VOLUME III-C

CAPITAL PROJECT DESCRIPTION FOR PIPELINE REPLACEMENT PROJECTS

(2023 – 2025)

W-1

Suburban Water Systems
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PROJECT DESIGN REPORT

FROM: Engineering Department

DATE: April 12, 2022

DISTRICT: WLM

SUBJECT: La Pluma Dr. and Pastrana Dr. Pipeline Replacement; CP-446

1. Executive Summary

The existing 2-inch and 4-inch grey plastic (GP), 8-inch asbestos cement (AC), and 8-inch steel (ST) mains in La Pluma Drive and Pastrana Drive area have experienced many breaks in the past years. They have reached the end of their useful lives and do not provide an adequate level of service to the customers. It is recommended that these 4-inch to 8-inch mains are replaced by approximately 17,820 LF of 4-inch to 8-inch PVC mains to provide a safe and reliable water supply to the customers in the area.

2. Introduction

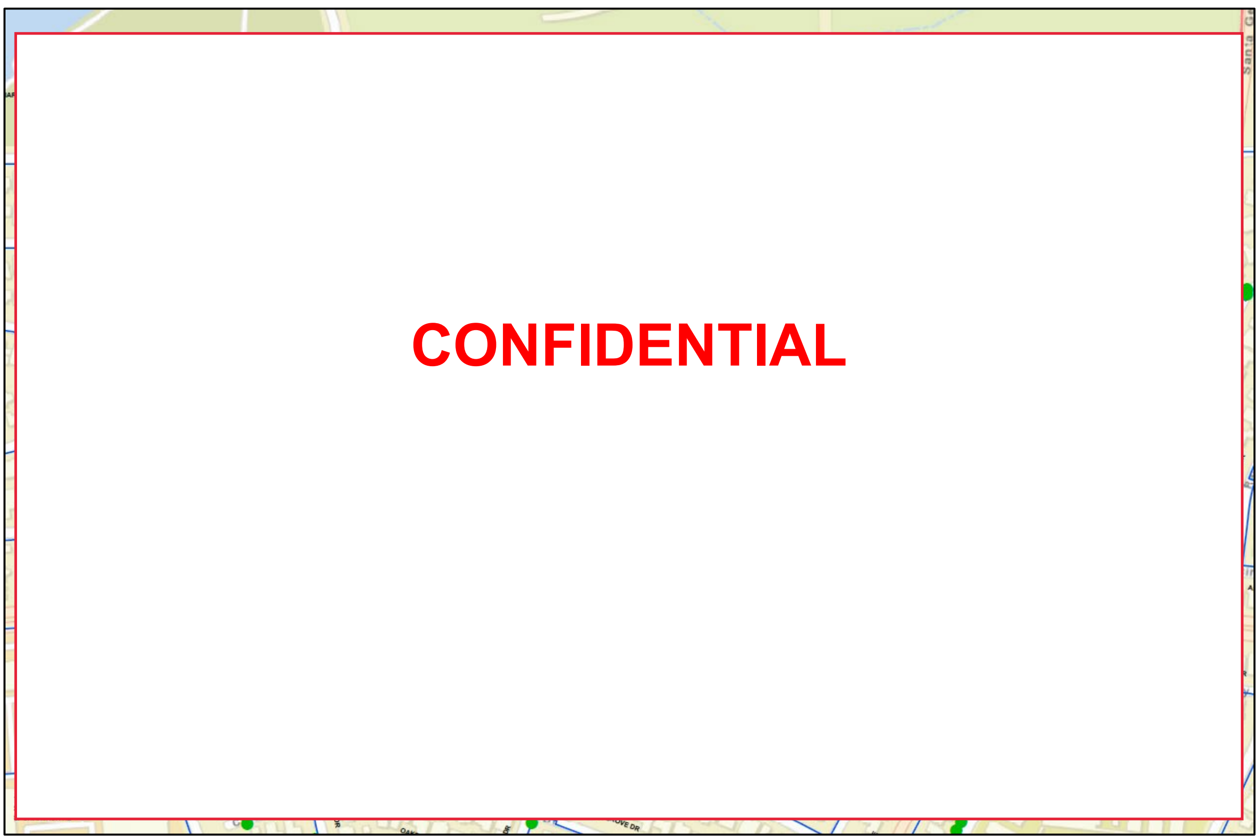
The existing 2-inch and 4-inch grey plastic (GP), 8-inch asbestos cement (AC), 8-inch steel (ST), and 8-inch mains of unknown material in the City of La Mirada on La Pluma Drive, Pastrana Drive, and adjacent streets, in the area west of Costa Mesa Drive, east of Adelfa Drive, north of Rosecrans Avenue, and south of Alicante Road, have experienced frequent main breaks. The breaks result in service interruptions and inconvenience to customers. Suburban has made piecemeal repairs to continue to provide service to its customers, but this is not a long-term solution. The water mains have reached the end of their useful lives. It is recommended to replace these existing 2-inch to 8-inch mains with approximately 17,820 LF 4-inch, 6-inch, and 8-inch PVC Pipes in the project area to provide a safe and reliable water supply to the customers.

Table 1 demonstrates a summary of the proposed pipeline replacement in this project, and Figure 1 shows the map of the project area. This project has been grouped per the recommendations of the pipeline condition assessment to include all mains that were constructed as part of this tract and are expected to continue to experience breaks. A detailed explanation of the grouping is outlined in Chapter 1 of the "*Suburban Water Systems Water Main Renewal Technical Memorandum, 2019,*" included in Workpaper VOLUME III-E.

Table 1. Replacement Schedule

Quantity	**Existing Main**		**Proposed Main**	
(feet)	**Size** (inch)	**Material**	**Size** (inch)	**Material**
2,680	2	AC/GP	4	PVC
4,280	4	AC/GP	6	PVC
2,340	4	AC/GP	8	PVC
800	8	AC	8	PVC
4,220	8	NOS	8	PVC
3,500	8	STL	8	PVC
17,820				

Figure 1. Project Area and Break Map



3. Project Background

Record drawings (Figure 2 and Figure 3) show the most existing pipe materials are Gray Plastic Pipe (GP) with some Asbestos Cement Pipe (AC), steel, and pipes of unknown material. These pipelines were originally built in 1955 during the development of TRACT 18730 under Project Number LM-6-55. They are a part of the distribution system in the 335 Zone in the Whittier / La Mirada District of Suburban.

Figure 2. Record Drawing 1

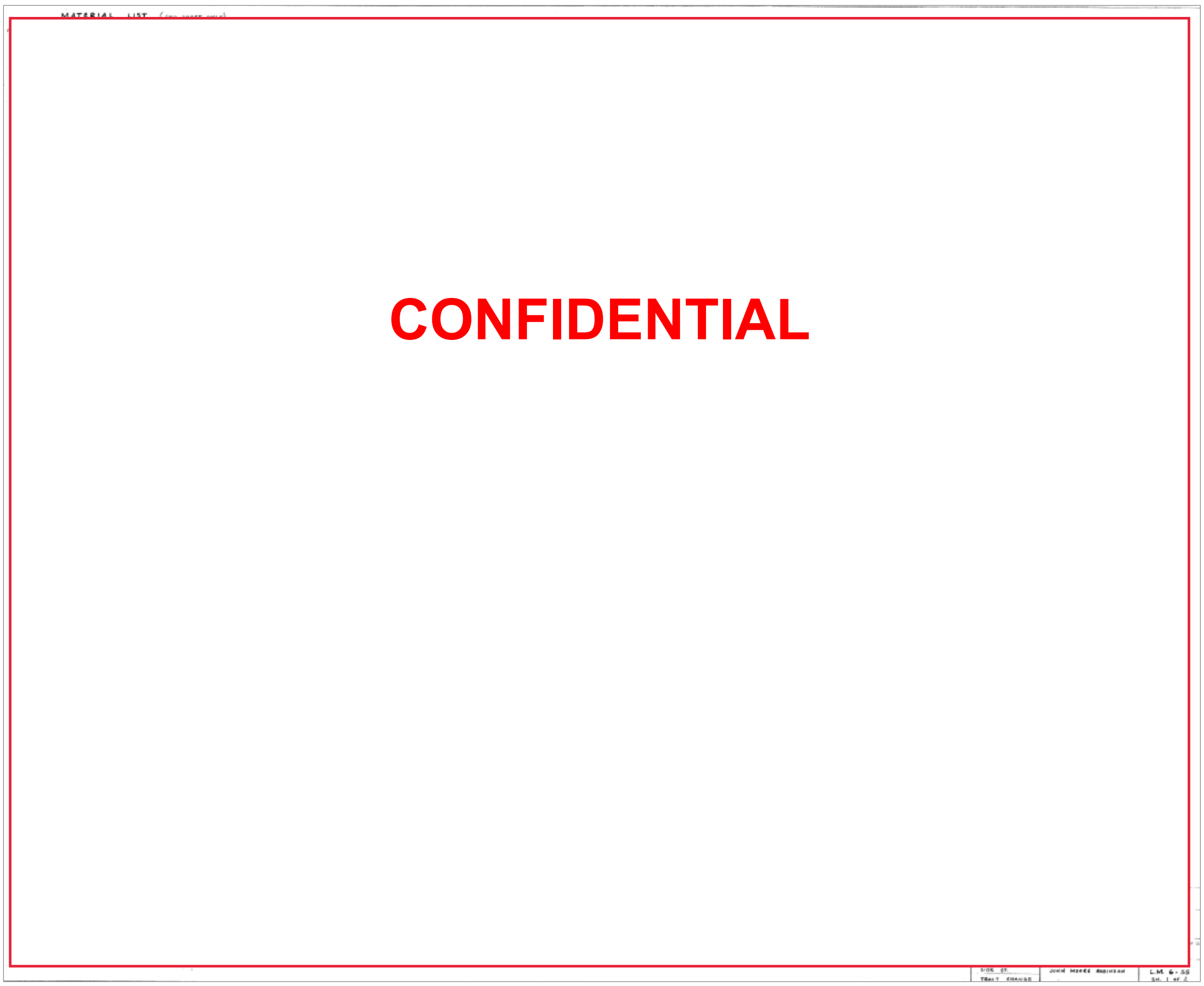


Figure 3. Record Drawing 2

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Suburban Water Systems (Suburban) started having water main break data in 1998. All the main breaks for this project from 1998 to 2021 are also shown in Table 2 and illustrated with green dots in Figure 1.

Table 2. Break Record

BREAK TYPE	BREAK DATE	ADDRESS	STREET	CITY
Main	4/21/2000			
Main	7/25/2000			
Main	5/23/2002			
Main	8/15/2002		CONFIDENTIAL	
Main	2/22/2003			
Main	3/12/2003			
Main	3/19/2003			

BREAK TYPE	BREAK DATE	ADDRESS	STREET	CITY
Main	10/26/2004			
Main	3/28/2005			
Main	6/16/2006			
Main	9/18/2006			
Main	12/22/2006			
Main	4/14/2007			
Main	1/1/2008			
Main	3/21/2008			
Main	7/1/2008			
Main	7/15/2011			
Main	5/4/2012			
Main	9/26/2012			
Main	12/9/2013			
Main	3/19/2014			
Main	6/9/2014			
Main	8/15/2014			
Main	11/17/2014			
Main	12/19/2014			
Main	9/21/2015			
Main	10/29/2015			
Main	4/4/2016			
Main	4/29/2016			
Main	5/13/2016			
Main	8/22/2016			
Main	1/3/2017			
Main	2/22/2017			
Main	12/13/2017			
Main	11/15/2019			
Main	4/29/2020			
Main	8/24/2020			
Main	12/14/2020			
Main	12/18/2020			
Main	5/27/2021			
Main	8/9/2021			
Total				

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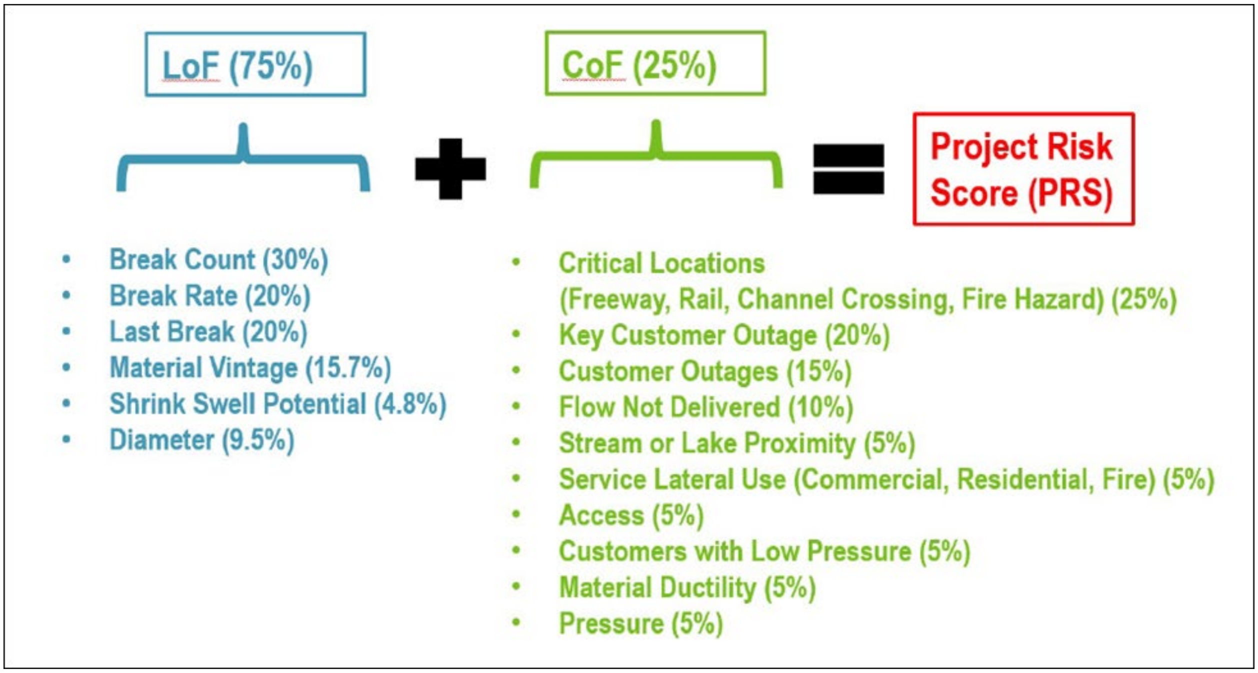
4. Project Risk Score (PRS)

In 2018 Suburban engaged HDR to perform an independent condition analysis of the pipeline infrastructure. See HDR's Suburban Water Systems Water Main Renewal Technical Memorandum 2019 included in Workpaper VOLUME III-E (HDR TM). To evaluate the system, HDR developed a Risk Model for pipeline renewal and replacement. This model calculated a Project Risk Score (PRS) to quantify the relative risk of failure from very low to severe. This methodology considers the likelihood of failure (LoF) and the consequence of failure (CoF) of the main. Each of the PRS criterion (LoF and CoF) are made up of many factors. Figure 4 summarizes the PRS calculation methodology.

Figure 4. Risk Calculation Method



4.1 PRS Calculation Methodology

As shown in Figure 4, the LoF weight is 75 percent and the CoF weight is 25 percent. The PRS is on a scale of zero to one hundred, LoF can contribute up to 75 points, and the CoF can contribute up to 25 points. Each factor was scored on a 0 to 10 scale (Factor Score), where 0 represents the lowest risk, and 10 represents the highest risk. A detailed explanation of each factor is explained in chapter 3 of the 2019 technical memorandum. Each pipeline segment is calculated separately for its LoF and CoF based on the following equation:

LoF Score = ∑ (LoF Factor Score x 10 x Weight x Criterion Weight)

CoF Score = ∑ (CoF Factor Score x 10 x Weight x Criterion Weight)

The PRS for each segment is the summation of LoF and CoF:

PRS = LoF Score + CoF Score

The final PRS for the entire project is a weighted average of pipe risk score by length:

Final Project Risk Score = ∑ (PRS x Length) ÷ ∑ (Length)

4.2 PRS Calculation Results

Table 3 below summarizes the PRS provided by HDR TM 2019 for this replacement project.

Table 3. Summary of PRS

Project #	Sum of Pipe_Length*	Average of LoF_PRS	Average of CoF_PRS	Average of PRS
LM-6-55	16,526	66.2	1.6	68.8

*****: The pipe length in Table 3 is from the current GIS database. The estimated replacement length is different. It is measured with new alignments, appurtenances, tie-ins, and any line segment within the project boundary but not included in the current GIS under the same Project Number.

Figure 5 is the PRS map for this project from the HDR TM 2019.

Figure 5. Project Risk Score Map

5. Improvement Alternative's Summary

Alternative 1 – Do nothing. This alternative continues to use the existing pipelines, resulting in continued repairs when breaks occur. This is an undesirable option because the pipelines will continue to fail, interrupting service customers. This will cause poor customer service and higher costs for repairs and piecemeal replacement.

Alternative 2 – Rehabilitate the existing water main. Three rehabilitation methods were evaluated for this alternative.

- Pipebursting
- Sliplining
- Cured-In-Place Pipe (CIPP)

A detailed description of each rehabilitation method is shown below.

Pipebursting – Pipebursting is a method by which the existing pipe is opened and forced outward by a bursting tool. A hydraulic or pneumatic expansion head (part of the bursting tool) is pulled through the existing pipeline, typically using a cable and winch. As the expansion head is pulled through the existing pipe, it pushes that pipe radially outward until it breaks apart, creating a space for the new pipe. The bursting device also pulls the new pipeline behind it, immediately filling the void created by the old, burst pipe with the new pipe. Pipebursting can be used to replace the existing pipe with a similarly sized or larger pipe.

Pipebursting is not recommended if the existing pipe is asbestos cement because the process leaves broken asbestos pieces in the ground. When the pipe is disturbed, it is considered a waste disposal site and is subject to National Emission Standards for Hazardous Air Pollutants (NESHAP) requirements. Friable asbestos fibers lead to cancer of the lungs, known as mesothelioma. Future maintenance activities such main repairs due to breaks or replacing service lines will be required and may lead to health concerns.

Sliplining – Sliplining is inserting a new pipe by pulling or pushing it into the existing pipe and grouting the annular space. After it is in place, the pipe is grouted to hold the lining in place and for additional rigidity.

Sliplining new pipes will generally have a significantly reduced cross-sectional area. Sliplining is not recommended if maintaining or increasing fire flow in the area is required.

CIPP – A cured-in-place pipe (CIPP) is a trenchless rehabilitation method to repair existing pipelines. It is a jointless, seamless pipelining within an existing pipe. The process of CIPP involves inserting and running a felt lining into a pre-existing pipe that is the subject of repair. The resin within the liner is then exposed to a curing element to make it attach to the inner walls of the pipe. Once fully cured, the lining now acts as a new pipeline.

Like sliplining, CIPP is not recommended if maintaining or increasing fire flow is required because the cross-sectional area of the pipeline after rehabilitation is reduced.

There are some common limitations for all three rehabilitation methods compared with open trench replacement:

1. Rehabilitation methods are used for sewer pipelines. Sewer pipelines are straight and are usually deeper than water lines. Offsets and fittings make using these methods

more costly. Open trenching deep sewer mains are also more expensive than water mains installed 42-60 inches deep.

2. Typically, there is only one main in the street that serves customers and cannot be switched to other mains during the construction of a new main. A temporary by-pass system is required to provide continuous service to customers. During summer, water in the by-pass pipe is heated because it is in direct contact with the sun. Driveways are blocked by the above-ground pipe and can easily be damaged.
3. Installation pits are required when horizontal and vertical alignment changes are substantial that the new pipe won't be able to pull or push through the existing pipe. Most Suburban's record drawings in the 50s and 60s don't include profile views of the pipelines, and it is suspected that there are multiple offsets. Offsets are required to avoid underground utilities such as gas, cable, water, and storm drain. Most often, water lines cross these utilities multiple times on a street. Digging pits will result in delays and continuous customer interruptions and increase construction costs.
4. Open trench pipe replacement method minimizes water interruptions to one, eight (8) hour shutdown to connect the new pipeline to the existing system, and one, thirty (30) minute shutdown to switch customer services. Mains must be pressure tested and disinfected. There are occasions when passing bacteriological testing can take several weeks due to positive e-coli results. Open trench replacement allows new mains, valves, and service connections to be pressure tested and disinfected before the final shut down to connect to the existing system. Trenchless rehabilitation of the existing pipelines can only be constructed section by section. Each section requires a much longer shutdown time for service connection, pressure testing, and disinfection to bring back the service and move on to the next one. Replacing the pipelines using rehabilitation techniques will add more time to the project resulting in more costs.

Rehabilitation methods are good alternatives for specific applications like steep hills, where surfaces cannot be disturbed, and if there are no service connections on the main. Suburban's pipeline contractors have not performed rehabilitation methods on residential streets with services. Health and environmental concerns have not been fully addressed when using them on AC pipes. Additional fittings and offsets require more deep excavation pits and will increase the cost and duration of the project. It is not recommended to rehabilitate neighborhood pipelines and continue replacing pipelines using an open trench method.

Alternative 3 – Replace existing water mains with approximately 17,820 L.F. of 4”, 6”, and 8” PVC pipes and associated appurtenances, as shown in Table 1. This Alternative will improve the integrity of the distribution system, eliminate service interruptions in this area, and ensure safe and reliable service to the customers.

According to the Association for the Advancement of Cost Engineering, this alternative is Class 3 of Opinion of Probable Construction Cost (OPCC) for constructing the replacement pipelines. The expected accuracy range for Class 3 is between +10% to +30%. Therefore, a 10% contingency is used in the OPCC.

Description	**Quantity**	**Unit**	**Unit Cost**	**Cost**
Construct 8-inch PVC	10,860	L.F.	$130	$1,411,800
8-inch Gate Valves	26	Each	$1,960	$50,960
8-inch Tie-In	9	Each	$6,840	$61,560
Construct 6-inch PVC	4,280	L.F.	$120	$513,600
6-inch Gate Valve	8	Each	$1,660	$13,280
Construct 4-inch PVC	2,680	L.F.	$110	$294,800
4-inch Gate Valve	9	Each	$1,380	$12,420
6-inch Fire Hydrant	31	Each	$10,870	$336,970
2-inch Blow-off	9	Each	$5,330	$47,970
6-inch service assembly	1	Each	$14,270	$14,270
2-inch service assembly	1	Each	$4,920	$4,920
1-inch service	332	Each	$2,110	$700,520
AC Removal and Replacement	17,820	L.F.	$50	$891,000
Construct Pipeline Offset	72	Each	$3,500	$252,000
Cut, Plug and Abandon of Existing Pipeline	1	LS	$9,034	$9,034
Traffic Rated (H-20) Meter Lids	332	Each	$250	$83,000
Install Test Head Furnishing for Pressure Testing	18	Each	$3,610	$64,980
Landscaping Removal & Replacement	1	LS	$12,644	$12,644
Guard underground services	1	LS	$16,540	$16,540
Line Item Subtotal				$4,792,268
Mobilization			3%	$143,768
De-mobilization			2%	$95,845
Construction Subtotal				**$5,031,881**
Engineering and Inspection			12%	$603,826
Subtotal				$5,635,707
Contingency			10%	$563,571
Subtotal				$6,199,278
General Administration			13.972%	$866,163
Total				**$7,065,000**

6. Basis for Budgeted Cost

The total OPCC includes Engineering and Inspection, General Administration, and Contingency factors. The Engineering and Inspection factor accounts for the estimated direct cost required to plan, design, and inspect the project, permit fees, and the cost of internal labor. The General Administration factor considers Suburban's general administrative expenses. The contingency factor accounts for unforeseen construction conflicts and complications that could result in additional project costs.

7. Impact of Deferral

The longer this pipeline replacement is deferred, the older the pipes will become, the likelihood of failure will increase, and the frequency of breaks will increase. The breaks will increasingly cause undesirable service interruptions to customers, and the overall system condition will exponentially worsen.

8. Recommendation

- Alternative #1 is not feasible because it does not resolve the interruptions of service issues to customers and does not prevent the degradation of the integrity of the water system infrastructure in this area.
- Alternative #2 has limitations with making this Alternative lose its cost-benefit and construction efficiency.
- Alternative #3 is recommended because it provides full reliability, quality, and abundance of service to the customer in the area. Suburban recommends Alternative #3.

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PROJECT DESIGN REPORT

FROM: Engineering Department

DATE: March 9, 2022

DISTRICT: WLM

SUBJECT: Mar Vista Street and Las Pasadas Road Pipeline Replacement; CP-448

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1. Executive Summary

The existing 4-inch, 6-inch asbestos cement (AC) mains and 6-inch PVC mains on La Sierra Ave. and Las Pasadas Road south of Mar Vista Street have experienced frequent main breaks in the past years. They have reached the end of their useful lives and do not provide an adequate level of service to the customers. It is recommended that these 4-inch and 6-inch AC mains are replaced by approximately 5,350 LF of 4-inch to 12-inch PVC pipes to provide a safe and reliable water supply to the customers in the area.

2. Introduction

The existing 4-inch, 6-inch asbestos cement (AC) mains and 6-inch PVC mains on La Sierra Avenue and Las Pasadas Road and adjacent streets in the City of Whittier, south of Mar Vista Road, west of Colima Road, have experienced frequent main breaks. The breaks result in service interruptions and inconvenience to customers. Suburban has made piecemeal repairs to continue to provide service to its customers, but this is not a long-term solution. The water mains have reached the end of their useful lives. It is recommended to replace these existing 4-inch and 6-inch mains with approximately 5,350 LF 4-inch, 6-inch, 8-inch, and 12-inch PVC Pipes in the project area to provide a safe and reliable water supply to the customers.

Figure 1 shows the map of the project area and Table 1 demonstrates a summary of the proposed pipeline replacement in this project. This major part of this project has been grouped per the recommendations of the pipeline condition assessment to include all mains that were constructed as part of this tract and are expected to continue to experience breaks. In addition, three small projects with severe risk are joined together. These projects are geographically adjacent in the area where the City of Whittier (the City) is planning to reconstruct streets. The City advises that Suburban replace these water mains before any of the City's street projects. A detailed explanation of the grouping is outlined in Chapter 1 of the "*Suburban Water Systems Water Main Renewal Technical Memorandum, 2019,*" included in Workpaper VOLUME III-E.

