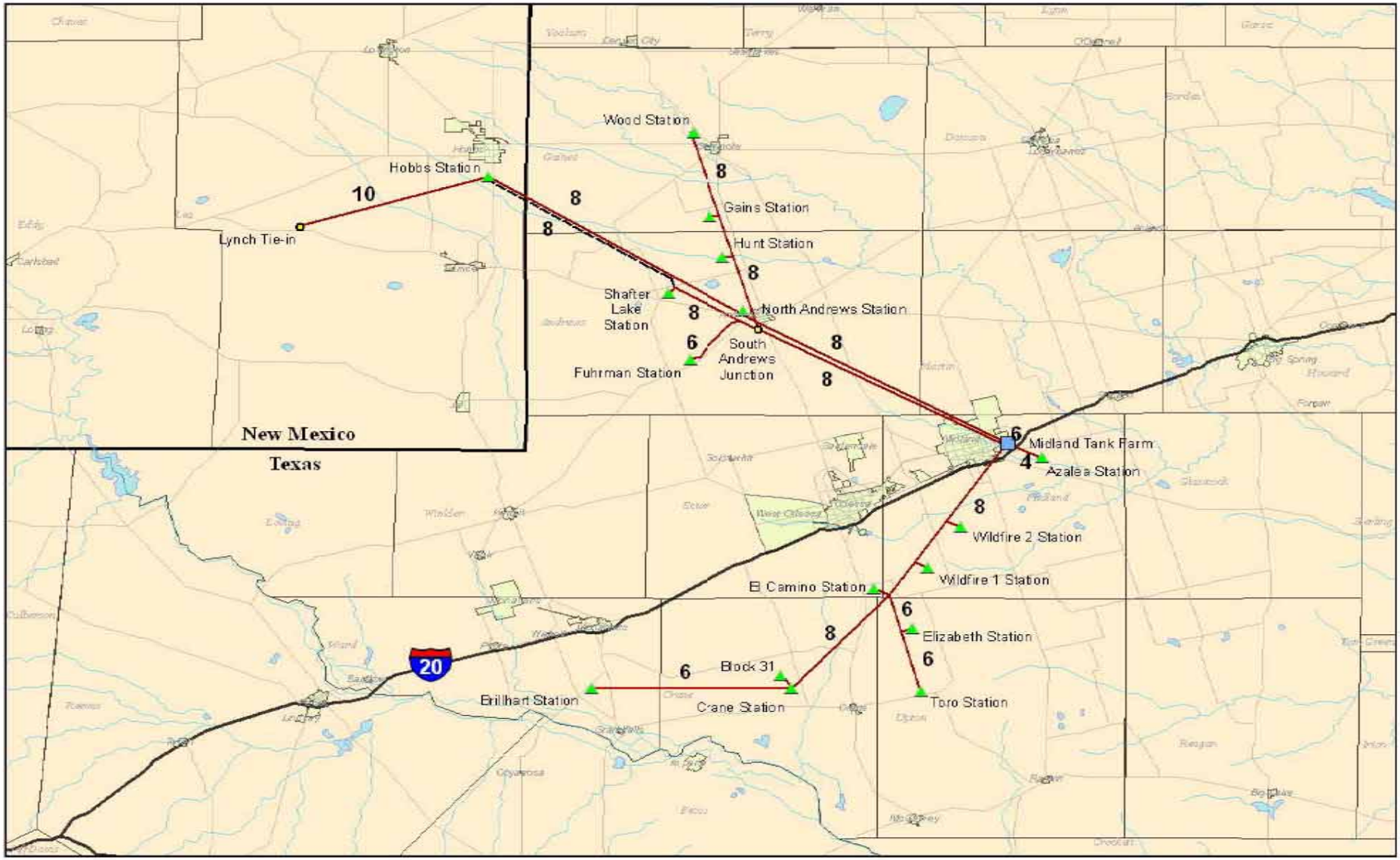
Midland Crude Pipeline System

Internal Corrosion Hazard Assessment

Station | Tank Farm | Tie-in | Interstates | Pipeline | Shut-in Line | Major Roads | Rivers | Urban Areas | Lakes

