MesaWater DISTRICT

Dedicated to Satisfying our Community's Water Needs

AGENDA
MESA WATER DISTRICT
BOARD OF DIRECTORS
Tuesday, April 16, 2019
1965 Placentia Avenue, Costa Mesa, CA 92627
3:30 p.m. Special Board Meeting

ENGINEERING AND OPERATIONS COMMITTEE MEETING
Tuesday, April 16, 2019 at 3:30 p.m.

CALL TO ORDER

PLEDGE OF ALLEGIANCE

PUBLIC COMMENTS

Items Not on the Agenda: Members of the public are invited to address the Board on items which are not on the agenda. Each speaker is limited to three minutes. The Board will set aside 30 minutes for public comments.

Items on the Agenda: Members of the public may comment on agenda items before action is taken, or after the Board has discussed the item. Each speaker is limited to three minutes. The Board will set aside 60 minutes for public comments.

CONSENT CALENDAR ITEMS:
Approve all matters under the Consent Calendar by one motion unless a Board member, staff, or a member of the public requests a separate action.

1. Developer Project Status Report
2. Mesa Water and Other Agency Projects Status Report
3. Water Quality Call Report
4. Committee Policy & Resolution Review
5. Water Operations Status Report

ACTION ITEMS:
Items recommended for approval at this meeting may be agendized for approval at a future Board meeting.

None

PRESENTATION AND DISCUSSION ITEMS:

6. Meter Technology Assessment

REPORTS:

7. Report of the General Manager
8. Directors' Reports and Comments

INFORMATION ITEMS:

9. Production Well Costs

In compliance with California law and the Americans with Disabilities Act, if you need disability-related modifications or accommodations, including auxiliary aids or services in order to participate in the meeting, or if you need the agenda provided in an alternative format, please contact the District Secretary at (949) 631-1206. Notification 48 hours prior to the meeting will enable Mesa Water District (Mesa Water) to make reasonable arrangements to accommodate your requests.

Members of the public desiring to make verbal comments utilizing a translator to present their comments into English shall be provided reasonable time accommodations that are consistent with California law.

Agenda materials that are public records, which have been distributed to a majority of the Mesa Water Board of Directors (Board), will be available for public inspection at the District Boardroom, 1965 Placentia Avenue, Costa Mesa, CA and on Mesa Water's website at ***www.MesaWater.org****. If materials are distributed to the Board less than 72 hours prior or during the meeting, the materials will be available at the time of the meeting.*

ADJOURNMENT

DEVELOPER PROJECT STATUS REPORT

PROJECT STATUS - DEVELOPER PROJECTS			
FILE NO.	PROJECT ADDRESS	PROJECT DESCRIPTION	PROJECT NOTES/STATUS
MC 2149	1620-1644 Whittier Avenue and 970 16th Street	89 Single Family Homes	Plans received and plan check fees paid 2/2/14. Permit issued on 7/23/15. Pre-con meeting held on 7/27/15. Pipeline installation on 10/21/15. Pressure test and chlorination on 11/5/15. Bac-T testing completed on 11/24/15 and 11/25/15. Waterline tied-in angle-stops locked on 12/14/15. 4-1" meters installed on model homes on 2/25/16. 1-1.5" irrigation meter and 1-1" domestic meter installed and locked on 4/5/16. Inspected rock base on 7/11/16. Installed 7-1" meters on 7/13/16. Flow-thru tested on 8/25/16, 9/8/16. Rock base and meters installed on 11/3/16. Flow-thru check on 12/1/16, 4/5/17. Meters installed on 8/21/17, 10/5/17. Meters installed on 4/25/18. Meters installed 6/28/18 and again on 8/13/18. Contacting site in order to test 2 irrigation backflow devices.
MC 2204	1672 Placentia	31 Single Family Homes	Plans received and plan check fees paid on 8/26/15. Second plan check submitted on 2/11/16 and returned on 2/26/16. Mylars submitted, fees paid, and permit issued on 5/5/16. Tee cut-ins on 6/22/16. Pressure Test and Bac-T test on 7/7/16. Water main turned on 7/21/16. Services installed and locked off on 9/6/16. Meter installation on 10/28/16. Backflows tested on 11/16/16. Backflow tested on 12/9/16. Rock base on 2/1/17. Service placement on 2/16/17. Meters installed on 3/28/17. Backflows tested on 3/30/17. Meters installed and locked off on 2/20/18. Contacting site in order to test remaining 4 backflow devices.
MC 2233	1560 Placentia	81 Single Family Homes	Plans received and plan check fees paid on 1/20/16. Request for additional information requested on 1/28/16. Requested information submitted on 2/24/16. Plan check picked up on 4/18/16. Second plan check submitted on 5/18/16. Mylar drawings and fee payment received on 7/5/16. Permit issued on 7/11/16. Mainline installed on 8/24/16. Hydrant laterals installed on 8/25/16. Services installed on 9/1/16. Mainline installed on 9/20/16. Pressure and Bac-T test on 9/28/16. Laterals installed on 9/29/16 and 10/5/16. Mainline charged on 10/17/16. Angle stop adjusted on 12/6/16. Meter and meter box placement on 1/5/17. Services adjusted to grade on 3/2/17. Meter installation on 5/3/17. Site meeting on 7/26/17. Service placement on 9/6/17. Meter box placement on 2/9/18. Meters installed and locked off on 5/21/18, 6/28/18, 7/13/18, 8/8/18, and again on 10/10/18. Concrete pads placed on 10/24/18 and 10/25/18. Meters installed on 12/4/18, 1/7/19, 1/29/19 and again on 3/21/19. Contacting site in order to test remaining backflow devices.

DEVELOPER PROJECT STATUS REPORT

PROJECT STATUS - DEVELOPER PROJECTS			
FILE NO.	PROJECT ADDRESS	PROJECT DESCRIPTION	PROJECT NOTES/STATUS
MC 2235	671 W 17th Street	177 Condos	Plans received and plan check fees paid on 1/21/16. Hydraulic model initiated 2/24/16. Second plan check submitted on 3/24/16 and picked up 4/17/16. Mylar drawings and fee payment received on 7/5/16. Permit issued on 7/11/16. Demolition of existing services on 8/16/16. Mainline installation on 12/6/16. Service laterals installed on 1/9/17. Pressure test on 2/6/17. Bac-t test on 2/15/17. Bedding and service line placement on 4/3/17. Meter box placement on 5/8/17. Follow-up site visit on 5/17/17. Service abandonment on 8/30/17. Valve cans raised on 9/22/17. Meter box placement on 10/19/17. Gravel base on 12/5/17. Meter box placement on 2/14/18. Meters installed and locked off on 6/1/18, 7/17/18, on 8/1/18, and again on 9/7/18. Backflow tested on 9/11/18. Meters installed and locked off on 9/18/18, 9/25/18, and again on 10/5/18. Backflow tested on 10/9/18 and again on 2/27/19. Meters installed and locked off on 11/27/18, 12/5/18, 12/18/18, 1/10/19, 2/8/19, 2/21/19, 3/4/19, and again on 3/12/19. Engineering coordinating with Operations and Customer Services to determine remaining items in order to close project.
C003-16-01	788 Center Street	2 Single Family Homes	Plans received and plan check fees paid on 6/28/16. Plans returned on 7/14/16. Fees paid and permit issued on 1/6/17. Pre-con held on 1/16/18. Service installed on 3/8/18. Meters installed and locked on 3/13/18. Awaiting call for backflow testing to complete project. Contacting site to schedule backflow testing to complete project.
C0012-17-02	929 Baker Street	55 Detached Condos	Plans received and plan check fees paid on 9/27/16. Plans picked up on 10/18/16. Plans submitted on 2/22/17. Plans returned on 3/6/17. Fees paid and permit issued on 3/21/17. Precon held on 6/1/17. Services installed on 8/31/17. Mainline turned on 9/14/17. Meters installed and locked on 2/26/18. Awaiting call for backflow testing to complete project. Meters installed and locked on 8/6/18. Backflow tested on 8/24/18. Site check done on 9/25/18, homes are still under construction. Meters installed and locked off on 11/2/18. Meters installed again on 1/10/19. Flowthru system tested on 3/22/19. Tom Walker being contacted for backflow testing for irrigation services.

DEVELOPER PROJECT STATUS REPORT

PROJECT STATUS - DEVELOPER PROJECTS			
FILE NO.	PROJECT ADDRESS	PROJECT DESCRIPTION	PROJECT NOTES/STATUS
C0014-18-01	1585 MacArthur	Commercial Building	Plans received and plan check fees paid on 3/27/18. Comments returned on 4/5/18. Awaiting resubmittal. Plans approved, final fees paid and permit issued on 8/7/18. Construction inspections are currently in progress with mainlines being excavated on 8/29/18, 9/5/18, 9/6/18. Backflow for fireline installed on 9/12/18. Service abandonments completed on 10/16/18. Services installed on 2/26/19. Meters installed and locked off on 2/28/19. One meter upgraded on 4/2/19.
C0027-17-01	231 Flower Street	Meter Upgrade	Plans received and plan check fees paid on 3/23/17. Fees paid and permit issued on 4/21/17. Site visit on 10/30/17, and again on 5/30/18; no progress to report. Site visit on 8/20/18 and 9/25/18 with no activity. Engineering to follow up on 4/9/19.
C0029-17-01	127 23rd Street	4 Single Family Homes	Plans received and plan check fees paid on 5/12/17. Fees paid and permit issued on 8/3/17. Awaiting call for initial inspections. Service installed on 2/8/18. Meters installed and locked on 2/15/18. Awaiting call for backflow testing to complete project. Spoke to property owner on 10/10/18, construction will be done by the end of 2018 to test flowthru system. Waiting on service abandonments to be completed.
C0035-18-01	146 18th Street	2 Single Family Homes	Plans received and plan check fees paid on 8/8/17. Fees paid and permit issued on 9/21/17. Meters installed and locked on 10/20/17. Site visit on 1/9/18; Awaiting call for backflow testing to complete project.
C0037-18-01	2850 Mesa Verde Drive East	11 Single Family Homes	Plans received and plan check fees paid on 8/17/17. Fees paid and permit issued on 10/18/17. Manifold installation on 12/6/17. Meters installed on 12/29/17. Irrigation meter installed on 3/28/18. Backflow test on 4/18/18. Meters placed and locked on 5/31/18. Site visit done to verify progress on 8/20/18. Meters installed on 9/21/18.
C0039-18-01	172/174 Costa Mesa Street	2 Single Family Homes	Plans received and plan check fees paid on 8/22/17. Fees paid and permit issued on 8/29/17. Precon meeting held on 2/6/19. Services installed on 2/8/19. Meter installed and locked off on 2/19/19.
C0041-18-01	160 & 162 E 18th Street	2 Single Family Homes	Plans received and plan check fees paid on 9/27/17. Fees paid and permit issued on 11/2/17. Meters installed and locked on 3/26/18. Meters installed and locked on 6/28/18. Backflow tested on 10/29/18.
C0042-18-01	335 & 337 16th Place	2 Single Family Homes	Plans received and plan check fees paid on 10/26/17. Final fees paid on 8/8/18. Site visit on 8/20/18; contractor still grading the area.

DEVELOPER PROJECT STATUS REPORT

PROJECT STATUS - DEVELOPER PROJECTS			
FILE NO.	PROJECT ADDRESS	PROJECT DESCRIPTION	PROJECT NOTES/STATUS
C0044-18-01	276 E 19th Street	Meter Upgrade	Plans received and plan check fees paid on 1/21/18. Final mylar signed on 2/28/19. Precon held on 3/4/19. Meter installed and locked off on 3/6/19. Backflow tested on 4/3/19.
C0047-18-01	3505 Cadillac Avenue	Commercial Building	Plans received and plan check fees paid on 1/22/18. Fees paid and permit issued on 4/10/18. Services placed on 5/2/18. Thrustblocks placed on 6/6/18. Pressure test performed on 7/9/18. Engineering to follow up on 4/9/19.
C0048-18-01	235 Baker	Commercial Building	Plans received and plan check fees paid on 2/15/18. Fees paid and permit issued on 4/13/18. Site visit on 8/20/18 to verify work status; no construction. Engineering to follow up on 4/9/19.
C0049-18-01	428 E 17th Street	Restaurant	Plans received and plan check fees paid on 1/26/18. Fees paid and permit issued on 5/4/18. Pressure test on 5/25/18. Shutdown for tee cut-in on 6/5/18. One fire service is active, the other is stubbed to property. Awaiting call for fireline pressure test and samples. Water service manifold stubbed to property. Pressure test and Bac-T tests done on 9/7/18, 9/11/18 and again on 9/13/18. Pressure test performed on 10/22/18.
C0051-18-01	1650 Monrovia	Senior Living Complex	Plans received and plan check fees paid on 2/15/18. Comments returned on 3/12/18. Revised submittal received on 4/24/18. Project to undergo hydraulic model analysis. Second plan check complete. Easements recorded on 8/14/18. Final fees paid on 8/23/18. Precon meeting held on 9/26/18. Fireline excavation and thrustblock placement on 11/27/18. Meters installed on 1/10/19. Health samples performed on 1/30/19 and 1/31/19.
C0052-18-01	302 Cabrillo	2 Single Family Homes	Plans received and plan check fees paid on 2/26/18. Fees paid and permit issued on 5/7/18. Awaiting initial calls for inspections. Verified with new property owner on 3/11/19 that construction will begin soon.
C0053-18-01	1908 Tustin	Single Family Home	Plans received and plan check fees paid on 3/8/18. Fees paid and permit issued on 3/13/18. Engineering to follow up on 4/9/19.
C0054-18-01	3505 Cadillac Avenue, Unit O-101	Commercial Building	Plans received and plan check fees paid on 5/7/18. Fees paid and permit issued on 5/22/18. Tapping sleeve, and hot tapping done on 5/2/18. Thrustblock placement inspections on 5/2/18, 6/6/18, and 7/9/18. Pressure test done on 7/9/18. Fireline turned on 9/12/18.

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FILE NO.	PROJECT ADDRESS	PROJECT DESCRIPTION	PROJECT NOTES/STATUS
C0056-18-01	2033 Republic Avenue	Single Family Home Service & Meter Upgrade	Plans received and plan check fees paid on 6/19/18. Comments returned for second plan check review on 6/28/18. Second plan check submitted 7/26/18, and redlines picked up on 8/20/18. Third plan check submitted on 12/13/18, and redlines picked up on 1/15/19. Fourth and final plan check submitted on 1/24/19, and redlines picked up on 1/29/19.
C0058-18-01	585 & 595 Anton Boulevard	Apartment Complex	Plans received and plan check fees paid on 6/8/18. Currently in plan check. Meeting scheduled with owner on 9/12/18 to go over questions they have. Plans approved to perform demolition for grading only at this time; construction plans are being reviewed. Operations is currently working on practice shutdowns for service connection tie-in. Precon with contractor held on 1/22/19. Shutdowns for abandonments performed on 3/14/19, 3/18/19, and on 3/19/19.
C0060-19-01	3505 Cadillac Avenue, Unit F-9	Commercial Building New Fire Line	Plans received and plan check fees paid on 7/23/18. Permit issued for major service line and fire systems infrastructure. Final permit will be reviewed when tenant improvements are submitted. Fireline excavation and thrustblock placement on 12/10/18 and 12/14/18. New T.I. was submitted on 3/8/19 to continue plan check and approve final permit. Engineering is following up on 4/9/19.
C0061-19-01	3033 Bristol Street, Space 2071	Restaurant Expansion	Plans received and plan check fees paid on 8/16/18. Awaiting final payment of fees. Engineering is following up on 4/9/19.
C0062-19-01	1591 & 1593 Riverside	Two Single Family Homes	Plans received and plan check fees paid on 12/14/18. Final fees paid on 2/6/19. Permit issued on 2/13/19. Precon held on 2/28/19. Services installed on 3/4/19.
C0063-19-01	1375 Sunflower	Commercial Building	Plans received and plan check fees paid on 12/14/18. Customer picked up redlines on 12/31/18. Second plan check submitted on 1/11/19, and redlines picked up on 1/29/19. Third plan check submitted on 1/31/19.Final permit fees paid on 3/26/19.
C0064-19-01	1975, 1977, 1981, 1985 Placentia Avenue	Commercial Building	Plans received and plan check fees paid on 11/6/18. Currently in plan check. Final plan check fees paid on 1/15/19. Permit issued on 1/17/19. Precon held on 2/14/19. Hot-Tap performed on 2/20/19. Meters installed on 3/4/19, and again on 3/22/19. Backflow tested on 3/5/19, and another on 3/22/19.