Figure 1. Project Area and Break Map

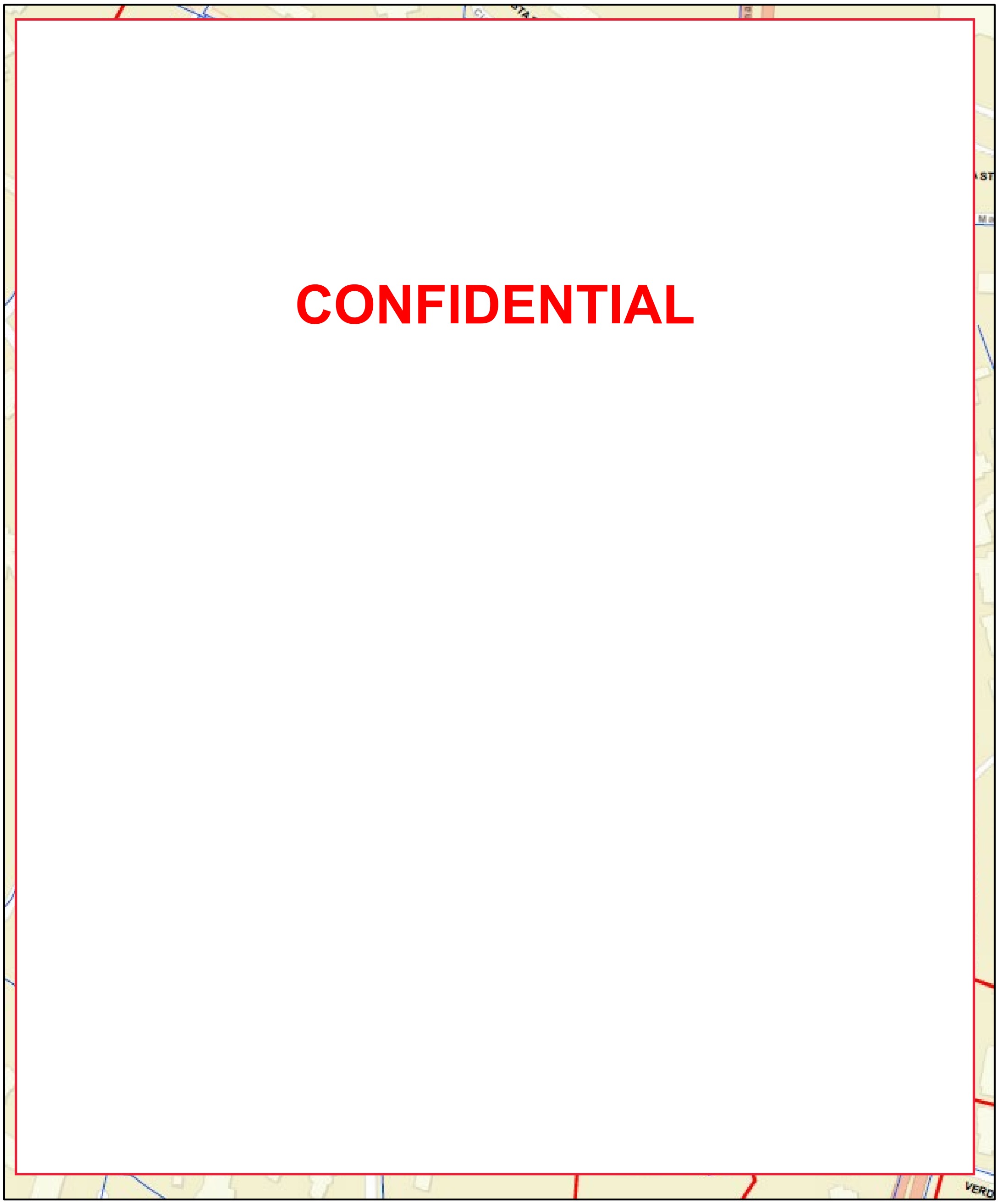

Table 1. Replacement Schedule

Quantity	**Existing Main**		**Proposed Main**	
(feet)	**Size** (inch)	**Material**	**Size** (inch)	**Material**
430	4	AC	4	PVC
470	-	-	4	PVC
2300	4	AC	8	PVC
450	4	AC	12	PVC
750	6	AC	6	PVC
500	6	AC	8	PVC
450	6	AC	12	PVC
5,350				

3. Project Background

Record drawings (Figures 2-5) show the existing pipe materials are Asbestos Cement Pipe (AC). These pipelines were originally built in 1953, 1960, 1962, and 1979 during the development of TRACT 19788, TRACT 18574, TRACT 27252 and adjacent areas. They are a part of the distribution system in the 600 Zone in the Whittier/La Mirada District of Suburban.

Figure 2. Record Drawing 1

Figure 3. Record Drawing 2

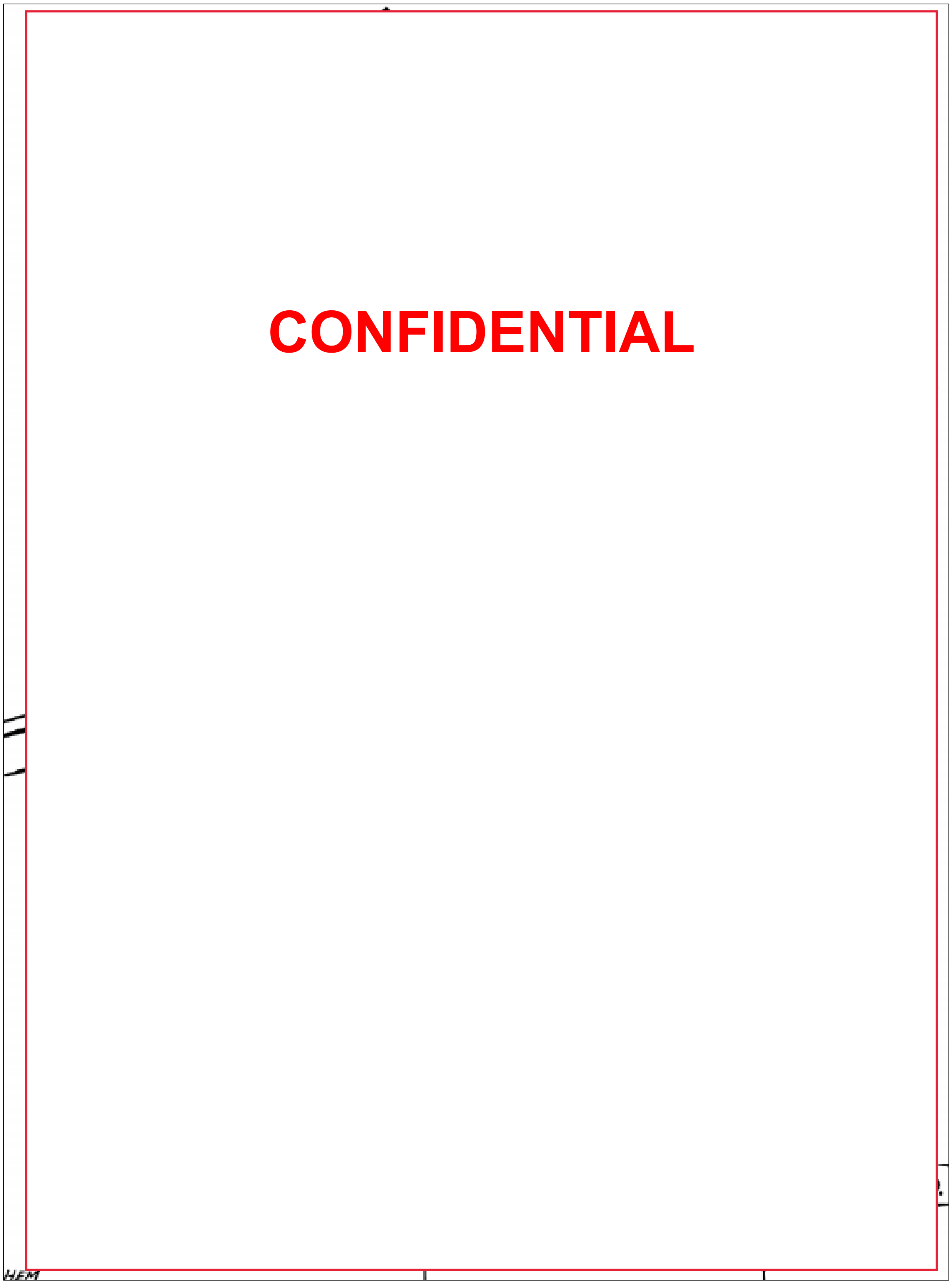

Figure 4. Record Drawing 3

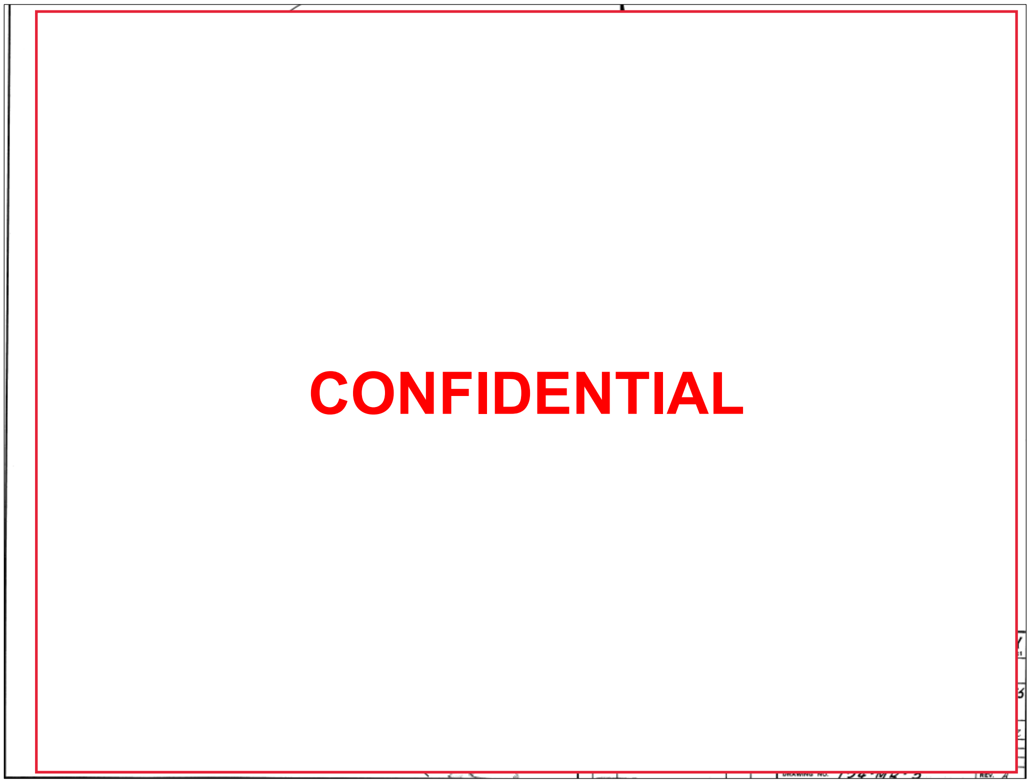

Figure 5. Record Drawing 4

Suburban Water Systems (Suburban) water main break data is available from 1998. All the main breaks for this project on record from 1998 to 2021 are also shown in Table 2 and illustrated with green dots in Figure 1.

Table 2. Break Record

BREAK TYPE	BREAK DATE	ADDRESS	STREET	CROSS STREET	CITY
Main	8/12/1998				
Main	3/19/1999				
Main	4/5/1999				
Main	1/6/2000				
Main	4/14/2000				
Main	5/15/2000				
Main	8/19/2000				
Main	9/13/2000				
Main	9/19/2000				
Main	11/27/2001				
Main	12/3/2001				
Main	9/3/2002				
Main	9/26/2003				
Main	10/30/2003				
Main	9/2/2004				
Main	9/18/2004				
Main	9/27/2004				
Main	10/1/2004				
Main	1/1/2008				
Main	7/1/2008				
Main	6/24/2010				
Main	3/8/2011				
Main	5/14/2012				
Main	6/2/2014				
TOTAL BREAK	**24**				

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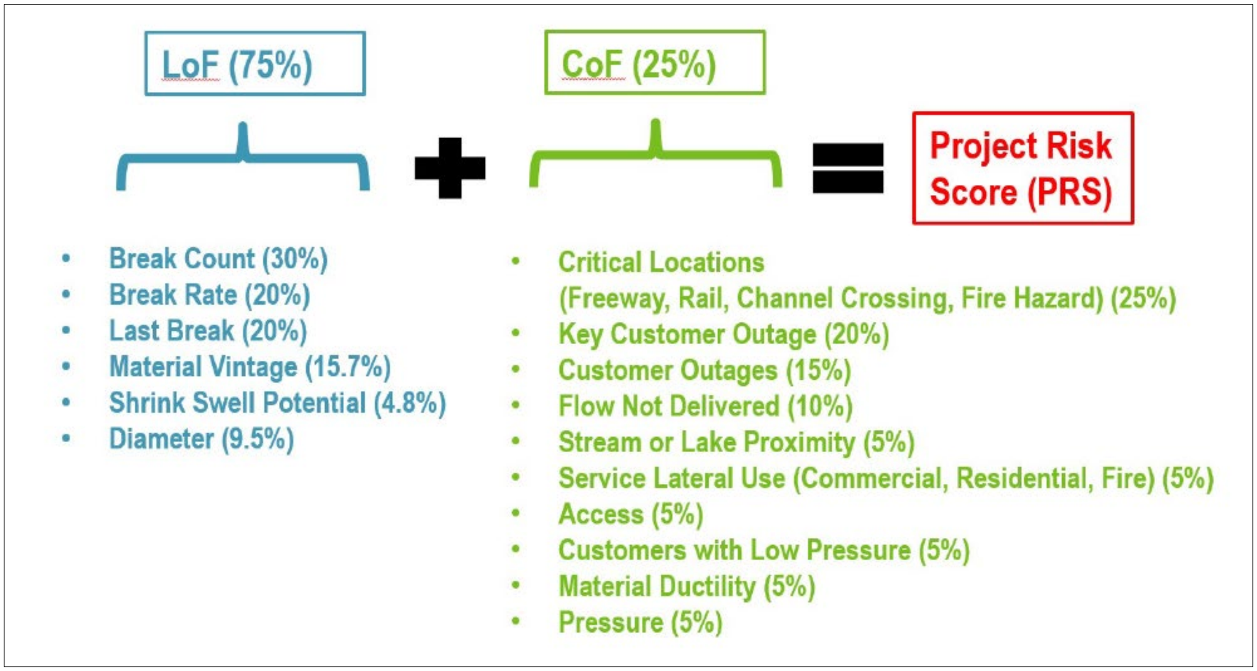
4. Project Risk Score (PRS)

In 2018 Suburban engaged HDR to perform an independent condition analysis of the pipeline infrastructure. See HDR's Suburban Water Systems Water Main Renewal Technical Memorandum 2019 included in Workpaper VOLUME III-E (HDR TM). To evaluate the system, HDR developed a Risk Model for pipeline renewal and replacement. This model calculated a Project Risk Score (PRS) to quantify the relative risk of failure from very low to severe. This methodology considers the likelihood of failure (LoF) and the consequence of failure (CoF) of the main. Each of the PRS criterion (LoF and CoF) are made up of many factors. Figure 6 summarizes the PRS calculation methodology.

Figure 6. Risk Calculation Method



4.1 PRS Calculation Methodology

As shown in Figure 6, the LoF weight is 75 percent and the CoF weight is 25 percent. The PRS is on a scale of zero to one hundred, LoF can contribute up to 75 points, and the CoF can contribute up to 25 points. Each factor was scored on a 0 to 10 scale (Factor Score), where 0 represents the lowest risk, and 10 represents the highest risk. A detailed explanation of each factor is explained in chapter 3 of the 2019 technical memorandum. Each pipeline segment is calculated separately for its LoF and CoF based on the following equation:

$$\text{LoF Score} = \sum (\text{LoF Factor Score} \times 10 \times \text{Weight} \times \text{Criterion Weight})$$

$$\text{CoF Score} = \sum (\text{CoF Factor Score} \times 10 \times \text{Weight} \times \text{Criterion Weight})$$

The PRS for each segment is the summation of LoF and CoF:

PRS = LoF Score + CoF Score

The final PRS for the entire project is a weighted average of pipe risk score by length:

Final Project Risk Score $= \sum$ **(PRS x Length)** $\div \sum$ **(Length)**

4.2 PRS Calculation Result

Table 3 below summarizes the PRS provided by HDR TM 2019 for this replacement project.

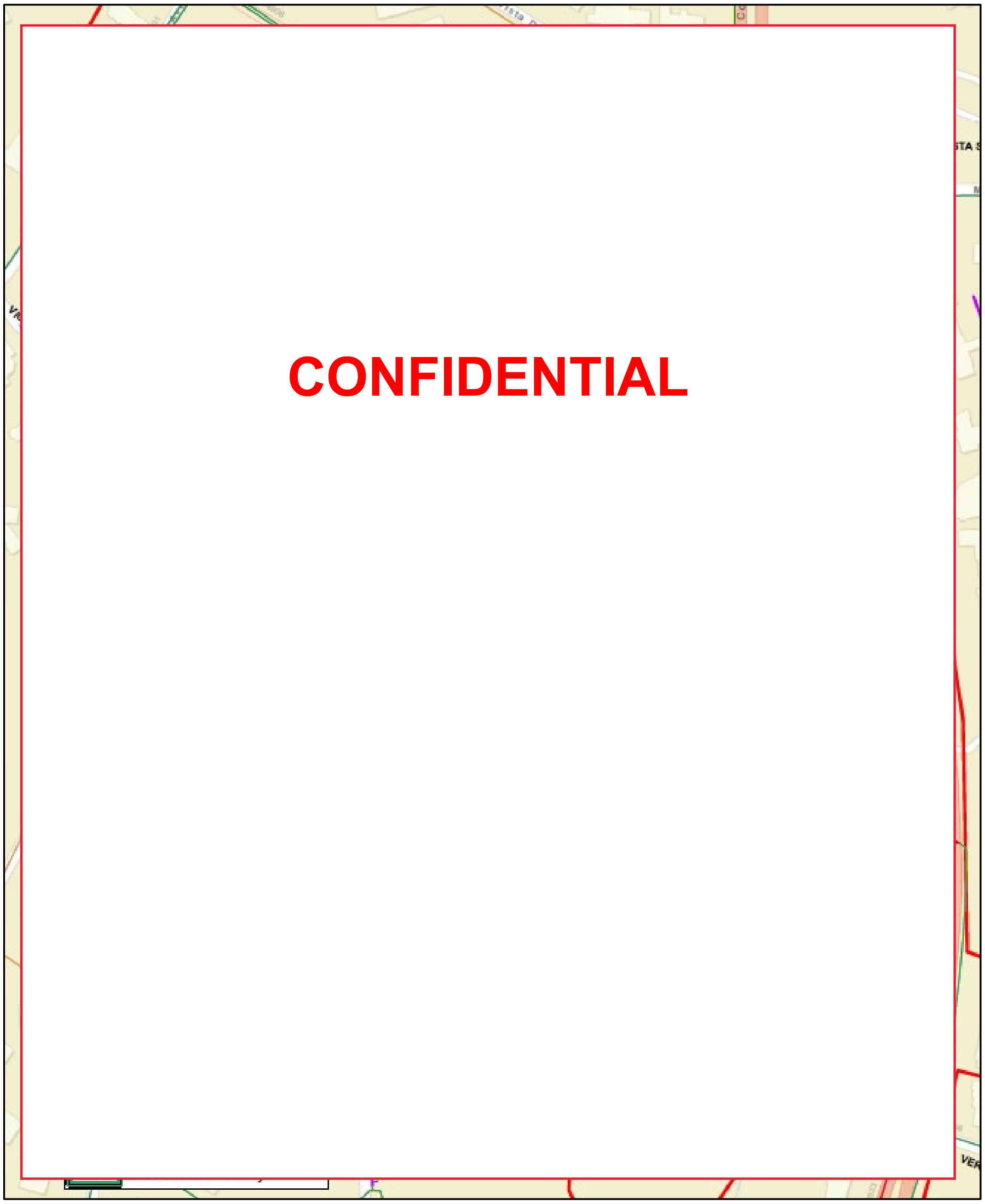
Table 3. Summary of PRS

Project #	Sum of Pipe_Length*	Average of LoF_PRS	Average of CoF_PRS	Average of PRS
638-MR-3	2,600	60.3	4.4	64.8
641-MR-1	287	44.4	5.3	50.0
79-1114	983	38.8	3.9	42.3
754-MR-3	580	37.5	3.1	41.1

*: The pipe length in Table 3 is from the current GIS database. The estimated replacement length is different. It is measured with new alignments, appurtenances, tie-ins, and any line segment within the project boundary but not included in the current GIS under the same Project Number.

Figure 7 is the PRS map for this project from the HDR TM 2019.

Figure 7. Project Risk Score Map



5. Improvement Alternative’s Summary

Alternative 1 – Do nothing. This alternative continues to use the existing pipelines, resulting in continued repairs when breaks occur. This is an undesirable option because the pipelines will continue to fail, interrupting service customers. This will cause poor customer service and higher costs for repairs and piecemeal replacement.

Alternative 2 – Rehabilitate the existing water main. Three rehabilitation methods were evaluated for this alternative.

- Pipebursting
- Sliplining
- Cured-In-Place Pipe (CIPP)

A detailed description of each rehabilitation method is shown below.

Pipebursting – Pipebursting is a method by which the existing pipe is opened and forced outward by a bursting tool. A hydraulic or pneumatic expansion head (part of the bursting tool) is pulled through the existing pipeline, typically using a cable and winch. As the expansion head is pulled through the existing pipe, it pushes that pipe radially outward until it breaks apart, creating a space for the new pipe. The bursting device also pulls the new pipeline behind it, immediately filling the void created by the old, burst pipe with the new pipe. Pipebursting can be used to replace the existing pipe with a similarly sized or larger pipe.

Pipebursting is not recommended if the existing pipe is asbestos cement because the process leaves broken asbestos pieces in the ground. When the pipe is disturbed, it is considered a waste disposal site and is subject to National Emission Standards for Hazardous Air Pollutants (NESHAP) requirements. Friable asbestos fibers lead to cancer of the lungs, known as mesothelioma. Future maintenance activities such main repairs due to breaks or replacing service lines will be required and may lead to health concerns.

Sliplining – Sliplining is inserting a new pipe by pulling or pushing it into the existing pipe and grouting the annular space. After it is in place, the pipe is grouted to hold the lining in place and for additional rigidity.

Sliplining new pipes will generally have a significantly reduced cross-sectional area. Sliplining is not recommended if maintaining or increasing fire flow in the area is required.

CIPP – A cured-in-place pipe (CIPP) is a trenchless rehabilitation method to repair existing pipelines. It is a jointless, seamless pipelining within an existing pipe. The process of CIPP involves inserting and running a felt lining into a pre-existing pipe that is the subject of repair. The resin within the liner is then exposed to a curing element to make it attach to the inner walls of the pipe. Once fully cured, the lining now acts as a new pipeline.

Like sliplining, CIPP is not recommended if maintaining or increasing fire flow is required because the cross-sectional area of the pipeline after rehabilitation is reduced.

There are some common limitations for all three rehabilitation methods compared with open trench replacement:

1. Rehabilitation methods are used for sewer pipelines. Sewer pipelines are straight and are usually deeper than water lines. Offsets and fittings make using these methods more costly. Open trenching deep sewer mains are also more expensive than water mains installed 42-60 inches deep.
2. Typically, there is only one main in the street that serves customers and cannot be switched to other mains during the construction of a new main. A temporary by-pass system is required to provide continuous service to customers. During summer, water in the by-pass pipe is heated because it is in direct contact with the sun. Driveways are blocked by the above-ground pipe and can easily be damaged.
3. Installation pits are required when horizontal and vertical alignment changes are substantial that the new pipe won't be able to pull or push through the existing pipe. Most Suburban's record drawings in the 50s and 60s don't include profile views of the pipelines, and it is suspected that there are multiple offsets. Offsets are required to avoid underground utilities such as gas, cable, water, and storm drain. Most often, water lines cross these utilities multiple times on a street. Digging pits will result in delays and continuous customer interruptions and increase construction costs.
4. Open trench pipe replacement method minimizes water interruptions to one, eight (8) hour shutdown to connect the new pipeline to the existing system, and one, thirty (30) minute shutdown to switch customer services. Mains must be pressure tested and disinfected. There are occasions when passing bacteriological testing can take several weeks due to positive e-coli results. Open trench replacement allows new mains, valves, and service connections to be pressure tested and disinfected before the final shut down to connect to the existing system. Trenchless rehabilitation of the existing pipelines can only be constructed section by section. Each section requires a much longer shutdown time for service connection, pressure testing, and disinfection to bring back the service and move on to the next one. Replacing the pipelines using rehabilitation techniques will add more time to the project resulting in more costs.

Rehabilitation methods are good alternatives for specific applications like steep hills, where surfaces cannot be disturbed, and if there are no service connections on the main. Suburban's pipeline contractors have not performed rehabilitation methods on residential streets with services. Health and environmental concerns have not been fully addressed when using them on AC pipes. Additional fittings and offsets require more deep excavation pits and will increase the cost and duration of the project. It is not recommended to rehabilitate neighborhood pipelines and continue replacing pipelines using an open trench method.

Alternative 3 – Replace the existing water main with approximately 5,350 L.F. of 4" - 12" PVC pipes and associated appurtenances as shown in Table 1. This Alternative will improve the integrity of the distribution system, eliminate service interruptions in this area, and ensure safe and reliable service to the customers.

According to the Association for the Advancement of Cost Engineering, this alternative is Class 3 of Opinion of Probable Construction Cost (OPCC) for constructing the replacement pipelines. The expected accuracy range for Class 3 is between +10% to +30%. Therefore, a 10% contingency is used in the OPCC.

Description	Quantity	Unit	Unit Cost	Cost
Construct 12-inch PVC	900	L.F.	$190	$171,000
12-inch Butterfly Valves	2	Each	$4,050	$8,100
12-inch Tie-In	2	Each	$8,900	$17,800
Construct 8-inch PVC	2800	L.F.	$130	$364,000
8-inch Gate Valves	4	Each	$1,960	$7,840
8-inch Tie-In	1	Each	$6,840	$6,840
Construct 6-inch PVC	750	L.F.	$120	$90,000
6-inch Gate Valve	1	Each	$1,660	$1,660
Construct 4-inch PVC	900	L.F.	$110	$99,000
4-inch Gate Valve	2	Each	$1,380	$2,760
6-inch Fire Hydrant	6	Each	$10,870	$65,220
2-inch Blow-off	2	Each	$5,330	$10,660
1-inch service	51	Each	$2,110	$107,610
AC Removal and Replacement	5350	L.F.	$50	$267,500
Construct Pipeline Offset	22	Each	$3,500	$77,000
Cut, Plug and Abandon of Existing Pipeline	1	LS	$9,034	$9,034
Traffic Rated (H-20) Meter Lids	51	Each	$250	$12,750
Install Test Head Furnishing for Pressure Testing	5	Each	$3,610	$18,050
Landscaping Removal & Replacement	1	LS	$12,643	$12,643
Guard underground services	1	LS	$16,540	$16,540
Line Item Subtotal				$1,366,007
Mobilization			3%	$40,980
De-mobilization			2%	$27,320
Construction Subtotal				**$1,434,307**
Engineering and Inspection			12%	$172,117
Subtotal				$1,606,424
Contingency			10%	$160,642
Subtotal				$1,767,067
General Administration			13.972%	$246,895
Total				**$2,014,000**

6. Basis for Budgeted Cost

The total estimated project cost includes Engineering and Inspection, General Administration, and Contingency factors. The Engineering and Inspection factor accounts for the estimated direct cost required to plan, design, and inspect the project, permit fees, and cost of internal labor. The General Administration factor considers Suburban's general administrative costs.

The contingency factor accounts for unforeseen construction conflicts and complications that could result in additional project costs.

7. Impact of Deferral

The longer this pipeline replacement is deferred, the older the pipes will become and the likelihood of failure will increase, and the frequency of breaks will increase. The breaks will increasingly cause undesirable interruptions of service to customers and the overall system condition will exponentially worsen.

8. Recommendation

- Alternative #1 is not feasible because it does not resolve the interruptions of service issues to customers and does not prevent the degradation of the integrity of the water system infrastructure in this area.
- Alternative #2 has limitations with making this Alternative lose its cost-benefit and construction efficiency.
- Alternative #3 is a better solution because it provides full reliability, quality, and abundance of service to the customer in the area. Suburban recommends Alternative #3.