Direction of Flow

Figure 2
Date - July 07



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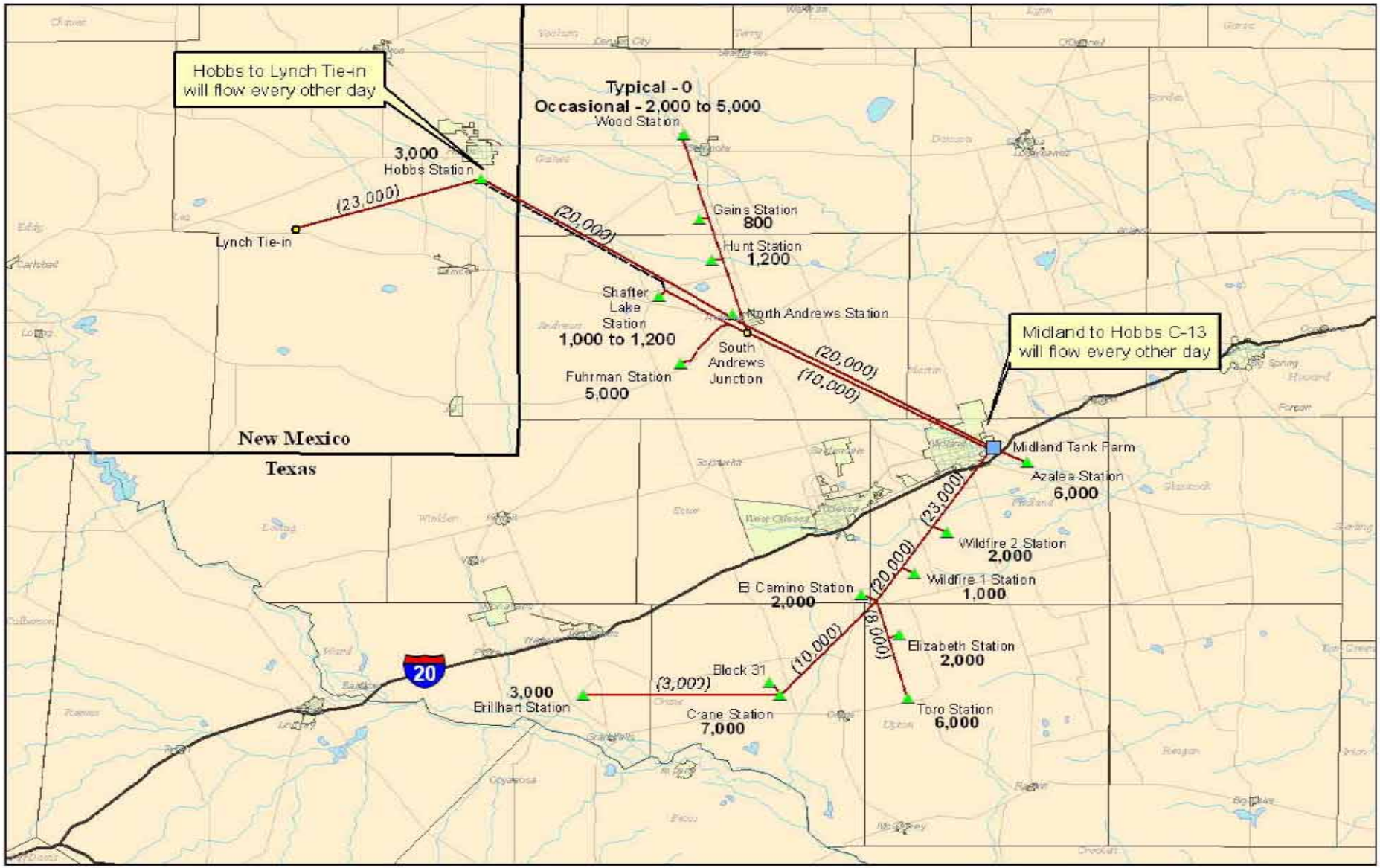
Line Size (inches)

Figure 3
Date - July 07



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Midland Crude Pipeline System