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FILE NO.	PROJECT ADDRESS	PROJECT DESCRIPTION	PROJECT NOTES/STATUS
C0065-19-01	245 Knox Rd	Single Family Home	Plans received and plan check fees paid on 11/7/18. Final fees paid on 2/5/19. Precon meeting held on 2/8/19. Meter installed and locked off on 2/21/19. Flowthru system checked on 3/20/19.
C0065-19-02	1545 Westminster	Single Family Home	Plans received and plan check fees paid on 11/7/18. Final fees paid on 2/5/19. Precon meeting held on 2/8/19. Services installed on 2/12/19. Meter installed and locked off on 2/21/19. Flowthru system checked on 3/20/19.
C0066-19-01	2062 Pomona	Single Family Home	Plans received and plan check fees paid on 11/29/18. Final fees paid on 1/22/19. Precon held on 2/5/19. Services installed on 2/11/19.
C0067-19-01	3505 Cadillac Avenue, Suite A	Commercial Building New Fire Line	Plans received and plan check fees paid on 12/14/18. Plans picked up on 12/20/18. Second plan check submitted 1/9/19, and picked up again on 1/15/19. Third plan check submitted on 1/25/19. Final permit fees paid on 2/7/19. Permit issued on 2/13/19. Precon held on 2/22/19. Services installed on 2/28/19, and Chloriated. Hot-Tap done on 3/1/19. Bac-T tests perfomed on 3/5 and 3/6/19. Concrete pad done on 3/8/19. Backflow tested and fireline turned on, on 3/11/19.
C0069-19-01	767 W 17th Street	Meter Upgrade	Plans received and plan check fees paid on 1/7/19. Second plan check submitted 3/21/19, and redlines picked up on 3/26/19. Final permit fees paid on 3/27/19.
C0070-19-01	3333 Bristol Street Space 3001	Commercial Building	Plans received and plan check fees paid on 1/3/19. Customer picked up redlines on 1/7/19. Second plan check submitted on 1/15/19, and redlines picked up on 1/31/19. Third plan check submitted on 2/12/19, and redlines picked up on 2/14/19. Final fees paid on 2/28/19. Permit issued on 3/11/19. Precon meeting held on 3/18/19.
C0071-19-01	2277 Harbor Boulevard	Commercial Building	Plans received and plan check fees paid on 1/7/19. Customer picked up redlines on 1/25/19. Second plan check submitted on 1/28/19, and redlines picked up on 1/31/19.
C0072-19-01	168 & 170 Cabrillo	Two Single Family Homes	Plans received and plan check fees paid on 1/14/19.Customer picked up redlines on 1/24/19.
C0073-19-01	55 Fair Drive	Vanguard University Student Center	Plans received and plan check fees paid on 1/14/19. Customer picked up redlines on 2/12/19. Second plan check submitted on 3/11/19. Third/Fourth (and final) plan check submitted on 3/14/19 and redlines picked up on 3/25/19.
C0074-19-01	2538 Oxford Lane	Single Family Home	Plans received and plan check fees paid on 11/14/18. Customer picked up redlines on 1/31/19. Second plan check submitted on 2/1/19, and redlines picked up on 2/5/19.

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FILE NO.	PROJECT ADDRESS	PROJECT DESCRIPTION	PROJECT NOTES/STATUS
C0075-19-01	2942 Century Place	Commercial Building	Plans received and plan check fees paid on 1/23/19. Customer picked up redlines on 1/29/19, and redlines picked up on 2/8/19. Second plan check submitted 3/25/19, and redlines picked up on 4/2/19.
C0076-19-01	2948 Randolph	Commercial Building	Plans received and plan check fees paid on 1/23/19. Customer picked up redlines on 2/1/19. Second plan check/mylars submitted on 2/11/19. Final fees paid on 2/14/19. Permit issued on 2/14/19. Precon held 2/22/19. Services installed on 3/19/19. Meter installed and backflow tested on 3/20/19.
C0077-19-01	1922 Pomona	Commercial Building	Plans received and plan check fees paid on 1/28/19. Customer picked up redlines on 2/1/19. Second plan check submitted on 2/5/19, and redlines picked up again on 2/12/19. Final fees paid on 2/27/19. Permit issued on 3/11/19. Precon meeting held on 3/19/19. Meter installed 3/28/19.
C0078-19-01	3505 Cadillac Avenue, F-5	Commercial Building New Fire Line	Plans received and plan check fees paid on 1/31/19. Customer picked up redlines on 2/5/19. Second plan check submitted on 3/8/19. Final permit fees paid on 4/2/19.
C0079-19-01	1957 Newport Boulevard	Meter Upgrade	Plans received and plan check fees paid on 2/5/19. Customer picked up redlines on 2/27/19. Meeting on 3/5/19 with customer to discuss easement.
C0080-19-01	246 Tulane Road	Meter Upgrade	Plans received and plan check fees paid on 2/6/19. Customer picked up redlines on 2/12/19. Second plan check was submitted on 3/4/19, and redlines picked up on 3/11/19.
C0081-19-01	2060 Maple Avenue	Single Family Home	Plans received and plan check fees paid on 11/22/18. Owner put plans on hold and resubmitted on 2/5/19. Customer picked up redlines on 2/12/19. Second plan check was submitted on 2/21/19, and redlines picked up on 2/28/19. Third plan check submitted on 2/28/19, and redlines picked up on 3/5/19. Fourth (and final) plan check submitted on 3/26/19 and returned on 4/2/19. Final permit fees paid on 4/2/19.
C0058-19-01	585 & 595 Anton Boulevard (P2)	Apartment Complex	Plans received and plan check fees paid on 2/5/19. Customer picked up redlines on 2/8/19. Second plan check submitted 3/11/19, and redlines picked up on 3/25/19. Waiting Hydraulic Analysis by MBI due on 4/5/19.
C0082-19-01	3323 Hyland Avenue	Apartment Complex	Plans received and plan check fees paid on 2/20/19. Customer picked up redlines on 3/4/19. Second plan check submitted 3/26/19, and redlines picked up on 4/2/19.

DEVELOPER PROJECT STATUS REPORT

PROJECT STATUS - DEVELOPER PROJECTS			
FILE NO.	PROJECT ADDRESS	PROJECT DESCRIPTION	PROJECT NOTES/STATUS
C0083-19-01	175 Costa Mesa	Meter Upgrade	Plans received and plan check fees paid on 2/20/19. Customer picked up redlines on 3/4/19.
C0084-19-01	410 E 17th Street	Commercial Business	Plans received and plan check fees paid on 2/20/19. Customer picked up redlines on 3/4/19.
C0085-19-01	3030 Airway Avenue, Suite B	Commercial Business	Plans received and plan check fees paid on 3/5/19. Customer picked up redlines on 3/12/19. Second plan check submitted 04/1/19.
C0086-19-01	285 22nd Street	Residential Care Facility	Plans received and plan check fees paid on 3/11/19. Customer picked up redlines on 3/19/19.
C0087-19-01	1885 Anaheim Avenue	Church	Plans received and plan check fees paid on 3/15/19. Precon meeting held on 4/1/19. Work being completed on 4/1/19.

MESA WATER AND OTHER AGENCY PROJECTS STATUS REPORT
April 2019

Project Title: OC-44 Replacement and Rehabilitation Evaluation and Cathodic Protection Study

File No.: M 2034

Description: Evaluate potential repair and replacement options

Status: The Habitat Mitigation and Monitoring Plan (HMMP) has been updated by Michael Baker (former RBF) to reflect the USACE's process and submitted to Mesa Water for review on 1/8/16. Once the HMMP is revised and approved (1/19/16) it will be forwarded to all agencies, including the Coastal Commission. Draft 1602 Streambed Permit obtained on 12/18/15. Final 1602 Streambed Permit pending CDFW will be issued while HMMP is accepted. U.S. Army Corps of Engineers' 404 permit received on 2/10/16. Revised HMMP sent to CCC for review and approval. Project is pending CCC's approval at an upcoming hearing. On 2/29/16, a meeting with Fletcher Jones Motorcars, City of Newport Beach, MBI (former RBF), and City of Huntington Beach was held to discuss issues associated with proposed construction activities. Traffic Plan prepared and submitted to the City of Newport Beach for approval on 6/29/16. Per request of CCC a dewatering plan was prepared and submitted for approval. Mesa Water staff, MBI and CCC met on 10/6/16 and discussed mitigation conditions. Project approved at CCC Public Hearing on 12/7/16. MBI is working on finalizing the HMMP and construction plans and will submit them to CCC. Staff met with MBI on 5/1/17 and discussed comments after reviewing the draft final HMMP. New proposed mitigation criteria received from CCC on 7/5/17 reducing mitigation requirements from 1.6 acres to 0.66 acres. Coastal Development Permit for Construction is anticipated in December, 2017. The project re-start meeting was held on 9/7/17. On 10/30/17 met with City of Newport Beach and City of HB to discuss permit requirements and project access. Met w/Fletcher Jones, Skender Construction, City of HB, MBI to discuss access to the site and scheduling on November 21, 2017. Reviewing the 100% Design Plans & Specs (received on 11/28/17) along with the Pipeline Design Schedule, Construction Monitoring Treatment Plan (CMTP), and proposal for Natural Resources/Regulatory Services during construction activities. Bid solicitation is scheduled for late January 2018. Project sent out to bid on January 30, 2018. Pre-bid meeting held on 2/15/18. Construction bid solicitation was cancelled due to ongoing coordination issues for the final Coastal Development permit. Project was deferred to FY20. On 8/1/18, Orange County Public Works issued a one-year extension to the previously issued Encroachment Permit. The Caltrans Encroachment Permit extension application is under review as of 8/13/18. The CCC extended the permit a year without hearing. MBI moved forward with the amendment to reduce mitigation. The updated information was forwarded by MBI to CCC in the week of August 6, 2018 and November 2, 2018. Staff held a stakeholder coordination meeting on 1/3/2019. Request for Bids sent out to contractors on February 6, 2019. Six bids received on 3/6/19. E&O Committee recommended award of the contract to lowest bidder (E.J. Meyer Company) on 3/19/19. Staff is working on preparing the contract. (4/4/19)

Project Title: Well Automation and Rehabilitation

File No.: MC 2101

Description: Rehabilitate all clear water wells and add remote control SCADA capabilities

Status: Construction activities began at Well 5 on October 3, 2016 with demolition and well rehabilitation beginning in the first week. Video of Well 5 showed scale on the louvers, and potential failure of an unused sounding tube and a small area of the louvers potentially requiring swage patches. Repair completed on November 29, 2016. Well 5 rehabilitation resumed on December 3, 2016. Well 5 chemical facility pad has been constructed and is awaiting a weather forecast of 8 days with no predicted rain to apply the chemical-resistant coatings to the concrete. Well 5 pumping development began on January 4, 2017, and produced fine sand at pumping rates above 1100 gpm. Repairs were made to Well 5, and test pumping performed in February showed acceptable well production over 2500 gpm with manageable sand. Construction is substantially complete at the Well 5 site. A start up planning meeting was held on March 29, 2017. Well 5 is running as needed and producing good quality water. Well 7 rehabilitation is complete, The Well 7 pump was installed the week of August 28, 2017, and Well 7 is operational and good quality water. Construction of the Well 3 chemical facilities was begun in July 2017. The concrete for the Well 3 chemical facilities is cured and coated, and the chemical tanks and canopy are currently being installed. Well 3 rehabilitation is complete and test pumping achieved over 1600 gpm. Construction at Well 9 began in October with relocation of the backup generator and chemical facilities construction. Coating of the Well 9 chemical facilities was completed in December, and the chemical tanks and canopy are installed. Witness testing for the new pumps for Wells 3 and 9 was completed January 2018, and pumps were installed the week of June 4. Construction at Well 3 and Well 9 is substantially complete. Flushing and chlorination of Well 3 and Well 9 were conducted during in July 2018. Well 3 initial startup was on July 17, 2018. Well 9 initial startup was on July 30, 2018. Well 3 and Well 9 have completed their seven-day tests. Work at Well 1 began on August 13, 2018. The video of Well 1 showed a biofilm. Well 1 has received brushing and airlifting of fill material, as well as acid and chlorine treatment in October 2018. Pumping redevelopment produced 2,300 gallons per minute. The Well 1 chemical facilities are constructed and the chemical tanks are set. The prefabricated electrical building was delivered and set on December 10, 2018, and the Well pump was installed on December 11, 2018. Startup of Well 1 occurred on February 21, 2019, and Well 1 completed its 7-day performance test with no interruption. The Construction and Start Up phase of the project is complete, and the project is being closed out. A project close-out briefing will be provided at the June E&O meeting. (4/4/19)

Project Title: Pipeline Testing Program

File No.: MC 2141

Description: Implement Resolution No. 1442 Replacement of Assets to annually perform non-destructive testing of 1% of the distribution system, and destructive testing of segments that are shown to have less than 70% of original wall thickness by non-destructive testing.

Status: Extraction of six sections of ACP and two sections of CIP are in process for 2017 destructive testing. ACP samples were sent to WSP Canada for destructive testing. Results were received on August 1, 2017. CIP samples will be sent to McWane Ductile's lab in Ohio for destructive testing. Results were received on June 30, 2017. A Request for Qualifications for consulting services for the Pipeline Integrity Testing Program was released in May 2017. Four Statements of Qualifications were received and a recommendation for contract award to HDR was approved by the E&O Committee on July 20, 2017. ACP test results were received on July 31, 2017. Results have been analyzed, and were presented at the November Committee meeting. Average ACP total useful life is expected to be approximately 142 years. A process for determining when a pipeline has reached the end of its useful life and how much of the pipeline to replace was implemented. One 8" ACP line in Harbor Boulevard from Wilson to 19th Street was recommended for replacement. Kickoff meeting for a close interval survey of the 12" Cast Iron Pipe in 19th Street was held on December 28, 2017, and the Consultant has completed the field work. The report is expected in April 2018. Operations staff has collected four ACP pipe samples during valve replacement projects, and one during an AC mainline repair. The samples have been sent to a laboratory for remaining wall thickness measurements, and the reports show that while they have lost structural thickness, the remaining useful life is still 35 - 53 years. The mainline break sample showed the smallest remaining useful life and shortest total useful life of any AC sample. Additional AC pipe samples from valve replacements are being collected. Echologics performed three miles of non-destructive wall thickness measurements during the week of February 12, 2018. A report of the results was received in March 2018. All non-destructive and destructive test data were added to GIS in April and May 2018. The mainline break map in GIS is currently being updated. A comprehensive review of cathodic protection test stations was performed in April and May 2018. The report and recommendations was received on June 20, 2018, and recommendations are being reviewed. Five AC pipe samples and nine soil samples collected during valve replacements in 2018 were delivered by the contractor and sent to labs for pipe wall thickness measurements and soil corrosivity analysis. Results show that the expected total useful life of AC pipe is approximately 138 years. Two AC pipe samples were collected during valve replacements in November 2018 and sent to the lab for wall thickness measurements. Results were received on January 10, 2019. One sample is being further analyzed. Three miles of AC pipe constructed in 1956 were selected for non-destructive wall thickness measurement, which occurred during the week of January 14, 2019. The report was received on February 8, 2019. Five AC pipe samples are planned to be collected and sent for wall thickness measurements as part of routine valve replacements in April 2019. (4/4/19)

Project Title: Mesa Water Administration Building Improvements & HVAC Replacement/Operation Building Repair Projects

File No.: MC 2171

Description: Evaluate the existing HVAC system, provide recommendations for improved efficiency and operations of the system, provide design, construction management, and construction.

Status: Request for proposals for providing Construction Management during construction was sent out to nine consultants on 8/15/18. Three proposals received on 8/28/18. Held interviews with all three proposers on 9/4/18. Jett Construction Management's (JCM) approach appeared to be the most comprehensive given their proposed project staff and HVAC and roof construction experience. Bid set documents for construction have been finalized and sent out to bid on 9/6/18. Three bids were received on 10/4/18. The lowest responsive bid was approximately $1M over the Engineer's Estimate. On 10/22/18 Board cancelled the bid and authorized staff to negotiate with lowest bidder. On 10/26/18 RFB for Operations Building Repair Project sent out to bid with the bid opening date 11/5/18. On 11/5/18 staff finalized negotiations with the low bidder (Snyder Langston). On 11/8/18 the Board approved the Administration Building Improvements & HVAC Replacement/Operations Building Repair Projects with Snyder Langston. The contracts with Snyder were signed on 11/13/18 and Notices for Proceed issued on 12/6/18. On 2/11/19 Snyder completed painting, carpeting and concrete floor polishing, installation of interior portion of the HVAC system, ceiling tiles and baseboards, rehabilitation of the upstairs and downstairs restrooms, overall cleaning. Also the furniture in supervisors and water quality office were reassembled. The Administration Staff started moving to the temporary office trailer. The contractor continued working on the roof of the Operations Building on installation of ducts and preparing for the upcoming rain. Starting from February 15 the contractor worked on the HVAC replacement on the second floor of the Administration building and EOC. The work completed to date included demolishing of old ducted HVAC piping, blocking for HVAC units, installation of HVAC units, installation of refrigerant and condensate piping, electrical work, painting, installation of the ceiling tiles and partial demolition of roofing for HVAC platform installation. At the same time the design for the Boardroom Improvements has been taking place. Project in progress. (4/4/19)

Project Title: Chandler & Croddy Wells and Pipeline Project

File No.: M18-113

Description: Design, documentation, and permitting for two new wells located on Chandler Avenue and Croddy Way in the City of Santa Ana and the distribution pipeline connecting the wells to Mesa Water's supply system.

Status: Tetra Tech has been contracted to complete the design, documentation, and permitting for the Chandler and Croddy Wells and Pipeline Project. Initial data request sent to Tetra Tech on September 7, 2017. Met with Division of Drinking Water regarding well locations on September 20, 2017. Preliminary hydrological evaluation received on September 29, 2017. Board approved demolition of existing structures and

dedicated well facility with option to evaluate long-term lease potential as market conditions dictate at both sites at November 2017 E&O. Butier Engineering has been contracted to provide Construction Management Services. Preliminary Design Report (PDR) for the distribution pipeline was reviewed and returned on March 6, 2018. Well site layouts were presented to the Board in May. DDW waiver for 50-foot control zone is currently being drafted. The revised PDR for the pipeline and the well sites was received in June 2018. A workshop to discuss review comments was held on August 14, 2018. 50% design for the Croddy Pipeline was received and the design review workshop occurred on November 26, 2018. 50% design for the wells is scheduled for submittal in February 2019. The draft CEQA Mitigated Negative Declaration was received on January 22, 2019, and filed for 30-day public comment on February 20, 2019 and completed on March 22, 2019. Four agencies submitted minor comments. A public meeting to adopt the Mitigated Negative Declaration has been noticed for the April 11, 2019 Board of Directors meeting. The revised Preliminary Design Report for the Chandler and Croddy Wells was received on March 5, 2019, and is being reviewed by staff.(4/4/2019)

Project Title: Santa Ana Pressure Reducing Station Refurbishment Project

File No.: M17-002A

Description: The work will involve replacement of three (3) butterfly valves, one (1) existing pressure relief valve, precast concrete discharge structure, reconfiguring four (4) Cla-Val control valves, general refurbishments to the vault interior, and site work.