W-3

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PROJECT DESIGN REPORT

FROM: Engineering Department

DATE: March 22, 2022

DISTRICT: WLM

SUBJECT: Lashburn Street and Groveside Avenue Pipeline Replacement; CP-458

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1. Summary

The existing 4-inch, 6-inch, 8-inch, and 10-inch asbestos cement (AC) mains in the area Lashburn Street and Groveside Avenue have experienced many breaks in the past years. They have reached the end of their useful lives and do not provide an adequate level of service to the customers. It is recommended that these existing AC mains be replaced by approximately 7,380 LF of 6-inch to 12-inch PVC mains to provide a safe and reliable water supply to the customers in the area.

2. Introduction

The existing 4-inch, 6-inch, 8-inch, and 10-inch asbestos cement (AC) mains in the area Lashburn Street and Groveside Avenue, west of north of 1st Avenue, east of Kentucky Avenue, north of Leffingwell Road, and south of Lashburn Street, have experienced frequent main breaks in the past years causing service interruptions and inconvenience to customers. Suburban has made piecemeal repairs to continue to provide service to its customers, but this is not a long-term solution. The water mains have reached the end of their useful lives. It is recommended to replace the existing 2-inch to 10-inch AC mains with approximately 7,380 LF 6-inch, 8-inch, and 12-inch PVC Pipes in the project area to provide a safe and reliable water supply to the customers.

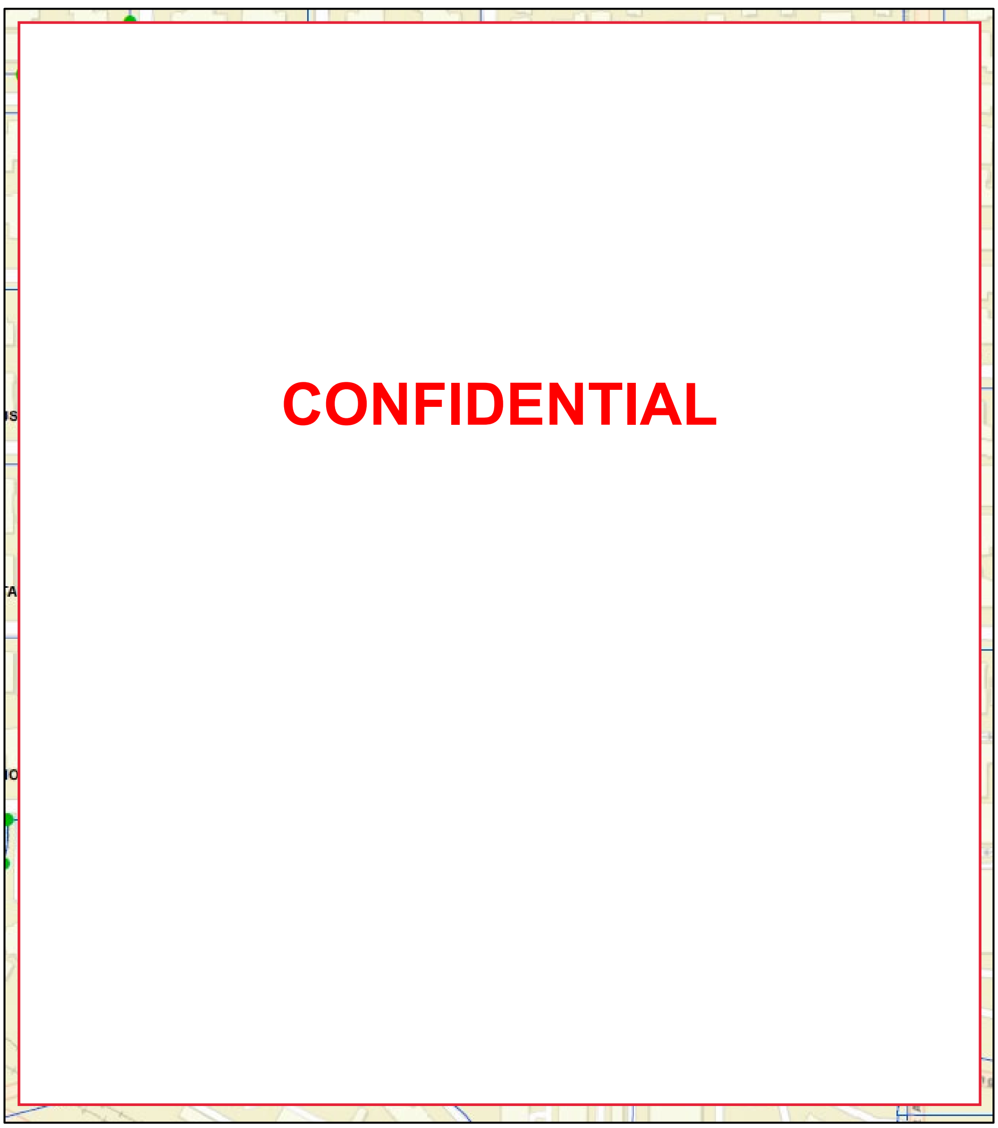
Table 1 present a summary of pipeline replacement in this project and as Figure 1 shows the project area. This project has been grouped per the recommendations of the pipeline condition assessment to include all mains that were constructed as part of this tract and are expected to continue to experience breaks. A detailed explanation of the grouping is outlined in Chapter

1 of the "*Suburban Water Systems Water Main Renewal Technical Memorandum, 2019,*" included in Workpaper VOLUME III-E.

Table 1. Replacement Schedule

Quantity	**Existing Main**		**Proposed Main**	
(feet)	**Size** (inch)	**Material**	**Size** (inch)	**Material**
1,510	4	AC	6	PVC
1,900	6	AC	8	PVC
3,070	8	AC	8	PVC
540	8	AC	12	PVC
360	10	AC	12	PVC
7,380				

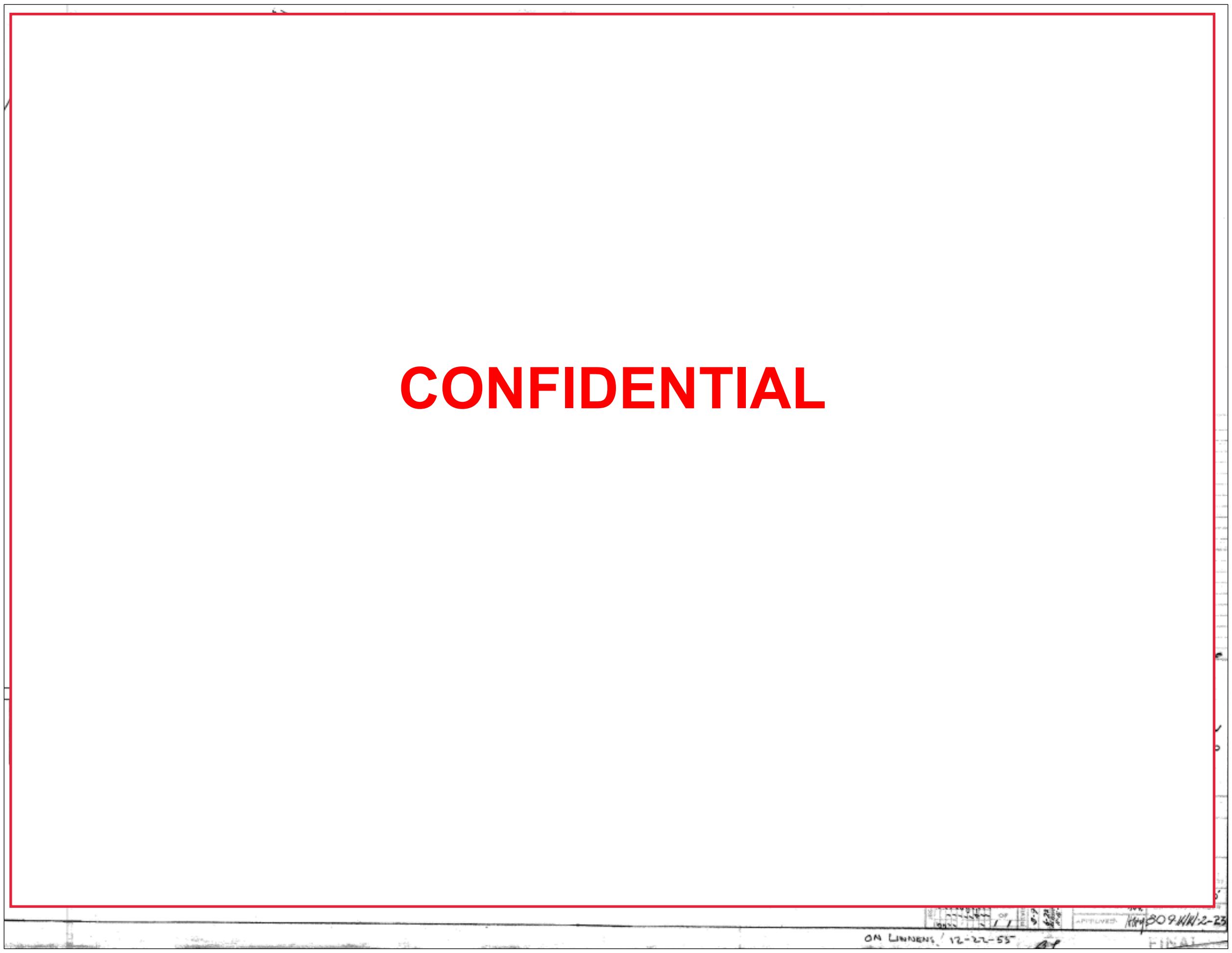
Figure 1. Project Area and Break Map



3. Project Background

Record drawing (Figure 2) shows the existing pipe materials are 4-inch to 8-inch AC pipes originally built in 1955 during the development of TRACT 18586 under the Project Number 809-WW-2 in the City of Whittier. They are a part of the distribution system in the 400 Zone in the Whittier/La Mirada District of Suburban.

Figure 2. Record Drawing



Suburban Water Systems (Suburban) water main break data is available from 1998. All the main breaks for this project on record from 1998 to 2021 are also shown in Table 2 and illustrated with green dots on Figure 1.

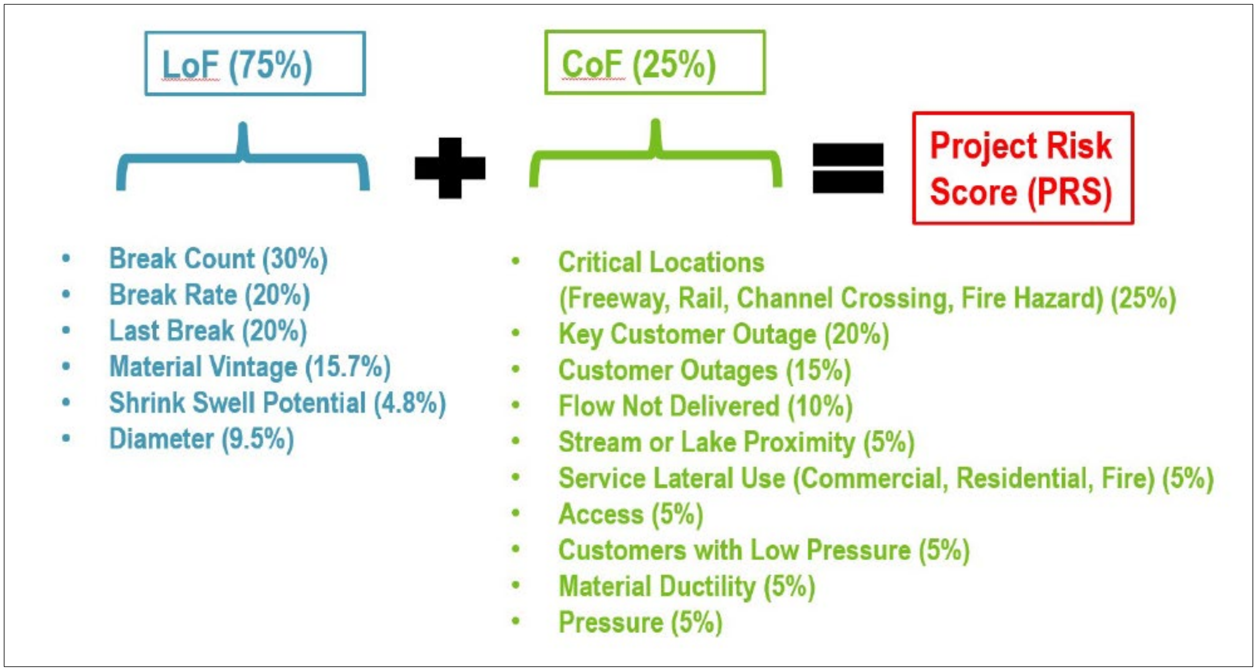
Table 2. Break Record

BREK TYPE	BREAK DATE	ADDRESS	STREET	CITY
Main	4/6/1998			
Main	2/22/2000			
Main	10/23/2001			
Main	2/4/2002			
Main	10/6/2003			
Main	7/24/2004			
Main	2/10/2009			
Main	9/19/2010		CONFIDENTIAL	
Main	10/1/2013			
Main	11/28/2016			
Main	5/1/2018			
Main	8/11/2020			
TOTAL BREAK				

4. Project Risk Score (PRS)

In 2018 Suburban engaged HDR to perform an independent condition analysis of the pipeline infrastructure. See HDR's Suburban Water Systems Water Main Renewal Technical Memorandum 2019 included in Workpaper VOLUME III-E (HDR TM). To evaluate the system, HDR developed a Risk Model for pipeline renewal and replacement. This model calculated a Project Risk Score (PRS) to quantify the relative risk of failure from very low to severe. This methodology considers the likelihood of failure (LoF) and the consequence of failure (CoF) of the main. Each of the PRS criterion (LoF and CoF) are made up of many factors. Figure 3 summarizes the PRS calculation methodology.

Figure 3. Risk Calculation Method



4.1 PRS Calculation Methodology

As shown in Figure 3, the LoF weight is 75 percent and the CoF weight is 25 percent. The PRS is on a scale of zero to one hundred, LoF can contribute up to 75 points, and the CoF can contribute up to 25 points. Each factor was scored on a 0 to 10 scale (Factor Score), where 0 represents the lowest risk, and 10 represents the highest risk. A detailed explanation of each factor is explained in chapter 3 of the 2019 technical memorandum. Each pipeline segment is calculated separately for its LoF and CoF based on the following equation:

$$\text{LoF Score} = \sum (\text{LoF Factor Score} \times 10 \times \text{Weight} \times \text{Criterion Weight})$$

$$\text{CoF Score} = \sum (\text{CoF Factor Score} \times 10 \times \text{Weight} \times \text{Criterion Weight})$$

The PRS for each segment is the summation of LoF and CoF:

$$\text{PRS} = \text{LoF Score} + \text{CoF Score}$$

The final PRS for the entire project is a weighted average of pipe risk score by length:

$$\textbf{Final Project Risk Score} = \sum (\textbf{PRS x Length}) \div \sum (\textbf{Length})$$

4.2 PRS Calculation Results

Table 3 below summarizes the PRS provided by HDR TM 2019 for this replacement project.

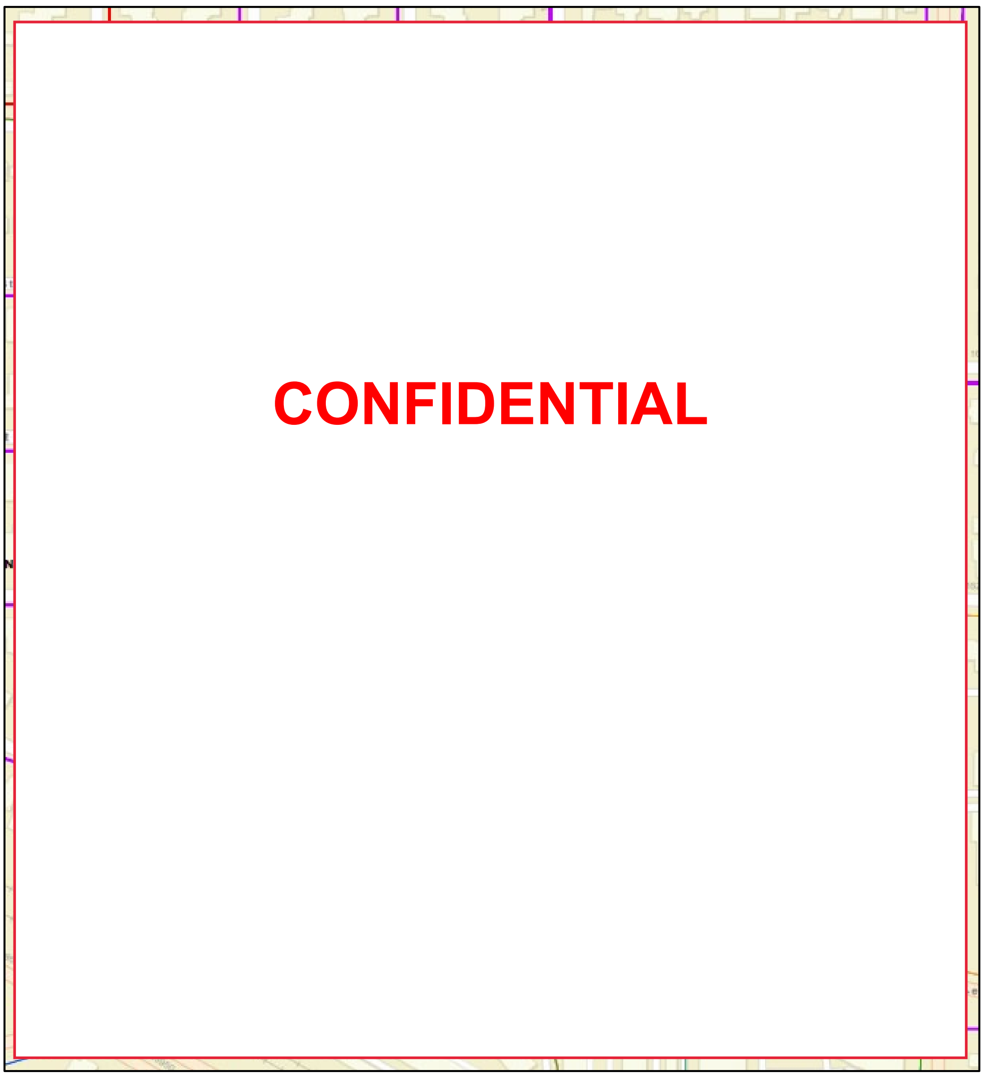
Table 3. Summary of PRS

Project #	Sum of Pipe_Length*	Average of LoF_PRS	Average of CoF_PRS	Average of PRS
LM-6-55	13,220	66.2	1.6	68.8

*****: The pipe length in Table 3 is from the current GIS database. The estimated replacement length is different. It is measured with new alignments, appurtenances, tie-ins, and any line segment within the project boundary but not included in the current GIS under the same Project Number.

Figure 4 is the PRS map for this project from the HDR TM 2019.

Figure 4. Project Risk Score Map



5. Improvement Alternative's Summary

Alternative 1 – Do nothing. This alternative continues to use the existing pipelines, resulting in continued repairs when breaks occur. This is an undesirable option because the pipelines will continue to fail, interrupting service customers. This will cause poor customer service and higher costs for repairs and piecemeal replacement.

Alternative 2 – Rehabilitate the existing water main. Three rehabilitation methods were evaluated for this alternative.

- Pipebursting
- Sliplining
- Cured-In-Place Pipe (CIPP)

A detailed description of each rehabilitation method is shown below.

Pipebursting – Pipebursting is a method by which the existing pipe is opened and forced outward by a bursting tool. A hydraulic or pneumatic expansion head (part of the bursting tool) is pulled through the existing pipeline, typically using a cable and winch. As the expansion head is pulled through the existing pipe, it pushes that pipe radially outward until it breaks apart, creating a space for the new pipe. The bursting device also pulls the new pipeline behind it, immediately filling the void created by the old, burst pipe with the new pipe. Pipebursting can be used to replace the existing pipe with a similarly sized or larger pipe.

Pipebursting is not recommended if the existing pipe is asbestos cement because the process leaves broken asbestos pieces in the ground. When the pipe is disturbed, it is considered a waste disposal site and is subject to National Emission Standards for Hazardous Air Pollutants (NESHAP) requirements. Friable asbestos fibers lead to cancer of the lungs, known as mesothelioma. Future maintenance activities such main repairs due to breaks or replacing service lines will be required and may lead to health concerns.

Sliplining – Sliplining is inserting a new pipe by pulling or pushing it into the existing pipe and grouting the annular space. After it is in place, the pipe is grouted to hold the lining in place and for additional rigidity.

Sliplining new pipes will generally have a significantly reduced cross-sectional area. Sliplining is not recommended if maintaining or increasing fire flow in the area is required.

CIPP – A cured-in-place pipe (CIPP) is a trenchless rehabilitation method to repair existing pipelines. It is a jointless, seamless pipelining within an existing pipe. The process of CIPP involves inserting and running a felt lining into a pre-existing pipe that is the subject of repair. The resin within the liner is then exposed to a curing element to make it attach to the inner walls of the pipe. Once fully cured, the lining now acts as a new pipeline.

Like sliplining, CIPP is not recommended if maintaining or increasing fire flow is required because the cross-sectional area of the pipeline after rehabilitation is reduced.

There are some common limitations for all three rehabilitation methods compared with open trench replacement:

1. Rehabilitation methods are used for sewer pipelines. Sewer pipelines are straight and are usually deeper than water lines. Offsets and fittings make using these methods more costly. Open trenching deep sewer mains are also more expensive than water mains installed 42-60 inches deep.
2. Typically, there is only one main in the street that serves customers and cannot be switched to other mains during the construction of a new main. A temporary by-pass system is required to provide continuous service to customers. During summer, water in the by-pass pipe is heated because it is in direct contact with the sun. Driveways are blocked by the above-ground pipe and can easily be damaged.
3. Installation pits are required when horizontal and vertical alignment changes are substantial that the new pipe won't be able to pull or push through the existing pipe. Most Suburban's record drawings in the 50s and 60s don't include profile views of the pipelines, and it is suspected that there are multiple offsets. Offsets are required to avoid underground utilities such as gas, cable, water, and storm drain. Most often, water lines cross these utilities multiple times on a street. Digging pits will result in delays and continuous customer interruptions and increase construction costs.
4. Open trench pipe replacement method minimizes water interruptions to one, eight (8) hour shutdown to connect the new pipeline to the existing system, and one, thirty (30) minute shutdown to switch customer services. Mains must be pressure tested and disinfected. There are occasions when passing bacteriological testing can take several weeks due to positive e-coli results. Open trench replacement allows new mains, valves, and service connections to be pressure tested and disinfected before the final shut down to connect to the existing system. Trenchless rehabilitation of the existing pipelines can only be constructed section by section. Each section requires a much

longer shutdown time for service connection, pressure testing, and disinfection to bring back the service and move on to the next one. Replacing the pipelines using rehabilitation techniques will add more time to the project resulting in more costs.

Rehabilitation methods are good alternatives for specific applications like steep hills, where surfaces cannot be disturbed, and if there are no service connections on the main. Suburban's pipeline contractors have not performed rehabilitation methods on residential streets with services. Health and environmental concerns have not been fully addressed when using them on AC pipes. Additional fittings and offsets require more deep excavation pits and will increase the cost and duration of the project. It is not recommended to rehabilitate neighborhood pipelines and continue replacing pipelines using an open trench method.

Alternative 3 – Replace existing water mains with approximately 7,380 L.F. of 6-inch, 8-inch, and 12-inch PVC pipes and associated appurtenances as shown in Table 1. This Alternative will improve the integrity of the distribution system, eliminate service interruptions in this area, and ensure safe and reliable service to the customers.

According to the Association for the Advancement of Cost Engineering, this alternative is Class 3 of Opinion of Probable Construction Cost (OPCC) for constructing the replacement pipelines. The expected accuracy range for Class 3 is between +10% to +30%. Therefore, a 10% contingency is used in the OPCC.

Description	Quantity	Unit	Unit Cost	Cost
Construct 12-inch PVC	900	L.F.	$190	$171,000
12-inch Butterfly Valves	2	Each	$4,050	$8,100
12-inch Tie-In	3	Each	$8,900	$26,700
Construct 8-inch PVC	4970	L.F.	$130	$646,100
8-inch Gate Valves	15	Each	$1,960	$29,400
8-inch Tie-In	8	Each	$6,840	$54,720
Construct 6-inch PVC	1510	L.F.	$120	$181,200
6-inch Gate Valve	4	Each	$1,660	$6,640
6-inch Fire Hydrant	11	Each	$10,870	$119,570
2-inch Blow-off	1	Each	$5,330	$5,330
1-inch service	149	Each	$2,110	$314,390
AC Removal and Replacement	7380	L.F.	$50	$369,000
Construct Pipeline Offset	30	Each	$3,500	$105,000
Cut, Plug and Abandon of Existing Pipeline	1	LS	$9,034	$9,034
Traffic Rated (H-20) Meter Lids	149	Each	$250	$37,250
Install Test Head Furnishing for Pressure Testing	7	Each	$3,610	$25,270
Landscaping Removal & Replacement	1	LS	$12,644	$12,644
Guard underground services	1	LS	$16,540	$16,540
Line Item Subtotal				$2,137,888
Mobilization			3%	$64,137
De-mobilization			2%	$42,758
Construction Subtotal				**$2,244,782**
Engineering and Inspection			12%	$269,374
Subtotal				$2,514,156
Contingency			10%	$251,416
Subtotal				$2,765,572
General Administration			13.972%	$386,406
Total				**$3,152,000**

6. Basis for Budgeted Cost

The total estimated project cost includes Engineering and Inspection, General Administration, and Contingency factors. The Engineering and Inspection factor accounts for the estimated direct cost required to plan, design and inspect the project, permit fees, and cost of internal labor. The General Administration factor considers Suburban’s general administrative costs. The contingency factor accounts for unforeseen construction conflicts and complications that could result in additional project costs.

7. Impact of Deferral

The longer this pipeline replacement is deferred, the older the pipes will become, the likelihood of failure will increase, and the frequency of breaks will increase. The breaks will increasingly cause undesirable service interruptions to customers, and the overall system condition will exponentially worsen.

8. Recommendation

- Alternative #1 is not feasible because it does not resolve the interruptions of service issues to customers and does not prevent the degradation of the integrity of the water system infrastructure in this area.
- Alternative #2 has limitations with making this Alternative lose its cost-benefit and construction efficiency.
- Alternative #3 is a better solution because it provides full reliability, quality, and abundance of service to the customer in the area. Suburban recommends Alternative #3.

W-4

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PROJECT DESIGN REPORT

FROM: Engineering Department

DATE: March 23, 2022

DISTRICT: WLM

SUBJECT: Safari Road Pipeline Replacement; CP-376

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1. Executive Summary

The existing 4-inch to 12-inch asbestos cement (AC) pipes in Safari Road and Amsdell Avenue areas have experienced many breaks in the past years. They have reached the end of their useful lives and do not provide an adequate level of service to the customers. It is recommended that these 4-inch to 12-inch existing AC mains be replaced by approximately 4,770 LF of 6-inch to 12-inch PVC mains to provide a safe and reliable water supply to the customers in the area.

2. Introduction

The existing 4-inch to 12-inch inch asbestos cement (AC) pipes along Safari Road, Walburg Street, Caffel Way, Amsdell Avenue, and Hawkstone Avenue in 265 Zone of Whittier / La Mirada District have experienced frequent main breaks in the past years, causing service interruptions and inconvenience to customers. In addition, the location of this project is in an area with many obstacles to access for repairs, such as block walls and wrought iron fences. Within the fences, dogs often make it impossible to make repairs or read meters. Suburban has made many piecemeal repairs to continue to provide service to its customers, but this is not a long-term solution. The water mains have reached the end of their useful lives. It is recommended to replace the existing 4-inch,6-inch, and 8-inch AC mains with 4,770 LF 6-inch, 8-inch, and 12-inch PVC Pipes in the project area to provide a safe and reliable water supply to the customers.