Internal Corrosion Hazard Assessment

Station — Pipeline — Urban Areas

Tank Farm — Shut-in Line — Lakes

Tie-in — Major Roads

Interstates — Rivers

Crude Volume (Barrels per day)
( ), Cumulative Volume

Figure 4

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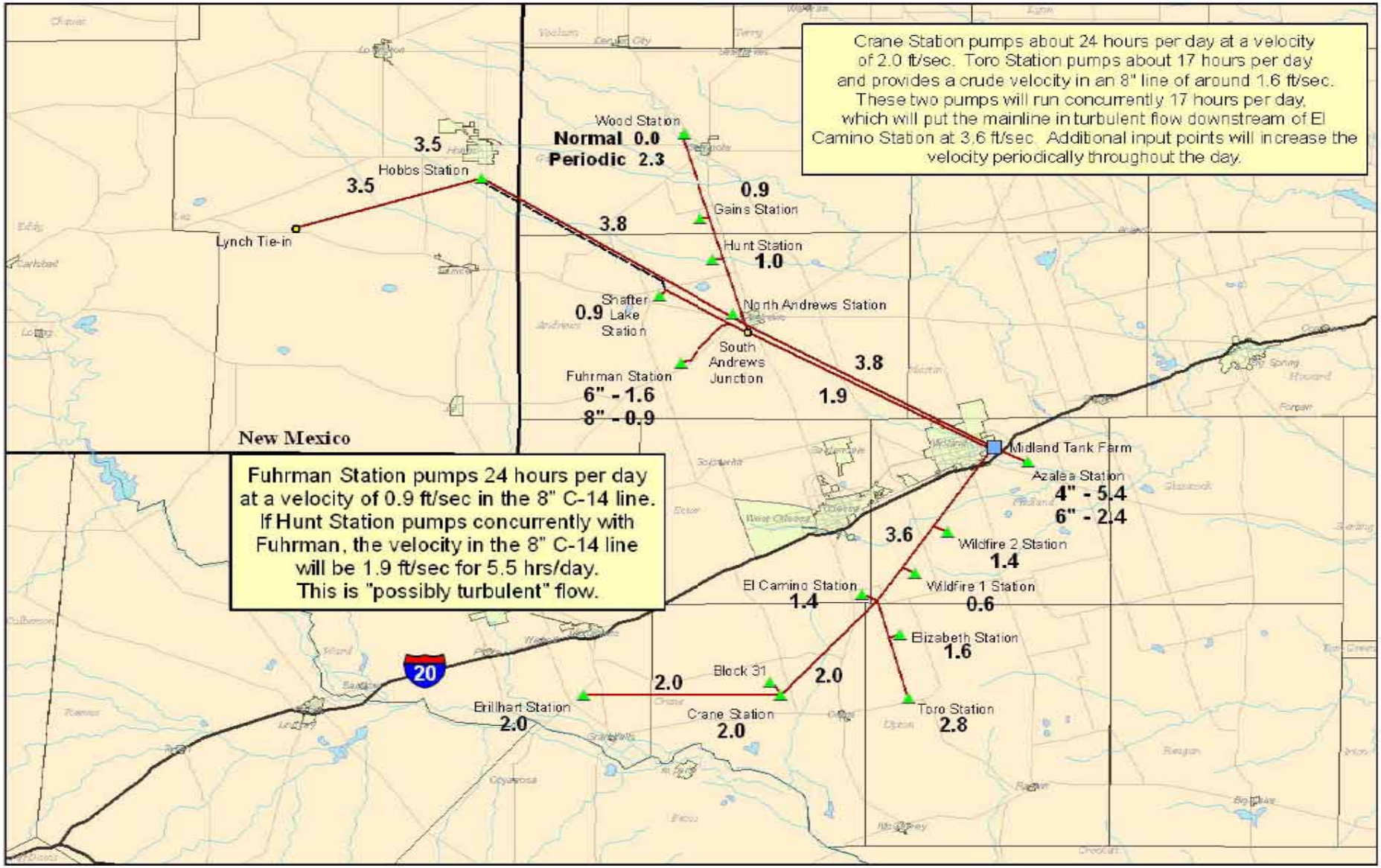

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Midland Crude Pipeline System

Internal Corrosion Hazard Assessment

Station | Tank Farm | Tie-in | Interstates | Pipeline | Shut-in Lines | Major Roads | Rivers | Urban Areas | Lakes

Crude Velocity When Pipeline Pumps Are Running (ft/sec)