Status: Mesa Water has contracted with Michael Baker International to perform the design of the project. The design was completed in late January 2018 and the bid package was sent out to bid on February 8, 2018. Pre-bid meetings and site walk were held on 2/20/18 and 3/6/18, respectively. Three bids were received on March 13, 2018. Staff has recommended that the construction contract be awarded to J.R. Filanc, Inc., as the lowest bidder. E&O Committee recommended awarding contract to J.R. Filanc, Inc. on March 20, 2018 and Board approved it on April 12, 2018. The contract was finalized (5/1/18) and signed on 5/3/18. The kick-off meeting was held on May 21, 2018. Electrical work was completed the week of 10/15/18. Concrete work completed in the week of 11/12/18. Pipeline shutdown took place between 11/26/18 and 12/1/18. Final testing and acceptance completed on February 6, 2019. The contractor is working on providing replacement actuators for the existing plug valves and on refurbishment of the 6“bypass cla-valve. The replacement actuators have been ordered by the contractor. On 3/8/19 the contractor replaced damaged micro switch on train No. 4. Project in progress. (4/4/19)

Project Title: Meter Technology Evaluation

File No.: MC 2248

Description: The lifespan of a water meter is approximately 15 years. As a meter ages, the accuracy drops off due to wear. In preparation for its annual water meter replacement, staff has been reviewing water meter technology determining what water meter and reading solutions would be the best fit for Mesa Water’s aging register technology. With today’s technology, there are several types of meters and meter reading solutions available. The most common are as follows: Fixed Network,

Automatic Meter Reading (AMR) System, Handheld or Touch Technology, and Advanced Metering Analytics - Cellular Endpoint.

Status: Mesa Water is preparing a Technical Memo which would include information of the existing aging metering technology in comparison with proposed new meter reading solutions. Technical memo is presented in this packet. (4/8/19)

Project Title: Reservoirs 1 & 2 Chemical Systems Design

File No.: M18-117

Description: Improve disinfection and mixing in both reservoirs to improve water quality and minimize nitrification.

Status: Final Design Contract awarded to Hazen & Sawyer on February 14, 2018. 50% design report received on July 17, 2018. Design review workshop took place in September 2018. A site visit to Laguna Beach County's El Morro reservoirs occurred on November 8, 2018, to evaluate the Vortex mixing system. Staff met with the designer on December 5, 2018, to incorporate design-for-reliability and design-for-maintainability principals into the mixing system design. The consultant is working with the mixer supplier to ensure that the reliability and maintainability requirements will be met at both the reservoir sites. The consultant provided a Technical Memo summarizing the maintainability and reliability of the mixer on April 4, 2019. (4/4/2019)

Water Quality Call Report
March 2019

Date: 3/4/2019
Source: Phone
Address: 3505 Cadillac
Description: Customer reported yellowish sandy water.

Outcome: Some sediments from the pipe may have been stirred up during fireline installation which caused the yellowish sandy water. Customer was asked to call back if water did not clear up. Followed up with customer the following morning and water has cleared.

Date: 3/11/2019
Source: Phone/Visit
Address: 965 Azalea
Description: Customer called after hours and spoke to Duty Operator regarding light yellow water in one of the toilets.

Outcome: Duty operator had customer check all her fixtures and only one toilet had the yellow water. The water was clear at all other fixtures. She was advised to flush her house lines and water quality staff would follow up the following morning. Water quality staff checked customer's water the following day and confirmed that the yellow water was only coming from one toilet which had a power flush system that was about five years old. Customer will research the system to see if any parts can rust and leach color.

Date: 3/15/2019
Source: Phone
Address: 3050 Madison
Description: Unknown caller left a message and reported sandy colored water.

Outcome: Called customer back several times during the day of the initial call and over the course of several days. Left customer several voice messages but was never able to get a hold of customer. Customer never called back.

Date: 3/22/2019
Source: Phone
Address: 2865 El Rio Circle
Description: Customer concerned about rotten egg odor for the last two weeks.

Outcome: Walked customer through troubleshooting process. It was determined that the water did not have any odor from the hot or the cold tap. Suggested customer disinfect the drain because it when the water is turned on. Followed up with customer 4 days later and the odor issue had been resolved.

COMMITTEE POLICY & RESOLUTION REVIEW

ENGINEERING and OPERATIONS COMMITTEE

Policy Assignments for 2019

Policy Name	Resolution No.	Date Adopted	Revision Schedule	Last Reviewed
Replacement of Assets Including Pipeline and Well Rehabilitation	1442	03/15/14	Review and update every 3 – 5 years	03/15/14
Rules and Regulations for Water Service	1514	07/12/18	Review and update as needed	07/12/18
Standard Specifications and Standard Drawings		05/03/18	Review and update as needed	05/03/18
Urban Water Management Plan	1477	06/09/16	Review and update as required every 5 years	06/09/16

Water Operations Status Report
July 1, 2018 - March 31, 2019

Operations Department Status Report	Wk Unit	Plan Days	Act Days	Plan Qty	Act Qty	Plan Cost	Actual Cost
01 - HYDRANTS							
WD-0101 - HYDRANT MAINTENANCE	HYDRANTS	127	94	2537	1777	$51,262	$34,440
WD-0102 - HYDRANT PAINTING	HYDRANTS	10	0	317	1	$4,235	$56
WD-0103 - HYDRANT REPAIR	HYDRANTS	39	16	45	15	$12,497	$5,818
Program 01 TOTAL		176	110			$67,994	$40,314
02 - VALVES							
WD-0201 - DISTRIBUTION VALVE MAINTENANCE	VALVES	90	77	1804	1459	$37,062	$29,130
WD-0202 - NIGHT VALVE MAINTENANCE	VALVES	7	0	82	0	$2,985	$0
Program 02 TOTAL		97	77			$40,047	$29,130
03 - METERS							
WD-0301 - NEW METER INSTALLATION	METERS	19	22	139	201	$45,658	$92,345
WD-0302 - RAISE REPLACE METER BOX	BOXES	9	5	43	10	$7,158	$1,945
WD-0303 - METER LEAK INVESTIGATION/REPAIR	INV/REP	30	25	234	195	$8,668	$11,931
WD-0305 - ANGLE STOP/BALL VALVE REPLACE	REPLACE	54	66	108	126	$31,765	$24,001
WD-0306 - LARGE METER TEST/REPAIR - C	TESTS	18	4	88	11	$7,294	$1,373
Program 03 TOTAL		130	122			$100,543	$131,595
04 - MAIN LINES							
WD-0401 - MAIN LINE REPAIR	REPAIRS	90	28	15	4	$41,073	$11,496
WD-0402 - AIR VAC MAINTENANCE/REPAIR	REPAIRS	20	19	119	112	$7,513	$6,548
WD-0403 - UNIDIRECTIONAL FLUSHING	FEET	0	0	277089	0	$0	$0
Program 04 TOTAL		110	47			$48,586	$18,044
05 - SERVICE LINES							
WD-0501 - SERVICE LINE REPAIR	REPAIRS	42	44	16	24	$17,170	$17,497
Program 05 TOTAL		42	44			$17,170	$17,497
06 - CAPITAL							
CAP AV - CAPITAL AIR VACUUM REPLACE	AIR VACS	30	0	5	0	$12,239	$0
CAP BI - CAPITAL BYPASS & METER INSTALL	REPLACE	12	1	1	1	$6,388	$253
CAP FH - CAPITAL HYDRANT UPGRADE	HYDRANTS	102	122	15	17	$82,216	$80,404
CAP LM - CAPITAL LARGE METERS	METERS	45	24	107	78	$125,025	$44,185
CAP MV - CAPITAL MAINLINE VALVE REPLACE	VALVES	85	94	15	19	$63,485	$50,760
CAP SL - CAPITAL SERVICE LINE REPLACE	SERVICES	28	20	8	4	$14,142	$8,098
CAP SM - CAPITAL SMALL METERS	METERS	88	102	1094	1111	$104,467	$131,475
CAP SS - CAPITAL SAMPLE STATION REPLACE	STATIONS	5	13	5	5	$2,108	$4,548
Program 06 TOTAL		395	376			$410,070	$319,723
TOTAL						$684,410	$556,303

MEMORANDUM

Dedicated to Satisfying our Community's Water Needs

TO: Engineering and Operations Committee
FROM: Phil Lauri, P.E., Assistant General Manager
DATE: April 16, 2019
SUBJECT: Meter Technology Assessment

RECOMMENDATION

Recommend that the Board of Directors approve the following:

a. Designate Badger Meter Equipment and Software as the Mesa Water Standard;
b. Implement Option No. 2 with Option 1B as a Pilot Program;
c. Re-Evaluate the Full Automated Meter Reader System Costs and Potential Adoption in 5-Years;
d. Perform a Meter Reading Route Optimization Assessment; and
e. Update Mesa Water's Standard Specifications and Standard Drawings for Water Service for Meter Technology Standardization.

STRATEGIC PLAN

Goal #1: Provide a safe, abundant, and reliable water supply.
Goal #2: Practice perpetual infrastructure renewal and improvement.

PRIOR BOARD ACTION/DISCUSSION

None.

BACKGROUND

Mesa Water has approximately 25,000 water meters ranging in size from 5/8" to 10". The District has a wide array of customers with major segments defined as residential, multi-family, commercial, industrial, and irrigation. 88% of the District's meters are 1" or less in size with 70% of total meters falling into the residential classification. The purpose of the Meter Technology Technical Memorandum (see Attachment A) is to assess the state of meter technology currently used throughout the District, identify current and emerging automated meter technologies, and provide meter program standardization recommendations, costs, and an implementation strategy while ensuring efficient operations and maintenance, maintaining efficient use of its resources, and providing valuable tools to assist both Mesa Water and its customers in water conservation efforts.

DISCUSSION

The District has mainly installed nutating disc style meters with manual encoders (dial style readers) in the small meter class (≤2") for the last several decades with as many as seven different meter manufacturers. Large meters (>2") consist of disc meters, turbo meters, and compound meters. The District currently uses the Badger Read Center (BRC) as its meter reading interface with the Cogsdale Customer Service database. A variety of automated meter reading (AMR) technologies have also been installed and evaluated over the past two decades on hard to read meter locations and a small number of high usage customer accounts. The AMR

technologies consist of devices that transmit meter encoder dial reads electronically to a remote computer or handheld device through radio frequencies. The AMR technologies consist of Touch Read devices (TR), classic endpoints (CE) with one-way transmission capabilities, and migratable endpoints (ME) with two-way transmission capabilities. The District currently has over 500 plus variations of AMR endpoints in place with various ages and functionalities. Many of the older AMR devices originally installed have started to fail due to degrading battery life.

Standardizing meter technology is an important step with the ever growing requirement for information by a variety of stakeholders (e.g., customers, regulatory agencies, District staff, etc.). Standardization allows for efficient and accurate meter reading, data management, and equipment maintenance. The District currently reads 60 of its 61 meter routes manually once every two months with two Field Customer Service Representatives. The one other route is read monthly. The average meter reading rate is 1 minute and 10 seconds per meter with a minimum read time of 0.2 minutes per meter (full AMR Route 953) and a maximum of 10 minutes per meter. Routes are read by both walking and driving methodologies. The recent 2015-2016 State of California Drought restrictions mandated that the District reduce its total usage by 25%. The District's existing AMR technology was a key component to the success of achieving the 25% target reduction and allowed the District to work with its higher use customers to identify areas where reductions could be made using AMR data profiling. However, what was recognized during this conservation mandate period was that many of the District's top users were not setup with AMR technologies, making data profiling and conservation management a difficult challenge.

Evaluation of recent AMR technologies have determined that the AMR industry continues to advance in terms of functionality, sophistication, life-cycle, accuracy, reliability and costs. The three main AMR technologies are the ME, automated metering infrastructure (AMI), and cellular endpoint technology. AMI requires an owner to invest in a dedicated fixed antenna and local data collector network. Cellular endpoint technology allows owners to use existing cellular phone infrastructure to connect directly to meter endpoints to transmit meter data to a web based hosted system. Both ME and cellular endpoint technologies are expandable to an AMI based system if desired. From a cost perspective, an AMI based system requires a large capital investment (e.g., ~$12M for a Mesa Water size system) for a dedicated backbone antenna system similar to a radio-based SCADA system. Thus, a cellular endpoint or ME based system or combination thereof appears to be the most cost efficient and practical approach for a water agency similar in size to Mesa Water.

Other challenges with the current meter reading system includes the following:

- Confined space requirements for access to meters located in deep vaults;
- Meters in hard to read locations (e.g., HOA gated communities, parking lanes, etc.);
- BRC software is at end-of-life and not compatible with Windows 10;
- Existing AMR register compatibility with meter reading devices; and
- Meter reading approach for newer live-work high density developments.

While AMR technologies provide efficiency in meter reading solutions, there is a financial tradeoff to the amount of AMR technology that would be financially beneficial to implement. Analysis of the District's consumption reveals that approximately 50% of usage comes from 5% of its customers. This equates to 1,530 meters with 60% of those meters in the 1.5" and 2" meter sizes. Equipping these Top 50% consumption meters with cellular technology would provide the District's highest

users with real-time conservation management tools to proactively manage their consumption and would allow the District to collect monthly revenue without having to read the meters among the many other benefits (e.g., leak detection potential, etc.).

The following three options have been considered to implement limited cellular/AMR technology within the District's meter system:

Option 1 – Route 600 Update: This option replaces all 212 aging Route 600 meters, registers, and CEs. This would upgrade the end-of-life existing AMR technology and continue to use the BRC until it is no longer supported by Badger. Option 1 cost is approximately $368,000.

Option 1B – Route 600 Update with ME and Cellular Endpoints: This option replaces 107 of the 212 Route 600 meters with cellular endpoints and the other meters with MEs. This option also requires that the Badger Beacon web-based system be implemented to communicate with the cellular endpoints. Option 1B could function as a pilot program for a future Option 2 (see below). Option 1B is approximately $415,000

Option 2 – Highest Usage Accounts and Hard to Read Locations: This option implements cellular endpoints across all 1,530 meters and 58 routes representing the District's Top 50% usage to give real-time data management tools to both the District and its highest use customers. This option will also implement the Beacon software solution to communicate with the cellular endpoints. Option 2 is approximately $1,100,000.

Option 3 – Highest Usage Accounts and Complete AMR: In addition to the Option 2 approach, the remaining District meters will be replaced with MEs over a defined near-term period (1-8 years) to allow for efficient meter reading solutions (e.g., driving routes only) long-term. This approach would save approximately 1 full-time staff person when fully implemented. The cost to implement both Options 2 and 3 is approximately $9,300,000.

Assessment of the aforementioned options demonstrates that the most cost effective long-term solution is Option 2. Option 2 provides a balance of equipping the District's highest users with AMR technology that provides long-term benefits to both the District and the customer. Option 2 also provides the much needed software upgrade to the Beacon system. Recent small and large meter testing from the annual Water Loss Audit Program analysis has determined that the meter replacement frequency can be moved from 15 to 18 years without impacting the meter accuracy per the American Water Works Association (AWWA) Meter M6 Manual. The District spends approximately $344,000 per year in replacing small and large meters. Thus, deferring regular meter replacements for the next three years will provide the necessary capital funds to fully implement Option 2 with minimal impact to the District's capital budget.

Meter standardization is also critical to efficiently maintaining and reading the District's meters. Standardization of one meter, register, and AMR technology is important to achieve equipment compatibility, reliability, accuracy, and maintenance. The District has had long-term success with Badger meter and recommends standardizing around their equipment and software system. Provisions to ensure competitive pricing will be implemented that use a regional consumer price index or State of California negotiated contract pricing.

Staff recommends that the Board approve the following:

a. Designate Badger Meter Equipment and Software as the Mesa Water Standard;
b. Implement Option No. 2 with Option 1B as a Pilot Program;
c. Re-Evaluate the Full Automated Meter Reader System Costs and Potential Adoption in 5-Years;
d. Perform a Meter Reading Route Optimization Assessment; and
e. Update Mesa Water's Standard Specifications and Standard Drawings for Water Service for Meter Technology Standardization.

FINANCIAL IMPACT

In Fiscal Year 2019, no funds were budgeted for Meter Technology Assessment. In Fiscal Years 2020, 2021, and 2022 funds from the Small and Large Meter Program will be used to facilitate the Meter Technology Program.

ATTACHMENTS

Attachment A: Meter Technology Technical Memorandum

Meter Technology
Technical Memorandum

Contributing Mesa Water Departments

Engineering

Operations

Customer Service

April 4, 2019

Table of Contents

Executive Summary

Mesa Water District (District) is a county water district that serves approximately 17,000 acre-feet per year (AFY) to approximately 110,000 people throughout the City of Costa Mesa, portion of City of Newport Beach, and John Wayne Airport. The purpose of this Meter Technology Memorandum is to assess the state of meter technology currently used throughout the District, identify current and emerging automated meter technologies, provide meter program standardization recommendations, costs, and an implementation strategy.

The District serves 100 percent of its water demands from seven main production groundwater wells, three reservoirs with a storage capacity of approximately 31 million gallons, 316 miles of pipeline, and approximately 25,000 water meters ranging in size from 5/8" to 10". The District has a wide array of users with major segments defined as residential, multi-family, commercial, industrial, and irrigation. 88% of the District's meters are 1" or less in size with 70% of total meters falling into the residential classification.