Figure 1 shows the project area, and Table 1 present a summary of pipeline replacement in this project. This project has been grouped per the recommendations of the pipeline condition assessment to include all mains that were constructed as part of this tract and are expected to continue to experience breaks. A detailed explanation of the grouping is outlined in Chapter 1 of the "*Suburban Water Systems Water Main Renewal Technical Memorandum, 2019*" included in Workpaper VOLUME III-E.

Figure 1. Project Area and Break Map

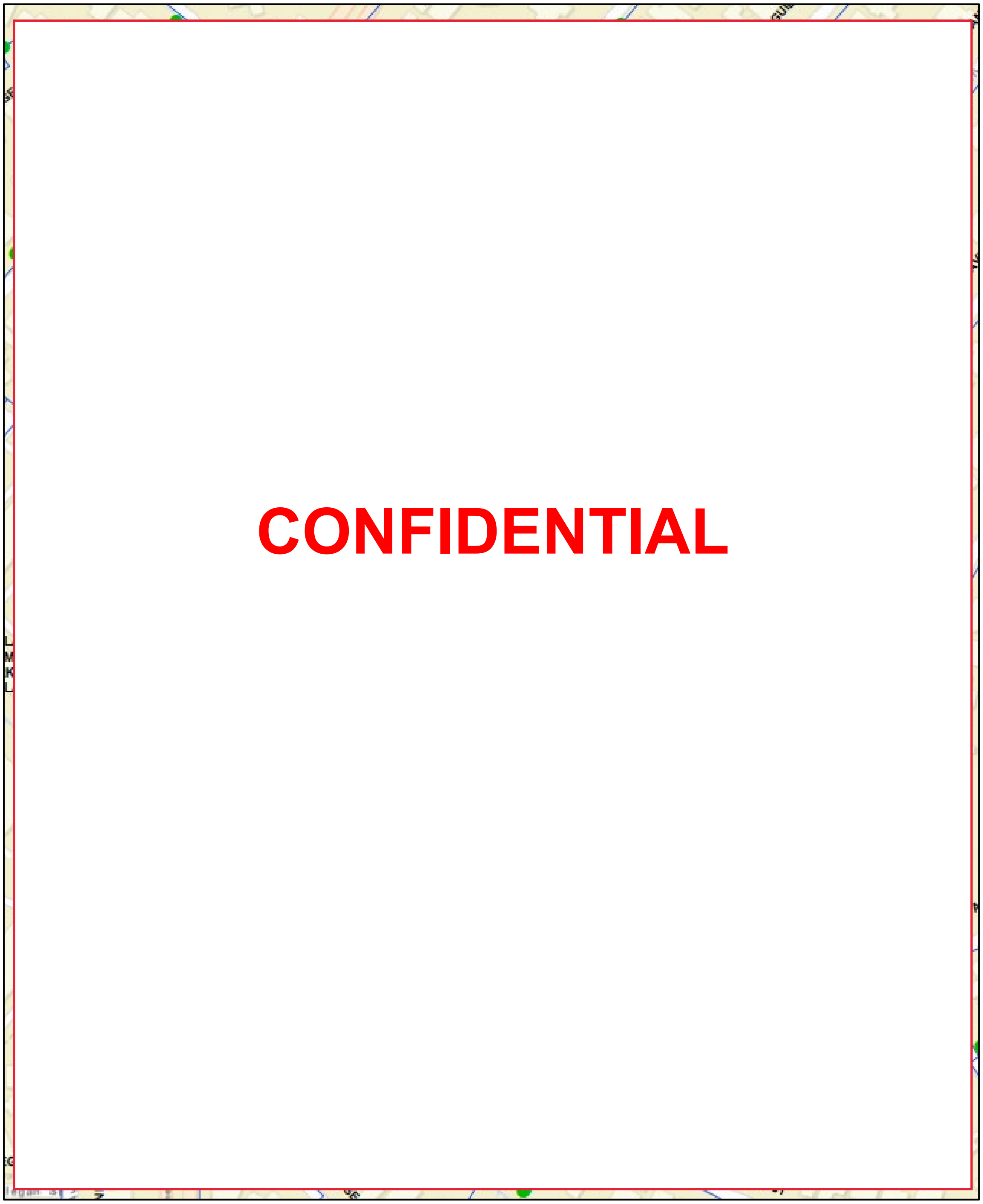


Table 1. Project Scope of Water Main Replacement

Street Name	Quantity	Existing Main		Proposed Main	
	(feet)	**Size** (inch)	**Material**	**Size** (inch)	**Material**
Safari	400	4	AC	6	PVC
Safari	550	8	AC	12	PVC
Safari	450	12	AC	12	PVC
Walburg	300	12	AC	12	PVC
Painter	570	12	AC	12	PVC
Caffel	350	4	AC	6	PVC
Caffel	400	8	AC	8	PVC
Amsdell	500	8	AC	8	PVC
Reis	450	8	AC	8	PVC
Reis	200	12	AC	12	PVC
Hawkstone	200	4	AC	6	PVC
Hawkstone	400	8	AC	8	PVC
Total	**4,770 LF**				**PVC**

3. Project Background

Record drawing (Figures 2) shows the existing pipelines were originally installed in 1967 during the development of TRACT 28271 under the Project number 67-2682 in the unincorporated Los Angele County area. These pipelines are part of the distribution system in 265 Zone in Whittier / La Mirada District of Suburban.

Suburban Water Systems (Suburban) water main break data is available from 1998. All the main breaks for this project on record from 1998 to 2021 are also shown in Table 1 and illustrated with green dots in Figure 1.

Figure 2. Record Drawing for the Project Area

Table 2. Break Record

BREAK TYPE	BREAK DATE	ADDRESS	STREET	CITY
Main	7/19/1999	[redacted]		
Main	9/23/2000			
Main	2/3/2004			
Main	8/16/2004			
Main	10/6/2004			
Main	10/31/2004			
Main	1/21/2005			
Main	6/29/2006			
Main	9/4/2007			
Main	9/4/2007			
Main	8/29/2009			
Main	9/4/2010			
Main	7/9/2012			
Main	5/9/2013			
Main	8/19/2019			
Main	7/29/2020			
Main	9/14/2020			
Main	8/9/2021			
Main	9/29/2021			
Total Break				

CONFIDENTIAL

4. Location of Pipe

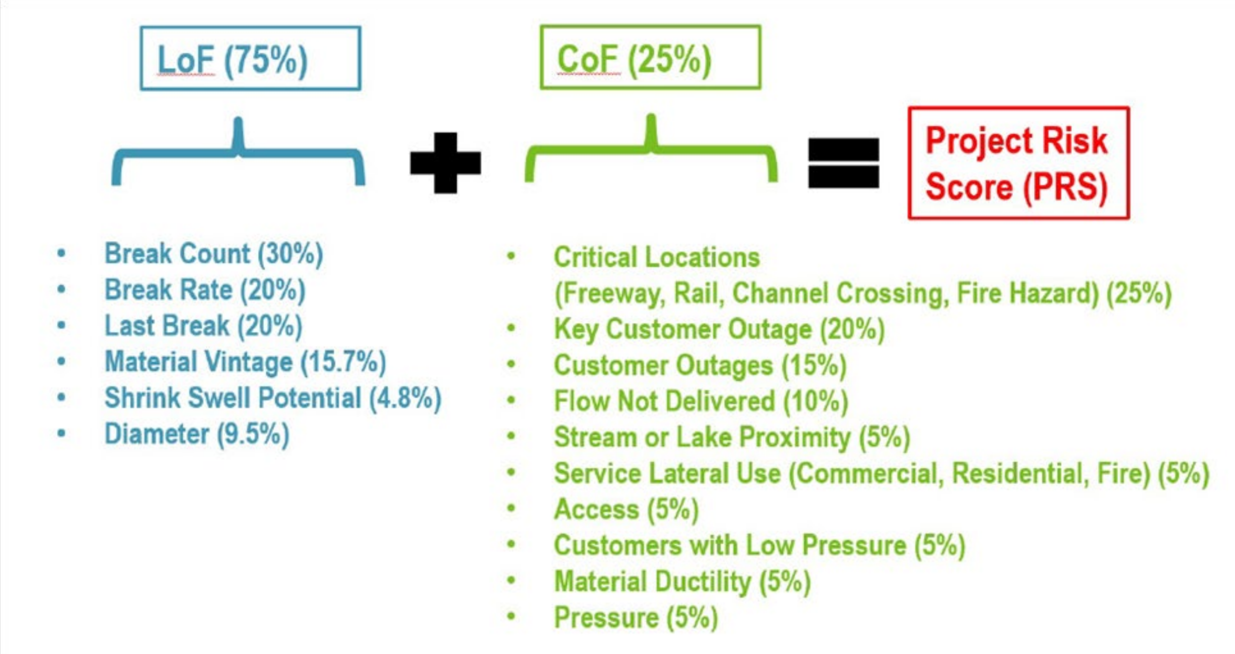
The existing pipelines in the project area are in the residential neighborhood behind curbs. According to Suburban's field crews: "water main on these mentioned streets sit in hard to reach areas high in the yards of customers with many obstacles such as dogs, block walls, and wrought iron fences". Therefore, when a break occurs, it is not only very hard for Suburban crews accessing to make the repair, but also brings more damage to the property. Each main break repair not only interrupted the water supply in the neighborhood but may also change the landscaping and property structures including removing big trees and fences. Figure 4 is a street view from Google Map at 13323 Walburg Street, which is at the corner of Safari Dr. and Walburg St. There have been 2 breaks in front of this house in 2006 and 2021.

Figure 3. Street View on Safari

5. Project Risk Score (PRS)

In 2018 Suburban engaged HDR to perform an independent condition analysis of the pipeline infrastructure. See HDR's Suburban Water Systems Water Main Renewal Technical Memorandum 2019 included in Workpaper VOLUME III-E (HDR TM). To evaluate the system, HDR developed a Risk Model for pipeline renewal and replacement. This model calculated a Project Risk Score (PRS) to quantify the relative risk of failure from very low to severe. This methodology considers the likelihood of failure (LoF) and the consequence of failure (CoF) of the main. Each of the PRS criterion (LoF and CoF) are made up of many factors. Figure 4 summarizes the PRS calculation methodology.

Figure 4. Risk Calculation Method



4.1. PRS Calculation Methodology

As shown in Figure 4, the LoF weight is 75 percent and the CoF weight is 25 percent. The PRS is on a scale of zero to one hundred, LoF can contribute up to 75 points, and the CoF can contribute up to 25 points. Each factor was scored on a 0 to 10 scale (Factor Score), where 0 represents the lowest risk, and 10 represents the highest risk. A detailed explanation of each factor is explained in chapter 4 of the technical memorandum. Each pipeline segment is calculated separately for its LoF and CoF based on the following equation:

LoF Score = ∑ (LoF Factor Score x 10 x Weight x Criterion Weight)

CoF Score = ∑ (CoF Factor Score x 10 x Weight x Criterion Weight)

The PRS for each segment is the summation of LoF and CoF:

PRS = LoF Score + CoF Score

The final PRS for the entire project is a weighted average of pipe risk score by length:

Final Project Risk Score = ∑ (PRS x Length) ÷ ∑ (Length)

4.2. PRS Calculation Result

Table 3 below summarizes the PRS provided by HDR TM 2019 for this replacement project.

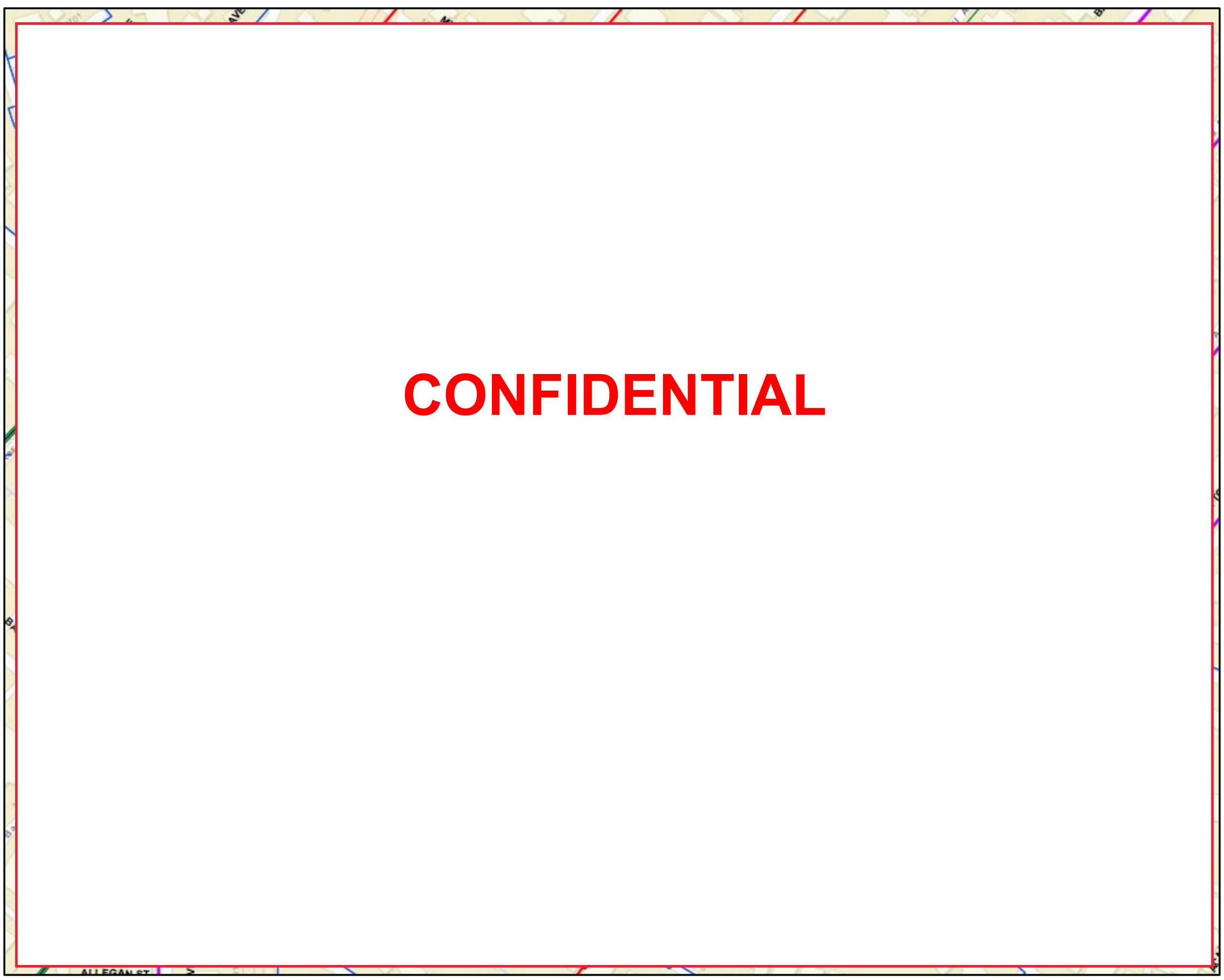
Table 3. Summary of PRS

Project #	Sum of Pipe_Length*	Average of LoF_PRS	Average of CoF_PRS	Average of PRS
67-2682	4,438	60.4	1.3	61.7

*****: The pipe length in Table 3 is from the current GIS database. The estimated replacement length is different. It is measured with new alignments, appurtenances, tie-ins, and any line segment within the project boundary but not included in the current GIS under the same Project Number.

Figure 5 is the PRS map for this project from the HDR TM 2019.

Figure 5. Project Risk Score Map



6. Improvement Alternative's Summary

Alternative 1 – Do nothing. This alternative continues to use the existing pipelines, resulting in continued repairs when breaks occur. This is an undesirable option because the pipelines will continue to fail, interrupting service customers. This will cause poor customer service and higher costs for repairs and piecemeal replacement.

Alternative 2 – Rehabilitate the existing water main. Three rehabilitation methods were evaluated for this alternative.

- Pipebursting
- Sliplining
- Cured-In-Place Pipe (CIPP)

A detailed description of each rehabilitation method is shown below.

Pipebursting – Pipebursting is a method by which the existing pipe is opened and forced outward by a bursting tool. A hydraulic or pneumatic expansion head (part of the bursting tool) is pulled through the existing pipeline, typically using a cable and winch. As the expansion head is pulled through the existing pipe, it pushes that pipe radially outward until it breaks apart, creating a space for the new pipe. The bursting device also pulls the new pipeline behind it, immediately filling the void created by the old, burst pipe with the new pipe. Pipebursting can be used to replace the existing pipe with a similarly sized or larger pipe.

Pipebursting is not recommended if the existing pipe is asbestos cement because the process leaves broken asbestos pieces in the ground. When the pipe is disturbed, it is considered a waste disposal site and is subject to National Emission Standards for Hazardous Air Pollutants (NESHAP) requirements. Friable asbestos fibers lead to cancer of the lungs, known as mesothelioma. Future maintenance activities such main repairs due to breaks or replacing service lines will be required and may lead to health concerns.

Sliplining – Sliplining is inserting a new pipe by pulling or pushing it into the existing pipe and grouting the annular space. After it is in place, the pipe is grouted to hold the lining in place and for additional rigidity.

Sliplining new pipes will generally have a significantly reduced cross-sectional area. Sliplining is not recommended if maintaining or increasing fire flow in the area is required.

CIPP – A cured-in-place pipe (CIPP) is a trenchless rehabilitation method to repair existing pipelines. It is a jointless, seamless pipelining within an existing pipe. The process of CIPP involves inserting and running a felt lining into a pre-existing pipe that is the subject of repair. The resin within the liner is then exposed to a curing element to make it attach to the inner walls of the pipe. Once fully cured, the lining now acts as a new pipeline.

Like sliplining, CIPP is not recommended if maintaining or increasing fire flow is required because the cross-sectional area of the pipeline after rehabilitation is reduced.

There are some common limitations for all three rehabilitation methods compared with open trench replacement:

1. Rehabilitation methods are used for sewer pipelines. Sewer pipelines are straight and are usually deeper than water lines. Offsets and fittings make using these methods more costly. Open trenching deep sewer mains are also more expensive than water mains installed 42-60 inches deep.
2. Typically, there is only one main in the street that serves customers and cannot be switched to other mains during the construction of a new main. A temporary by-pass system is required to provide continuous service to customers. During summer, water in the by-pass pipe is heated because it is in direct contact with the sun. Driveways are blocked by the above-ground pipe and can easily be damaged.
3. Installation pits are required when horizontal and vertical alignment changes are substantial that the new pipe won’t be able to pull or push through the existing pipe. Most Suburban’s record drawings in the 50s and 60s don’t include profile views of the pipelines, and it is suspected that there are multiple offsets. Offsets are required to avoid underground utilities such as gas, cable, water, and storm drain. Most often, water lines cross these utilities multiple times on a street. Digging pits will result in delays and continuous customer interruptions and increase construction costs.
4. Open trench pipe replacement method minimizes water interruptions to one, eight (8) hour shutdown to connect the new pipeline to the existing system, and one, thirty (30) minute shutdown to switch customer services. Mains must be pressure tested and disinfected. There are occasions when passing bacteriological testing can take several weeks due to positive e-coli results. Open trench replacement allows new mains, valves, and service connections to be pressure tested and disinfected before the final shut down to connect to the existing system. Trenchless rehabilitation of the existing pipelines can only be constructed section by section. Each section requires a much

longer shutdown time for service connection, pressure testing, and disinfection to bring back the service and move on to the next one. Replacing the pipelines using rehabilitation techniques will add more time to the project resulting in more costs.

Rehabilitation methods are good alternatives for specific applications like steep hills, where surfaces cannot be disturbed, and if there are no service connections on the main. Suburban's pipeline contractors have not performed rehabilitation methods on residential streets with services. Health and environmental concerns have not been fully addressed when using them on AC pipes. Additional fittings and offsets require more deep excavation pits and will increase the cost and duration of the project. It is not recommended to rehabilitate neighborhood pipelines and continue replacing pipelines using an open trench method.

Alternative 3 – Replace the existing water main with approximately 4,770 LF 6-inch, 8-inch, and 10-inch PVC pipes and associated appurtenances. This Alternative will improve the integrity of the distribution system, eliminate service interruptions in this area, and ensure safe and reliable service to the customers.

According to the Association for the Advancement of Cost Engineering, this alternative is Class 3 of Opinion of Probable Construction Cost (OPCC) for constructing the replacement pipelines. The expected accuracy range for Class 3 is between +10% to +30%. Therefore, a 10% contingency is used in the OPCC.

Description	Quantity	Unit	Unit Cost	Cost
Construct 12-inch PVC	2070	L.F.	$190	$393,300
12-inch Butterfly Valves	8	Each	$4,050	$32,400
12-inch Tie-In	2	Each	$8,900	$17,800
Construct 8-inch PVC	1750	L.F.	$130	$227,500
8-inch Gate Valves	8	Each	$1,960	$15,680
8-inch Tie-In	1	Each	$6,840	$6,840
Construct 6-inch PVC	950	L.F.	$120	$114,000
6-inch Gate Valve	5	Each	$1,660	$8,300
6-inch Fire Hydrant	10	Each	$10,870	$108,700
2-inch Blow-off	3	Each	$5,330	$15,990
1-inch service	148	Each	$2,110	$312,280
AC Removal and Replacement	4770	L.F.	$50	$238,500
Construct Pipeline Offset	20	Each	$3,500	$70,000
Cut, Plug and Abandon of Existing Pipeline	1	LS	$9,034	$9,034
Traffic Rated (H-20) Meter Lids	148	Each	$250	$37,000
Install Test Head Furnishing for Pressure Testing	5	Each	$3,610	$18,050
Landscaping Removal & Replacement	1	LS	$12,644	$12,644
Guard underground services	1	LS	$16,540	$16,540
Line Item Subtotal				$1,654,558
Mobilization			3%	$49,637
De-mobilization			2%	$33,091
Construction Subtotal				**$1,737,286**
Engineering and Inspection			12%	$208,474
Subtotal				$1,945,760
Contingency			10%	$194,576
Subtotal				$2,140,336
General Administration			13.972%	$299,048
Total				**$2,439,000**

7. Basis for Budgeted Cost

The total Class 5 Opinion of Probable Construction Cost includes Engineering and Inspection, General Administration, and Contingency factors. The Engineering and Inspection factor accounts for the estimated direct cost required to plan, design and inspect the project, permit fees, and cost of internal labor. The General Administration factor considers Suburban's general administrative costs. The contingency factor accounts for unforeseen construction conflicts and complications that could result in additional project costs.

8. Impact of Deferral

The longer pipeline replacement is deferred, the older the pipes, the more deterioration of the existing pipe will get. This not only increases the potential for failures and breaks that will cause continuing interruptions of service to customers but also increase the overall cost for repairs and replacement.

9. Recommendation

- Alternative #1 is not feasible because it does not resolve the interruptions of service issues to customers and does not prevent the degradation of the integrity of the water system infrastructure in this area.
- Alternative #2 has limitations with making this Alternative lose its cost-benefit and construction efficiency.
- Alternative #3 is a better solution because it provides full reliability, quality, and abundance of service to the customer in the area. Suburban recommends Alternative #3.

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PROJECT DESIGN REPORT

FROM:	Engineering Department
DATE:	March 25, 2022
DISTRICT:	WLM
SUBJECT:	Dittmar Drive & Kibbee Avenue Pipeline Replacement; CP-473

1. Executive Summary

The existing 4-inch to 8-inch asbestos cement (AC) pipes in Dittmar Drive & Kibbee Avenue area have experienced many breaks in the past years. They have reached the end of their useful lives and do not provide an adequate level of service to the customers. It is recommended that these 4-inch to 8-inch existing AC mains be replaced by approximately 5,250 LF of 6-inch to 8-inch PVC mains to provide a safe and reliable water supply to the customers in the area.

2. Introduction

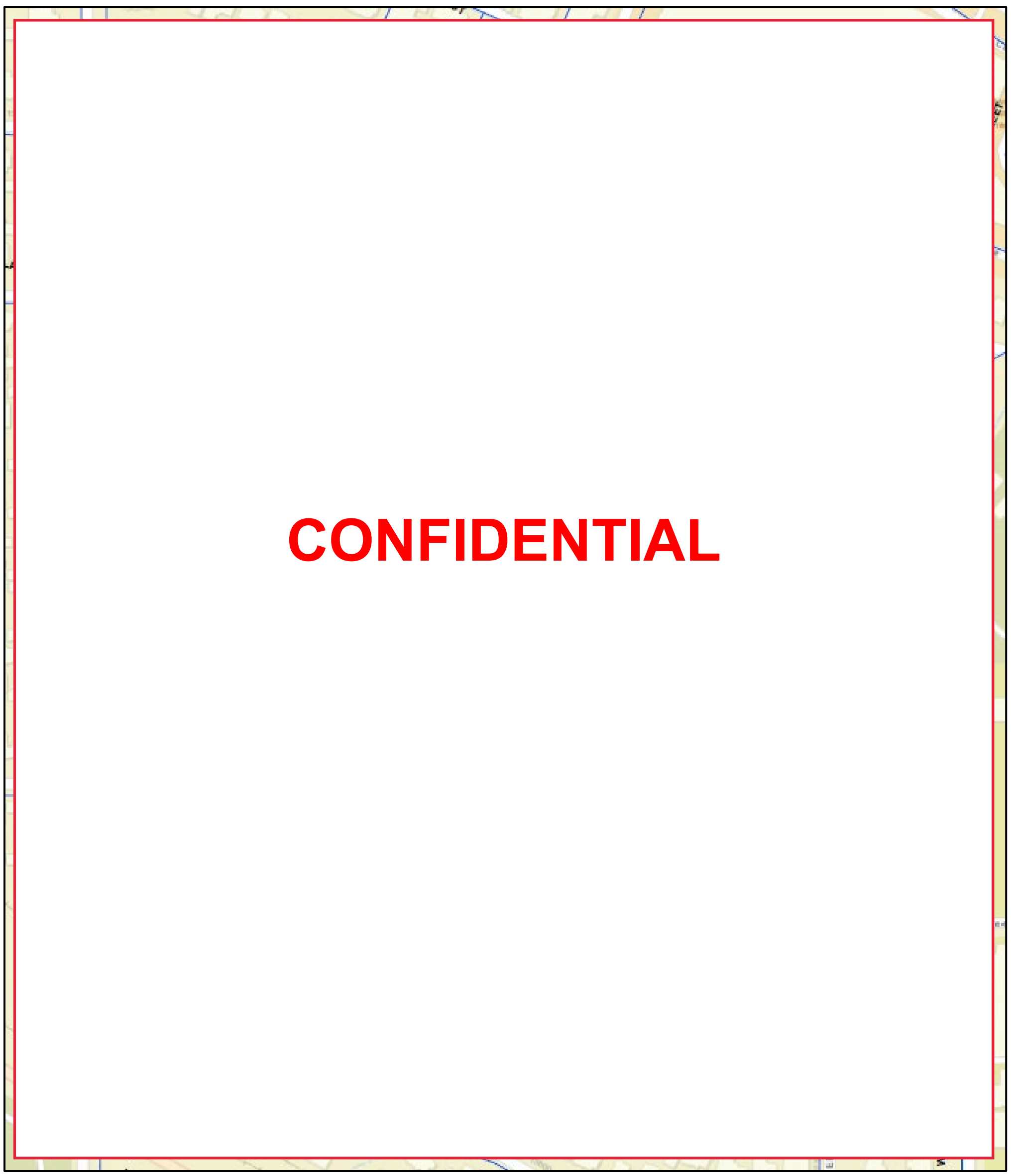
The existing 4-inch, 6-inch, and 8-inch AC mains on Dittmar Dr., Portadar Dr., Kibbee Ave., El Braso Dr., La Alba Dr., and Woodstead Ave. in the City of Whittier have experienced frequent main breaks in the past years causing service interruptions and inconvenience to customers. Suburban has made piecemeal repairs to continue to provide service to its customers, but this is not a long-term solution. The water mains have reached the end of their useful lives. It is recommended to replace the existing 4-inch,6-inch, and 8-inch AC mains with 5,250 LF 6-inch and 8-inch PVC Pipes in the project area to provide a safe and reliable water supply to the customers.

