Seattle City Light

Advanced Metering Program
LOB: Technical Metering

Field Meter Investigation | AMI-TMO.026

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Status: Completed
Version 1.2

Finalized: 06/15/2018

1. Process Properties

Process Author:	Adam Filby
Process Name:	Field Meter Investigation
Process Number:	AMI-TMO.026
Contributors:	Brad Harris, John McClaine, Todd Ellermeier, Carmela Kowaleski, Monica Davis
Business Approvers:	Adam Filby
Version:	1.2

2. Acronym Definition

Acronym	Definition
AMI	Advanced Metering Infrastructure
CC	Crew Chief
CCB	Customer Contact and Billing
CCO	Crew Coordinator Office
ETM	Endpoint Test Manager (L+G)
FA	Field Activity
IWR	Integrated WanGate Radio (L+G)
MDM	Meter Data Management system
MSA	Management System Analyst
RMA	Return Merchandise Authorization
WO	Work Order

3. Revision History

Date	Vers.	Description of Changes	Reviser
11/01/2017	1.1	Brought to bi-weekly review meeting with Britt Luzzi and Adam Filby. Adam asked that we review this process with Crew Chief Todd Ellermeier and Carmela Kawaleski to see if	Samantha Henson

3. Revision History

Date	Vers.	Description of Changes	Reviser
		anything have changed since the last time it was mapped out.	
06/15/2018	1.2	Updated references to 'Meter Technician' to 'Meter Electrician' to align with appropriate role title.	Jana Flynn

4. Objective: *Describes what the process does and what it accomplishes.*

This business process details a combination of six different field meter investigation work practices. The field meter investigation processes for each of the six are similar and related, but will require diversity in completing the actual field work. The objective in performing field meter investigations is to: test metrology accuracy, verify functional integrity, replace meters as required, troubleshoot communication issues, troubleshoot operational functions, and identify security or tampering issues in and for AMI meters.
Note: There are three additional field meter work practices that are in the planning stages or for future consideration and these are detailed to the degree they can be based on present information.

5. Pre-Process Requirements *What should happen or needs to be in place before the business activity can be carried out. This could be a product, a service, a result, an event, a trigger to some other use case or work…etc.*

- Deployment of AMI meters
- Customers with concerns about a high electric bill
- Correct information collected from the customer regarding what their concern is for a high bill complaint. Because not all high bill complaints are based on increased usage only, the paperwork prepared by the Customer Contact Center personnel, Electric Service Representative, Electric Service Engineer that accompanies a high bill meter test must identify what is the customer's exact concern about their electric bill.

Is it:

- Energy usage (kWhs) (all rates)
- Power usage (kW) (medium – high demand commercial rates)
- Power factor billing (kvarhs) (commercial rates)

- Transformer losses (commercial rates)
- Rates or rate increases
- Paying opt-out fees (residential rates)
- Demand billing - with new meters [previously Three Phase Self-contained (3PSC) meters were installed with demand registers only on 480V (SC) services] and this will possibly lead to high bill complaints because of a new demand charge. All AMI meters are demand meters, so this will mean all commercial accounts will now have the possibility of being billed demand.
- Inconsistent meter reads (with estimated bills) where now the reads and bills are very consistent
- The timeframe of the high bill (the information provided should list actual billing period of the high bill)

Suspect meter failures:

- Blank display
- Wrong program
    - Wrong displays (register read issues)
- Missing or wrong meter voltage(s)
- Remote demand reset failure (through Command Center or CC&B)
- Failure of (local) remote communication (L+G field troubleshooting equipment, IWR and ETM) to establish field meter radio communication
- Meter load profile collection errors
- Firmware issues (meter and radio)
- DCW issues
- AMI meters that fail to communicate with Command Center
- A meter room of AMI meters not communicating with Command Center
- An AMI meter where the disconnect/reconnect device malfunctions
- Suspect meter tampering on an AMI meter
- Alarm from an AMI meter temperature sensor (future promised functionality)
- All catastrophic meter errors, failures or alarms reported through Command Center
    - Meter measurement error detected
    - Meter nonvolatile memory failure detected
    - Meter RAM failure detected