Figure 8

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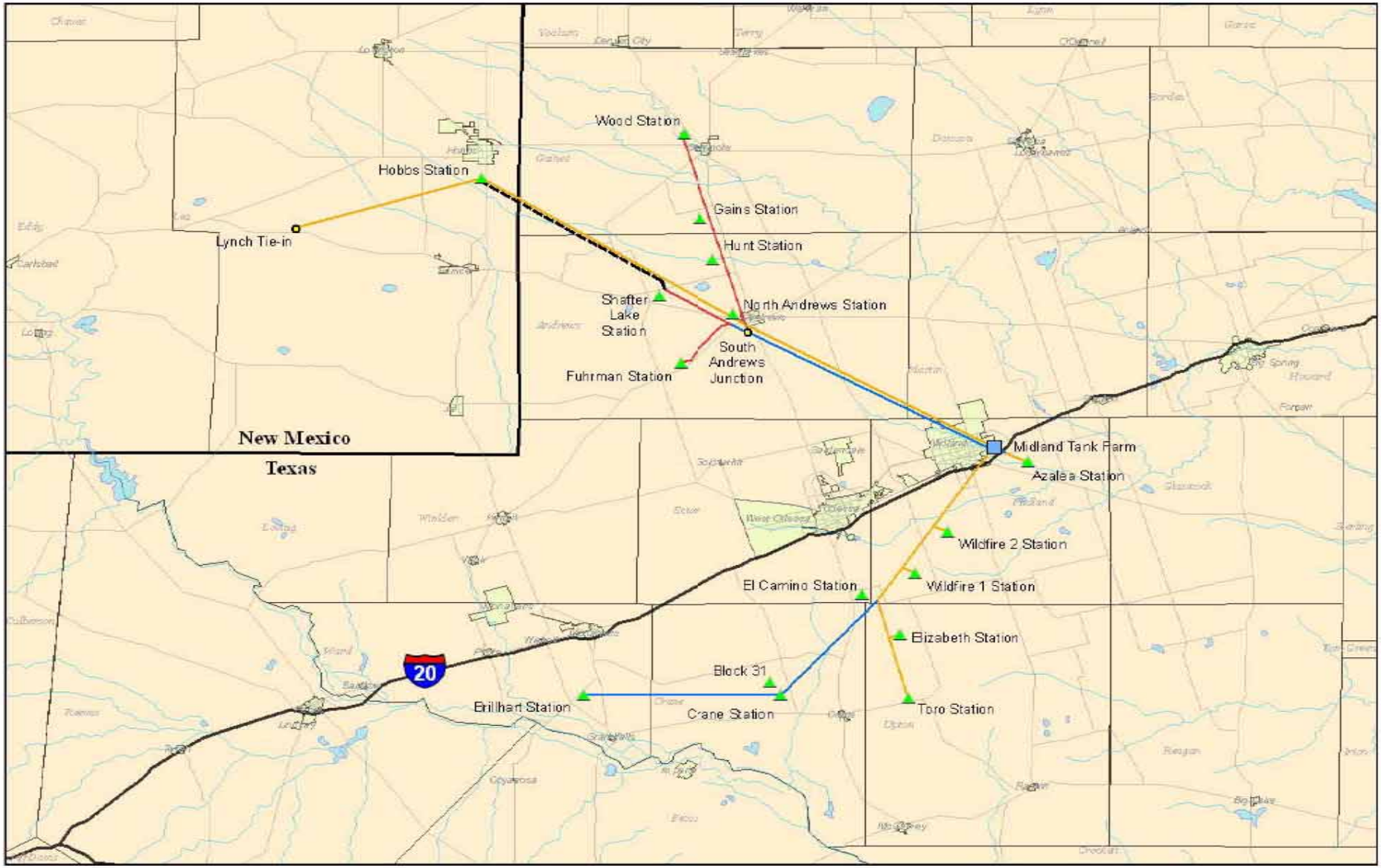

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Midland Crude Pipeline System

Internal Corrosion Hazard Assessment

Station
Tank Farm
Tie-in
Shut In Lines
Stratified Flow
Possibly Turbulent Flow
Turbulent Flow

Liquid Flow Regime When Pumps Are Running

Figure 9
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Midland Crude Pipeline System

Internal Corrosion Hazard Assessment

Station
Tank Farm
Tie-in
Interstates
Piggable Lines
Non Piggable Lines
Major Roads
Rivers
Urban Areas
Lakes

Piggable Lines

Figure 11
Date - July 07

Data Collection

- **Data to be Collected:**
  - Presence of Water
  - Acid gas concentration
  - Oxygen concentration
  - Presence of Microbes
  - System Pressure
  - System Temperature
  - Corrosion rate

- **Sample Collection Methodology:**
  - Routine sampling
  - Unannounced Spot Testing
  - Receipt Point Upsets
  - Custody Transfer Testing
  - On - line Monitoring
  - Third Party Reporting