Table 1 present a summary of pipeline replacement in this project and Figure 1 shows the project area. This project has been grouped with two separate severe risk projects geographically connected to each other per the recommendations of the pipeline condition assessment to include all mains that were constructed as part of this tract and are expected to continue to experience breaks. These projects are geographically adjacent in the area where the City of Whittier (the City) is planning to reconstruct streets. The City advises that Suburban replace these water mains before any of the City's street projects. A detailed explanation of the grouping is outlined in Chapter 1 of the "*Suburban Water Systems Water Main Renewal Technical Memorandum, 2019,*" included in Workpaper VOLUME III-E.

Table 1. Replacement Schedule

Quantity	**Existing Main**		**Proposed Main**	
(feet)	**Size** (inch)	**Material**	**Size** (inch)	**Material**
2000	4	AC	6	PVC
470	6	AC	6	PVC
2800	8	AC	8	PVC
5,270				

Figure 1. Project Area and Break Map



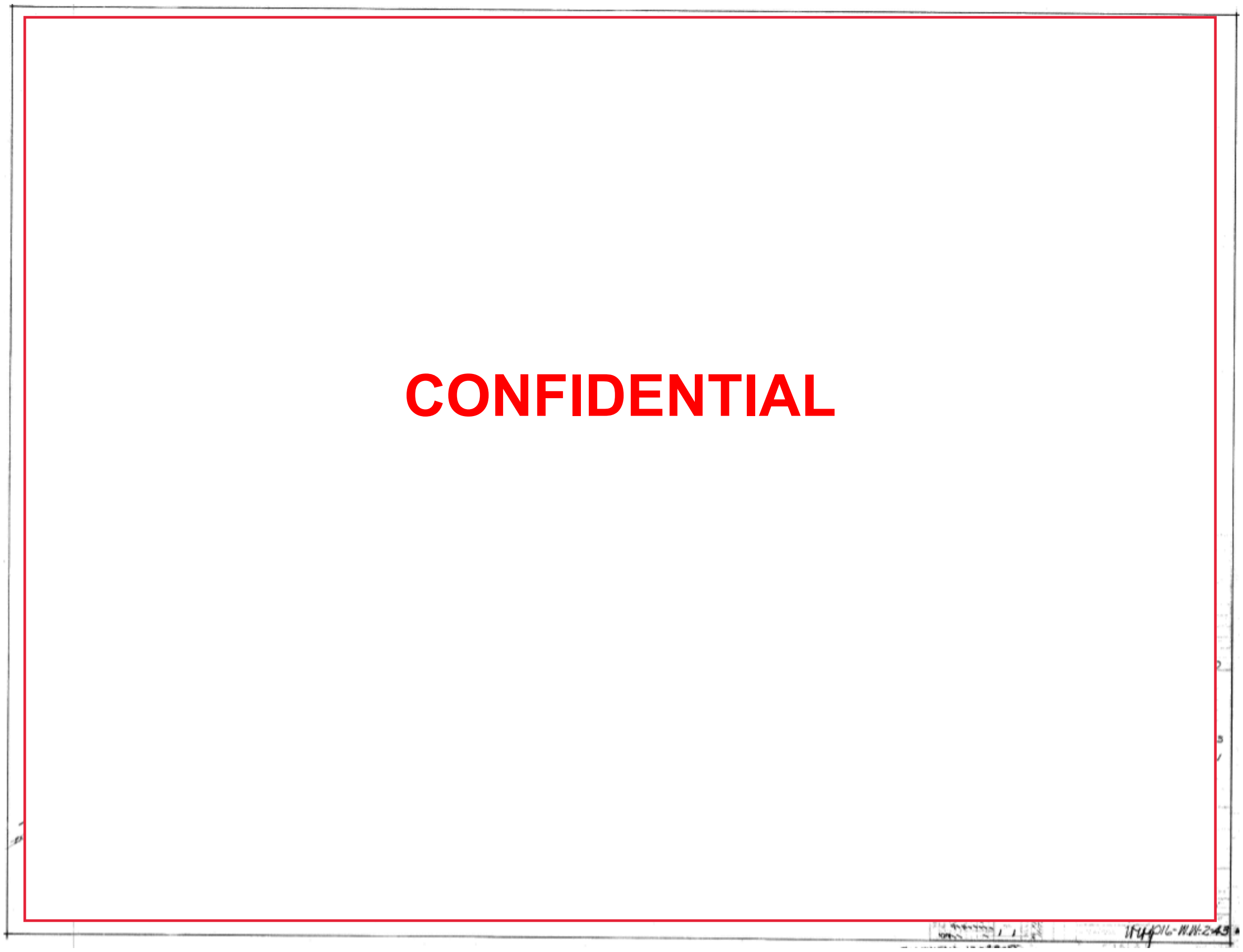
3. Project Background

Record drawings (Figures 2 - 3) show the existing pipelines were originally built between 1954 to 1955 under the development of TRACT 15777 and TRACT 16996 in the City of Whittier. These pipelines are part of the distribution system in 400 Zone in Whittier / La Mirada District of Suburban.

- Project 757-WW-2, TRACT 1577, Built in 1954
- Project 1016-WW-2, TRACT 16996, Built in 1955

Figure 2. Record Drawing Part 1

Figure 3. Record Drawing Part 2



Suburban Water Systems (Suburban) water main break data is available from 1998. All the main breaks for this project on record from 1998 to 2021 are also shown in Table 1 and illustrated with green dots on Figure 1.

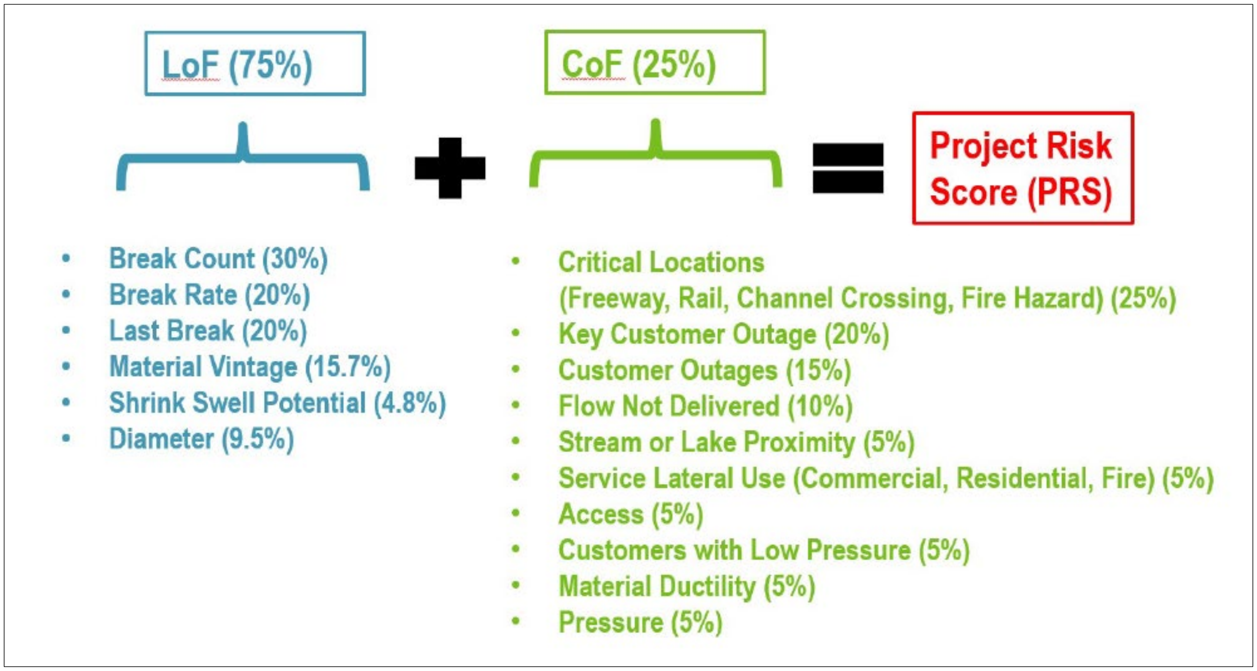
Table 2. Break Record

BRAKE TYPE	BRAKE DATE	ADDRESS	STREET	CITY
Main	3/16/1998			
Main	3/29/2000			
Main	10/12/2001			
Main	7/2/2002			
Main	11/21/2002			
Main	3/31/2003			
Main	9/14/2005		CONFIDENTIAL	
Main	9/7/2015			
Main	5/15/2016			
Main	8/8/2017			
Total				

4. Project Risk Score (PRS)

In 2018 Suburban engaged HDR to perform an independent condition analysis of the pipeline infrastructure. See HDR's Suburban Water Systems Water Main Renewal Technical Memorandum 2019 included in Workpaper VOLUME III-E (HDR TM). To evaluate the system, HDR developed a Risk Model for pipeline renewal and replacement. This model calculated a Project Risk Score (PRS) to quantify the relative risk of failure from very low to severe. This methodology considers the likelihood of failure (LoF) and the consequence of failure (CoF) of the main. Each of the PRS criterion (LoF and CoF) are made up of many factors. Figure 4 summarizes the PRS calculation methodology.

Figure 4. Risk Calculation Method



4.1. Break History

As shown in Figure 4, the LoF weight is 75 percent and the CoF weight is 25 percent. The PRS is on a scale of zero to one hundred, LoF can contribute up to 75 points, and the CoF can contribute up to 25 points. Each factor was scored on a 0 to 10 scale (Factor Score), where 0 represents the lowest risk, and 10 represents the highest risk. A detailed explanation of each factor is explained in chapter 3 of the 2019 technical memorandum. Each pipeline segment is calculated separately for its LoF and CoF based on the following equation:

$$\text{LoF Score} = \sum (\text{LoF Factor Score} \times 10 \times \text{Weight} \times \text{Criterion Weight})$$

$$\text{CoF Score} = \sum (\text{CoF Factor Score} \times 10 \times \text{Weight} \times \text{Criterion Weight})$$

The PRS for each segment is the summation of LoF and CoF:

$$\text{PRS} = \text{LoF Score} + \text{CoF Score}$$

The final PRS for the entire project is a weighted average of pipe risk score by length:

$$\textbf{Final Project Risk Score} = \sum \textbf{(PRS x Length)} \div \sum \textbf{(Length)}$$

4.2. PRS Calculation Results

Table 3 below summarizes the PRS provided by HDR TM 2019 for this replacement project.

Table 3. Summary of PRS

Project #	Sum of Pipe_Length*	Average of LoF_PRS	Average of CoF_PRS	Average of PRS
757-WW-2	1,445	42.2	1.8	45.1
1016-WW-2	3,594	49.8	2.1	52.1

*: The pipe length in Table 3 is from the current GIS database. The estimated replacement length is different. It is measured with new alignments, appurtenances, tie-ins, and any line segment within the project boundary but not included in the current GIS under the same Project Number.

Figure 5 is the PRS map for this project from the HDR TM 2019.

Figure 5. Project Risk Score Map

5. Improvement Alternative's Summary

Alternative 1 – Do nothing. This alternative continues to use the existing pipelines, resulting in continued repairs when breaks occur. This is an undesirable option because the pipelines will continue to fail, interrupting service customers. This will cause poor customer service and higher costs for repairs and piecemeal replacement.

Alternative 2 – Rehabilitate the existing water main. Three rehabilitation methods were evaluated for this alternative.

- Pipebursting
- Sliplining
- Cured-In-Place Pipe (CIPP)

A detailed description of each rehabilitation method is shown below.

Pipebursting – Pipebursting is a method by which the existing pipe is opened and forced outward by a bursting tool. A hydraulic or pneumatic expansion head (part of the bursting tool) is pulled through the existing pipeline, typically using a cable and winch. As the expansion head is pulled through the existing pipe, it pushes that pipe radially outward until it breaks apart, creating a space for the new pipe. The bursting device also pulls the new pipeline behind it, immediately filling the void created by the old, burst pipe with the new pipe. Pipebursting can be used to replace the existing pipe with a similarly sized or larger pipe.

Pipebursting is not recommended if the existing pipe is asbestos cement because the process leaves broken asbestos pieces in the ground. When the pipe is disturbed, it is considered a waste disposal site and is subject to National Emission Standards for Hazardous Air Pollutants (NESHAP) requirements. Friable asbestos fibers lead to cancer of the lungs, known as mesothelioma. Future maintenance activities such main repairs due to breaks or replacing service lines will be required and may lead to health concerns.

Sliplining – Sliplining is inserting a new pipe by pulling or pushing it into the existing pipe and grouting the annular space. After it is in place, the pipe is grouted to hold the lining in place and for additional rigidity.

Sliplining new pipes will generally have a significantly reduced cross-sectional area. Sliplining is not recommended if maintaining or increasing fire flow in the area is required.

CIPP – A cured-in-place pipe (CIPP) is a trenchless rehabilitation method to repair existing pipelines. It is a jointless, seamless pipelining within an existing pipe. The process of CIPP involves inserting and running a felt lining into a pre-existing pipe that is the subject of repair. The resin within the liner is then exposed to a curing element to make it attach to the inner walls of the pipe. Once fully cured, the lining now acts as a new pipeline.

Like sliplining, CIPP is not recommended if maintaining or increasing fire flow is required because the cross-sectional area of the pipeline after rehabilitation is reduced.

There are some common limitations for all three rehabilitation methods compared with open trench replacement:

1. Rehabilitation methods are used for sewer pipelines. Sewer pipelines are straight and are usually deeper than water lines. Offsets and fittings make using these methods more costly. Open trenching deep sewer mains are also more expensive than water mains installed 42-60 inches deep.
2. Typically, there is only one main in the street that serves customers and cannot be switched to other mains during the construction of a new main. A temporary by-pass system is required to provide continuous service to customers. During summer, water in the by-pass pipe is heated because it is in direct contact with the sun. Driveways are blocked by the above-ground pipe and can easily be damaged.
3. Installation pits are required when horizontal and vertical alignment changes are substantial that the new pipe won't be able to pull or push through the existing pipe. Most Suburban's record drawings in the 50s and 60s don't include profile views of the pipelines, and it is suspected that there are multiple offsets. Offsets are required to avoid underground utilities such as gas, cable, water, and storm drain. Most often, water lines cross these utilities multiple times on a street. Digging pits will result in delays and continuous customer interruptions and increase construction costs.
4. Open trench pipe replacement method minimizes water interruptions to one, eight (8) hour shutdown to connect the new pipeline to the existing system, and one, thirty (30) minute shutdown to switch customer services. Mains must be pressure tested and disinfected. There are occasions when passing bacteriological testing can take several weeks due to positive e-coli results. Open trench replacement allows new mains, valves, and service connections to be pressure tested and disinfected before the final shut down to connect to the existing system. Trenchless rehabilitation of the existing pipelines can only be constructed section by section. Each section requires a much

longer shutdown time for service connection, pressure testing, and disinfection to bring back the service and move on to the next one. Replacing the pipelines using rehabilitation techniques will add more time to the project resulting in more costs.

Rehabilitation methods are good alternatives for specific applications like steep hills, where surfaces cannot be disturbed, and if there are no service connections on the main. Suburban's pipeline contractors have not performed rehabilitation methods on residential streets with services. Health and environmental concerns have not been fully addressed when using them on AC pipes. Additional fittings and offsets require more deep excavation pits and will increase the cost and duration of the project. It is not recommended to rehabilitate neighborhood pipelines and continue replacing pipelines using an open trench method.

Alternative 3 – Replace the existing water main with approximately 5,250 LF 6-inch and 8-inch PVC pipes and associated appurtenances as shown in Table 1. This Alternative will improve the integrity of the distribution system, eliminate service interruptions in this area, and ensure safe and reliable service to the customers.
According to the Association for the Advancement of Cost Engineering, this alternative is Class 3 of Opinion of Probable Construction Cost (OPCC) for constructing the replacement pipelines. The expected accuracy range for Class 3 is between +10% to +30%. Therefore, a 10% contingency is used in the OPCC.

Description	Quantity	Unit	Unit Cost	Cost
Construct 8-inch PVC	2800	L.F.	$130	$364,000
8-inch Gate Valves	7	Each	$1,960	$13,720
8-inch Tie-In	3	Each	$6,840	$20,520
Construct 6-inch PVC	2470	L.F.	$120	$296,400
6-inch Gate Valve	5	Each	$1,660	$8,300
6-inch Tie-In	2	Each	$6,550	$13,100
6-inch Fire Hydrant	8	Each	$10,870	$86,960
2-inch Blow-off	2	Each	$5,330	$10,660
1-inch service	133	Each	$2,110	$280,630
AC Removal and Replacement	5270	L.F.	$50	$263,500
Construct Pipeline Offset	22	Each	$3,500	$77,000
Cut, Plug and Abandon of Existing Pipeline	1	LS	$9,034	$9,034
Traffic Rated (H-20) Meter Lids	133	Each	$250	$33,250
Install Test Head Furnishing for Pressure Testing	5	Each	$3,610	$18,050
Landscaping Removal & Replacement	1	LS	$12,644	$12,644
Guard underground services	1	LS	$16,540	$16,540
Line Item Subtotal				$1,524,308
Mobilization			3%	$45,729
De-mobilization			2%	$30,486
Construction Subtotal				**$1,600,523**
Engineering and Inspection			12%	$192,063
Subtotal				$1,792,586
Contingency			10%	$179,259
Subtotal				$1,971,845
General Administration			13.972%	$275,506
Total				**$2,247,000**

6. Basis for Budgeted Cost

The total estimated project cost includes Engineering and Inspection, General Administration, and Contingency factors. The Engineering and Inspection factor accounts for the estimated direct cost required to plan, design and inspect the project, permit fees, and cost of internal labor. The General Administration factor considers Suburban's general administrative costs. The contingency factor accounts for unforeseen construction conflicts and complications that could result in additional project costs.

7. Impact of Deferral

The longer this pipeline replacement is deferred, the older the pipes will become and the likelihood of failure will increase, and the frequency of breaks will increase. The breaks will increasingly cause undesirable interruptions of service to customers and the overall system condition will exponentially worsen.

8. Recommendation

- Alternative #1 is not feasible because it does not resolve the interruptions of service issues to customers and does not prevent the degradation of the integrity of the water system infrastructure in this area.
- Alternative #2 has limitations with making this Alternative lose its cost-benefit and construction efficiency.
- Alternative #3 is a better solution because it provides full reliability, quality, and abundance of service to the customer in the area. Suburban recommends Alternative #3.

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PROJECT DESIGN REPORT

FROM: Engineering Department

DATE: March 26, 2022

DISTRICT: WLM

SUBJECT: Rushford Street & Mollyknoll Avenue Pipeline Replacement; CP-474

1. Executive Summary

The existing 4-inch to 8-inch asbestos cement (AC) pipes in Rushford Street & Mollyknoll Avenue area have experienced many breaks in the past years. They have reached the end of their useful lives and do not provide an adequate level of service to the customers. It is recommended that these 4-inch to 8-inch existing AC mains be replaced by approximately 4,820 LF of 4-inch to 8-inch PVC mains to provide a safe and reliable water supply to the customers in the area.

2. Introduction

The existing 4-inch, 6-inch, and 8-inch AC mains on Lashburn St., Rushford St., Stanmon St., Hornell St., and Mollyknoll Ave. in the City of Whittier have experienced frequent main breaks in the past years causing service interruptions and inconvenience to customers. Suburban has made piecemeal repairs to continue to provide service to its customers, but this is not a long-term solution. The water mains have reached the end of their useful lives. It is recommended to replace the existing 4-inch,6-inch, and 8-inch AC mains with 4,820 LF 4-inch, 6-inch, and 8-inch PVC Pipes in the project area to provide a safe and reliable water supply to the customers.

Figure 1 shows the project area, and Table 1 present a summary of pipeline replacement in this project. This project has been grouped per the recommendations of the pipeline condition assessment to include all mains that were constructed as part of this tract and are expected to continue to experience breaks. A detailed explanation of the grouping is outlined in Chapter 1 of the "*Suburban Water Systems Water Main Renewal Technical Memorandum, 2019,*" included in Workpaper VOLUME III-E.

Figure 1. Project Area and Break Map

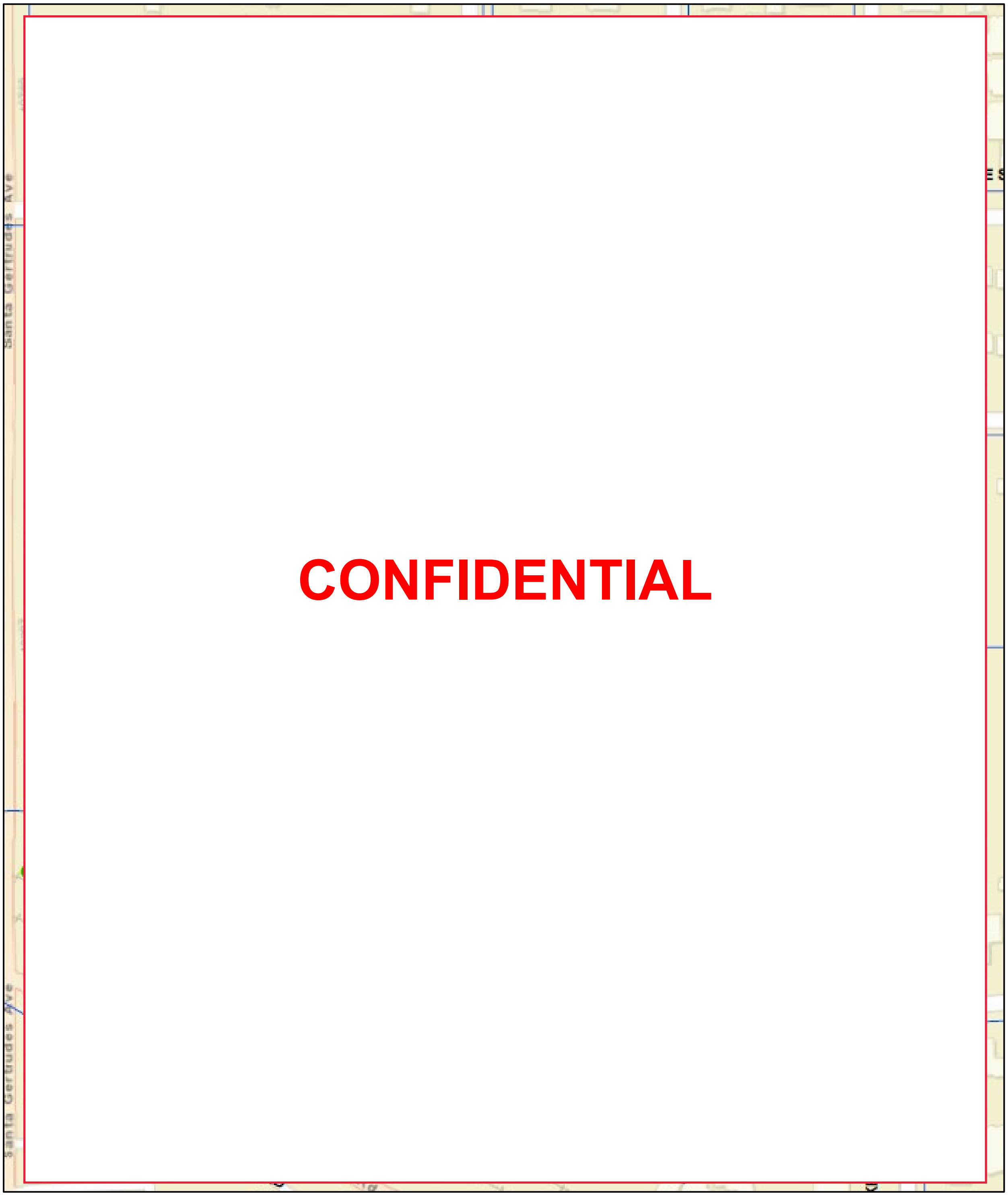


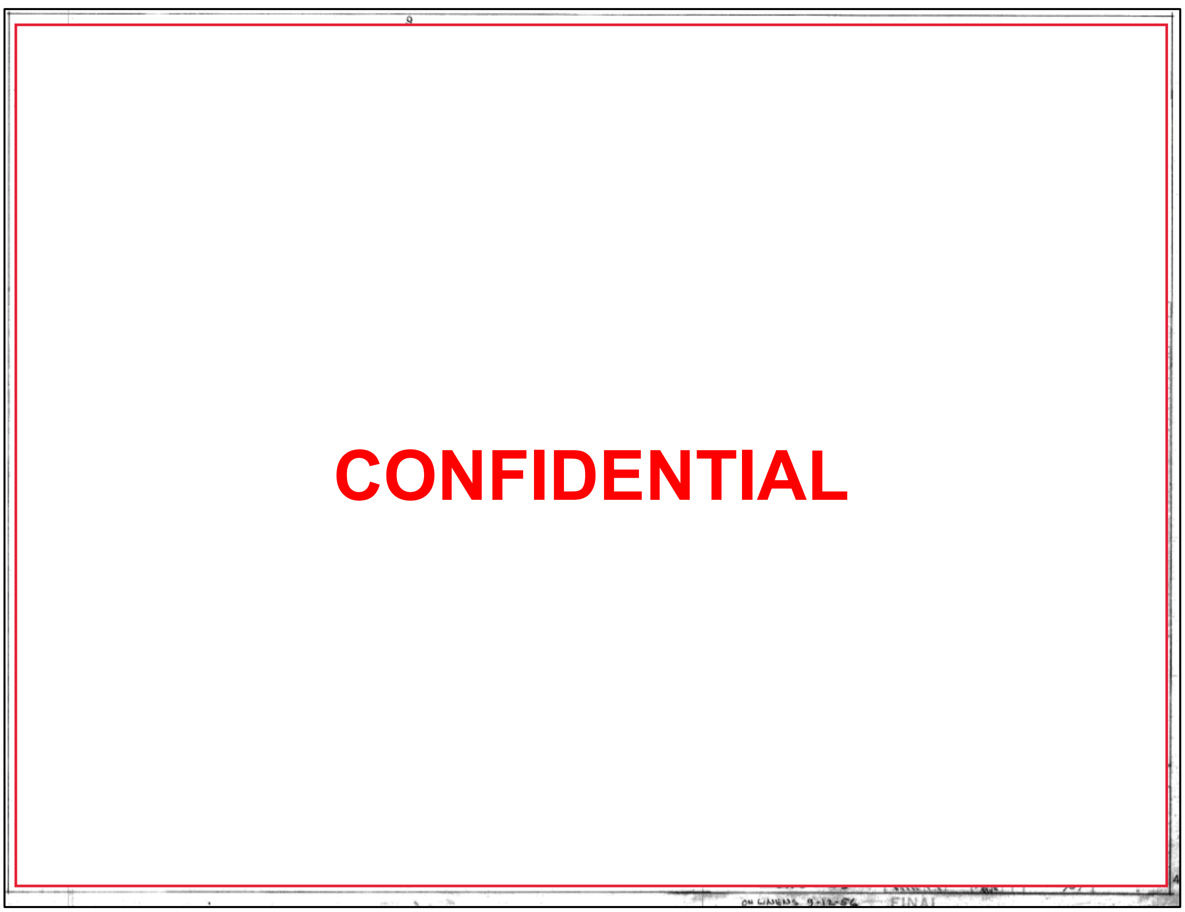
Table 1. Replacement Schedule

Quantity	**Existing Main**		**Proposed Main**	
(feet)	**Size** (inch)	**Material**	**Size** (inch)	**Material**
150	4	AC	4	PVC
770	4	AC	6	PVC
2,000	6	AC	6	PVC
1,900	8	AC	8	PVC
4,820				

3. Project Background

Record drawing (Figures 2) shows the existing pipelines were originally built in 1956 under the development of TRACT 21012 under Project Number 1068-WW-2 in the City of Whittier. These pipelines are part of the distribution system in 400 Zone in Whittier / La Mirada District of Suburban.