Creation (automated or manual) of Field Activity or Work Order detailing the necessity or required work for a field meter investigation on AMI meters

- These field meter investigation orders will be for:
    - High bill complaint meter tests
    - Suspect meter failure meter tests
    - Failed meter communication meter replacements
    - Meter room fix-ups (working with L+G communication personnel)
    - Trouble calls on damaged meters and related field metering equipment
    - Failed operation of the AMI meter disconnect/reconnect functionality meter replacement
    - Meter tamper and revenue protection meter test and meter replacement
    - Meter temperature issues used in detection of hot meter sockets (later in deployment and then on-going)

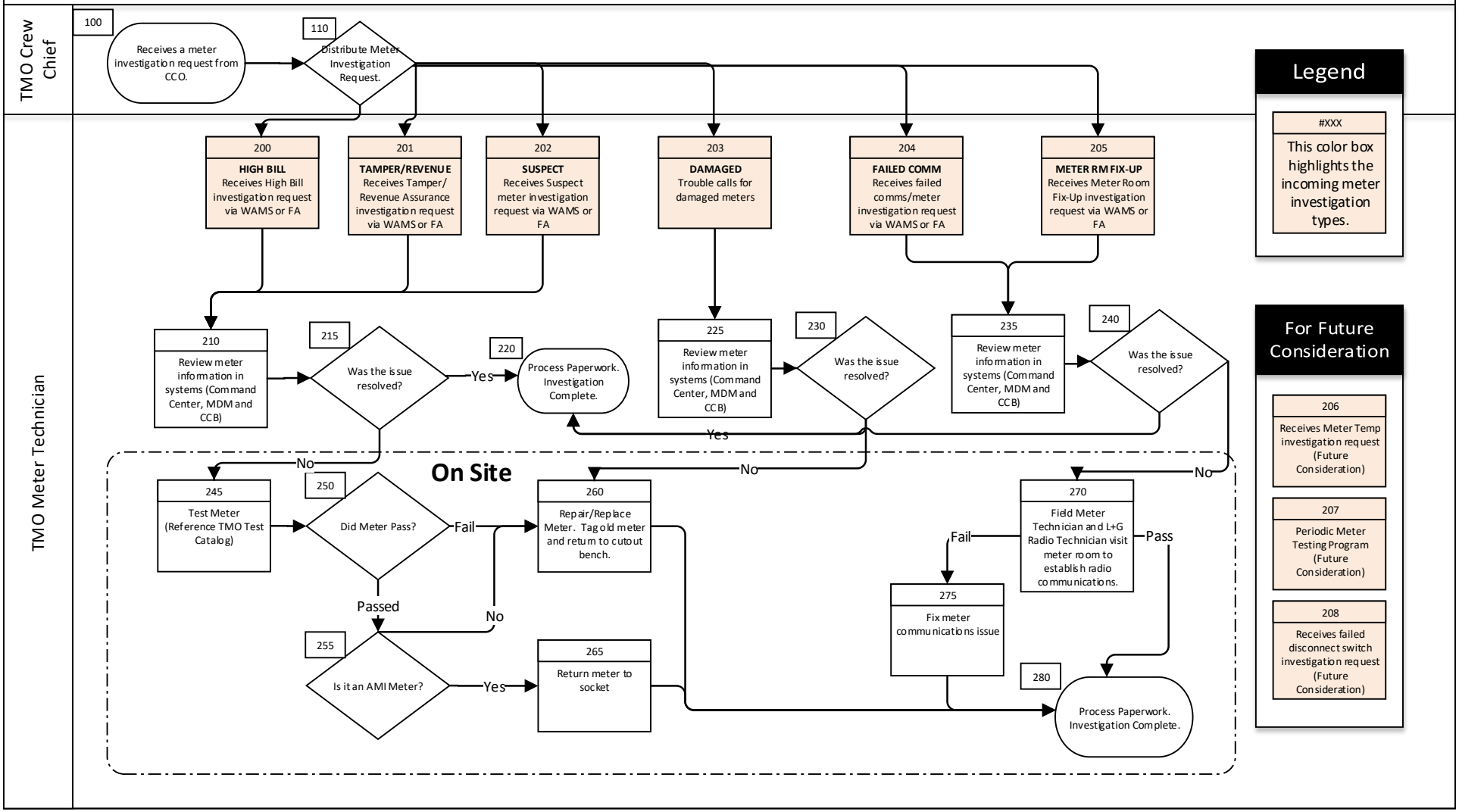
6. Post-Process Requirements *What is the expected outcome or end-result from achieving the goal through carrying out the business activity? This could be a product, a service, a result, an event, a trigger to come other use case or work*