The District has mainly installed nutating disc style meters with manual encoders (dial style readers) in the small meter class (≤2") for the last several decades with as many as seven different meter manufacturers. Large meters (>2") consist of disc meters, turbo meters, and compound meters. The District currently uses the Badger Read Center (BRC) as its meter reading interface with the Cogsdales Customer Service database. A variety of automated meter reading (AMR) technologies have also been installed and evaluated over the past two decades on hard to read meter locations and a small number of high usage customer accounts. The AMR technologies consist of devices that transmit meter encoder dial reads electronically to a remote computer or handheld device through radio frequencies. The AMR technologies consist of Touch Read devices (TR), classic endpoints (CE) with one-way transmission capabilities, and migratable endpoints (ME) with two-way transmission capabilities. The District currently has over 500 plus variations of AMR endpoints in place with various ages and functionalities. Many of the older AMR devices originally installed have started to fail due to degrading battery life.

Standardizing meter technology is an important step with the ever growing requirement for information by a variety of stakeholders (e.g., Customers, regulatory, District staff, etc.). Standardization allows for efficient and accurate meter reading, data management, and equipment maintenance. The District currently reads 60 of its 61 meter routes manually once every two months with two meter reading staff. The one other route is read monthly. The average meter reading rate is 1 minute and 10 seconds per meter with a minimum read time of 0.2 minutes per meter (full AMR Route 953) and a maximum of 10 minutes per meter. Routes are read by both walking and driving methodologies. The recent 2015-2016 State of California Drought restrictions mandated that the District reduce its total usage by 25%. The District's existing AMR technology was a key component to the success of achieving the 25% target reduction and to allow the District to work with its higher use customers to identify areas where reductions could be made using AMR data profiling. However, what was recognized during this conservation mandate period was that many of the District's top users were not setup with AMR technologies making data profiling and conservation management a difficult challenge.

Evaluation of recent AMR technologies have determined that the AMR industry continues to advance in terms of functionality, sophistication, life-cycle, accuracy, reliability and costs. The three main AMR technologies are the ME, automated metering infrastructure (AMI), and cellular endpoint technology. AMI requires an owner to invest in a dedicated fixed antenna and local data collector network. Cellular endpoint technology allows owners to use existing cellular phone infrastructure to connect directly to meter endpoints to transmit meter data to a web based hosted system. Both ME and cellular endpoint technologies are expandable to an AMI based system if desired. From a cost perspective, an AMI based system requires a large capital investment (e.g., ~$12M for a Mesa Water size system) for a dedicated backbone antenna system similar to a radio based SCADA system. Thus, a cellular endpoint or ME based system or combination thereof appears to be the most cost efficient and practical approach for a water agency similar in size to the District.

Other challenges with the current meter reading system includes the following:

- Confined space requirements for access to meters located in deep vaults;
- Meters in hard to read locations (e.g., HOA gated communities, parking lanes, etc.);
- BRC software is at end-of-life and not compatible with Windows 10;
- Existing AMR register compatibility with meter reading devices; and
- Meter reading approach for newer live-work high density developments

While AMR technologies provide efficiency in meter reading solutions, there is a financial tradeoff to the amount of AMR technology that an agency would financially be beneficial to implement. Analysis of the District's consumption reveals that approximately 50% of usage comes from 5% of its customers. This equates to 1,530 meters with 60% of those meters in the 1.5" and 2" meter sizes. Equipping these Top 50% consumption meters with cellular technology would provide the District's highest users with real-time conservation management tools to proactively manage their consumption and would allow the District to collect monthly revenue without having to read the meters among the many other benefits (e.g., Leak detection potential, etc.). The following three options have been considered to implement limited cellular/AMR technology within the District's meter system:

Option 1 – Route 600 Update: This option replaces all 212 aging Route 600 meters, registers, and MEs. This would upgrade the end-of-life existing AMR technology and continue to use the BRC until it is no longer supported by Badger. Option 1 cost is approximately $368,000.

Option 1B – Route 600 Update with ME and Cellular Endpoints: This option replaces 107 of the 212 Route 600 meters with cellular endpoints and the other meters with MEs. This option also requires that the Badger Beacon web based system be implemented to communicate with the cellular endpoints. Option 1B could function as a pilot program for a future Option 2 (see below). Option 1B is approximately $415,000

Option 2 – Highest Usage Accounts and Hard to Read Locations: This option implements cellular endpoints across all 1,530 meters and 58 routes representing the District's Top 50% usage to give real-time data management tools to both the District and its customers. This option will also implement the Beacon software solution to communicate with the cellular endpoints. Option 2 is approximately $1,100,000.

Option 3 – Highest Usage Accounts and Complete AMR: In addition to the Option 2 approach, the remaining District meters will be replaced with MEs over a defined near-term period (1-8 years) to allow for efficient meter reading solutions (e.g., Driving routes only) long-term. This approach would save approximately 1 full-time staff person when fully implemented. The cost to implement both Options 2 and 3 is approximately $9,300,000.

Assessment of the aforementioned options demonstrates that the most cost effective long-term solution is Option 2. Option 2 provides a balance of equipping the District's highest users with AMR technology that provides long-term benefits to both the District and the customer. Option 2 also provides the much needed software upgrade to the Beacon system. Recent small and large meter testing from the annual Water Loss Audit Program analysis has determined that the meter replacement frequency can be moved from 15 to 18 years without impacting the meter accuracy per the American Water Works Association (AWWA) Meter M6 Manual. The District spends approximately $344,000 per year in replacing small and large meters. Thus, deferring regular meter replacements for the next three years will provide the necessary capital funds to fully implement Option 2 with minimal impact to the District's capital budget.

Meter standardization is also critical to efficiently maintaining and reading the District's meters. Standardization of one meter, register, and AMR technology is important to achieve equipment compatibility, reliability, accuracy, and maintenance. The District has had long-term success with Badger meter and recommends standardizing around their equipment and software system. Provisions to ensure competitive pricing will be implemented. Thus, the following recommendations are provided:

1. Use Badger Meter Equipment and Software as Mesa Water Standard
2. Implement Option No. 2
3. Re-Evaluate Full System AMR System Adoption in 5-Years
4. Perform Meter Route Optimization Assessment
5. Update Mesa Water Standard Plans and Specifications for Water Service

Section 1: Introduction

Mesa Water owns and maintains approximately 25,000 potable water meters ranging in size from 5/8" to 10". These meters are used to primarily serve single-family and multi-family residences along with varying commercial, industrial, fire protection, irrigation, and institutional uses. The purpose of this technical memo is to:

1. Assess current industry meter, register and endpoint technologies;
2. Determine a standardized meter and register replacement technology for:

- New Residential Developments
- Commercial Developments
- Irrigation Uses
- Highest Usage Customers

3. Identify high usage customers and hard to read locations across all service accounts
4. Assess and standardize meter reading device technologies
5. Identify required software platforms to support meter reading activities
6. Determine software integration requirements
7. Develop a plan to update Route 600 failing register technologies
8. Develop a program implementation approach and cost

Section 2: Existing Meter Technology

A. Meter Characteristics

Mesa Water uses a variety of different meter types based on the application. Meter types include nutating disc, turbo, and compound technologies. Nutating disc meter technology is mostly used in the residential small meter class (5/8" to 2"). Turbo meters are mainly used for consistent large flow applications (e.g., Hotels, irrigation, etc.). Compound meters are used for varying flow applications (e.g., Hospitals, apartment complexes, etc.) and will usually contain a turbine meter for the large flow component and a displacement meter for the low-end flow component.

Mesa Water has a wide array of service meter sizes and customer types. The following is a breakdown of the meter use by size and consumption:

Table 1 – Meter Size & Consumption

Meter Size (inches)	No. of Meters	% by Size	Average Annual Consumption (HCF)	% by Consumption	Average Age (Years)
0.62	17196	68.8%	2,077,788	31.8%	11.1
0.75	2178	8.7%	405,866	6.2%	10.3
1	2668	10.7%	562,354	8.6%	8.6
1.5	958	3.8%	688,448	10.5%	9.9
2	1265	5.1%	1,791,725	27.4%	10.0
3	77	0.3%	256,390	3.9%	14.8
4	156	0.6%	299,958	4.6%	16.4
6	292	1.2%	192,216	2.9%	15.6
8	172	0.7%	263,008	4.0%	16.9
10	20	0.1%	65	0.0%	14.0
	24,982	100.0%	6,537,819	100.0%	10.8

Approximately 88% of the District's meters are 1" and less in size. This meter group represents approximately 47% of the District's annual average consumption (based on 5-year average). The District classifies its meter types into the following primary and secondary categories:

Table 2 – Meter Classifications

Primary Meter Classification		Secondary Meter Classification	
S	Single-Family Residential	D	Domestic
T	Multi-Family Residential (Single Unit)	I	Irrigation
M	Multi-Family Residential (Multi-Unit)	F	Fire lines
C	Commercial	B	Domestic with Irrigation
I	Industrial	J	Domestic with Fire
G	Government Agency	A	All (Domestic, Irrigation, & Fire)
A	Agriculture	X	Abandoned
H	Hydrant/Construction		
X	Abandoned		

Table 2 defines how the District classifies its consumption across varying usage categories. The Primary classification identifies the main category of usage followed by a secondary identification. For example, a classification of SD indicates that the meter is a Single-Family Residential Domestic meter type and all usage from these meter types can be aggregated into this category. Table 3 provides a breakdown of the number of meters by size and primary meter classification.

Table 3 – Primary Meter Classification

Meter Size (Inches)	No. of Meters by Primary Classification							
	S	**T**	**M**	**C**	**I**	**G**	**A**	**X**
0.62	12,246	2,762	953	1,034	65	34	0	101
0.75	1,104	232	503	281	29	12	0	17
1.00	837	243	845	551	77	73	0	42
1.50	16	47	336	437	45	53	0	24
2.00	30	72	454	498	49	118	0	44
3.00	0	1	32	17	0	23	1	3
4.00	1	4	28	89	6	23	0	5
6.00	4	7	15	199	33	24	0	9
8.00	0	0	2	115	26	20	0	9
	14238	**3368**	**3168**	**3233**	**330**	**388**	**1**	**254**

B. Meter Manufacturers

The District has used a varying array of meter manufacturers for the past several decades. These manufacturers include Badger, Hershey, Neptune, Metron, Precision, Rockwell, and Sensus. Since 2000, the District has mainly installed Badger, Sensus, and Neptune meters. With the implementation of the District's customer service database (Cogsdale) in 1999, tracking of the meter manufacturer was not a standard attribute that was tracked. Thus, the number of meters by manufacturer is mostly unknown without doing a detailed field meter verification.

C. Meter Register and End Point Technologies

Various types of register technologies have been used in the District's meter system over the past several decades. Historically, all meters had a manual read register that had a six or eight digit dial register/encoder, similar to the odometer on a car. The manual read register has been a trident technology and is still widely used by Mesa Water and many water agencies throughout the world. The term register and encoder are used synonymously. The register is defined as the combination of the inter-gear workings and dial indicator. The encoder portion is more specifically referred to as the electronic equipment portion of the register that transfers the number of disc nutations into an actual number of measured water units on a manual dial read. Figure 1 shows a typical manual register/encoder.

Figure 1 – Manual Register

Like many industrial sectors, technological innovation has spread into the utility sector with the adaptation of electronic methods to ease the meter reading function and provide higher levels of efficiency. Several other utility sectors (e.g., Power, gas, etc.) have already converted large portions of their service areas to these electronic formats using electronic register technologies. Automatic register technologies have progressed over many years and continue to advance in their sophistication, capabilities, and of course costs.

Mesa Water has selectively evaluated and implemented a small array of these various automatic register technologies and endpoints over the years to bring efficiencies to meter routes that are difficult to read or were classified as high usage accounts. A meter endpoint is the device that transmits the encoder dial read via a radio wave signal to a remote reading device. The various automatic meter-reading products evaluated on a small scale have included the Sensus Touch Read (TR), the Badger Automated Meter Reading (AMR) Classic Endpoints (CE), and the Badger AMR Migratable Endpoints (ME). The following is a brief description of each type and their functionality:

1. **Sensus Touch Read**: The TR was one of the first commercially available electronic registers that universally fit all manufacturers' meters. The TR reads the manual dial position by measuring a magnetic flux signal, which is than translated into a numerical reading. The TR has traditionally been read using a hand-held wand that uploads the read data into a portable computer. Figures 2 and 3 show a typical TR register and reading.

Figure 2 – Touch Read Register

Figure 3 –Touch Read Meter Reading

2. **Badger CE/ME**: The Badger CE is a one-way radio communication register. The register broadcasts via radio frequencies every four seconds and is collected by a mobile collection device. The CE queries the encoder continuously and also has the ability to profile usage patterns. The encoder is wired to the CE which is positioned just below the opening in a meter box/vault lid to provide adequate line of sight for radio wave transmission. Mesa Water use computer-mounted devices in its service trucks to drive routes 600 and 953 equipped with CE/ME registers and collect meter data reads. Badger estimates battery life to last approximately 20 years depending on environmental factors, transmitting usage, and other external factors.

   While the Badger ME looks similar to the CE it contains two-way communication capability. This can be helpful to change setup protocols (e.g., How often data is collected, etc.). Also, the ME can transmit profile usage

wirelessly whereas the CE must be physically accessed to connect to the handheld computer to download profile data. Figure 4 shows a typical CE/ME register and endpoint device.

Figure 4 – Badger CE/ME Register & Endpoint

Register Challenges: The challenge associated with each register type varies based on the technology available when it was installed. The challenges with each are as follows:

1. **Sensus TR**:

- Shortened battery life
- Batteries are not replaceable
- Installations require(d) difficult wiring and mounting protocols
- Requires manual reading when batteries fail
- Physical access for manual entry requires confined space protocols

The Sensus TRs were mainly installed along Route 600 over twenty years ago. The model of TRs originally installed began to fail due to low battery life and these models were no longer available due to compatibility issues with the TR reading device. Many of these TRs were converted to a universal CE at the time of battery failure of these systems. At present the older universal CEs batteries are now failing after several years of use and these registers and endpoints need to be replaced with a newer state of technology and longer life battery system.

2. **Badger CE**

- Inability to upload data wirelessly
- Requires physical access to the vault to get usage profile data
- Requires physical access to the vault to perform a manual read for failed battery
- Batteries cannot be replaced without replacing the register endpoint

3. **Badger ME**

- Battery life of 20 years is uncertain

- Requires physical access to the vault to perform a manual read for failed battery
- Batteries cannot be replaced without replacing the register endpoint

D. Meter Replacement Cycle

There are numerous factors in determining how frequent to replace a meter. These factors include the meter type, size, and years of service. These parameters are outlined as the standard guidelines in American Water Works Association (AWWA) M6 Meter Manual. Other parameters to consider outlined by the AWWA M6 includes the average distribution system pressure in which the meter has been operating within and the volumetric usage that has passed the meter over its life-cycle.

Small Meter Replacement: For several years the District tested and repaired its small meters in-house following the AWWA M6 process. Meter testing and repair was initially used to determine the replacement frequency and to maintain the District's small meter assets. However, as the cost of small manual read meters continued to decline over the years, the cost to repair meters exceeded the cost of just replacing them on a regular life-cycle frequency. Meters routinely slow-down (e.g., Under register) over time, thus, reducing the amount of revenue the District would collect for a unit of water sold. The AWWA M6 guidelines indicate that meters at three flow ranges (e.g., Low, medium, and high) shall be 98.5% to 101.5% accurate for all three flow ranges. If a meter tests outside of this range the District's revenue loss will be magnified as the accuracy declines to justify the cost to replace the meter. Thus, accurate meters and standardized meter replacement program are critical to ensure accurate customer billing and revenue streams.

Early meter testing determined that a meter replacement life cycle of ten years for all small meter classifications (e.g., 5/8" to 2") was sufficient to maintain accurate metering functionality within the standards of the AWWA M6. This was a standard for many years at the District. As meter technology has advanced so has the long-term meter accuracy. In 2012 the District adopted a 15-year replacement cycle for its small meter classifications as it was determined that meters were still registering accurately after 15 years of average usage. Recent small meter testing performed through the annual Water Loss Audit has determined that the average small meter life cycle has experienced no significant degradation in accuracy of the five hundred plus small meters tested that were approximately 15 years of age. The District's water loss Consultant has recommended that the meter replacement frequency should be moved to 18 years based on the meter testing data. Small meter testing will be conducted on meters older than 15 years to refine this recommendation to ensure no deviations from the AWWA M6 accuracy range.

Large Meter Replacements: The large meter program replacement is more complex as meters 3" and larger are costly to replace and most large meters can be calibrated and repaired in the field by qualified meter technicians. The District has a total of 717 large meters (e.g. > 3"). 235 of the 717 large meters are large domestic or combined domestic/fire line meters that are annually tested and calibrated. The remaining 585

meters are fire line tattletale meters (5/8" or 1" meters) on 3" to 8" fire service lines that do not actually have a large meter but has the tattletale meter in parallel to monitor if unauthorized flow is being registered. The average age of the 235 large meters is 16.0 years old.

Over the past decade only 3 large domestic meters have been replaced. Replacements are required if:

- Meter could not be repaired because parts were not available
- Cost of repair exceeded a new meter
- Repaired meter could not be calibrated and tested to AWWA M6 accuracy

E. Meter Box Types & Sizes

The District has traditionally used concrete meter boxes over the past several decades as the standard for both its small and large meter (where applicable) installations. Meter boxes are fabricated by a variety of manufacturers and are based on an industry wide standard shape and size to accommodate the standard AWWA meter lay lengths. The following sections detail the District's meter box standards.