Figure 2. Record Drawing



Suburban Water Systems (Suburban) water main break data is available from 1998. All the main breaks for this project on record from 1998 to 2021 are also shown in Table 1 and illustrated with green dots on Figure 1.

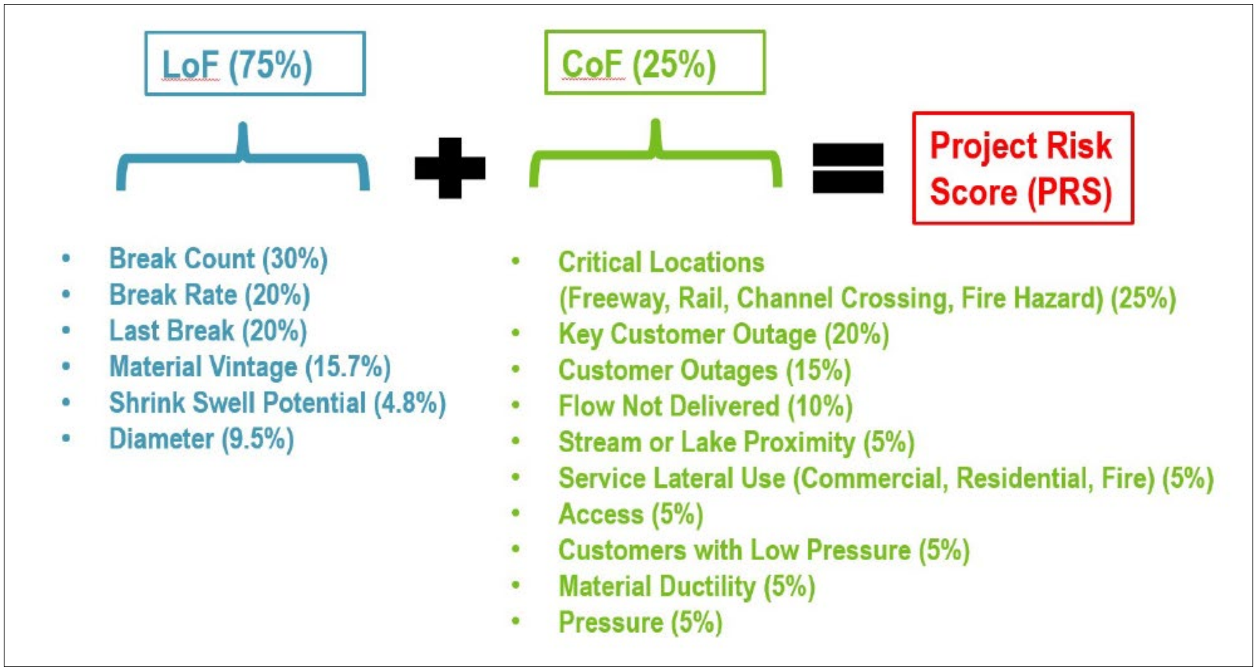
Table 2. Break Record

BREAK TYPE	BREAK DATE	ADDRESS	STREET	CITY
Main	10/15/1998	[redacted]	[redacted]	[redacted]
Main	5/5/2004	[redacted]	[redacted]	[redacted]
Main	9/5/2006	[redacted]	[redacted]	[redacted]
Main	3/1/2008	[redacted]	[redacted]	[redacted]
Main	4/15/2008	[redacted]	[redacted]	[redacted]
Main	5/30/2008	CONFIDENTIAL	[redacted]	[redacted]
Main	12/17/2014	[redacted]	[redacted]	[redacted]
Main	8/11/2016	[redacted]	[redacted]	[redacted]
Main	12/28/2016	[redacted]	[redacted]	[redacted]
Main	9/17/2018	[redacted]	[redacted]	[redacted]
Main	10/20/2020	[redacted]	[redacted]	[redacted]
Total		[redacted]		

4. Project Risk Score (PRS)

In 2018 Suburban engaged HDR to perform an independent condition analysis of the pipeline infrastructure. See HDR's Suburban Water Systems Water Main Renewal Technical Memorandum 2019 included in Workpaper VOLUME III-E (HDR TM). To evaluate the system, HDR developed a Risk Model for pipeline renewal and replacement. This model calculated a Project Risk Score (PRS) to quantify the relative risk of failure from very low to severe. This methodology considers the likelihood of failure (LoF) and the consequence of failure (CoF) of the main. Each of the PRS criterion (LoF and CoF) are made up of many factors. Figure 3 summarizes the PRS calculation methodology.

Figure 3. Risk Calculation Method



4.1. PRS Calculation Methodology

As shown in Figure 3, the LoF weight is 75 percent and the CoF weight is 25 percent. The PRS is on a scale of zero to one hundred, LoF can contribute up to 75 points, and the CoF can contribute up to 25 points. Each factor was scored on a 0 to 10 scale (Factor Score), where 0 represents the lowest risk, and 10 represents the highest risk. A detailed explanation of each factor is explained in chapter 3 of the 2019 technical memorandum. Each pipeline segment is calculated separately for its LoF and CoF based on the following equation:

LoF Score = $\sum$ (LoF Factor Score x 10 x Weight x Criterion Weight)

CoF Score = $\sum$ (CoF Factor Score x 10 x Weight x Criterion Weight)

The PRS for each segment is the summation of LoF and CoF:

PRS = LoF Score + CoF Score

The final PRS for the entire project is a weighted average of pipe risk score by length:

Final Project Risk Score = $\sum$ **(PRS x Length)** ÷ $\sum$ **(Length)**

4.2. PRS Calculation Results

Table 3 below summarizes the PRS provided by HDR TM 2019 for this replacement project.

Table 3. Summary of PRS

Project #	Sum of Pipe_Length*	Average of LoF_PRS	Average of CoF_PRS	Average of PRS
1068-WW-2	4,518	50.4	1.4	51.8

*****: The pipe length in Table 3 is from the current GIS database. The estimated replacement length is different. It is measured with new alignments, appurtenances, tie-ins, and any line segment within the project boundary but not included in the current GIS under the same Project Number.

Figure 4 is the PRS map for this project from the HDR TM 2019.

Figure 4. Project Risk Score Map

5. Improvement Alternative's Summary

Alternative 1 – Do nothing. This alternative continues to use the existing pipelines, resulting in continued repairs when breaks occur. This is an undesirable option because the pipelines will continue to fail, interrupting service customers. This will cause poor customer service and higher costs for repairs and piecemeal replacement.

Alternative 2 – Rehabilitate the existing water main. Three rehabilitation methods were evaluated for this alternative.

- Pipebursting
- Sliplining
- Cured-In-Place Pipe (CIPP)

A detailed description of each rehabilitation method is shown below.

Pipebursting – Pipebursting is a method by which the existing pipe is opened and forced outward by a bursting tool. A hydraulic or pneumatic expansion head (part of the bursting tool) is pulled through the existing pipeline, typically using a cable and winch. As the expansion head is pulled through the existing pipe, it pushes that pipe radially outward until it breaks apart, creating a space for the new pipe. The bursting device also pulls the new pipeline behind it, immediately filling the void created by the old, burst pipe with the new pipe. Pipebursting can be used to replace the existing pipe with a similarly sized or larger pipe.

Pipebursting is not recommended if the existing pipe is asbestos cement because the process leaves broken asbestos pieces in the ground. When the pipe is disturbed, it is considered a waste disposal site and is subject to National Emission Standards for Hazardous Air Pollutants (NESHAP) requirements. Friable asbestos fibers lead to cancer of the lungs, known as mesothelioma. Future maintenance activities such main repairs due to breaks or replacing service lines will be required and may lead to health concerns.

Sliplining – Sliplining is inserting a new pipe by pulling or pushing it into the existing pipe and grouting the annular space. After it is in place, the pipe is grouted to hold the lining in place and for additional rigidity.

Sliplining new pipes will generally have a significantly reduced cross-sectional area. Sliplining is not recommended if maintaining or increasing fire flow in the area is required.

CIPP – A cured-in-place pipe (CIPP) is a trenchless rehabilitation method to repair existing pipelines. It is a jointless, seamless pipelining within an existing pipe. The process of CIPP involves inserting and running a felt lining into a pre-existing pipe that is the subject of repair. The resin within the liner is then exposed to a curing element to make it attach to the inner walls of the pipe. Once fully cured, the lining now acts as a new pipeline.

Like sliplining, CIPP is not recommended if maintaining or increasing fire flow is required because the cross-sectional area of the pipeline after rehabilitation is reduced.

There are some common limitations for all three rehabilitation methods compared with open trench replacement:

1. Rehabilitation methods are used for sewer pipelines. Sewer pipelines are straight and are usually deeper than water lines. Offsets and fittings make using these methods more costly. Open trenching deep sewer mains are also more expensive than water mains installed 42-60 inches deep.
2. Typically, there is only one main in the street that serves customers and cannot be switched to other mains during the construction of a new main. A temporary by-pass system is required to provide continuous service to customers. During summer, water in the by-pass pipe is heated because it is in direct contact with the sun. Driveways are blocked by the above-ground pipe and can easily be damaged.
3. Installation pits are required when horizontal and vertical alignment changes are substantial that the new pipe won’t be able to pull or push through the existing pipe. Most Suburban’s record drawings in the 50s and 60s don’t include profile views of the pipelines, and it is suspected that there are multiple offsets. Offsets are required to avoid underground utilities such as gas, cable, water, and storm drain. Most often, water lines cross these utilities multiple times on a street. Digging pits will result in delays and continuous customer interruptions and increase construction costs.
4. Open trench pipe replacement method minimizes water interruptions to one, eight (8) hour shutdown to connect the new pipeline to the existing system, and one, thirty (30) minute shutdown to switch customer services. Mains must be pressure tested and disinfected. There are occasions when passing bacteriological testing can take several weeks due to positive e-coli results. Open trench replacement allows new mains, valves, and service connections to be pressure tested and disinfected before the final shut down to connect to the existing system. Trenchless rehabilitation of the existing pipelines can only be constructed section by section. Each section requires a much

longer shutdown time for service connection, pressure testing, and disinfection to bring back the service and move on to the next one. Replacing the pipelines using rehabilitation techniques will add more time to the project resulting in more costs.

Rehabilitation methods are good alternatives for specific applications like steep hills, where surfaces cannot be disturbed, and if there are no service connections on the main. Suburban's pipeline contractors have not performed rehabilitation methods on residential streets with services. Health and environmental concerns have not been fully addressed when using them on AC pipes. Additional fittings and offsets require more deep excavation pits and will increase the cost and duration of the project. It is not recommended to rehabilitate neighborhood pipelines and continue replacing pipelines using an open trench method.

Alternative 3 – Replace the existing water main with approximately 4,820 LF 4-inch, 6-inch, and 8-inch PVC pipes and associated appurtenances. This Alternative will improve the integrity of the distribution system, eliminate service interruptions in this area, and ensure safe and reliable service to the customers.

According to the Association for the Advancement of Cost Engineering, this alternative is Class 3 of Opinion of Probable Construction Cost (OPCC) for constructing the replacement pipelines. The expected accuracy range for Class 3 is between +10% to +30%. Therefore, a 10% contingency is used in the OPCC.

Description	Quantity	Unit	Unit Cost	Cost
Construct 8-inch PVC	1900	L.F.	$130	$247,000
8-inch Gate Valves	4	Each	$1,960	$7,840
8-inch Tie-In	2	Each	$6,840	$13,680
Construct 6-inch PVC	2770	L.F.	$120	$332,400
6-inch Gate Valve	6	Each	$1,660	$9,960
6-inch Tie-In	3	Each	$6,550	$19,650
Construct 4-inch PVC	150	L.F.	$110	$16,500
4-inch Gate Valve	1	Each	$1,380	$1,380
6-inch Fire Hydrant	8	Each	$10,870	$86,960
2-inch Blow-off	1	Each	$5,330	$5,330
1-inch service	133	Each	$2,110	$280,630
AC Removal and Replacement	4820	L.F.	$50	$241,000
Construct Pipeline Offset	20	Each	$3,500	$70,000
Cut, Plug and Abandon of Existing Pipeline	1	LS	$9,034	$9,034
Traffic Rated (H-20) Meter Lids	133	Each	$250	$33,250
Install Test Head Furnishing for Pressure Testing	5	Each	$3,610	$18,050
Landscaping Removal & Replacement	1	LS	$12,644	$12,644
Guard underground services	1	LS	$16,540	$16,540
Line Item Subtotal				$1,421,848
Mobilization			3%	$42,655
De-mobilization			2%	$28,437
Construction Subtotal				**$1,492,940**
Engineering and Inspection			12%	$179,153
Subtotal				$1,672,093
Contingency			10%	$167,209
Subtotal				$1,839,303
General Administration			13.972%	$256,987
Total				**$2,096,000**

6. Basis for Budgeted Cost

The total estimated project cost includes Engineering and Inspection, General Administration, and Contingency factors. The Engineering and Inspection factor accounts for the estimated direct cost required to plan, design and inspect the project, permit fees, and cost of internal labor. The General Administration factor considers Suburban's general administrative costs. The contingency factor accounts for unforeseen construction conflicts and complications that could result in additional project costs.

7. Impact of Deferral

The longer this pipeline replacement is deferred, the older the pipes will become and the likelihood of failure will increase, and the frequency of breaks will increase. The breaks will increasingly cause undesirable interruptions of service to customers and the overall system condition will exponentially worsen.

8. Recommendation

- Alternative #1 is not feasible because it does not resolve the interruptions of service issue to customers and does not prevent the degradation of the integrity of the water system infrastructure in this area.
- Alternative #2 has limitations with make this Alternative loose its cost benefit and construction efficiency.
- Alternative #3 is a better solution because it provides full reliability, quality and abundance of service to the customer in the area. Suburban recommends Alternative #3.

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PROJECT DESIGN REPORT

FROM: Engineering Department

DATE: April 11, 2022

DISTRICT: WLM

SUBJECT: Scribner Avenue Pipeline Replacement; CP-378

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1. Executive Summary

The existing 4-inch and 6-inch asbestos cement (AC) mains in Scribner Avenue and Trumball Street area have experienced many breaks in the past years, reached the end of their useful lives, and do not provide an adequate level of service to the customers. It is recommended that these existing mains be replaced by approximately 2,650 LF of 4-inch to 8-inch PVC mains to provide a safe and reliable water supply to the customers in the area.

2. Introduction

The existing 4-inch and 6-inch AC mains on Scribner Avenue, Trumball Street, and Carmenita Road north and east of Lake Marie Elementary School in the unincorporated Los Angeles County area have experienced frequent main breaks in the past years causing service interruptions and inconvenience to customers. Suburban has made piecemeal repairs to continue to provide service to its customers, but this is not a long-term solution. The water mains have reached the end of their useful lives. It is recommended to replace the existing 4-inch and 6-inch with 2,650 LF 6-inch and 8-inch PVC CL-305 Pipe in the project area to provide a safe and reliable water supply to the customers.

Figure 1 shows the project area and Table 1 presents a summary of pipeline replacement. This project has been grouped per the recommendations of the pipeline condition assessment to include all mains that were constructed as part of this tract and are expected to continue to experience breaks. A detailed explanation of the grouping is outlined in Chapter 1 of the "*Suburban Water Systems Water Main Renewal Technical Memorandum, 2022,*" included in Workpaper VOLUME III-E.

Figure 1. Project Map

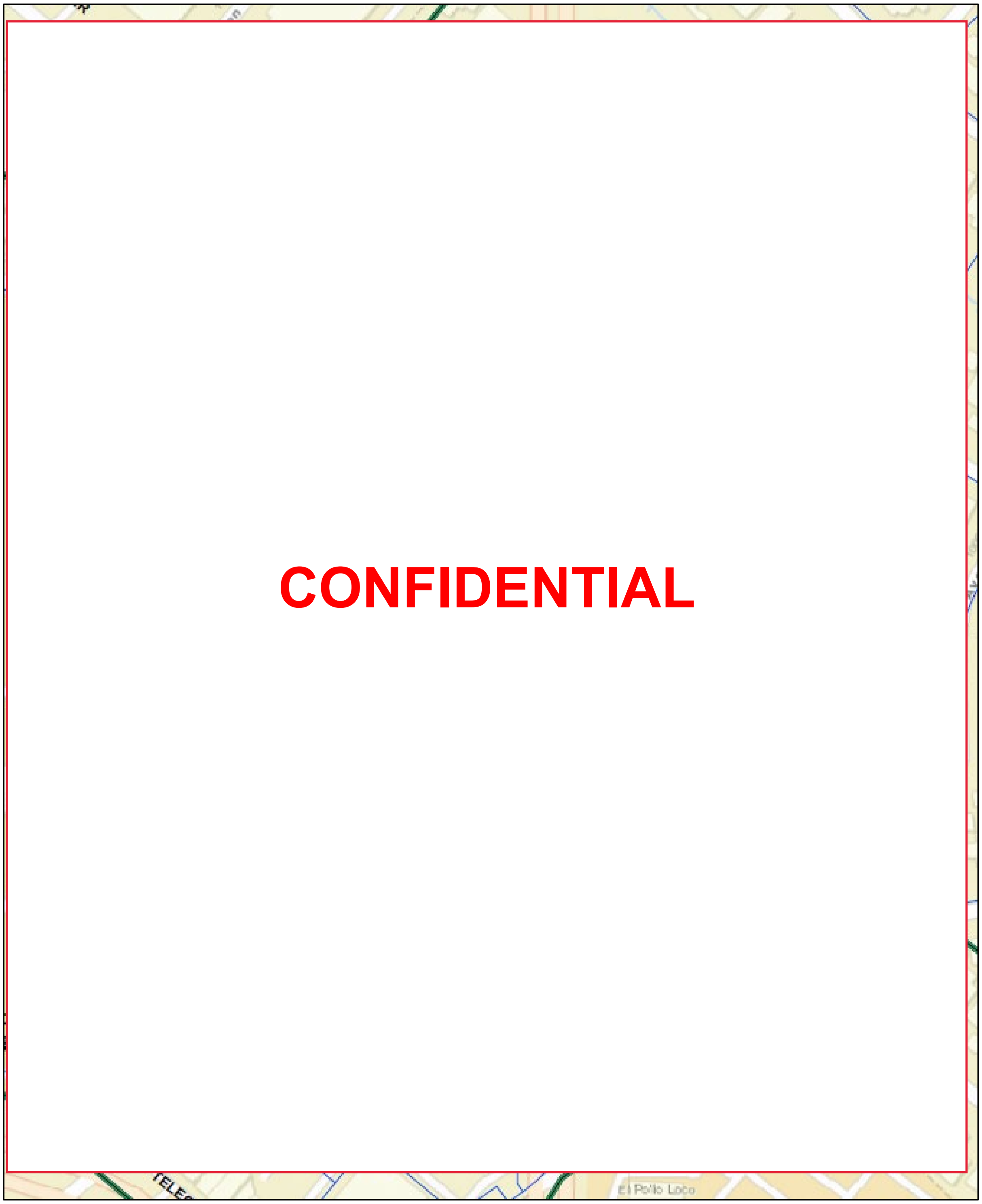

Table 1. Replacement Schedule

Quantity	Existing Main		Proposed Main	
(feet)	**Size** (inch)	**Material**	**Size** (inch)	**Material**
370	4	AC	4	PVC
350	4	AC	6	PVC
430	4	AC	8	PVC
420	6	AC	6	PVC
1,080	6	AC	8	PVC
2,650				

3. Project Background

Record drawing (Figure 2) shows the existing pipe materials are 4-inch and 6-inch Asbestos Cement pipes (AC). These pipelines were originally built in 1959 during the development of TRACT 21307 and TRACT 18574 under Project Number 1800-WW-2. They are a part of the distribution system in the 265 Zone in the Whittier/La Mirada District of Suburban. In addition, part of this project is in the Disadvantage Areas according to SB 535 (see Figure 3).

Figure 2. Record Drawing

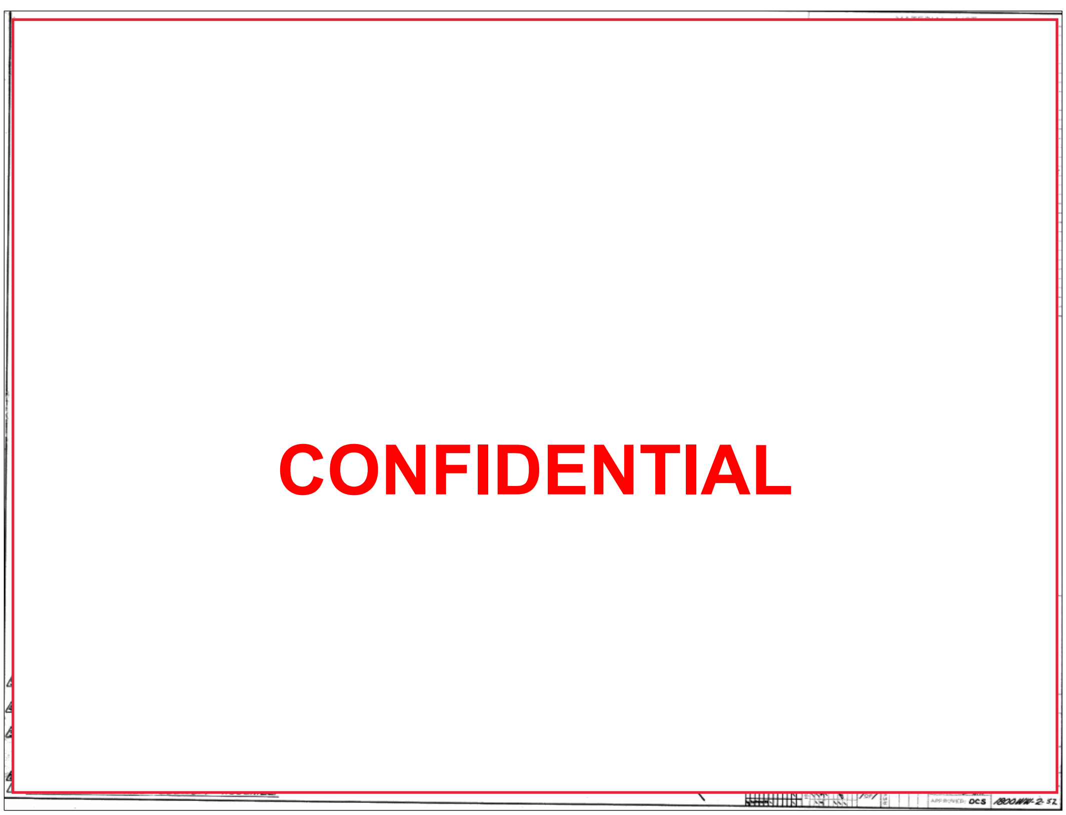

Figure 3. SB 535 Disadvantage Areas

Suburban Water Systems (Suburban) water main break data is available from 1998. All the main breaks for this project on record from 1998 to 2021 are also shown in Table 2 and illustrated with green dots in Figure 1.

Table 2. Break Record

BREAK TYPE	BREAK DATE	HOUSE_NUMB	STREETNAME	CITY
Main	9/1/1999			
Main	8/22/2001			
Main	8/7/2002			
Main	8/24/2009			
Main	7/8/2010			
Main	7/5/2015			
Main	9/6/2016			
Main	7/5/2018			
Main	10/16/2018			
Main	3/1/2021			
Main	9/9/2021			
Main	9/24/2021			
TOTAL				

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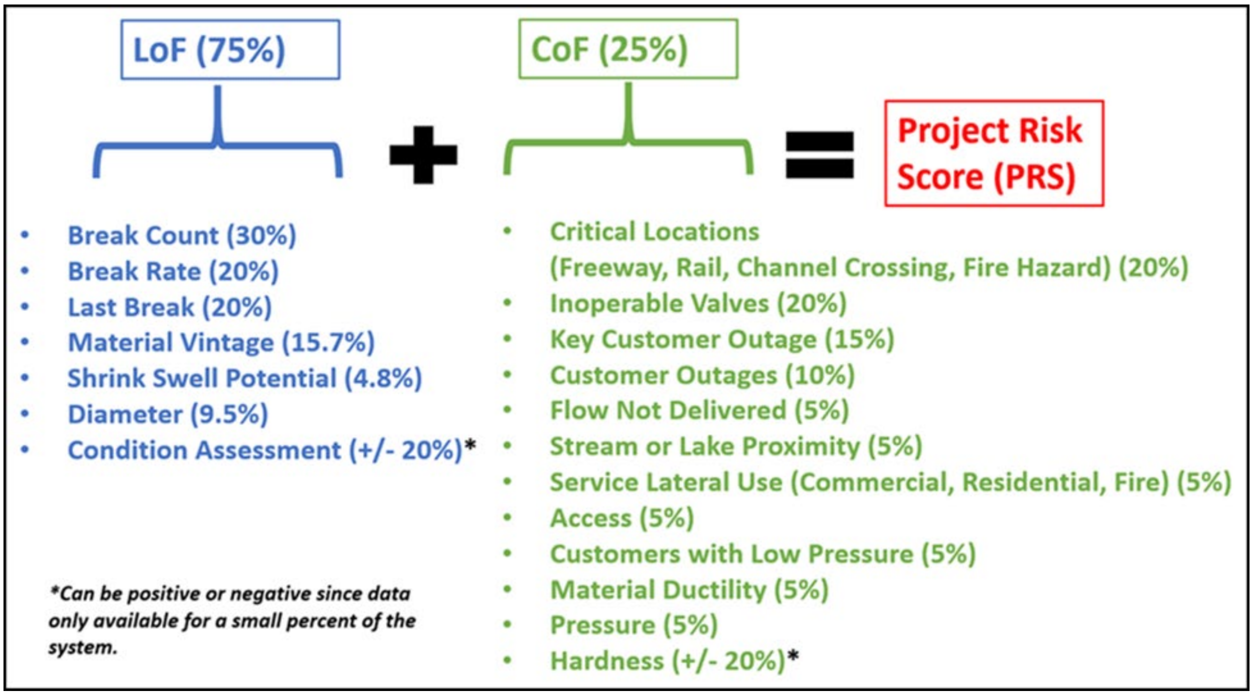
4. Project Risk Score (PRS)

In 2018 Suburban engaged HDR to perform an independent condition analysis of the pipeline infrastructure. HDR updated the study in 2022. See HDR's Suburban Water Systems Water Main Renewal Technical Memorandum 2022 included in Workpaper VOLUME III-E (HDR TM). To evaluate the system, HDR developed a Risk Model for pipeline renewal and replacement. This model calculated a Project Risk Score (PRS) to quantify the relative risk of failure from very low to severe. This methodology considers the likelihood of failure (LoF) and the consequence of failure (CoF) of the main. Each of the PRS criterion (LoF and CoF) are made up of many factors. Figure 4 summarizes the PRS calculation methodology.