- Field meter issues are investigated and the results are communicated to the responsible group who created the field investigation order
- High bill complaint meter test results are communicated to the City Light customer who registered the complaint
- High bill resolution information is communicated to the City Light customer who registered the complaint
- Failed meters under warranty are returned to L+G (Landis+Gyr) following the RMA process
- Meter investigations for meter tampering or energy diversion are successfully billed and collected on or prosecuted
- The City Light Meter Engineer tracks and quantifies all meter failures to indicate any failure trends in L+G meters

7. Assumptions *What are the assumptions used in creating the business use case? Include dependencies, timeline, conditions.*

- A knowledgeable and skilled City Light Meter Engineer will be available for support and expertise
- Meter communication network (GridStream) issues (including meter room fix-up) are correctly identified and repaired by L+G
- There is sufficient manpower available to track and quantify trends in L+G meter failures
- Future plans for full integration of Command Center: meter alerts, alarms and cautions are completed
- Future L+G plans of providing a truly functioning meter temperature sensor are completed and become operational
- Field Meter Electricians and Field Crew Chiefs will receive required training to be able to easily navigate and do the required research in MDM, CC&B and Command Center and radio shop

8. Process Map



9. Activity Descriptions

Activity Number	Action	Actor	System or Manual	Resources needed Implement
100	The Crew Chief receives a meter investigation request from	Crew Chief (CC)	System	WAMS WO/ CCB FA
110	The Crew Chief will distribute the meter investigation request to the Field Meter Electrician	Crew Chief (CC)	System	WAMS WO/ CCB FA
200	The Meter Electrician receives a request from their Crew Chief for a field meter investigation on a high bill complaint registered by a City Light customer.	Meter Electrician	System	WAMS WO/ CCB FA
201	The Meter Electrician receives a request from their Crew Chief to perform a field meter investigation for an L+G meter that has suspected tampering or current diversion. Field meter investigations where tampering is confirmed will require a field meter test to ensure that the meter metrology was not affected by the customer and is measuring accurately	Meter Electrician	System	WAMS WO/ CCB FA

202	The Meter Electrician receives a request from their Crew Chief to perform a field meter investigation and meter test for Field Activities related to suspect meters. All of the below field meter investigation items are deemed to be suspect meter failures: Blank display Wrong program Wrong displays (register read issues) Wrong communication network address Missing or wrong meter voltage(s) Remote demand reset failure Failure of (local) remote communication (L+G field troubleshooting equipment, IWR and ETM) to establish field meter radio communication Load profile collection errors Firmware issues (meter and radio) DCW issues All catastrophic meter errors, failures or alarms reported through Command Center Meter measurement error detected Meter nonvolatile memory failure detected Meter RAM failure detected All of the listed field meter investigations will require a field meter test to ensure that the meter metrology was not affected by the listed failure and is working accurately before the meter is replaced. **Important Note:** This group of meter field investigations will be created from information collected through Command Center and the FA or Work Order information that will accompany the field meter investigation will be an automated process once full integration is complete. In the meantime, creation of the FA's and or Work Order will be a manual process.	Meter Electrician	Manual	Reported through a trouble call