Small Meter Installations: The District uses standard composite meter boxes that vary on the size of meter to be installed. Mesa Water's Standard Specifications and Drawings for Construction of Water Facilities govern the installation of meter boxes and meters. The following are the three typical size meter boxes that are used per Standard Drawing No. 3:

Meter Box No.	Meter Size	Box Size
4	0.62" & 0.75"	12"W x 20"L x 12"D
5	1"	13"W x 24"L x 12"D
6	1.5" & 2"	17"W x 30"L x 12"D

Meter lay lengths are standardized amongst meter manufacturers per AWWA specifications and fit properly within the meter boxes for small meter installations to accommodate meter reading, maintenance, and installation of endpoint devices. Figure 5 shows a typical installation of a small meter and ME/CE device.

Figure 5 – Small Meter Installation w/CE Device

Large Meter Installations: Meters 3" and larger are installed above ground along with the applicable backflow assembly device per the District's Standard Drawing No. 22 as the larger meters will service domestic, fire, irrigation or combination thereof. The District had an older standard that allowed 3" and larger meter installations to be installed in an underground vault depending on the site conditions. This standard has been discontinued due to the challenge associated with confined space entry, meter maintenance, and meter reading difficulties (for deep vaults) but existing vaults are currently found along Route 600. Refer to Section 3.C for discussions of meter vault challenges.

Figure 6 shows an above ground large meter and endpoint installation using a special harness adaptor to host the endpoint attachment.

Figure 6 – Large Meter Installation w/CE/ME Device

Meter installations for small and large meter installations are standardized around AWWA standards and are accommodating to new meter reading technology being proposed by manufacturers. Minor challenges with CE/MEs, cellular endpoints, and AMI endpoints continue to be line of sight and proximity obstructions associated with transmission through concrete and metal lids. Less obstructions exist with the composite materials associated with the newer small meter box standard. Most meter box manufacturers fabricate special meter box lids now that allow for the placement of the endpoint within the box that has a cutout for the endpoint placement flush with the meter box lid. Large meter vaults with metal lids require modification for placement of the endpoint just below a cutout on the meter vault lid. This can present a challenge if the meter lids are located in parking lanes.

The District's meter readers experience a high rate of first time read success on Route 953 where the entire route is equipped with MEs (See Section 4D for discussion of meter reading methods with MEs). On occasion re-reads are required if the ME is unable to effectively transmit the read as the meter reader drives by.

Findings:

2.1 69% of the District's meters are 5/8"
2.2 47% of consumption is from meters 1" and smaller
2.3 Seven meter manufacturers have been used throughout the District

2.4 Meter manufacturers are not tracked in the Cogsdale database
2.5 AMR technology use is not standardized throughout the District
2.6 Existing Sensus TR and Universal CE batteries are failing requiring manual reading
2.7 Recent small meter program testing demonstrates that meter accuracy is maintained up to an average of 18 years
2.8 Small meter replacements are based on a 15 year replacement cycle
2.9 Large meter replacements are based on the inability to repair or recalibrate
2.10 The District uses industry standard composite meter boxes accommodating of future AMR and Cellular technologies

Section 3: Customer Consumption

A. Demands

The District's annual demands have declined over the past several years mainly due to focus on conservation efforts. This has been especially noticeable as population growth has increased, demands have steadily decreased over the past decade. The District's annual average demand in fiscal year 2018 was 17,314 acre-feet per year. Approximately 43% of total usage is used by meters 2" and larger (Refer to Table 1) and approximately 33% of consumption coming from the 5/8" meter classification which represents approximately 68% of the total number of meters (17,196) in the system.

Figure 7 shows the District's total usage verses the number of total meters in the distribution system. Analysis of this graph demonstrates that approximately 50% of the District's consumption is attributed to 1,530 meters.

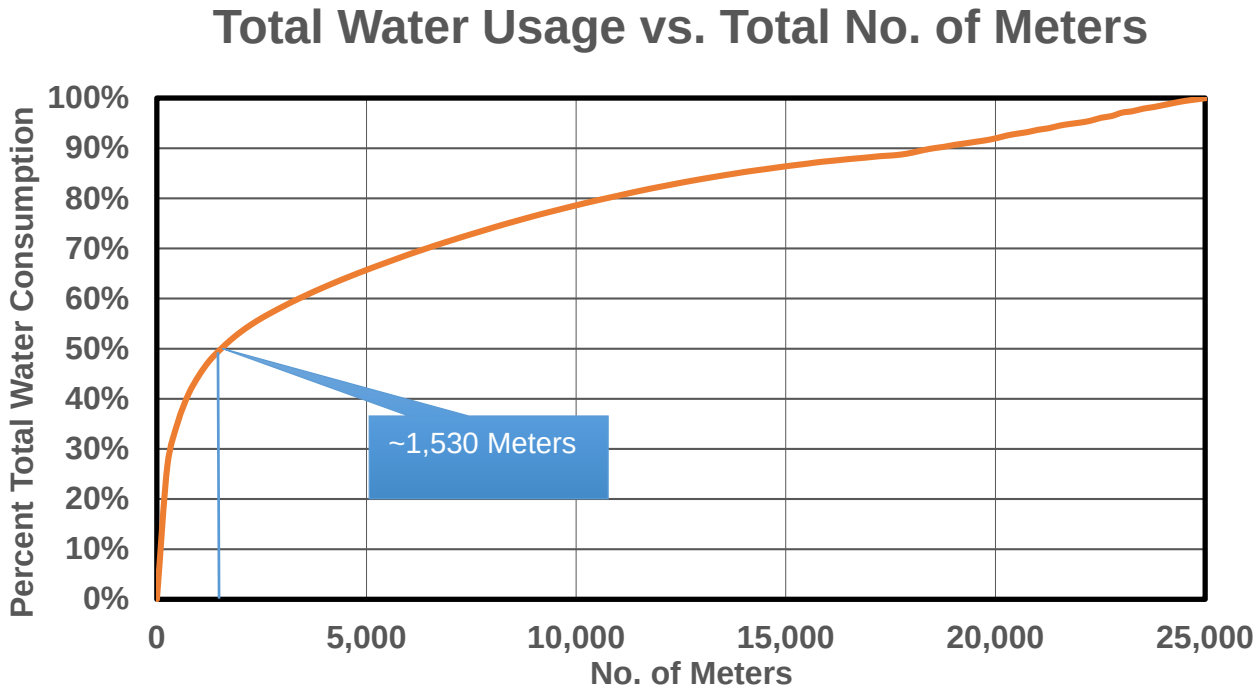


Figure 7 – Mesa Water® Cumulative Consumption

Table 4 shows the breakdown of the top 50% of consumption by meter size:

Table 4
Top 50% Usage

Meter Size (Inches)	No. of Meters	% by Meters	Usage (HCF)	% by Usage
0.625	69	4.5%	60,397	1.8%
0.75	115	7.5%	94,229	2.9%
1	275	18.0%	214,925	6.6%
1.5	363	23.7%	485,935	14.9%
2	620	40.5%	1,473,710	45.0%
3	44	2.9%	239,265	7.3%
4	28	1.8%	289,776	8.9%
6	9	0.6%	155,411	4.7%
8	7	0.5%	258,185	7.9%
	1,530	**100%**	**3,271,834**	**100%**

B. High Usage Customers

The top 50% usage is mostly represented by meters 2 inches and greater. Many of the higher usage customers are part of meter Route 600 which was developed several years ago by the District to account for higher frequency meter reading and revenue collection. Route 600 has 212 accounts associated with it. Route 600 mainly contains commercial, institutional, and industrial (CII) users. Route 600 also has progressively included the addition of fire line services over the years at the request of customers to have their domestic and fire line accounts read and billed in the same monthly cycle.

The benefit of Route 600 was originally setup to help both the District's customers in managing their monthly expenditures and the District to collect a steady revenue stream on its highest users. During the 2015/2016 statewide drought mandate the District re-evaluated it largest consumers and worked with customers to reduce consumption to help meet the District's target usage reduction of 25%. This effort included reading and providing monthly updates on consumption to the Top 250 users, shutting-off all irrigation meters, and public outreach to remind customers of the state's drought restrictions. Analysis of the Top 250 users revealed that only 37.5% of the Top 250 at that time were associated with Route 600. It was also recognized that is was time intensive to read the Top 250 as many of the route's meters had to be read manually as many of the Top 250 did not have CE or ME registers. Many of the CII customers during the drought expressed their interest in having technology that allowed them to monitor their usage and then respond accordingly based on seasonal demand and current conservation requirements.

C. Hard to Read Locations

For the past many decades the District has allowed large meter installations to be located in underground vaults. This standard was allowed to accommodate development requirements for both aesthetics and functional placement for deeper

water mains. This standard was adopted many decades ago before confined space entry requirements were established. The placement of meters in vaults present the following challenges:

1. Manual meter reading
2. Maintenance
3. Repairs
4. Meter testing
5. Confined space entry requirements

Many of the District's larger meters are located in deep vaults that possess one or all of the aforementioned challenges. Figures 8 and 9 show an example of a deep vault with either a TR or a converted CE register.

Figure 8 –TR Meter Vault

Figure 9 – Converted TR Universal CE Meter Vault

In an effort to alleviate the manual meter reading and confined space entry issues, Route 600 was originally equipped with the Universal TR technology. This was effective for many years and simplified the meter reading issues. As technology

advanced and portions of Route 600 TR batteries failed some of these meters were converted to CE and ME register technologies.

Portions of other meter routes were also equipped with CE and ME register technologies for hard to read locations. Many of the hard to read locations are above ground but with restricted access. Typical examples of these types of installations are as follows:

1. Gated communities
2. John Wayne Airport
3. Vaults in parking lanes/Streets

While the District has done good work identifying and automating its meter reading functionality in much of the larger users and hard to read locations over the past decades, the technology has been sporadically implemented with no specific criteria and does not have a uniform register platform across all of its largest customers. Additionally, many of the original TRs that were converted to the Universal CEs now are experiencing failing batteries requiring extensive effort to read these locations manually.

Findings:

3.1 Top 50% of consumption is achieved with 1,530 meters
3.2 45% of the Top 50% of consumption is in the 2" meter size
3.3 37.5% of the 2015 drought Top 250 were from Route 600
3.4 Top usage customers will change based on conservation policies
3.5 No District standard exists to define a hard to read or hard to access meter

Section 4: Mesa Water Meter Routes

A. Meter Reading Background

The District has a total of 25,024 meters allocated across 61 routes. 60 of the meter routes are read on a bi-monthly frequency and are identified as being on the 800 series (read in even months) or the 900 series (read in odd months) routes. A summary of the routes and the associated register technology is as follows:

Table 5 – Meter Route and Register Type

Meter Route	No. of Meters	Read Frequency	Register Type				
			Manual	TR	TR/CE	CE	ME
9XX	11,868	Bi-Monthly	11,582	0	0	12	274
8XX	12,841	Bi-Monthly	12,837	0	0	2	2
600	212	Monthly	26	10	89	82	5
200	42	Monthly	42	0	0	0	0
199	42	Monthly	31	6	0	5	0
Other	19		19	0	0	0	0
Total	**25,024**		**24,537**	**16**	**89**	**101**	**281**

Table 5 – Meter Route and Register Type

As previously indicated Route 600 contains a large portion of the District's automated meter reading technology (~38%). However, Route 953 has 274 MEs (~56%) and 12 CEs. Route 953 is read bi-monthly and was originally established as a driving route for larger commercial and irrigation meters that required meter readers to drive across the District's service area and get in and out of their vehicles to read a meter and drive to the next meter. Route 953 was retrofitted in 2009 with 274 MEs to reduce the amount of time required to read the route.

Routes 810, 834, 852, and 901 contain the remaining assortment of automated meter reading technology. Over the past four years, AMR technology has been sporadically implemented on the newer high-density live/work developments being constructed throughout the service area. Discussions with the meter reading staff has determined that the AMRs are being integrated to streamline the meter reading process within the developments. Focusing on the Top 50% users in regards to implementing AMR technology could provide a cost effective approach to managing the District's demands, meter reading challenges, and providing meaningful information to high usage customers through automation. Two parameters to evaluate the aforementioned criteria consists of analyzing cumulative consumption and the cumulative number of accounts to determine where the optimal management point exists. The following tables show each of these criteria sorted by these respective criteria:

Table 6 – Top 50% Users (By Usage)

Sorted by % Highest Usage								
Route No.	No. of Top 50% Accts (by Usage)	Total No. of Route Accts.	% Top 50% Accounts (By Usage)	Cumulative Top 50% Accts[1]	Total Route Usage (HCF)	Top 50% Usage[1]	Top 50% Cumulative Usage[1]	% Total Cumulative Usage[2]
600	107	212	7.0%	7.0%	718,018	21.9%	21.9%	11.0%
199	27	42	1.8%	8.8%	460,167	14.1%	36.0%	18.0%
911	90	331	5.9%	14.6%	183,975	5.6%	41.6%	20.8%
921	82	337	5.4%	20.0%	166,954	5.1%	46.7%	23.4%
828	62	337	4.1%	24.1%	142,000	4.3%	51.1%	25.5%
935	91	630	5.9%	30.0%	136,593	4.2%	55.3%	27.6%
927	87	430	5.7%	35.7%	131,959	4.0%	59.3%	29.6%
901	48	427	3.1%	38.8%	109,968	3.4%	62.6%	31.3%
838	74	429	4.8%	43.7%	105,012	3.2%	65.9%	32.9%
953	38	265	2.5%	46.1%	90,127	2.8%	68.6%	34.3%
854	60	470	3.9%	50.1%	78,542	2.4%	71.0%	35.5%
11	**766**	**3,910**		**50.1%**	**2,323,316**		**71.0%**	**35.5%**

Notes:
1. Based on 1,530 total meters and 3,271,834 HCF for the Top 50% usage (Average year from 2013-2017 customer billing data)
2. Based on total usage of 6,543,380 HCF usage (Average year from 2013-2017 customer billing data)

Table 7 – Top 50% Users (By Accounts)

Sorted by % Highest No. of Accounts								
Route No.	No. of Top 50% Accts (By Accts)	Total No. of Route Accts.	% Top 50% Accounts (By Accts)	Cumulative Accounts[1]	Total Route Usage (HCF)	Top 50% Usage (By Accts)	Top 50% Cumulative Usage[1] (By Accts)	% Total Cumulative Usage[2] (By Accts)
600	107	212	7.0%	7.0%	718,018	21.9%	21.9%	11.0%
935	91	630	5.9%	12.9%	136,593	4.2%	26.1%	13.1%
911	90	331	5.9%	18.8%	183,975	5.6%	31.7%	15.9%
927	87	430	5.7%	24.5%	131,959	4.0%	35.8%	17.9%
921	82	337	5.4%	29.9%	166,954	5.1%	40.9%	20.4%
838	74	429	4.8%	34.7%	105,012	3.2%	44.1%	22.0%
828	62	337	4.1%	38.8%	142,000	4.3%	48.4%	24.2%
854	60	470	3.9%	42.7%	78,542	2.4%	50.8%	25.4%
846	59	430	3.9%	46.5%	73,527	2.2%	53.1%	26.5%
907	58	529	3.8%	50.3%	43,181	1.3%	54.4%	27.2%
10	**770**	**4,135**		**50.3%**	**1,779,762**		**54.4%**	**27.2%**

Notes:

1. Based on 1,530 total meters and 3,271,834 HCF for the Top 50% usage (Average year from 2013-2017 customer billing data)
2. Based on total usage of 6,543,380 HCF usage (Average year from 2013-2017 customer billing data)

Evaluating the aforementioned results demonstrates the following observations:

- 51% of Top 50% cumulative usage and 25.5% of Total Cumulative Usage is achieved through 24.1% of cumulative accounts (368) over 5 routes (600, 199, 911, 921, and 828)
- 71% of Top 50% Cumulative Usage and 35.5% of Total Cumulative Usage is achieved through 50% of cumulative accounts (766) over 11 routes
- Approximately 770 accounts out of 4,000 total accounts represent 3.1% of total accounts and the Top 27.2% of consumption across 10 meter routes

While 1,530 meter accounts make up the Top 50% of consumption across 58 routes throughout the District, the aforementioned observations demonstrate that the highest usage is fairly linear (e.g., 770 meters is approximately 27.2% of total consumption verses 1,530 meters is 50% of total consumption) should a more targeted highest user group be desired. Table 7 also demonstrates that if the Top 27.2% of consumption were targeted as the highest users (by accounts), only 10 routes would be affected as opposed to 58 routes to achieve the Top 50% of highest usage. Similarly, Table 6 demonstrates that if the Top 25.5% of consumption were targeted as the highest users (by usage), only 5 routes would be affected as opposed to the 58 routes to achieve the Top 50% of highest usage.

B. Meter Reading Methodologies

The District's meter routes have a combination of reading formats. The formats consist of the following:

- **Walking Routes:** Requires meter readers to manually walk a predefined meter route and read each meter and input a numerical value into their handheld Badger Trimble device. Some walking routes have had MEs installed where new developments have been integrated into the existing route alignment. Routes that still contain both CE and ME endpoints require the meter readers to carry both the Badger Trimble device (ME equipped device) and the Northrup Grumman meter reading device (CE equipped device) as each unit is separately equipped with a CE transceiver or ME transceiver. The meter readers can also use the meter reading laptop to read these devices as the laptop is equipped with both CE and ME transceiver antennas. Badger's new Trimble 7 Ranger Meter Reading handheld device contains both ME and CE transceivers removing the need to carry multiple devices.

- **Driving Routes**: Driving routes have a combination of AMR CEs/MEs technology integrated with the manual read meters. Many of the driving routes still require a meter reader to drive to the location, get out of their vehicle, and manually read and enter the numerical value. Meter readers currently use the badger laptop to read routes 600 and 953 as these routes mostly consists of CE and ME endpoints. Route 953 is an example of this type of route that was converted in 2013 with ME registers. This conversion allowed meter reading time to be reduced from approximately 8 hours to 1 hour.