Figure 4. Risk Calculation Method



4.1 PRS Calculation Methodology

As shown in Figure 4, the LoF weight is 75 percent and the CoF weight is 25 percent. The PRS is on a scale of zero to one hundred, LoF can contribute up to 75 points, and the CoF can contribute up to 25 points. Each factor was scored on a 0 to 10 scale (Factor Score), where 0 represents the lowest risk, and 10 represents the highest risk. A detailed explanation of each factor is explained in chapter 4 of the technical memorandum. Each pipeline segment is calculated separately for its LoF and CoF based on the following equation:

LoF Score = ∑ (LoF Factor Score x 10 x Weight x Criterion Weight)

CoF Score = ∑ (CoF Factor Score x 10 x Weight x Criterion Weight)

The PRS for each segment is the summation of LoF and CoF:

PRS = LoF Score + CoF Score

The final PRS for the entire project is a weighted average of pipe risk score by length:

Final Project Risk Score = ∑ (PRS x Length) ÷ ∑ (Length)

4.2 PRS Calculation Results

Table 3 below summarizes the PRS provided by HDR TM 2022 for this replacement project.

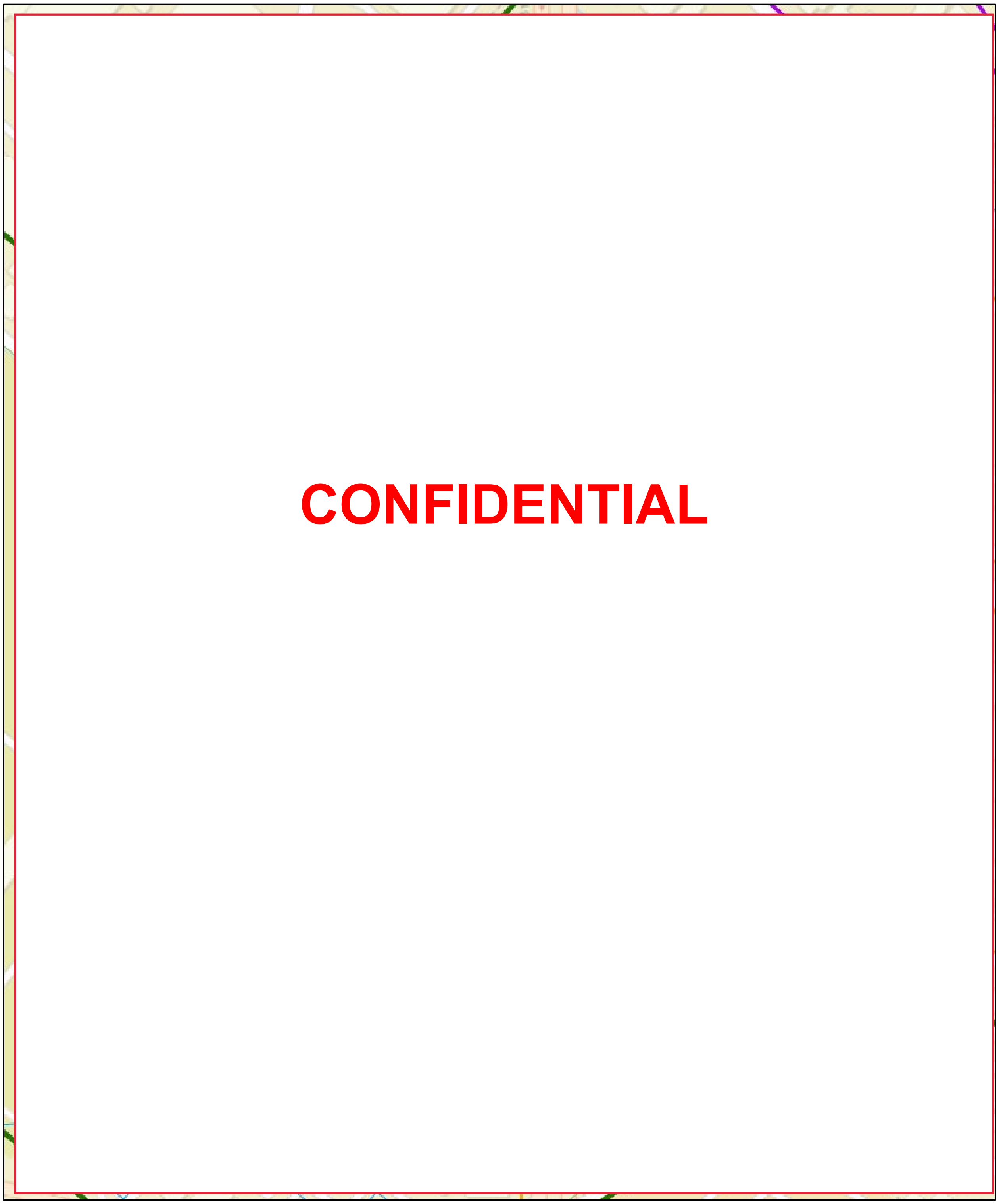
Table 3. Summary of PRS

Project #	Sum of Pipe_Length*	Average of LoF_PRS	Average of CoF_PRS	Average of PRS
1800-WW-2	1,618	77.9	-0.65	77.2

*: The pipe length in Table 3 is from the current GIS database. The estimated replacement length is different. It is measured with new alignments, appurtenances, tie-ins, and any line segment within the project boundary but not included in the current GIS under the same Project Number.

Figure 5 is the PRS map for this project from the HDR TM 2022.

Figure 5. Project Risk Score Map



5. Improvement Alternative's Summary

Alternative 1 – Do nothing. This alternative continues to use the existing pipelines, resulting in continued repairs when breaks occur. This is an undesirable option because the pipelines will continue to fail, interrupting service customers. This will cause poor customer service and higher costs for repairs and piecemeal replacement.

Alternative 2 – Rehabilitate the existing water main. Three rehabilitation methods were evaluated for this alternative.

- Pipebursting
- Sliplining
- Cured-In-Place Pipe (CIPP)

A detailed description of each rehabilitation method is shown below.

Pipebursting – Pipebursting is a method by which the existing pipe is opened and forced outward by a bursting tool. A hydraulic or pneumatic expansion head (part of the bursting tool) is pulled through the existing pipeline, typically using a cable and winch. As the expansion head is pulled through the existing pipe, it pushes that pipe radially outward until it breaks apart, creating a space for the new pipe. The bursting device also pulls the new pipeline behind it, immediately filling the void created by the old, burst pipe with the new pipe. Pipebursting can be used to replace the existing pipe with a similarly sized or larger pipe.

Pipebursting is not recommended if the existing pipe is asbestos cement because the process leaves broken asbestos pieces in the ground. When the pipe is disturbed, it is considered a waste disposal site and is subject to National Emission Standards for Hazardous Air Pollutants (NESHAP) requirements. Friable asbestos fibers lead to cancer of the lungs, known as mesothelioma. Future maintenance activities such main repairs due to breaks or replacing service lines will be required and may lead to health concerns.

Sliplining – Sliplining is inserting a new pipe by pulling or pushing it into the existing pipe and grouting the annular space. After it is in place, the pipe is grouted to hold the lining in place and for additional rigidity.

Sliplining new pipes will generally have a significantly reduced cross-sectional area. Sliplining is not recommended if maintaining or increasing fire flow in the area is required.

CIPP – A cured-in-place pipe (CIPP) is a trenchless rehabilitation method to repair existing pipelines. It is a jointless, seamless pipelining within an existing pipe. The process of CIPP involves inserting and running a felt lining into a pre-existing pipe that is the subject of repair. The resin within the liner is then exposed to a curing element to make it attach to the inner walls of the pipe. Once fully cured, the lining now acts as a new pipeline.

Like sliplining, CIPP is not recommended if maintaining or increasing fire flow is required because the cross-sectional area of the pipeline after rehabilitation is reduced.

There are some common limitations for all three rehabilitation methods compared with open trench replacement:

1. Rehabilitation methods are used for sewer pipelines. Sewer pipelines are straight and are usually deeper than water lines. Offsets and fittings make using these methods more costly. Open trenching deep sewer mains are also more expensive than water mains installed 42-60 inches deep.
2. Typically, there is only one main in the street that serves customers and cannot be switched to other mains during the construction of a new main. A temporary by-pass system is required to provide continuous service to customers. During summer, water in the by-pass pipe is heated because it is in direct contact with the sun. Driveways are blocked by the above-ground pipe and can easily be damaged.
3. Installation pits are required when horizontal and vertical alignment changes are substantial that the new pipe won't be able to pull or push through the existing pipe. Most Suburban's record drawings in the 50s and 60s don't include profile views of the pipelines, and it is suspected that there are multiple offsets. Offsets are required to avoid underground utilities such as gas, cable, water, and storm drain. Most often, water lines cross these utilities multiple times on a street. Digging pits will result in delays and continuous customer interruptions and increase construction costs.
4. Open trench pipe replacement method minimizes water interruptions to one, eight (8) hour shutdown to connect the new pipeline to the existing system, and one, thirty (30) minute shutdown to switch customer services. Mains must be pressure tested and disinfected. There are occasions when passing bacteriological testing can take several weeks due to positive e-coli results. Open trench replacement allows new mains, valves, and service connections to be pressure tested and disinfected before the final shut down to connect to the existing system. Trenchless rehabilitation of the existing pipelines can only be constructed section by section. Each section requires a much

longer shutdown time for service connection, pressure testing, and disinfection to bring back the service and move on to the next one. Replacing the pipelines using rehabilitation techniques will add more time to the project resulting in more costs.

Rehabilitation methods are good alternatives for specific applications like steep hills, where surfaces cannot be disturbed, and if there are no service connections on the main. Suburban's pipeline contractors have not performed rehabilitation methods on residential streets with services. Health and environmental concerns have not been fully addressed when using them on AC pipes. Additional fittings and offsets require more deep excavation pits and will increase the cost and duration of the project. It is not recommended to rehabilitate neighborhood pipelines and continue replacing pipelines using an open trench method.

Alternative 3 – Replace existing water mains with approximately 2,650 L.F. of 6" and 8" PVC pipes and associated appurtenances as shown in Table 1. This Alternative will improve the integrity of the distribution system, eliminate service interruptions in this area, and ensure safe and reliable service to the customers.

According to the Association for the Advancement of Cost Engineering, this alternative is Class 3 of Opinion of Probable Construction Cost (OPCC) for constructing the replacement pipelines. The expected accuracy range for Class 3 is between +10% to +30%. Therefore, a 10% contingency is used in the OPCC.

Description	Quantity	Unit	Unit Cost	Cost
Construct 8-inch PVC	1510	L.F.	$130	$196,300
8-inch Gate Valves	4	Each	$1,960	$7,840
8-inch Tie-In	2	Each	$6,840	$13,680
Construct 6-inch PVC	770	L.F.	$120	$92,400
6-inch Gate Valve	2	Each	$1,660	$3,320
Construct 4-inch PVC	370	L.F.	$110	$40,700
4-inch Gate Valve	2	Each	$1,380	$2,760
4-inch Tie-In	1	Each	$6,660	$6,660
6-inch Fire Hydrant	3	Each	$10,870	$32,610
2-inch Blow-off	3	Each	$5,330	$15,990
1-inch service	47	Each	$2,110	$99,170
AC Removal and Replacement	2650	L.F.	$50	$132,500
Construct Pipeline Offset	11	Each	$3,500	$38,500
Cut, Plug and Abandon of Existing Pipeline	1	LS	$9,034	$9,034
Traffic Rated (H-20) Meter Lids	47	Each	$250	$11,750
Install Test Head Furnishing for Pressure Testing	3	Each	$3,610	$10,830
Landscaping Removal & Replacement	1	LS	$12,644	$12,644
Guard underground services	1	LS	$16,540	$16,540
Line Item Subtotal				$743,228
Mobilization			3%	$22,297
De-mobilization			2%	$14,865
Construction Subtotal				**$780,389**
Engineering and Inspection			12%	$93,647
Subtotal				$874,036
Contingency			10%	$87,404
Subtotal				$961,440
General Administration			9%	$86,530
Total				**$1,048,000**

6. Basis for Budgeted Cost

The total estimated project cost includes Engineering and Inspection, General Administration, and Contingency factors. The Engineering and Inspection factor accounts for the estimated direct cost required to plan, design and inspect the project, permit fees, and cost of internal labor. The General Administration factor considers Suburban's general administrative costs. The contingency factor accounts for unforeseen construction conflicts and complications that could result in additional project costs.

7. Impact of Deferral

The longer this pipeline replacement is deferred, the older the pipes will become and the likelihood of failure will increase, and the frequency of breaks will increase. The breaks will increasingly cause undesirable interruptions of service to customers and the overall system condition will exponentially worsen.

8. Recommendation

- Alternative #1 is not feasible because it does not resolve the interruptions of service issues to customers and does not prevent the degradation of the integrity of the water system infrastructure in this area.
- Alternative #2 has limitations with making this Alternative lose its cost-benefit and construction efficiency.
- Alternative #3 is a better solution because it provides full reliability, quality, and abundance of service to the customer in the area. Suburban recommends Alternative #3.

W-8

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PROJECT DESIGN REPORT

FROM: Engineering Department
DATE: July 29, 2022
DISTRICT: WLM
SUBJECT: Scott Ave. and Lashburn St. Pipeline Replacement; CP-500

1. Executive Summary

The existing 4-inch, 6-inch, 8-inch, and 12-inch asbestos cement (AC) in Scott Avenue and Lashburn Street area have experienced many breaks in the past years, reached the end of their useful lives, and do not provide an adequate level of service to the customers. It is recommended that these 4-inch to 12-inch mains are replaced by approximately 13,250 LF of 6-inch to 12-inch PVC mains to provide a safe and reliable water supply to the customers in the area.

2. Introduction

The existing 4-inch, 6-inch, 8-inch, and 12-inch asbestos cement (AC) in the City of Whittier on Scott Avenue, Lashbur Street, and adjacent streets, in the area west of Kibbee Avenue, east of Scott Avenue, north of Leffingwell Road, and south of Lambert Road, have experienced frequent main breaks. The breaks result in service interruptions and inconvenience to customers. Suburban has made piecemeal repairs to continue to provide service to its customers, but this is not a long-term solution. The water mains have reached the end of their useful lives. It is recommended to replace these existing 4-inch to 12-inch mains with approximately 13,250 LF 6-inch, 8-inch, and 12-inch PVC Pipes in the project area to provide a safe and reliable water supply to the customers.

Figure 1 shows the map of the project area, and Table 1 demonstrates a summary of the proposed pipeline replacement in this project. This project has been grouped per the recommendations of the pipeline condition assessment to include all mains that were constructed as part of this tract and are expected to continue to experience breaks. A detailed explanation of the grouping is outlined in Chapter 1 of the "*Suburban Water Systems Water Main Renewal Technical Memorandum, 2022,*" included in Workpaper VOLUME III-E.

Figure 1. Project Area and Break Map

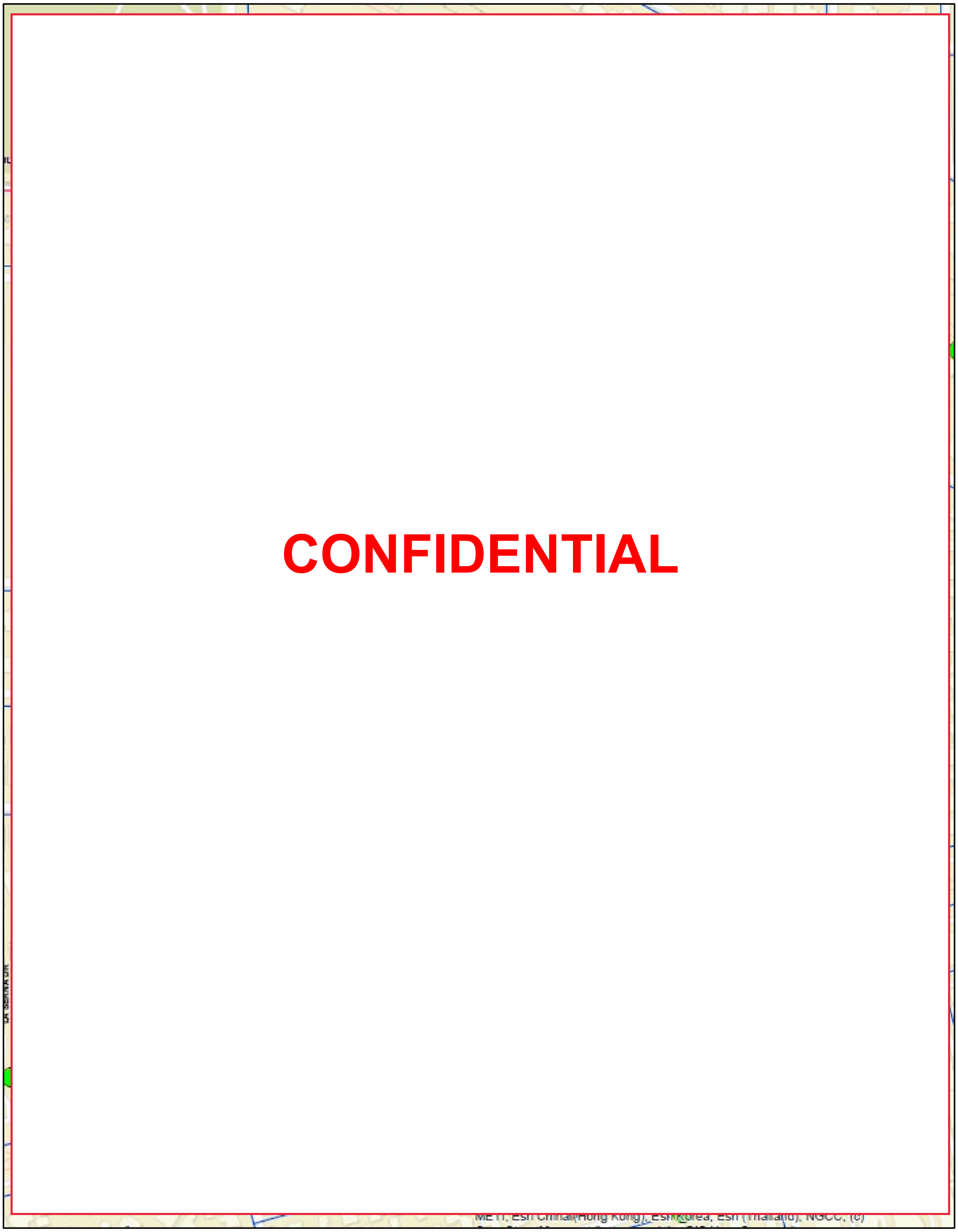


Table 1. Replacement Schedule

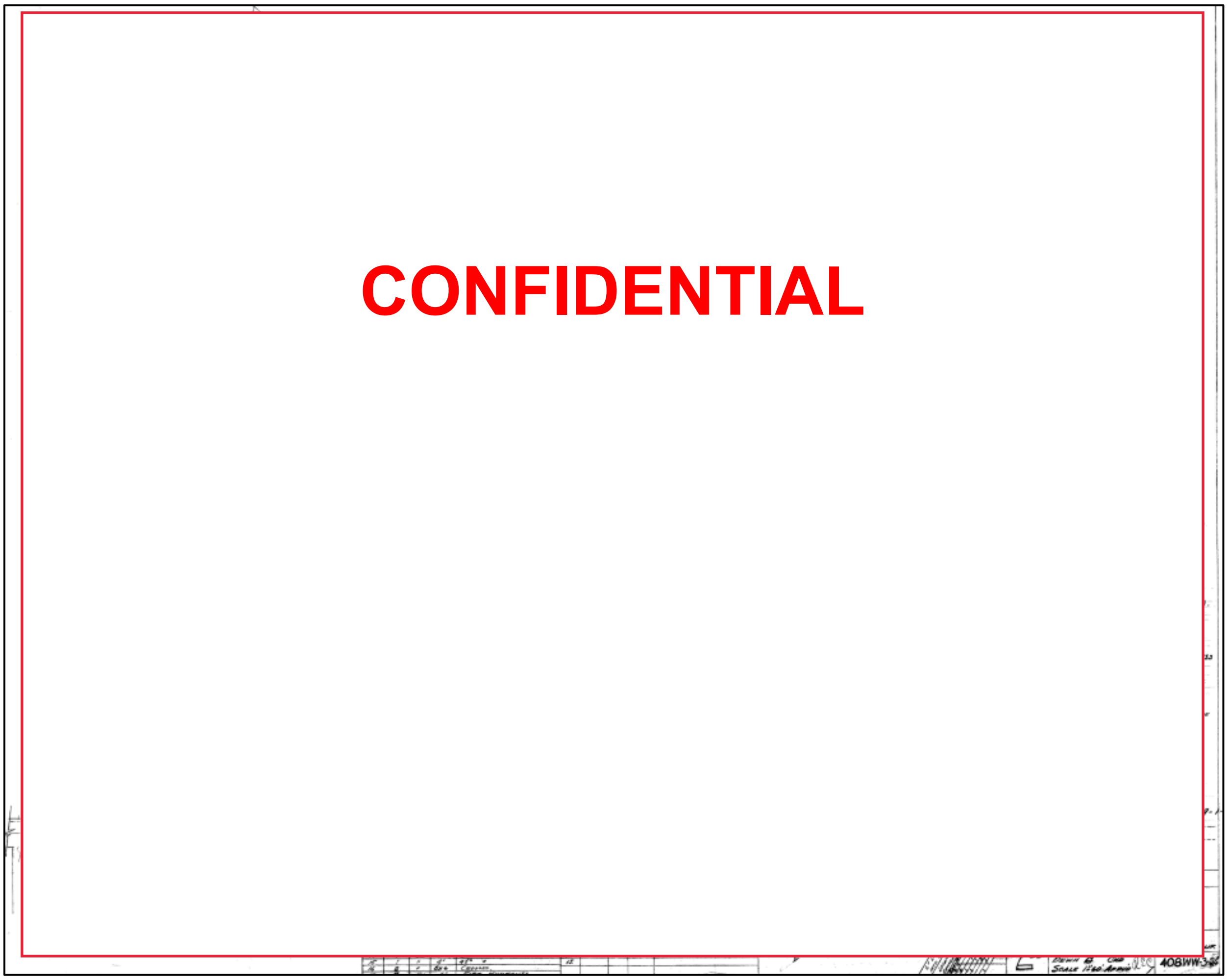
Quantity	**Existing Main**		**Proposed Main**	
(feet)	**Size** (inch)	**Material**	**Size** (inch)	**Material**
1,350	4	AC	6	PVC
5,500	6	AC	6	PVC
1,700	6	AC	8	PVC
4,450	8	AC	8	PVC
250	12	AC	12	PVC
13,250				

3. Project Background

Record drawings (Figure 2 and Figure 3) show the most existing pipe materials are Asbestos Cement Pipe (AC). These pipelines were originally built in 1952 during the development of TRACT 17667 under Project Number 408-WW-3. They are a part of the distribution system in the 400 Zone in the Whittier / La Mirada District of Suburban.

Figure 2. Record Drawing 1

Figure 3. Record Drawing 2



Suburban Water Systems (Suburban) started having water main break data in 1998. All the main breaks for this project from 1998 to 2021 are also shown in Table 2 and illustrated with green dots in Figure 1.

Table 2. Break Record

BREAK TYPE	BREAK DATE	ADDRESS	STREETNAME	CITY
Main	2/11/2000			
Main	5/8/2000			
Main	5/8/2000			
Main	8/30/2002			
Main	3/5/2003		CONFIDENTIAL	
Main	5/6/2005			
Main	7/14/2006			

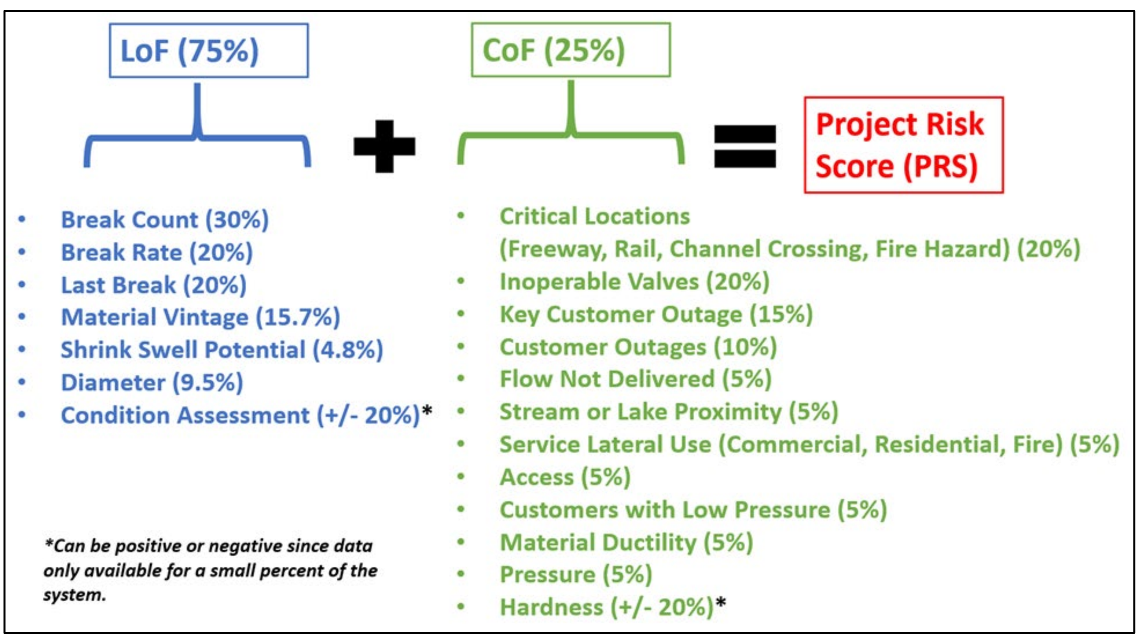
BREAK TYPE	BREAK DATE	ADDRESS	STREETNAME	CITY
Main	4/27/2007			
Main	8/4/2014			
Main	7/6/2016			
Main	9/7/2016			
Main	8/29/2018			
Main	2/22/2019			
Main	8/4/2021			
Total				

CONFIDENTIAL

4. Project Risk Score (PRS)

In 2018 Suburban engaged HDR to perform an independent condition analysis of the pipeline infrastructure. HDR updated the study in 2022. See HDR's Suburban Water Systems Water Main Renewal Technical Memorandum 2022 included in Workpaper VOLUME III-E (HDR TM). To evaluate the system, HDR developed a Risk Model for pipeline renewal and replacement. This model calculated a Project Risk Score (PRS) to quantify the relative risk of failure from very low to severe. This methodology considers the likelihood of failure (LoF) and the consequence of failure (CoF) of the main. Each of the PRS criterion (LoF and CoF) are made up of many factors. Figure 4 summarizes the PRS calculation methodology.