Activity Number	Action	Actor	System or Manual	Resources needed Implement
	The meter issues listed may be based in deeper rooted meter problems and if there are on-going Field Activities for meter tests related to these issues, then these should be considered as possible defects in the L+G meters. The detected on-going defects will need to be carefully detailed, so that they can be presented to L+G for resolution. The City Light Meter Engineer will track these defects during the Cut Out Bench process.			
203	The Meter Electrician receives a request from their Crew Chief or a dispatched order from the Crew Coordinator to perform a field meter investigation on a meter where the meter and/or related field metering equipment has been reported as damaged. When the meter is damaged, this will be an automatic replacement of the meter.	Meter Electrician	System	WAMS WO/ CCB FA
204	The Meter Electrician receives a request from their Crew Chief to perform a field meter investigation for a L+G meter that is not communicating with Command Center. (this meter investigation is not the same as a meter room fix-up investigation) Field meter investigations for not communicating meters will require a field meter test to ensure that the meter metrology was not affected by the communication failure and is measuring accurately before the meter is replaced.	Meter Electrician	System	WAMS WO/ CCB FA
205	A specially trained field ME receives a request from their Crew Chief to perform a field meter investigation for a L+G meter where all the meters in a meter room are not communicating with Command Center. (this meter investigation is not the same as the Failed Meter Communications) An additional meter communication fix-up is also identified when an individual meter in electrical service entrance equipment (switch gear) is not being heard by the GridStream network. These communication fix-ups with be the responsibility of <u>all</u> field Meter Electrician.	Meter Electrician	System	WAMS WO/ CCB FA

Activity Number	Action	Actor	System or Manual	Resources needed Implement
206	For future consideration The field Meter Electrician receives a request from their Crew Chief to perform a field meter investigation for a L+G meter where the on-board meter temperature sensor has sent an alarm to Command Center. Note: This functionality on the L+G meters is not available at the time of the creation of this business process document and should be available before the end of mass meter deployment.	TMO Crew/ Journey Worker	System	WAMS WO/ CCB FA
207	For future consideration To ensure the on-going correct and accurate operation of all installed electric meters at City Light a periodic meter test program must be a future consideration. This will allow for tracking of meter failures for many previously undiscovered field meter issues and will allow the possibility of identifying meter accuracy issues that are subtle and not easily found through other means used in the utility.	TMO Crew/ Journey Worker	System	WAMS WO/ CCB FA
208	For future consideration The field Meter Electrician receives a request from their Crew Chief to perform a field meter investigation for a L+G meter where the disconnect switch malfunctioned (open or closed). Field meter investigations for a meter disconnect switch failure will require a meter accuracy test when the failed switch is in the closed position. This accuracy test is to ensure that the meter metrology was not affected by the switch failure and is measuring accurately before the meter is replaced. When the failed disconnect switch is in the open position then this will be an automatic meter replacement. The meter cannot be tested with the disconnect switch in the failed (open) position.	TMO Crew/ Journey Worker	System	WAMS WO/ CCB FA
210	Review meter information in systems (Command Center, MDM and CCB)	TMO Crew/ Journey Worker		Command Center, MDM, and CCB
215	If the issue is resolved proceed to activity ID#220. If the issue was not resolved proceed to activity ID#245.	TMO Crew/ Journey Worker		

Activity Number	Action	Actor	System or Manual	Resources needed Implement
220	All required paper work will be completed by the field Meter Electrician and returned to their Crew Chief. The WAMS WO and or FA gets closed out by the Crew Chief/MSA. Once all paper work is reviewed by the Crew Chief then this information will be forwarded to the appropriate City Light departments and employees.	TMO Crew/ Journey Worker/Crew Chief/ MSA	Manual	