Driving verses walking routes should be a core metric in evaluating how much AMR technology the District may want to adopt and the cost associated with implementing such technology. Factors to consider in this evaluation include:

- Time savings in labor associated with driving verses walking against the AMR and cellular endpoint capital cost investment
- Increased customer service level or field maintenance work that could be recognized from time savings of driving verses walking routes
- Non-tangible safety benefit of meter reading injuries associated with the numerous miles walked
- Need to and/or ability to obtain relatively instantaneous meter data
- Accuracy of meter reading recognized from AMR technology verses manual reads

Other factors to consider in this evaluation pertain to how many meters should be and can be read on a single route. Originally 61 meter routes were established because this was accommodating to the manual meter reading process. This is no longer an obstacle with AMR technology. The number of meter reading routes could be substantially reduced with the following benefits:

- All retail meters could be read and billed within a few days at a specific time of month
- Billing could be done monthly on all or a portion of accounts with AMR technology

Specifics regarding meter reading metrics/statistics are covered in the following section.

C. Meter Route Alignments

The District's meter routes were established many years ago and have not varied in terms of alignment over the past several decades and have not been evaluated for efficiencies. Many of the routes were established as the City of Costa Mesa grew in both residential and commercial expansions. The original goal was to have a meter route only large enough to allow manual reading in half-day increments to allow for timely input, billing statement preparations, re-read of high anomaly reads, and perform any routine maintenance (e.g., Removal of excess dirt, replacement of broken lids, etc.) recognized in the meter reading process. Attachment A provides an overview of the District's sixty-one meter routes.

Development of AMR technology has drastically reshaped how routes can and should be read. The core issues arise at how much capital investment is required for the economic and non-tangible benefits that result from such an investment and redefining meter routes. Since the District's meter routes have not been evaluated for many years there are potentially large efficiencies that can be gained by studying this using the District's Geographical Information System (GIS) to assist with this. Benefits to evaluate and potentially redefine the District's meter routes are as follows:

- Provide efficiencies in drive time
- Provide safety in how vehicles traverse service area (e.g., Minimize left hand turns)
- Group meter routes by account types or locations (e.g., Hard to read locations)
- Streamline Cogsdale system meter reading process time

D. Meter Reading Statistics

The District's retail water meters have historically been read by two meter readers. Table 8 represents the 2017 meter reading data and statistics (excluding drive time to route locations) performed by two of the District's seasoned employees. Routes 199 and the 8XX and 9XX category routes are read bi-monthly. Route 600 is read monthly. It should be noted that driving routes include manual reads with sporadic AMR technology embedded.

Table 8 – 2017 Bi-Monthly Meter Reading Data

2017 Meter Read Data (Bi-Monthly)

Meter Route	Route Type	No. of Routes	Total No. Meters	Avg. Meters/ Route	Min. No. Meters/ Route	Max. No. Meters/ Route	Read Time (Hrs)	Avg. Read Time/Meter (Min/Meter)	Min Read Time/Meter (Min/Meter)	Max Read Time/Meter (Min/Meter)
199	Drive	1	44	44	44	44	4.3	5.8	5.8	5.8
200	Drive	1	42	42	42	42	7.1	10.1	10.1	10.1
600	Drive	1	216	216	216	216	5.4	1.5	1.5	1.5
8XX	Walk	17	6,883	405	250	572	80.9	0.7	0.6	0.9
8XX	Drive	3	899	300	241	342	14.5	1.0	0.7	1.2
8XX	Drive/Walk	11	4,777	434	349	595	160.0	2.0	0.6	1.0
9XX	Walk	14	6,270	448	353	551	76.4	0.7	0.7	0.9
9XX	Drive	6	2,238	373	271	430	59.4	1.6	0.2	1.2
9XX	Drive/Walk	7	3,223	460	374	628	42.4	0.8	0.6	1.0
Total		**61**	**24,592**	**403**	**42**	**628**	**450**	**1.10**	**0.2**	**10.1**
953	Drive	1	271	271	271	271	1.0	0.2	0.2	0.2

The average meter reading time across all meter routes is 1.10 minutes per meter. Average meter reading times for driving routes verses walking routes for the 8XX and 9XX routes are 1.0 verses 0.7 minutes per meter and 1.6 verses 0.7 minutes per meter, respectively. It appears counter intuitive that driving routes take more time on average than walking routes. However, upon closer evaluation and as previously mentioned, the driving routes are in areas where meters are spaced too far apart to walk between each location and it requires the meter reader to drive, get out of their vehicle, read the meter, and then drive to the next location. Thus, there is additional time required in reading these routes.

Route 953 was converted to a full AMR driving route. Evaluation of the meter metrics from this route demonstrate that meter reading takes approximately 0.2 minutes per meter or a total of 1 hour for the entire route which contains 271 meters. Should the District wish to convert a portion or all of its meters to an AMR technology, this is an excellent example of how the meter reading program could be streamlined. It should be noted that what is not included in these statistics are the distances of how long each route is. Route 953 does happen to span across much of the District's northern service area and is thus a conservative example as a base analysis for potential AMR implementation approaches.

Using Route 953 as a standard and assuming that not all routes are created equal in terms of access, AMR limits (e.g., Signal strength for meters off a driving path, etc.), geographic meter location, and other external factors provides the ability to look at potential labor savings for meter reading events. Table 9 provides an incremental time basis from 0.2 minutes per meter to 1.1 minutes per meter to read all the District's meters if AMR technology was used.

Table 9 – AMR Technology Meter Reading Time

Bi-Monthly Meter Reading Time for 24,592 Meters										
Mins/Meter	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1	1.1
Hours	82.0	123.0	163.9	204.9	245.9	286.9	327.9	368.9	409.9	450.9
Days	9.1	13.7	18.2	22.8	27.3	31.9	36.4	41.0	45.5	50.1

Table 9 demonstrates that if AMR technology (MEs) was uniformly integrated at every meter in the District it would take approximately 9.1 days to read all the meters with one employee or 4.5 days with two employees reading concurrently. This would be compared to approximately 50 days over the same bi-monthly time period it currently takes two employees to read all of the District's meters in the current configuration.

Further analysis would have to be conducted to determine that actual integrated AMR meter reading rate, however, Table 9 demonstrates the span of meter reading rate. A higher meter reading rate would result in less staff time saved. The best case scenario of 0.2 minutes per meter would result in an annual staff time savings of approximately 1.2 full time equivalent (FTE) staff. Using a more conservative approach of 0.4 minutes per meter would result in a staff time savings of approximately 1.0 FTE. The following assumptions should be noted for this example and evaluated in more detail if this approach is further considered by the District:

- Full AMR ME implementation
- Based on Route 953 drive length
- Doesn't include Cogsdale system processing
- Assumes 0.2 to 0.4 minutes per meter read
- Does not include time for reread/drive time of meters that do not transmit
- Does not allow for eyes on meter boxes for tampering or maintenance activities

Findings:

4.1 There are 61 meter reading routes containing 25,024 meters
4.2 71% of Top 50% Cumulative Usage is achieved through 50% of Cumulative Usage accounts (766) over 11 routes
4.3 Meter routes were established several decades ago and could benefit in efficiencies from re-evaluation
4.4 Average meter reading time across all District routes is 1.10 minutes per meter
4.5 Average meter reading time of 0.2 to 0.4 minutes per meter could be recognized with implementation of AMR across all District meters
4.6 Average meter reading time of 0.4 minutes per meter could result in a 1.0 FTE savings in labor

Section 5: New Meter & Register Technology

A. Existing Meter Technologies

Meter technology has slowly progressed over the past several years. Meter types vary by application. Typical meters found in the water industry include the following:

- Displacement or Positive Displacement
- Non-Displacement
- Differential Pressure
- Electronic
- Compound

In regards to retail meter applications the displacement meter (nutating disc) comprises the majority of American retail water systems for small and medium size meters. The nutating disc meter is highly accurate across a wide range of residential flows. Other meter technologies are continuing to develop (e.g., Electronic, etc.). Magnetic and ultrasonic flow meters have traditionally been used in larger production facilities but have been incrementally appearing in the domestic meter market for the past decade. The magnetic/ultrasonic flow meters have yet to gain a mainstream position in the retail water meter market mainly due to concerns about battery life, long-term accuracy, and the lack of an AWWA standard such as the AWWA M6 manual that governs displacement meters. As such, the nutating disc meter will remain the standard for the small to medium size meters for the foreseeable future as it is the most cost effective and reliable.

The District also uses compound meters for applications where there is a wide variation in large and small flows with varying usage patterns. Such an example would be a manufacturing business that uses large quantities of water for processing purposes. In such an event a large meter (3 inches and larger) will be used to capture the high end flows. Large meters often use turbo meters that are more accurate at high flows than the conventional displacement meters. However, large meters are not as accurate at capturing the low-end of the flow range for uses such as restrooms, irrigation, or other more minor uses. To accurately capture this low-end flow range an additional 1” meter is put either in serial or parallel with the large meter. This meter type is called a compound meter. Compound meter use and accuracy is provided for in the AWWA M6 Manual.

Displacement meters comprise over 97% of the District’s retail meter installations.

B. Proposed Meter Technologies

Meter technology advancement is relatively slow in comparison to other industry evolutions. The heart of the meter measuring mechanics has not drastically changed over the past several years. Water industry meters are manufactured, certified, and governed per the AWWA standards. While there are advancements in the electronic retail water meter market (e.g., Ultrasonic, magnetic, etc.) this technology has not been widely adopted by water retailers within the United States mainly due to the uncertainties regarding battery life, long-term accuracy, and lack of a standard of such meters. Additionally, the electronic meters have traditionally been more expensive making them less competitive. Thus, in the small to medium size meter ranges it appears that the nutating disc meter will remain the standard for several years to come in the United States water retail market. However, meter manufacturers are

pushing on making ultrasonic and magnetic meters the standard over the next 15 to 20 years as these meters do not have moving parts associated with them and are thought to have a longer useful life cycle and overall lower cost of operation.

The large meter retail standard will also continue to be turbine meters as these are more cost effective. The District uses magnetic flow meters at its production facilities and these meters are highly accurate and reliable. However, magnetic meters typically have a larger capital outlay than a turbine meter and require a dedicated power source that most retail customers are unwilling to invest in. Additionally, magnetic flow meters are unable to be calibrated in the field, whereas turbine meters can often be repaired, flow-tested, and calibrated in place. Thus, most retail agencies use and will continue to use turbine type meters for their large meter programs and high usage customer applications.

C. Proposed Register Technologies

Section 2 above describes the various technologies and basic functionalities used by the District today. The following is an overview of the trending register technologies:

AMR: The most basic AMR system provides one-way communication via radio read technology either by touch-read or drive-by reading. The ME register is the basis for an AMR type system. The following are the general characteristics of an AMR system:

- Reads as frequently as every 15 minutes or more
- Accurate bills in a timely fashion
- Improved work efficiency and safety
- Specialized reports
- Tamper and reverse-flow alarms
- Data collection and analysis capability
- Leak detection capability

The AMR system can be a stepping stone to a larger advanced metering infrastructure (AMI) system.

AMI: The AMI system provides two-way communication via a dedicated fixed antenna network system. The ME register is the basis for an AMI type system. The AMI has multiple components that require a localized data collector that transmits local collected meter data to a server via a larger regional antenna system. The AMI system is similar to the District's radio based SCADA system where each production facility transmits and receives data in five second intervals. The AMI system would require a more extensive antenna infrastructure system than the District's SCADA system as there would be approximately 25,000 meters to collect data from that would have line of sight radio transmission challenges. The following are the general characteristics of an AMI system:

- Reads as frequently as programmed
- Electronic meter reading (No meter reading staff required)

- Customer web access for consumption history
- Two-way communication for turn-ons and turn-offs
- Detailed billing down to gallon metric
- Real-time diagnostics and maintenance reports
- Data collection and analysis capability
- Leak detection capability

Cellular Endpoints: Cellular endpoint technology is a relatively newer technology that uses the existing cellular communications network to transmit meter data. Cellular technology is a great alternative to an AMI system as it doesn't require the extensive owner dedicated AMI antenna network system and local data collectors. The Cellular endpoint system uses the commercial cellular antenna network (i.e., AT&T, Verizon, etc.) The cellular endpoint registers do require a monthly subscription fee ($0.81-$0.89/month) for each account and maintains similar functionality of the ME register technology.

D. Register Technologies Benefits/Challenges

Table 10 provides an overview of the aforementioned register technologies advantages and disadvantages associated with implementing such systems:

Table 10 – Register Types Benefits/Challenges

Register Type	Advantages	Disadvantages
1. AMR	A. Two-way communication B. Faster & more accurate meter reading capability C. Radio read transmission D. Wireless data profiling E. Reduces vault confined entry	A. Costlier equipment than manual read B. Non-replaceable battery module C. Needs line of site to vehicle collection path
2. AMI	A. Two-way programmable communication B. No staff required for meter reading C. Wireless data profiling D. Leak Detection capability E. Reduces vault confined entry F. Customer access availability G. Real-time data querying	A. Costlier equipment than manual read B. Costlier than cellular or ME system C. Requires dedicated local data collectors D. Requires fixed antenna system E. Non-replaceable battery module F. Increase in customer service calls for customer data viewing
3. Cellular	A. Two-way communication potential B. Real-time meter reading (no staff time required) C. Real-time data querying D. Leak detection capability	A. Costlier equipment than manual read B. Requires monthly cellular fee C. Non-replaceable battery module D. Need proximity to cell tower system

	E. Reduces vault confined entry F. Customer access availability G. Uses existing cellular antenna system H. Similar endpoint design to ME	

Each system has its specific advantages and is best suited to a particular type of meter reading format dependent upon the control, information, and capital investment the agency desires and is willing to commit to. Commitment to any of the aforementioned systems requires careful cost evaluation, implementation, and phasing.

E. Meter and Register Technology Costs

There are three major cost components to each of the aforementioned meter technology systems. These cost elements include the meter body/register, endpoint, and installation labor. Other ancillary cost components include software, software setup and integration, handheld reading devices, laptops, subscription cellular service fees, and supporting infrastructure costs (for AMI systems). For cost analysis purposes, the following costs will be used for alternative comparisons:

Table 11 – Meter and Endpoint Cost

Meter Size (Inches)	Cost[1]
0.62	$133
0.75	$163
1.00	$214
1.50	$438
2.00 (Disc)	$613
2.00 (Turbo)	$982
3.00 (Turbo)	$1,232
4.00 (Turbo)	$1,789
6.00 (Turbo)	$3,289
8.00 (Turbo)	$3,654
Endpoint Type	**Cost[2]**
ME	$96
Cellular	$120

Notes:
1. Costs are for meter body & encoder only.
2. Costs are for endpoint only.

The installation labor costs basis will come from the District's computerized maintenance management system (CMMS) with the assumption that any installed system will be performed by District staff. These costs are used in subsequent analyses in Section 6.

The cost of an AMI based system has been estimated at approximately $11M to $12M based on rough order of magnitude cost estimate provided by meter vendors. The major benefit to an AMI system is from the ability to reduce and manage water loss

within a distribution system. Given that the District's water loss is at an unprecedented 3.9% the cost of an AMI does not appear warranted. Thus, implementation of an AMI system is not recommended given the limited benefits for the District and has been eliminated from further consideration in this analysis.

F. Software Integration Requirements

Existing Software/Hardware: The District currently uses the Cogsdale customer service system as its asset inventory and meter information and billing system for existing and new metered accounts. The systems work in conjunction with the Badger Orion Read Center software system that works through Citrix.

The District's meter readers have used the Northrup Grumman handheld hardware with the Orion Reading System (ORS) to collect reads from the older CE registers most of which are located along Route 600. This also requires a laptop with the meter reading software to be installed in the meter readers' truck to receive the transmitted data as the meter reader drives by.

The meter readers also carry with them the Badger handheld (Trimble) to read the newer Badger ME registers. The introduction of the Trimble system created complexity in the meter reading process, downloading and management of the meter reading data, and overall ease of use. However, the manual meter reading data is now mostly collected with the Trimble unit, which is a more efficient unit to read meters with than the Northrop Grumman. However, both handhelds have to be carried on each route because CE registers have been randomly installed along each route. An immediate efficiency is to replace all existing CEs and TRs registers so the Northrup Grumman can be eliminated and the Trimble unit can be used as the only meter reading standard moving forward.

Proposed Hardware/Software: The concept of standardizing around one meter manufacturer and register technology not only simplifies the meter reading, data management, and billing processes significantly, it also minimizes the software integration issues that are experienced with multiple register endpoint manufacturers not being compatible with the current or future software platform.

The Badger Read Center (BRC) has been a long time standard for Badger. The BRC is used as the interface between the meter reading devices to download meter read data to the Cogsdale database system. However, Badger has indicated that they will not be writing software patches for the necessary upgrades of the BRC software to be compatible with the Windows 10 Operating System. Thus, BRC will be unsupported within the next few years similar to when Microsoft quit supporting Windows XP. Therefore, a future migration to a new software platform will be required. Should the District choose not to upgrade its current register technology beyond its current configuration of CE and ME registers, the BRC will continue to function and accommodate the meter reading process for the near-term. However, Badger will ultimately quit supporting the BRC system over the long-term and the District will need

to be prepared to have a migration solution and plan in place to make the necessary transition to a more current software platform.

Badger recently introduced the Beacon Software System (Beacon). Beacon is a web based hosted system that functions similar to the BRC where meter-reading data is downloaded to the Cogsdale database system through Beacon. The main differences however are that Beacon will allow customers the ability to view real-time consumption data through a viewer portal and allow District staff to provide real-time programming functionality and communications to meters equipped with Cellular or AMI technologies. An added benefit is that manual meter reading data can be imported, stored, and viewed by customers as data is downloaded. Many of the other meter registers currently in the District's system are believed to work with the Beacon system much like they work with the BRC system.