Data Analysis

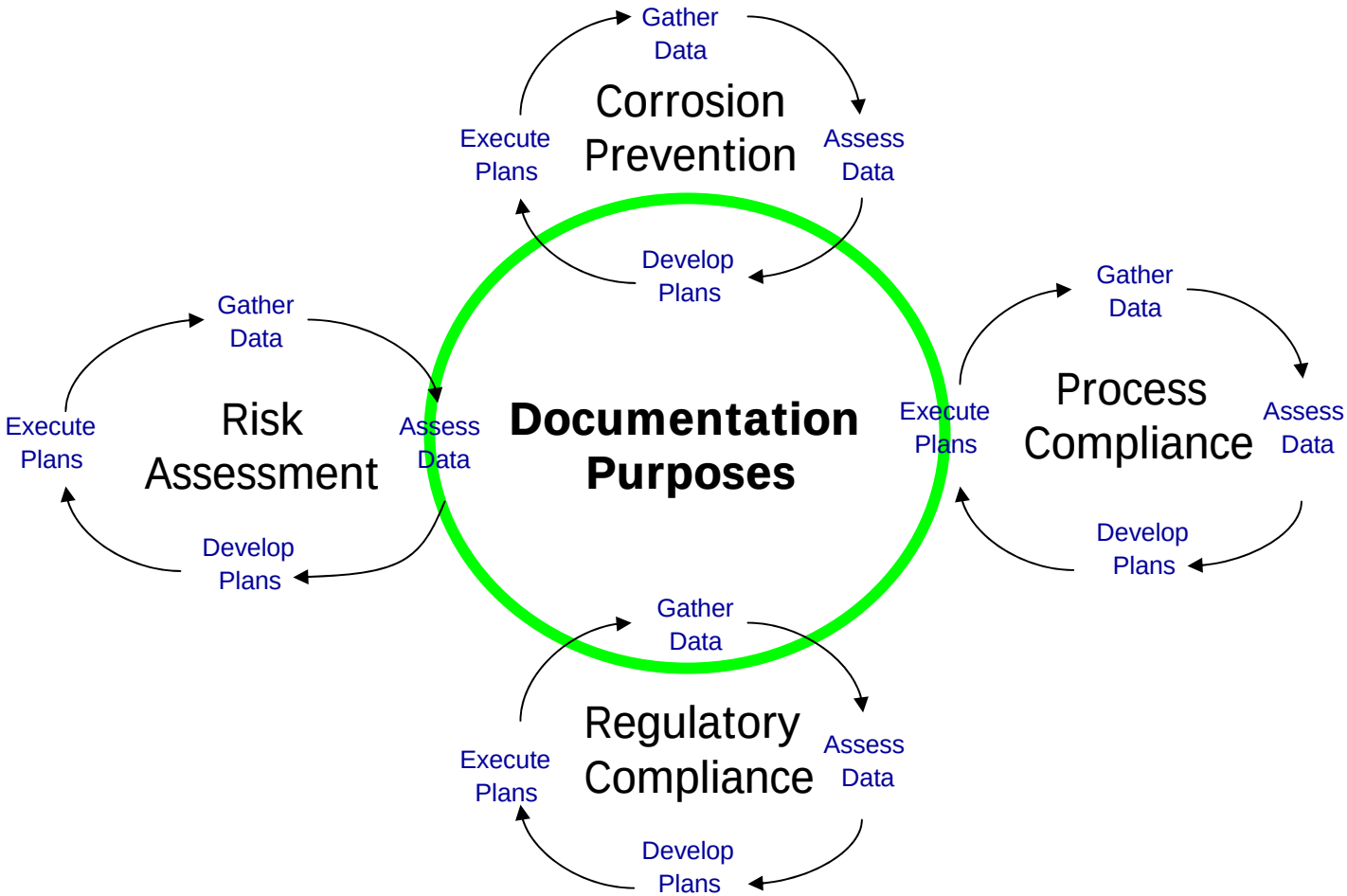
- Collected data is filtered based upon established product quality limits
- Operational SME review of filtered data
- Corrosion prevention SME review of filtered data
- Corrective actions are established based upon data analysis results

Corrective Action Strategies

- **Action Required**
  - Shut-in
  - Reduced Production
  - Maintenance Pigging
  - Chemical Treatment
  - Modify Piping Configuration
  - Modify System Flow
  - Warning Notification
  - On-line Monitoring
  - Automated “Slam-Valves”

- **No Action Required**
  - Proper System Design
  - Maintenance Pigging Program In-Place
  - Corrosion Inhibition Program In-Place
  - Upset Condition Determined to be Non-Corrosive

Documentation



Success Metrics

- Knowledge of incoming product quality
- Strategic implementation of internal corrosion prevention actions
- Company and regulatory compliance documentation
- Identification and continued monitoring of non-compliant receipt points
- Enhanced monitoring methodology
- Enhanced producer/shipper education and cooperation