245	All field meter investigations for high bill complaints (Box# 200) and for confirmed meter tampering (Box# 201) will be field accuracy tested (see TMO Test Catalog) before possible replacement of the meter. Where tampering or energy diversion is confirmed during a field investigation, then the on-site meter will be field accuracy tested. If the on-site meter is found to be outside of the below listed accuracy testing limits, then the meter will be removed (without any adjustments on an electromechanical meter) and quarantined then a replacement meter will be installed in the meter socket. For high bill complaints, and meter tampering the field test acceptable 'As Found' test results limits for <u>electromechanical meters</u> will be: Full Load Watthours 98.00% - 102.00% Light Load Watthours 98.00% - 102.00% Full Load Watthours at 50% Power Factor 98.00% - 102.00% If all of the <u>electromechanical meter's</u> 'As Found' accuracy tests (Full Load, Light Load, 50% Power Factor) on a high bill complaint or meter tampering are within ±2% (98.00 to 102.00%), then the meter will be returned to the socket <u>with no adjustments</u> (if no other issues are found). If any of the <u>electromechanical meter's</u> 'As Found' accuracy tests (Full Load, Light Load, 50% Power Factor) on a high bill complaint or meter tampering are beyond ±2%, (<98.00 to > 102.00%), then the meter will be replaced at the time of the field meter test. Note: No adjustments will be made to any electromechanical meters in an attempt to move any accuracy tests within ±2%. Note: On meter tampering investigations the meter will be removed and quarantined.	TMO Crew/ Journey Worker		Field meter accuracy testing equipment (RM-17 or Bantam Plus), Field Circuit Analyzer tool, TMO Test Catalog

	For high bill complaints and meter tampering, the field test acceptable 'As Left" test results for solid state meters are: Full Load Watts 99.00 – 101.00 % Light Load Watts 99.00 – 101.00 % Full Load Watthours at 50% Power Factor 99.00 – 101.00 % If all of the solid state meter's 'As Found' accuracy tests (Full Load, Light Load, 50% Power Factor) on a high bill complaint or meter tampering are within ±1% (99.00 to 101.00%), then the meter will be returned to the socket. (if no other issues are found). If any of the solid state meter's 'As Found' accuracy tests (Full Load, Light Load, 50% Power Factor) on a high bill complaint or meter tampering are beyond ±1%, (<99.00 to > 101.00%), then the meter will be replaced at the time of the field meter test. Note: On meter tampering investigations the meter will be removed and quarantined. Additionally, if the solid state meter's test accuracy on a high bill complaint or meter tampering is beyond ± .5% up to ± 1% (99.50% down to 99.00 or 100.50 up to 101.00%), then the meter will be set for replacement after resolution of the high bill complaint or the end of the meter tampering investigation. The future meter replacement will need to be scheduled for a date that coincides with final resolution of the high bill complaint or the end of the meter tampering investigation process. Also, some field meter investigations for high bill complaints and meter tampering where the meter is an instrument rated meter will at times require the use of a field circuit analyzer tool. On a high bill complaint to fully investigate the possibility of a high bill being caused by a problem or an issue with the instrument transformers and possible wiring issues the circuit analyzer will be used to identify these problems.			

Activity Number	Action	Actor	System or Manual	Resources needed Implement
	The circuit analyzer equipment will also be used when a meter tampering investigation is being done on an instrument rated meter where the customer may have diverted current or energy at the metering instrument transformers or related electrical equipment.			
250	If the meter passes proceed to activity ID#255. If the meter does not pass proceed to activity ID#260.	TMO Crew/ Journey Worker		
255	If the meter is an advanced meter proceed to activity ID#265. If the meter is not an advanced meter proceed to activity ID#260.	TMO Crew/ Journey Worker		
265	Return the meter to the meter socket. Meters tested for tampering that remain in the field will be secured in the meter base with high security measures.	TMO Crew/ Journey Worker		High security meter sealing