Other meter manufacturers have emerging web based hosted software solutions that also claim to be compatible with the District's Cogsdale database system. These systems have been evaluated at a high level and make similar claims as the Badger system in regards to capabilities, compatibility, and costs. However, the District has the most specific experience with Badger software platforms and have a large amount of installed Badger meters. Thus, considering the Beacon system as the long-term software platform solution appears to make the most cost-effective and practical approach.

Challenges: The challenges associated with any new software platform is in the compatibility with the older register technology currently embedded within the system. As such, the older TRs and converted Universal CEs would need to be changed to a meter/register type (ME or Cellular) compatible with the Beacon system.

Additionally, setup and configuration would be required with the Cogsdale database. This would require both Cogsdale and Badger to work together to develop the interface code necessary to have both systems communicate and accept the meter reading data from the new system. Fortunately, this has been done for other water agencies that also use Cogsdale as their customer service database and have adopted Beacon as their meter reading software platform. Thus, there is a good integration experience basis to allow for a relatively smooth transition.

Costs: The Beacon software system does not have an annual software licensing fee. However, non-AMI or non-Cellular accounts (ME and manual) hosted by the Beacon system cost $0.04 to $0.08 per month per account. AMI and Cellular based accounts have no monthly fee other than the monthly cellular service amount for those devices. The Beacon system also requires updated meter reading software to be installed on each meter readers laptop or tablet which has an annual licensing fee of $2,000 per year per device. For example, 23,500 hosted AMR or manual read accounts hosted on the Beacon system would cost approximately $11,000 per year.

Findings:

5.1 Small meter standard will continue to be the nutating disc for the next 10-15 years;
5.2 Large meter standard will continue to be the turbo meter with compound meters for varying flow applications;
5.3 Allowing multiple meter and register manufacturers to be installed across the distribution system provides challenges associated with efficient maintenance, inventory management, software integration and compatibility, and meter reading work-flow processes;
5.4 ME registers provide the most efficient meter reading and data management platform for non real-time data collection;
5.5 Cellular registers provide the most cost efficient meter reading and data management platform for real-time data collection;
5.6 AMI registers continue to have high implementation cost and are impractical with minimal benefit;
5.7 Cellular technology is approximately 25% more costly than ME technology;
5.8 Cellular technology should be considered for customers who would benefit from real-time data collection to minimize the monthly subscription fee impacts;
5.9 The District's existing BRC system will not be compatible with Windows 10 Operating System and will require a new meter reading software platform; and
5.10 Beacon is a web-based hosted system that is compatible with existing and future meter register technologies

Section 6: Implementation Options

The challenge of implementing any level of AMR technology is to ensure that value is provided to the District while maintaining the objectives discussed in Section 1. There are multiple scenarios to consider for the possible implementation of AMR along with manual read technology. Possible implementation strategies and options are as follows:

Option No. 1 – Route 600 Update: This Option would target replacement of the malfunctioning end of life Universal CEs and TR along Route 600 only with newer Badger MEs. The benefits and challenges of this Option are as follows:

Benefits:

1. Immediately updates outdated meter register technology;
2. Provides more efficient meter reading along Route 600;
3. Minimizes confined space entry to read meters;
4. Minimal capital program budget commitment; and
5. Removes redundant meter reading device requirement;

Challenges:

1. Does not address end of life BRC software platform;
2. No real-time water conservation data feedback availability;

This option makes the following assumptions:

- New meters, registers, and MEs will be installed at all 212 meter locations;
- No updated software platform will be provided;
- All meters/registers will be upgraded simultaneously;
- Existing meter routes will continue to be read manually and changed per the regular small meter frequency replacement requirement; and
- Meter reading routes will not be reconfigured at this time

The cost to implement an AMR Only upgrade to Route 600 is as follows:

Table 12

Route 600 Upgrade (AMR Only)										
Meter Size (Inches)	**0.62**	**0.75**	**1**	**1.5**	**2**	**3**	**4**	**6**	**8**	**Total**
Total Meters	6	8	4	8	40	55	39	30	22	212
Unit Costs	**$ 133**	**$ 163**	**$ 214**	**$ 438**	**$ 613**	**$ 1,232**	**$ 1,789**	**$ 3,289**	**$ 3,654**	**$ 11,525**
Meter/Register[1]	$ 133	$ 163	$ 214	$ 438	$ 613	$ 1,232	$ 1,789	$ 3,289	$ 3,654	$ 11,525
Capital Cost	**$ 844**	**$1,365**	**$ 887**	**$3,565**	**$ 28,735**	**$ 73,555**	**$73,881**	**$101,831**	**$ 82,706**	**$367,368**
Meter & Register	$ 798	$1,304	$ 856	$3,504	$ 24,520	$ 67,760	$69,771	$ 98,670	$ 80,388	$347,571
Installation Labor[2]	$ 46	$ 61	$ 31	$ 61	$ 4,215	$ 5,795	$ 4,110	$ 3,161	$ 2,318	$ 19,797
Total										**$367,368**

Notes:
1. Based on December 2018 pricing

2. Based on CMMS FY2018 ADP and labor costs

While this Option does address the Route 600 end of life replacement of the Universal CEs and TRs it does not provide for a path forward to address Mesa Water's end of life BRC software update. It also does not provide the District's highest use customers with any level of water conservation management tools when future State of California water conservation mandates are required.

An alternative approach to Option 1 is Option 1B, which is to install 107 cellular endpoints within Route 600 and MEs on the remaining meters. Since these 107 meters are part of the Top 50% Consumption of highest users, Option 1B would provide an opportunity to setup a pilot program that provides real-time water conservation management tools, establishes the necessary software upgrade setup and configuration, and installation and operational experience. The cost to implement Option 1B is as follows:

Table 13

Route 600 Upgrade (AMR & Cellular Endpoint High Use)

Meter Size (Inches)	0.62	0.75	1	1.5	2	3	4	6	8	Total
Total Meters	**6**	**8**	**4**	**8**	**40**	**55**	**39**	**30**	**22**	**212**
High Use	3	4	1	4	19	39	23	8	6	107
Regular Use	3	4	3	4	21	16	16	22	16	105
Unit Costs	**$ 253**	**$ 283**	**$ 334**	**$ 558**	**$ 733**	**$ 1,352**	**$ 1,909**	**$ 3,409**	**$ 3,774**	**$ 12,605**
Meter/Register[1]	$ 133	$ 163	$ 214	$ 438	$ 613	$ 1,232	$ 1,789	$ 3,289	$ 3,654	$ 11,525
Cellular Endpoint	$ 120	$ 120	$ 120	$ 120	$ 120	$ 120	$ 120	$ 120	$ 120	$ 1,080
Capital Cost	**$ 1,204**	**$ 1,845**	**$ 1,007**	**$ 4,045**	**$ 31,015**	**$ 78,235**	**$ 76,641**	**$102,791**	**$ 83,426**	**$ 380,208**
Meter & Register	$ 798	$ 1,304	$ 856	$ 3,504	$ 24,520	$ 67,760	$ 69,771	$ 98,670	$ 80,388	$ 347,571
Cellular Endpoint	$ 360	$ 480	$ 120	$ 480	$ 2,280	$ 4,680	$ 2,760	$ 960	$ 720	$ 12,840
Installation Labor[2]	$ 46	$ 61	$ 31	$ 61	$ 4,215	$ 5,795	$ 4,110	$ 3,161	$ 2,318	$ 19,797
Software Setup					**$30,000**					**$ 30,000**
Cogsdale Integration[3]					$10,000					
Badger Integration					$10,000					
Report Customization[4]					$10,000					
Training[5]					**$4,000**					**$ 4,000**
Annual Cell Service[6,7]					**$1,143**					**$ 1,143**
Total										**$ 415,351**

Notes:
1. Based on December 2018 pricing
2. Based on CMMS FY2018 ADP and labor costs
3. Assumed fixed costs based on dialogue with Badger. Need to confirm actual price w/Cogsdale vendor
4. Cost will depend on the level of detail and number of requested reports beyond the standard available system reports
5. Covers costs for two (2) 8 hour training sessions.
6. Monthly cell costs is $0.89/month/service. Cost could be as low as $0.81/month/service w/more units placed in service.
7. Long term monthly cell service costs price guarantee can be negotiated up front to ensure minimal cost increases.

Option 1B is approximately $58,000 more than Option 1 and it provides the foundation to incrementally expand to Options 2 or 3 in the appropriate time frame if this is the approach Mesa Water wanted to pursue.

It has been recommended by Mesa Water's Water Loss Program consultant to move the small and large meter replacement frequency from 15 years to 18 years. This proposed program change would allow the use of the small and large meter program funds for the next 3 years to use for the options discussed herein. The fiscal year 2019 combined small and large program meter replacement budget is $344,000. This would equate to a payback of 1.07 years and 1.21 years for Options 1 and 1B, respectively.

Option No. 2 - Highest Usage Accounts & Hard to Read Location Only: This approach targets the top usage accounts throughout the District. This approach would implement cellular technology to target the top 5% of the District's users and would include routes that contain larger irrigation and commercial accounts.

This option will require a targeted program implementation of 1,530 meters across 58 of the existing 61 meter routes. However, 50% of the meters for the Top 50% Consumption exist on the 11 routes shown in Table 13.

Table 13 – Meter Routes for 50% of Top 50% Consumption

	Top 50% Users by Size & Route									
	Meter Size									Total
Route No.	0.62	0.75	1	1.5	2	3	4	6	8	
600	3	4	1	4	19	39	23	8	6	107
935	0	2	1	7	81	0	0	0	0	91
911	2	6	19	22	41	0	0	0	0	90
927	1	1	3	49	33	0	0	0	0	87
921	4	2	9	19	48	0	0	0	0	82
838	5	2	35	11	21	0	0	0	0	74
828	0	0	4	15	43	0	0	0	0	62
854	4	3	6	27	20	0	0	0	0	60
846	5	5	24	12	13	0	0	0	0	59
907	0	24	32	1	1	0	0	0	0	58
858	5	21	22	6	3	0	0	0	0	57

This option would also eliminate the failing Universal CEs along Route 600. Most other routes have 10 or fewer meters on the Top 50% Consumption route. The benefits and challenges of this option are as follows:

Benefits:

1. Provides real-time consumption to Mesa Water's largest water consuming customers;
2. Allows proactive water conservation management by customers during time of drought mandate reductions;
3. Meter reading is performed automatically through a hosted connection;
4. Provides direct monthly billing of water consumption;
5. Provides direct monthly revenue of largest customer accounts;
6. Assists customers in identifying leaks within their system to avoid water loss;
7. Minimizes District employee access requirements for hard to read meter locations;
8. Simplifies meter reading process and eliminates requirements for using two separate meter reading devices; and
9. Updates end of life meter reading software platform.

Challenges:

1. Requires moderate capital investment;
2. Requires new software platform setup and integration;
3. Requires running two parallel software platforms if manual read meter data is not hosted on Beacon system;

4. Requires monthly costs to host manual read accounts in Beacon system;
5. Requires employee training and work-flow process setup.

This option makes the following assumptions:

- New meters, registers, and cellular endpoints will be installed at all 1,530 meter locations;
- Affected Route 953 meters will only have a register change out to cellular endpoints for its 38 affected meters;
- 105 Route 600 meters will need to have new AMR registers installed to eliminate the other challenges discussed in the aforementioned sections;
- Full conversion of all 1,530 high usage meters will occur simultaneously;
- Requires approximately 0.8 FTE Mesa Water staff labor to install all 1,530 meters, registers, and cellular endpoints;
- Implementation of Badger Beacon hosted software solution and supporting hardware for high usage accounts;
- Existing meter routes will continue to be read manually and changed per the revised 18-year small meter frequency replacement requirement; and
- Meter reading routes will not be reconfigured at this time

The following is a high level cost summary of what would be required to implement such a program:

Table 14

Top 50% Consumption - Cellular Enpoint Implementation Costs

Meter Size (Inches)	**0.62**	**0.75**	**1**	**1.5**	**2**	**3**	**4**	**6**	**8**	**Total**
Total Meters	69	115	275	363	620	44	28	9	7	1,530
Unit Costs	**$ 253**	**$ 283**	**$ 334**	**$ 558**	**$ 733**	**$ 1,352**	**$ 1,909**	**$ 3,409**	**$ 3,774**	**$ 12,605**
Meter/Register[1]	$ 133	$ 163	$ 214	$ 438	$ 613	$ 1,232	$ 1,789	$ 3,289	$ 3,654	$ 11,525
Cellular Endpoint	$ 120	$ 120	$ 120	$ 120	$ 120	$ 120	$ 120	$ 120	$ 120	$ 1,080
Capital Cost	**$ 17,983**	**$ 33,422**	**$ 93,947**	**$ 205,322**	**$ 519,791**	**$ 64,124**	**$ 56,402**	**$ 31,629**	**$ 27,156**	**$ 1,049,777**
Meter & Register	$ 9,177	$ 18,745	$ 58,850	$ 158,994	$ 380,060	$ 54,208	$ 50,092	$ 29,601	$ 25,578	$ 785,305
Cellular Endpoint	$ 8,280	$ 13,800	$ 33,000	$ 43,560	$ 74,400	$ 5,280	$ 3,360	$ 1,080	$ 840	$ 183,600
Installation Labor[2]	$ 526	$ 877	$ 2,097	$ 2,768	$ 65,331	$ 4,636	$ 2,950	$ 948	$ 738	$ 80,872
Software Setup					**$30,000**					**$ 30,000**
Cogsdale Integration[3]					$10,000					
Badger Integration					$10,000					
Report Customization[4]					$10,000					
Training[5]					**$4,000**					**$ 4,000**
Annual Cell Service[6,7]					**$16,340**					**$ 16,340**
Total										**$ 1,100,118**

Notes:

1. Based on December 2018 pricing

2. Based on CMMS FY2018 ADP and labor costs
3. Assumed fixed costs based on dialogue with Badger. Need to confirm actual price w/Cogsdale vendor

4. Cost will depend on the level of detail and number of requested reports beyond the standard available system reports

5. Covers costs for two (2) 8 hour training sessions.

6. Monthly cell costs is $0.89/month/service. Cost could be as low as $0.81/month/service w/more units placed in service.
7. Long term monthly cell service costs price guarantee can be negotiated up front to ensure minimal cost increases.

This approach would be implemented using District staff with onsite Badger training. The largest number of meters are in the 2" meter class followed by the 1.5" and 1" meters. Software setup will require both Cogsdale and Badger system support to work together to help configure the Badger Beacon software. The capital investment costs is approximately $1.05 million. Setup and configuration costs is approximately $34,000. Recurring costs is approximately $16,340 per year for the cellular service. Routine maintenance will be facilitated by District staff.

To cover the capital implementation cost, the typical District fiscal year 2019 Routine Capital Small Meter Replacement Program is scheduled to replace 1,459 small meters at a total cost of $344,000 per year. One approach to implementing Option No. 2 would be to defer the FY2020, FY2021, and FY2022 Routine Small and Large Meter Replacements and to focus on the Top 50% Consumption Program upgrade. This would equate to a payback of 3.2 years. Using the FY2019 replacement schedule over FYs 2020 through FY2022 would allow the approximate $1,032,000 to be used for this Top 50% Consumption Program upgrade without substantially impacting the capital improvement program.

Option No. 3 – High Usage Accounts & Complete AMR: This approach would include implementation of the cellular technology outlined in Option No. 2 of the high usage routes and hard to read locations and would replace all the manual read meters with an AMR technology comprehensively over a period of five to seven years. The benefits and challenges of this Option in addition to those listed in Option No. 2 above are as follows:

Benefits:

1. Minimizes meter reading time by approximately 1.0 FTE;
2. Provides highly accurate meter reads and eliminates errors in manual meter reading process;
3. Historical meter reading data can be collected during drought mandate periods to assist customers in achieving water reduction mandates;
4. Eliminates manual meter process and potential staff injuries from entering and exiting vehicles and potential injuries from walking routes;

Challenges:

1. Large capital investment required;
2. Potential for technology time-lapse if implementation is spanned across to many years;

This option makes the following assumptions:

- New meters, registers, and cellular endpoints will be installed at all 1,530 meter locations;
- Affected Route 953 meters will only have a register change out to cellular endpoints for its 38 affected meters;
- All other 23,432 existing meters will be changed to Badger meters and registers with MEs;

- Implementation of Badger meter/register/MEs can occur over a 1-8 year period;
- Full conversion of all 1,530 high usage meters will occur simultaneously;
- Implementation of Badger Beacon hosted software solution and supporting hardware for high usage accounts;
- AMR meters will be hosted in the new Beacon hosted system;
- Meter Reading Routes will not be reconfigured at this time

This approach allows for a phased implementation in both capital expenditure and available resources to install and setup the AMR technology. This also allows a progressive approach in regards to the meter replacement program so not all meters are due for replacement in one year. The following is the cost to fully-implement AMR technology across the District's other 23,452 meters:

Table 15

Comprehensive AMR Implementation										
Meter Size (Inches)	**0.62**	**0.75**	**1**	**1.5**	**2**	**3**	**4**	**6**	**8**	**Total**
Total Meters	17127	2063	2393	595	645	33	128	283	165	23,432
Unit Costs	**$ 229**	**$ 259**	**$ 310**	**$ 534**	**$ 709**	**$ 1,328**	**$ 1,885**	**$ 3,385**	**$ 3,750**	**$ 12,389**
Meter/Register[1]	$ 133	$ 163	$ 214	$ 438	$ 613	$ 1,232	$ 1,789	$ 3,289	$ 3,654	$ 11,525
Migratiable Endpoints	$ 96	$ 96	$ 96	$ 96	$ 96	$ 96	$ 96	$ 96	$ 96	
Capital Cost	**$ 4,052,702**	**$550,050**	**$760,080**	**$322,268**	**$525,270**	**$47,301**	**$254,768**	**$987,775**	**$636,136**	**$8,136,351**
Meter & Register	$ 2,277,891	$336,269	$512,102	$260,610	$395,385	$40,656	$228,992	$930,787	$602,910	$5,585,602
Migratiable Endpoint	$ 1,644,192	$198,048	$229,728	$ 57,120	$ 61,920	$ 3,168	$ 12,288	$ 27,168	$ 15,840	$2,249,472
Installation Labor[2]	$ 130,619	$ 15,733	$ 18,250	$ 4,538	$ 67,965	$ 3,477	$ 13,488	$ 29,820	$ 17,386	$ 301,277
Software Setup	**Included as Part of Option No. 1**									
Hosted Service[3]	**$19,683**									**$ 19,683**
Total										**$8,156,033**

Notes:

1. Based on December 2018 pricing
2. Based on CMMS FY2018 ADP and labor costs
3. $0.07/month/meter for hosted service on BRC

This Option could be implemented over a 1 year, 5 year, or 8 year period. The Cost of a one-year implementation is $8.1M. The challenge of a one-year implementation is of course the capital investment required to implement this within one year and all future meter replacements would be necessary at one point in time approximately 18 to 20 years from the initial installation. The benefit of a one-year implementation is that it is completed immediately and the District recognizes the benefits of the AMR technology outlined above and no technology gap potentially exists from taking too long to implement such a program.

The Cost of an 8-year implementation would be approximately $1M per year for the next 8 years. Approximately 8 routes per year would need to be converted to keep pace with

the 8-year implementation schedule. The challenge of this approach is the potential for a technology gap to occur where newer technology is phased in and integration and compatibility could become more difficult. The benefits of this approach are the per year capital reduction commitment and it phases the 18-20 year meter replacement cycle in future years.

The total cost for implementing Options 2 and 3 together is approximately $9.3M with a payback of 27 years using the $344,000 fiscal year 2019 small and large meter replacement budget.

Findings:

6.1 Option 1 provides the minimum updates to Route 600 with minimal capital investment; and
6.2 Option 1B establishes a pilot program that would provide the foundation for expansion to Option 2 and Option 3 if desired.
6.3 Mesa Water's existing BRC is at the end-of-life and will need eventual replacement regardless of Options 1, 2, or 3 implementation;
6.4 Option 2 provides immediate benefits to Mesa Water's highest use customers for real-time consumption data management;
6.5 Option 2 provides Mesa Water with meter reading efficiency of its largest users and hard to read locations;
6.6 Option 2 has a moderate capital investment;
6.7 Option 3 implementation recognizes approximately a 1.0 FTE in labor savings;
6.8 Option 3 brings provides high accuracy reads throughout the District's meter reading process;
6.9 Option 3 provides partial real-time data management coupled with a passive water data management system for future water conservation mandate efforts;
6.10 Option 3 is a large capital investment that will need consideration of phasing implementation over a 1 to 8 year period;

Section 7: Proposed Standards

New meter installations or meter replacements will benefit greatly having a standardized approach. A standardization approach needs to consider a standard meter manufacturer, property use, types of registers specific to the account type and function, meter reading process, consumption history, and supporting software platform. The following are proposed standards for managing Mesa Water's new meter installations and meter replacement program:

A. Meter Standard

Mesa Water's proposed meter standard will be based on the Badger meter body for all meter types. This standard is being proposed because Mesa Water has a successful history with the Badger product and has implemented many of these meters over the past several decades. Badger has over 100 plus years of manufacturing experience

and has been at the forefront of meter technology development. Thus, it is proposed that Badger meter be used solely as Mesa Water's standard.

To ensure that the District continues to get competitive pricing, Badger Meter has agreed to establish a long-term pricing structure the ties price increases to a national consumer price index. Mesa Water can also elect to solicit competitive bids at 5-year intervals to ensure competiveness is being maintained.

B. **Register Standard**

Mesa Water's proposed register standard will be based on the Badger technology for manual meters, AMR and cellular endpoints. For the same reasons indicated in Section A herein, the Badger system is being recommended and Badger has developed state of the art register and encoder technologies that are highly accurate and comply with the AWWA M6 manual. The proposed register standard will be based on a manual read 8-digit high resolution encoder (HR-E). This standard encoder will allow for integration of any future AMR/AMI endpoint if Mesa Water desired to migrate to that solution long-term.

C. **Automation Standard**

The District is made up of an assortment of property uses. These uses include residential, multi-family, commercial, industrial, and institutional uses. As such, meters and register technology that serve these use types requires specific functionality that accommodates both the customer and supports Mesa Water's meter reading process. The following is the proposed standards for how new meter installations and meter replacements will be facilitated for each of the following use types:

Table 16 – Meter/Register/Endpoint Standardization

Meter Use	Meter Style	Register	Endpoint
1. Residential[1]	Nutating Disc	8-Digit HR-E	None
2. Multi-Unit Residential[2/3]	Nutating Disc	8-Digit HR-E	ME
3. High Density	Master Meter	8-Digit HR-E	Cellular
4. Irrigation (<2")	Nutating Disc	8-Digit HR-E	Cellular
4b. Irrigation (>2")	Turbo	8-Digit HR-E	Cellular
5. Fire Lines	5/8" Tattletale	8-Digit HR-E	ME
6. Commercial[4]	<3" Nutating Disc >3" Combo Meter	8-Digit HR-E	ME[5]
7. High-Use[5]	<3" Nutating Disc >3" Combo Meter	8-Digit HR-E	Cellular
8. Hard to Access[6]	Varies	8-Digit HR-E	Cellular

Notes:

1. Single-family detached home
2. Single-family detached or attached townhomes with thrity or more units with meters located in front of home and within a development community.
3. Single-family homes within a development community with meters located within the public right-of-way in a meter bank shall not be equipped with MEs.
4. Meter size varies based on fixture unit count. Combo meters shall be designed for low and high flow usage patterns based on proposed architectural drawings and plumbing plans.
5. Meters are considered high use when average monthly flows are greater than 65 HCF/month (1"), 100 HCF/month (1.5"), 200 HCF/month (2"), 450 HCF/month (3"), 850 HCF/month (4"), 1,400 HCF/month (6"), and 3,000 HCF/month (8") shall be equipped with a cellular endpoint.
6. Hard to access locations shall be determined by the Meter Reading Group and submitted to the Plan Checker for integration into the approved plans.

The proposed standards are intended to be implemented as part of the Mesa Water plan checking process regardless of which meter implementation option is determined to be the best course of action.

Section 7: Recommendations & Implementation Strategy

A. Recommendations

1. **Use Badger Meter Equipment and Software as Mesa Water Standard**: Mesa Water should consider standardizing around the Badger Meter platform as outlined in the aforementioned sections. Badger meter has been in the business of manufacturing meters and registers for over one hundred plus years and manufactures a highly accurate meter. Mesa Water has numerous badger meters, registers, and MEs already in place within its distribution system and Mesa Water has used the Badger Read Center meter reading software platform for many years and is familiar with the nomenclature and work-flow process that are used in the proposed web-hosted Beacon system.

2. **Implement Option No. 2**: Implementation of Option No. 2 provides the most balanced approach of meter reading and reporting automation with consideration of capital cost expenditures. This approach automates approximately 5% of District's largest users and provides real-time data management tools to be used in future state mandated water conservation efforts. Option No. 2 focuses on the most relevant and cost effective customer segments and uses a proven cellular technology that does not require a customer owned extensive antenna array that the AMI system requires.

   Option No. 2 will also achieve the critical update to the Beacon web hosted meter reading software.

3. **Re-Evaluate Full System AMR System Adoption in 5-Years**: The District should re-evaluate the long-term conversion of its meter reading system again in five years to a full AMR system. Re-evaluation should reassess the state of register and meter technologies, the market trend, and cost of implementation. Should the District desire to move forward with full AMR implementation at that time the web-

hosted Beacon software that will be implemented in Option No. 2 will provide the required foundation for implementation and deployment. It is expected that costs will continue to decrease in the MEs as the product becomes more mainstream in water agencies systems.

4. **Perform Meter Route Optimization Assessment**: Mesa Water's meter routes should be evaluated for meter reading efficiencies. Meter routes were progressively laid out over several years as Mesa Water's service area was built-out. It appears that a meter route optimization has never been performed. A meter reading route optimization assessment should include at a minimum the following criteria:

    - No of meters read on each route;
    - Types of meters read on each route;
    - Traffic analysis to eliminate dangerous reading conditions for field staff;
    - Time to read routes for given technology;
    - Recommendations on how to reduce meter reading time and increase safety;
    - Driving routes verses drive/walking routes;
    - Recommendations where AMR could reduce meter reading time and increase safety;

    This assessment should be performed concurrent with implementation of Option No. 2 so route definitions can be reconfigured for the cellular endpoint accounts.

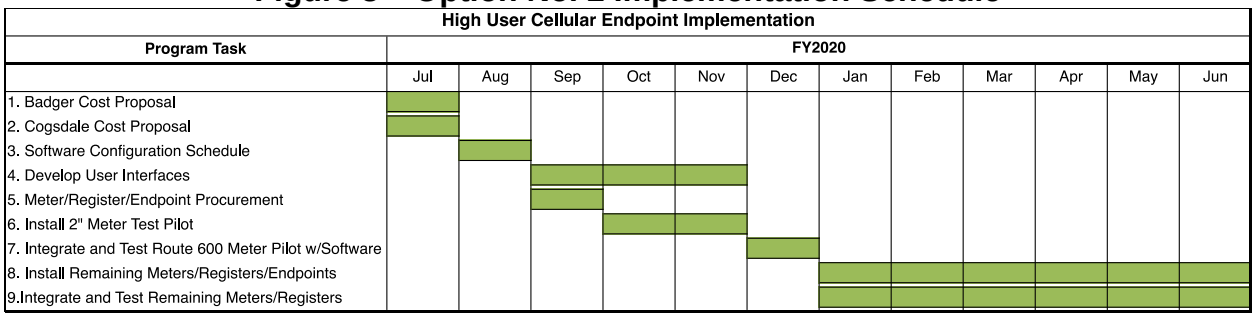
5. **Update Mesa Water Standard Plans and Specifications for Water Service**: The District's Standard Plans and Specifications for Water Service should be updated to include the standards for meter and register technology proposed in Section 7.C herein. These standards will assist in standardizing Mesa Water's meter replacements and new meter installations in the long-term to ensure uniformity, efficiency of repair, maintenance, and replacements, and meter reading efforts.

B. Implementation Approach: The following is the proposed sequence of implementation:

1. Obtain cost proposal from Badger to upgrade and configure Beacon system
2. Obtain cost proposal from Cogsdale to develop configuration interface;
3. Establish schedule for software configuration for Badger and Cogsdale systems;
4. Develop customer and Mesa Water user interfaces to view meter data;
5. Procure replacement meters, registers, and cellular endpoints for Option No. 2;
6. Install Route 600 meters, registers, and endpoints as pilot test;
7. Integrate and test Route 600 meters w/new software platform and interfaces;
8. Installation of meters, registers, and cellular endpoints in remaining meter routes;
9. Integrate and test remaining meter size installations w/new software platform and interfaces;

C. Schedule: The proposed schedule for implementation of the sequence defined in Section B herein is as follows:

Figure 8 – Option No. 2 Implementation Schedule



D. Program Costs: Mesa Water's meter testing program has determined that the life-cycle replacement frequency for the small and large meter programs should move from 15 years to 18 years. This change will largely offset the cost for implementation of Option No. 2 as the funds that would have been used for the next 3 years of the small and large meter capital replacement program can be used to implement Option No. 2. An additional $186,000 (or $62,000 per year for the next three years) will be necessary in the small and large meter replacement program to fully fund implementation of Option No. 2 in the next fiscal year. Long-term Badger meter costs for standardized equipment, long-term monthly cellular service costs (for cellular endpoints), and the web-hosted non-AMR/AMI accounts will be negotiated up front to ensure competitive pricing. Any cost increases will be tied to a regional consumer price index.

REPORTS:

7. REPORT OF THE GENERAL MANAGER

REPORTS:

8. DIRECTORS' REPORTS AND COMMENTS

MesaWater DISTRICT®

Dedicated to Satisfying our Community's Water Needs

MEMORANDUM

TO: Engineering and Operations Committee
FROM: Phil Lauri, P.E., Assistant General Manager
DATE: April 16, 2019
SUBJECT: Production Well Costs

RECOMMENDATION

This item is provided for information only.

STRATEGIC PLAN

Goal #1: Provide a safe, abundant, and reliable water supply.
Goal #2: Practice perpetual infrastructure renewal and improvement.
Goal #3: Be financially responsible and transparent.

PRIOR BOARD ACTION/DISCUSSION

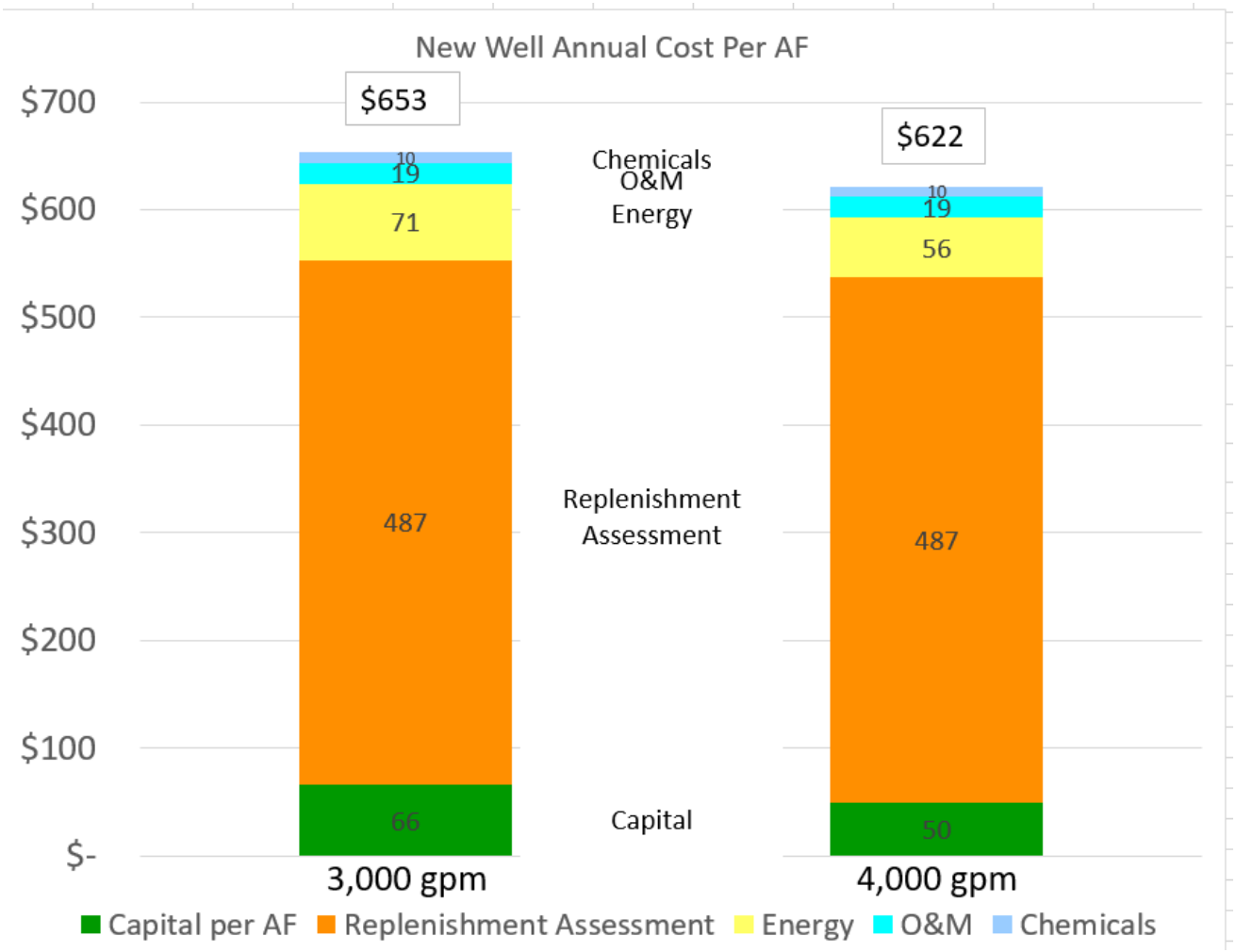
At its March 7, 2019 workshop, the Board of Directors (Board) requested an analysis of the capital and operating costs of a new water production well.

DISCUSSION

The cost components to build and operate a new water production well are as follows:

- Property Acquisition
- Capital
  - Professional Services (Planning, Design, & Construction Management)
  - Construction (Demolition, Well Drilling, Well Equipping and Pipeline Construction)
- Operations
  - Replenishment Assessment
  - Energy
  - Disinfection Chemicals
  - Operations and Maintenance

The following graph depicts the annualized cost per acre-foot for each of the aforementioned cost categories:



The Capital and Operating costs assume these costs are paid for from District funds rather than being financed with interest. These costs are amortized evenly over a 30-year period. The sum of all the costs are presented on a per acre-foot per year (AF/Y) of water produced basis. Two production scenarios of 3,000 gallons per minute (4,680 AF/Y) and 4,000 gallons per minute (6,240 AF/Y) are presented. Both scenarios assume the well runs constantly, with one day per month maintenance downtime (353 running days per year). Based on these assumptions, the total annual cost per AF of the 3,000 gallon per minute production scenario is $653 per AF. The total annual cost for the 4,000 gallon per minute production scenario is slightly lower at $621per AF, as the amortized capital costs are divided across a larger total production, and the energy cost per AF are slightly lower. In both cases, the Replenishment Assessment of $487 per AF charged by Orange County Water District is by far the largest cost, accounting for 75% and 78% of the total annual cost per AF.

FINANCIAL IMPACT

None.

ATTACHMENTS

None.