Activity Number	Action	Actor	System or Manual	Resources needed Implement
260	Meters on high bill complaints (Box 200) that fail the field 'As Found' accuracy test results limits will be replaced. This will cover both electromechanical and solid-state meters. When a meter that is tested during a tampering or energy diversion field investigation (Box 201) and the on-site meter is found to be outside of the required accuracy 'As Found' testing limits, then the meter will be removed and quarantined and a replacement meter will be installed in the meter socket. Damaged meters found as part of a trouble call (Box 203) will be replaced without a meter test. Field meter inspections for meters with suspect problems (Box 202) will be field accuracy tested and then all these meter will be replaced. Because L+G has the responsibility of troubleshooting all network communication issues, then any field meter investigation order that is given to a Meter Electrician for meter communication failures (Box 104) will be field accuracy tested and then become an automatic meter replacement. **Important Note:** In cases where a L+G AMI meter is removed for replacement (other than trouble call damage), the removed meter's warranty status (61 months from build date) will be reviewed at the Cutout Bench and when appropriate the meter will be RMA'd to L+G. **Important Note:** Tracking of all L+G AMI meter failures (by type or cause) will be documented by the City Light Meter Engineer (with the assistance of the Meter Shop Crew Chief) to provide evidence to L+G regarding early failure trends in their meters.	TMO Crew/ Journey Worker	Manual	

Activity Number	Action	Actor	System or Manual	Resources needed Implement
225	Review meter information if systems (Command Center, MDM and CCB)	TMO Crew/ Journey Worker		Command Center, MDM, and CCB
230	If the issue is resolved proceed to activity ID#220. If the issue was not resolved proceed to activity ID#260.			
235	Review meter information if systems (Command Center, MDM and CCB)	TMO Crew/ Journey Worker		Command Center, MDM, and CCB
240	If the issue is resolved proceed to activity ID#220. If the issue was not resolved proceed to activity ID#270.			
270	A specially trained field Meter Electrician along with a L+G Radio Technician will visit the meter room where the meters are not communicating. They will try to establish radio communications with Command Center using the IWR and RadioShop field communications troubleshooting tools. If they are unable to communicate Command Center, they will perform and meter room fix-up. **Note:** the actual field process used for the above described meter room fix-ups is in the planning stages at the time of the creation of this document and will require documentation once this process is in place. A second scenario of GridStream network and Command Center to meter communication failure which will require a field investigation and meter communication fix-up will be completed by all (trained) field Meter Electricians. This scenario will most likely be caused when the non-communicating meter is enclosed inside of the customer service entrance equipment metal cabinet.	Meter Electrician and L+G Radio Technician	Manual and Virtual	L+G field communication troubleshooting equipment (the IWR and RadioShop.

Activity Number	Action	Actor	System or Manual	Resources needed Implement
275	When communications cannot be established in a meter room then a meter room fix-up will be completed which will make it so all meters in the meter room can communicate with the GridStream network equipment. **Note:** the actual field process used for the above described meter room fix-ups is in the planning stages at the time of the creation of this document and will require documentation once this process is in place. When a non-communicating meter is enclosed inside of the customer's service entrance equipment metal cabinet and the meter radio signal is not able to get out. In these situations, the field Meter Electrician will install an external antenna to provide a path for the meter radio to communicate with GridStream. Each field Meter Electrician will have training to do these types individual meter communication fix-ups.	TMO Crew/ Journey Worker	Manual and Virtual	L+G field communication troubleshooting equipment (the IWR and RadioShop along with Endpoint Test Manager (L+G only) software products).

Activity Number	Action	Actor	System or Manual	Resources needed Implement
280	When the field Meter Inspection work is finished, all required paper work will be completed by the field Meter Electrician and returned to their Crew Chief. Once all paper work is reviewed by the Crew Chief then this information will be forwarded to the appropriate City Light departments and employees. **Important Note:** All collected meter usage information and previous meter type information, along with the MIV meter exchange notes will be provided as copies when the field Meter Investigation packet is returned to the Crew Chief as the investigation is complete. In field Meter Investigations where the field work could not be completed, the Meter Electrician will use the issued paperwork to detail the problems found, then turn this into their Crew Chief. The WAMS WO and or FA gets closed out by the Crew Chief/MSA.	TMO Crew/ Journey Worker/Crew Chief/ MSA	Manual	