Figure 4. Risk Calculation Method



4.1 PRS Calculation Methodology

As shown in Figure 4, the LoF weight is 75 percent and the CoF weight is 25 percent. The PRS is on a scale of zero to one hundred, LoF can contribute up to 75 points, and the CoF can contribute up to 25 points. Each factor was scored on a 0 to 10 scale (Factor Score), where 0 represents the lowest risk, and 10 represents the highest risk. A detailed explanation of each factor is explained in chapter 4 of the technical memorandum. Each pipeline segment is calculated separately for its LoF and CoF based on the following equation:

$$\text{LoF Score} = \sum (\text{LoF Factor Score} \times 10 \times \text{Weight} \times \text{Criterion Weight})$$

$$\text{CoF Score} = \sum (\text{CoF Factor Score} \times 10 \times \text{Weight} \times \text{Criterion Weight})$$

The PRS for each segment is the summation of LoF and CoF:

$$\text{PRS} = \text{LoF Score} + \text{CoF Score}$$

The final PRS for the entire project is a weighted average of pipe risk score by length:

$$\textbf{Final Project Risk Score} = \sum (\textbf{PRS x Length}) \div \sum (\textbf{Length})$$

4.2 PRS Calculation Result

Table 3 below summarizes the PRS provided by HDR TM 2022 for this replacement project.

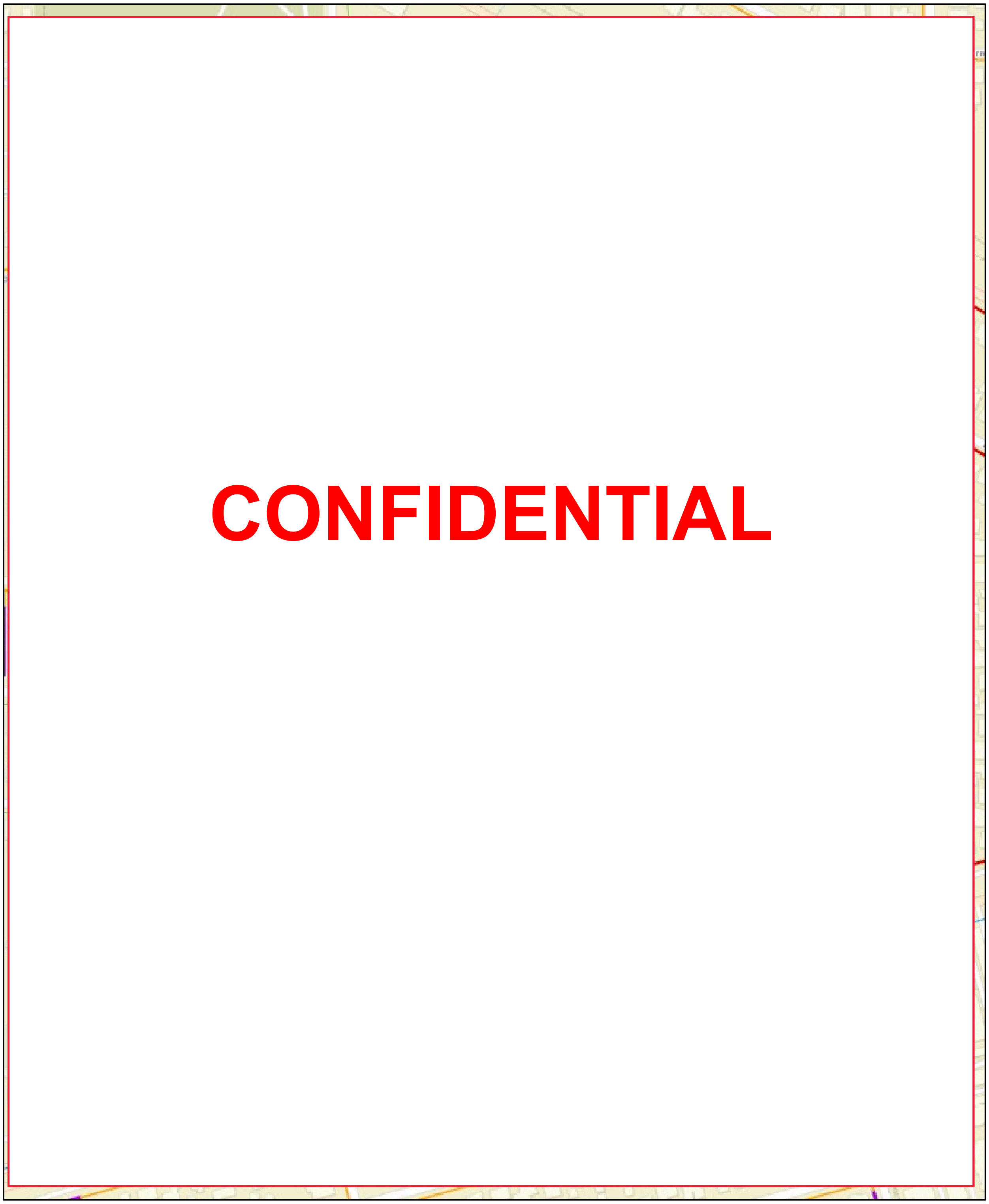
Table 3. Summary of PRS

Project #	Sum of Pipe_Length*	Average of LoF_PRS	Average of CoF_PRS	Average of PRS
408-WW-3	13,220	67.3	-0.9	66.4

*: The pipe length in Table 3 is from the current GIS database. The estimated replacement length is different. It is measured with new alignments, appurtenances, tie-ins, and any line segment within the project boundary but not included in the current GIS under the same Project Number.

Figure 5 is the PRS map for this project from HDR TM 2022.

Figure 5. Project Risk Score Map



5. Improvement Alternative's Summary

Alternative 1 – Do nothing. This alternative continues to use the existing pipelines, resulting in continued repairs when breaks occur. This is an undesirable option because the pipelines will continue to fail, interrupting service customers. This will cause poor customer service and higher costs for repairs and piecemeal replacement.

Alternative 2 – Rehabilitate the existing water main. Three rehabilitation methods were evaluated for this alternative.

- Pipebursting
- Sliplining
- Cured-In-Place Pipe (CIPP)

A detailed description of each rehabilitation method is shown below.

Pipebursting – Pipebursting is a method by which the existing pipe is opened and forced outward by a bursting tool. A hydraulic or pneumatic expansion head (part of the bursting tool) is pulled through the existing pipeline, typically using a cable and winch. As the expansion head is pulled through the existing pipe, it pushes that pipe radially outward until it breaks apart, creating a space for the new pipe. The bursting device also pulls the new pipeline behind it, immediately filling the void created by the old, burst pipe with the new pipe. Pipebursting can be used to replace the existing pipe with a similarly sized or larger pipe.

Pipebursting is not recommended if the existing pipe is asbestos cement because the process leaves broken asbestos pieces in the ground. When the pipe is disturbed, it is considered a waste disposal site and is subject to National Emission Standards for Hazardous Air Pollutants (NESHAP) requirements. Friable asbestos fibers lead to cancer of the lungs, known as mesothelioma. Future maintenance activities such main repairs due to breaks or replacing service lines will be required and may lead to health concerns.

Sliplining – Sliplining is inserting a new pipe by pulling or pushing it into the existing pipe and grouting the annular space. After it is in place, the pipe is grouted to hold the lining in place and for additional rigidity.

Sliplining new pipes will generally have a significantly reduced cross-sectional area. Sliplining is not recommended if maintaining or increasing fire flow in the area is required.

CIPP – A cured-in-place pipe (CIPP) is a trenchless rehabilitation method to repair existing pipelines. It is a jointless, seamless pipelining within an existing pipe. The process of CIPP involves inserting and running a felt lining into a pre-existing pipe that is the subject of repair. The resin within the liner is then exposed to a curing element to make it attach to the inner walls of the pipe. Once fully cured, the lining now acts as a new pipeline.

Like sliplining, CIPP is not recommended if maintaining or increasing fire flow is required because the cross-sectional area of the pipeline after rehabilitation is reduced.

There are some common limitations for all three rehabilitation methods compared with open trench replacement:

1. Rehabilitation methods are used for sewer pipelines. Sewer pipelines are straight and are usually deeper than water lines. Offsets and fittings make using these methods more costly. Open trenching deep sewer mains are also more expensive than water mains installed 42-60 inches deep.
2. Typically, there is only one main in the street that serves customers and cannot be switched to other mains during the construction of a new main. A temporary by-pass system is required to provide continuous service to customers. During summer, water in the by-pass pipe is heated because it is in direct contact with the sun. Driveways are blocked by the above-ground pipe and can easily be damaged.
3. Installation pits are required when horizontal and vertical alignment changes are substantial that the new pipe won’t be able to pull or push through the existing pipe. Most Suburban’s record drawings in the 50s and 60s don’t include profile views of the pipelines, and it is suspected that there are multiple offsets. Offsets are required to avoid underground utilities such as gas, cable, water, and storm drain. Most often, water lines cross these utilities multiple times on a street. Digging pits will result in delays and continuous customer interruptions and increase construction costs.
4. Open trench pipe replacement method minimizes water interruptions to one, eight (8) hour shutdown to connect the new pipeline to the existing system, and one, thirty (30) minute shutdown to switch customer services. Mains must be pressure tested and disinfected. There are occasions when passing bacteriological testing can take several weeks due to positive e-coli results. Open trench replacement allows new mains, valves, and service connections to be pressure tested and disinfected before the final shut down to connect to the existing system. Trenchless rehabilitation of the existing pipelines can only be constructed section by section. Each section requires a much

longer shutdown time for service connection, pressure testing, and disinfection to bring back the service and move on to the next one. Replacing the pipelines using rehabilitation techniques will add more time to the project resulting in more costs.

Rehabilitation methods are good alternatives for specific applications like steep hills, where surfaces cannot be disturbed, and if there are no service connections on the main. Suburban's pipeline contractors have not performed rehabilitation methods on residential streets with services. Health and environmental concerns have not been fully addressed when using them on AC pipes. Additional fittings and offsets require more deep excavation pits and will increase the cost and duration of the project. It is not recommended to rehabilitate neighborhood pipelines and continue replacing pipelines using an open trench method.

Alternative 3 – Replace existing water mains with approximately 13,250 L.F. of 6", 8", and 12" PVC pipes and associated appurtenances, as shown in Table 1. This Alternative will improve the integrity of the distribution system, eliminate service interruptions in this area, and ensure safe and reliable service to the customers.

According to the Association for the Advancement of Cost Engineering, this alternative is Class 3 of Opinion of Probable Construction Cost (OPCC) for constructing the replacement pipelines. The expected accuracy range for Class 3 is between +10% to +30%. Therefore, a 10% contingency is used in the OPCC.

Description	Quantity	Unit	Unit Cost	Cost
Construct 12-inch PVC	250	L.F.	$190	$47,500
12-inch Butterfly Valves	1	Each	$4,050	$4,050
12-inch Tie-In	2	Each	$8,900	$17,800
Construct 8-inch PVC	6,150	L.F.	$130	$799,500
8-inch Gate Valves	11	Each	$1,960	$21,560
8-inch Tie-In	4	Each	$6,840	$27,360
Construct 6-inch PVC	6,850	L.F.	$120	$822,000
6-inch Gate Valve	14	Each	$1,660	$23,240
6-inch Fire Hydrant	17	Each	$10,870	$184,790
1-inch service	265	Each	$2,110	$559,150
AC Removal and Replacement	13,250	L.F.	$50	$662,500
Construct Pipeline Offset	53	Each	$3,500	$185,500
Cut, Plug and Abandon of Existing Pipeline	1	LS	$9,034	$9,034
Traffic Rated (H-20) Meter Lids	265	Each	$250	$66,250
Install Test Head Furnishing for Pressure Testing	13	Each	$3,610	$46,930
Landscaping Removal & Replacement	1	LS	$12,644	$12,644
Guard underground services	1	LS	$16,540	$16,540
Line Item Subtotal				$3,506,348
Mobilization			3%	$105,190
De-mobilization			2%	$70,127
Construction Subtotal				**$3,681,665**
Engineering and Inspection			12%	$441,800
Subtotal				$4,123,465
Contingency			10%	$412,347
Subtotal				$4,535,812
General Administration			9%	$408,223
Total				**$4,944,000**

6. Basis for Budgeted Cost

The total OPCC includes Engineering and Inspection, General Administration, and Contingency factors. The Engineering and Inspection factor accounts for the estimated direct cost required to plan, design, and inspect the project, the cost of permit fees, and the cost of internal labor. The General Administration factor considers Suburban’s general administrative expenses. The contingency factor accounts for unforeseen construction conflicts and complications that could result in additional project costs.

7. Impact of Deferral

The longer this pipeline replacement is deferred, the older the pipes will become, the likelihood of failure will increase, and the frequency of breaks will increase. The breaks will increasingly cause undesirable service interruptions to customers, and the overall system condition will exponentially worsen.

8. Recommendation

- Alternative #1 is not feasible because it does not resolve the interruptions of service issues to customers and does not prevent the degradation of the integrity of the water system infrastructure in this area.
- Alternative #2 has limitations with making this Alternative lose its cost-benefit and construction efficiency.
- Alternative #3 is recommended because it provides full reliability, quality, and abundance of service to the customer in the area. Suburban recommends Alternative #3.

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PROJECT DESIGN REPORT

FROM: Engineering Department
DATE: July 29, 2022
DISTRICT: WLM
SUBJECT: Orange Ave. and Sherway St. Pipeline Replacement; CP-502

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1. Executive Summary

The existing 4-inch, 6-inch, 8-inch asbestos cement (AC) mains, and 4-inch steel main in Orange Avenue and Sherway Street area have experienced many breaks in the past years. They have reached the end of their useful lives and do not provide an adequate level of service to the customers. It is recommended that these 4-inch to 8-inch mains are replaced by approximately 5,360 LF of 6-inch and 8-inch PVC mains to provide a safe and reliable water supply to the customers in the area.

2. Introduction

The existing 4-inch, 6-inch, and 8-inch AC mains in the City of West Covina on Orange Avenue, Sherway Street, and adjacent streets, in the area east of both Orange Avenue, west of Walnut Creek, and south of Sherway have experienced frequent main breaks. The breaks result in service interruptions and inconvenience to customers. Suburban has made piecemeal repairs to continue to provide service to its customers, but this is not a long-term solution. The water mains have reached the end of their useful lives. It is recommended to replace these existing 4-inch to 8-inch mains with approximately 5,360 LF of 6-inch and 8-inch PVC Pipes in the project area to provide a safe and reliable water supply to the customers.

Table 1 demonstrates a summary of the proposed pipeline replacement in this project, and Figure 1 shows the map of the project area. This project has been grouped per the recommendations of the pipeline condition assessment to include all mains that were constructed as part of this tract and are expected to continue to experience breaks. A detailed explanation of the grouping is outlined in Chapter 1 of the "*Suburban Water Systems Water Main Renewal Technical Memorandum, 2022,*" included in Workpaper VOLUME III-E.

Table 1. Replacement Schedule

Quantity	**Existing Main**		**Proposed Main**	
(feet)	**Size** (inch)	**Material**	**Size** (inch)	**Material**
2,400	4	AC	6	PVC
1,760	6	AC	6	PVC
1,200	8	STL	8	PVC
5,360				

Figure 1. Project Area and Break Map

3. Project Background

Record drawing (Figure 2) show that most existing pipe materials are AC pipes, except the 4-inch main on Walnut Creek Pkwy is steel pipe. These pipelines were originally built in 1948 during the development of TRACT 15063 under Drawing Number 053-SK-2. They are a part of the distribution system in the 547 Zone in the San Jose Hills District of Suburban.

Figure 2. Record Drawing

The proposed project is in the Disadvantage Areas according to SB 535 (see Figure 3).

Figure 3. Project in the SB 535 Disadvantage Areas

Suburban Water Systems (Suburban) started having water main break data in 1998. All the main breaks for this project from 1998 to 2021 are also shown in Table 2 and illustrated with green dots in Figure 1.

Table 2. Break Record

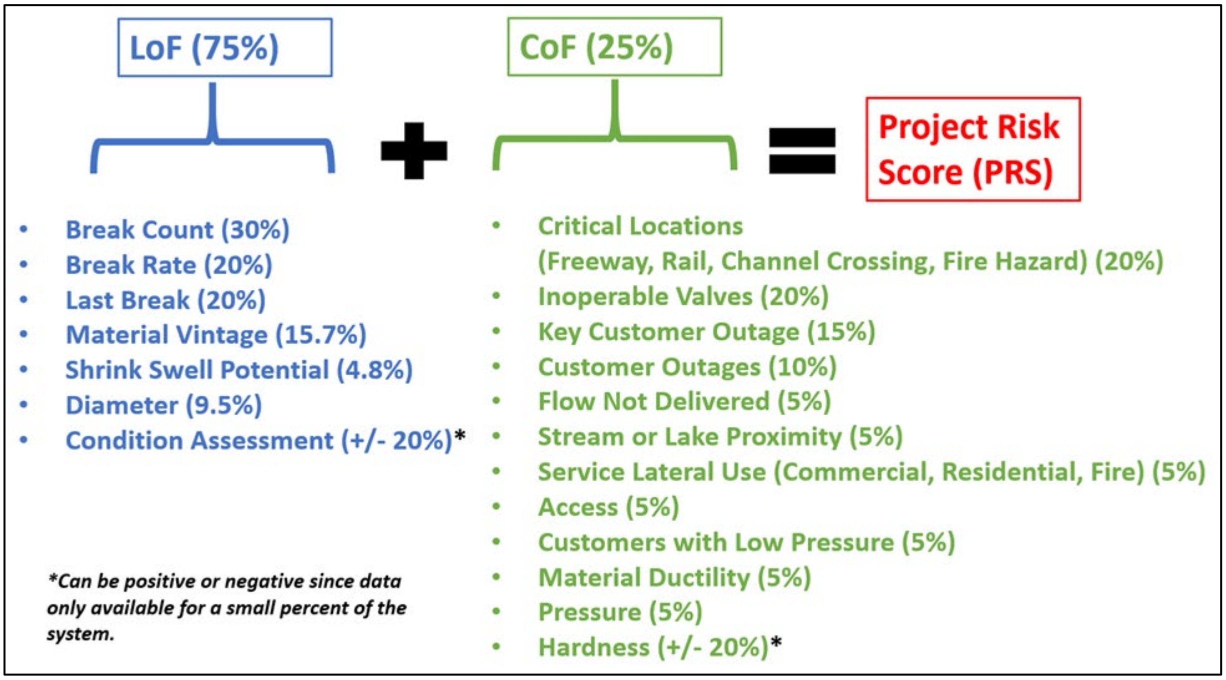
BREAK TYPE	BREAK DATE	ADDRESS	STREET	CITY
Main	1/30/2003			
Main	6/30/2005			
Main	3/1/2013			
Main	5/17/2015			
Main	1/14/2019			
TOTAL				

CONFIDENTIAL

4. Project Risk Score (PRS)

In 2018 Suburban engaged HDR to perform an independent condition analysis of the pipeline infrastructure. HDR updated the study in 2022. See HDR's Suburban Water Systems Water Main Renewal Technical Memorandum 2022 included in Workpaper VOLUME III-E (HDR TM). To evaluate the system, HDR developed a Risk Model for pipeline renewal and replacement. This model calculated a Project Risk Score (PRS) to quantify the relative risk of failure from very low to severe. This methodology considers the likelihood of failure (LoF) and the consequence of failure (CoF) of the main. Each of the PRS criterion (LoF and CoF) are made up of many factors. Figure 4 summarizes the PRS calculation methodology.

Figure 4. Risk Calculation Method



4.1 PRS Calculation Methodology

As shown in Figure 4, the LoF weight is 75 percent and the CoF weight is 25 percent. The PRS is on a scale of zero to one hundred, LoF can contribute up to 75 points, and the CoF can contribute up to 25 points. Each factor was scored on a 0 to 10 scale (Factor Score), where 0 represents the lowest risk, and 10 represents the highest risk. A detailed explanation of each factor is explained in chapter 4 of the technical memorandum. Each pipeline segment is calculated separately for its LoF and CoF based on the following equation:

$$\text{LoF Score} = \sum (\text{LoF Factor Score} \times 10 \times \text{Weight} \times \text{Criterion Weight})$$

$$\text{CoF Score} = \sum (\text{CoF Factor Score} \times 10 \times \text{Weight} \times \text{Criterion Weight})$$

The PRS for each segment is the summation of LoF and CoF:

$$\text{PRS} = \text{LoF Score} + \text{CoF Score}$$

The final PRS for the entire project is a weighted average of pipe risk score by length:

$$\textbf{Final Project Risk Score} = \sum \textbf{(PRS x Length)} \div \sum \textbf{(Length)}$$

4.2 PRS Calculation Result

Table 3 below summarizes the PRS provided by HDR TM 2022 for this replacement project.

Table 3. Summary of PRS

Project #	Sum of Pipe_Length*	Average of LoF_PRS	Average of CoF_PRS	Average of PRS
053-SK-2	4,780	65.0	1.4	63.7

*: The pipe length in Table 3 is from the current GIS database. The estimated replacement length is different. It is measured with new alignments, appurtenances, tie-ins, and any line segment within the project boundary but not included in the current GIS under the same Project Number.

Figure 5 is the PRS map for this project from HDR TM 2022.

Figure 5. Project Risk Score Map

5. Improvement Alternative's Summary

Alternative 1 – Do nothing. This alternative continues to use the existing pipelines, resulting in continued repairs when breaks occur. This is an undesirable option because the pipelines will continue to fail, interrupting service customers. This will cause poor customer service and higher costs for repairs and piecemeal replacement.

Alternative 2 – Rehabilitate the existing water main. Three rehabilitation methods were evaluated for this alternative.

- Pipebursting
- Sliplining
- Cured-In-Place Pipe (CIPP)

A detailed description of each rehabilitation method is shown below.

Pipebursting – Pipebursting is a method by which the existing pipe is opened and forced outward by a bursting tool. A hydraulic or pneumatic expansion head (part of the bursting tool) is pulled through the existing pipeline, typically using a cable and winch. As the expansion head is pulled through the existing pipe, it pushes that pipe radially outward until it breaks apart, creating a space for the new pipe. The bursting device also pulls the new pipeline behind it, immediately filling the void created by the old, burst pipe with the new pipe. Pipebursting can be used to replace the existing pipe with a similarly sized or larger pipe.

Pipebursting is not recommended if the existing pipe is asbestos cement because the process leaves broken asbestos pieces in the ground. When the pipe is disturbed, it is considered a waste disposal site and is subject to National Emission Standards for Hazardous Air Pollutants (NESHAP) requirements. Friable asbestos fibers lead to cancer of the lungs, known as mesothelioma. Future maintenance activities such main repairs due to breaks or replacing service lines will be required and may lead to health concerns.

Sliplining – Sliplining is inserting a new pipe by pulling or pushing it into the existing pipe and grouting the annular space. After it is in place, the pipe is grouted to hold the lining in place and for additional rigidity.

Sliplining new pipes will generally have a significantly reduced cross-sectional area. Sliplining is not recommended if maintaining or increasing fire flow in the area is required.

CIPP – A cured-in-place pipe (CIPP) is a trenchless rehabilitation method to repair existing pipelines. It is a jointless, seamless pipelining within an existing pipe. The process of CIPP involves inserting and running a felt lining into a pre-existing pipe that is the subject of repair. The resin within the liner is then exposed to a curing element to make it attach to the inner walls of the pipe. Once fully cured, the lining now acts as a new pipeline.

Like sliplining, CIPP is not recommended if maintaining or increasing fire flow is required because the cross-sectional area of the pipeline after rehabilitation is reduced.

There are some common limitations for all three rehabilitation methods compared with open trench replacement:

1. Rehabilitation methods are used for sewer pipelines. Sewer pipelines are straight and are usually deeper than water lines. Offsets and fittings make using these methods more costly. Open trenching deep sewer mains are also more expensive than water mains installed 42-60 inches deep.
2. Typically, there is only one main in the street that serves customers and cannot be switched to other mains during the construction of a new main. A temporary by-pass system is required to provide continuous service to customers. During summer, water in the by-pass pipe is heated because it is in direct contact with the sun. Driveways are blocked by the above-ground pipe and can easily be damaged.
3. Installation pits are required when horizontal and vertical alignment changes are substantial that the new pipe won't be able to pull or push through the existing pipe. Most Suburban's record drawings in the 50s and 60s don't include profile views of the pipelines, and it is suspected that there are multiple offsets. Offsets are required to avoid underground utilities such as gas, cable, water, and storm drain. Most often, water lines cross these utilities multiple times on a street. Digging pits will result in delays and continuous customer interruptions and increase construction costs.
4. Open trench pipe replacement method minimizes water interruptions to one, eight (8) hour shutdown to connect the new pipeline to the existing system, and one, thirty (30) minute shutdown to switch customer services. Mains must be pressure tested and disinfected. There are occasions when passing bacteriological testing can take several weeks due to positive e-coli results. Open trench replacement allows new mains, valves, and service connections to be pressure tested and disinfected before the final shut down to connect to the existing system. Trenchless rehabilitation of the existing pipelines can only be constructed section by section. Each section requires a much

longer shutdown time for service connection, pressure testing, and disinfection to bring back the service and move on to the next one. Replacing the pipelines using rehabilitation techniques will add more time to the project resulting in more costs.

Rehabilitation methods are good alternatives for specific applications like steep hills, where surfaces cannot be disturbed, and if there are no service connections on the main. Suburban's pipeline contractors have not performed rehabilitation methods on residential streets with services. Health and environmental concerns have not been fully addressed when using them on AC pipes. Additional fittings and offsets require more deep excavation pits and will increase the cost and duration of the project. It is not recommended to rehabilitate neighborhood pipelines and continue replacing pipelines using an open trench method.

Alternative 3 – Replace existing water mains with approximately 7,950 L.F. of 4", 6", and 8" PVC pipes and associated appurtenances, as shown in Table 1. This Alternative will improve the integrity of the distribution system, eliminate service interruptions in this area, and ensure safe and reliable service to the customers.

According to the Association for the Advancement of Cost Engineering, this alternative is Class 3 of Opinion of Probable Construction Cost (OPCC) for constructing the replacement pipelines. The expected accuracy range for Class 3 is between +10% to +30%. Therefore, a 10% contingency is used in the OPCC.

Description	Quantity	Unit	Unit Cost	Cost
Construct 8-inch PVC	1,200	L.F.	$130	$156,000
8-inch Gate Valves	4	Each	$1,960	$7,840
8-inch Tie-In	3	Each	$6,840	$20,520
Construct 6-inch PVC	4,160	L.F.	$120	$499,200
6-inch Gate Valve	10	Each	$1,660	$16,600
6-inch Fire Hydrant	11	Each	$10,870	$119,570
1-inch service	105	Each	$2,110	$221,550
AC Removal and Replacement	5,360	L.F.	$50	$268,000
Construct Pipeline Offset	22	Each	$3,500	$77,000
Cut, Plug and Abandon of Existing Pipeline	1	LS	$9,034	$9,034
Traffic Rated (H-20) Meter Lids	105	Each	$250	$26,250
Install Test Head Furnishing for Pressure Testing	5	Each	$3,610	$18,050
Landscaping Removal & Replacement	1	LS	$12,644	$12,644
Guard underground services	1	LS	$16,540	$16,540
Line Item Subtotal				$1,468,798
Mobilization			3%	$44,064
De-mobilization			2%	$29,376
Construction Subtotal				**$1,542,238**
Engineering and Inspection			12%	$185,069
Subtotal				$1,727,306
Contingency			10%	$172,731
Subtotal				$1,900,037
General Administration			9%	$171,003
Total				**$2,071,000**

6. Basis for Budgeted Cost

The total OPCC includes Engineering and Inspection, General Administration, and Contingency factors. The Engineering and Inspection factor accounts for the estimated direct cost required to plan, design, and inspect the project, the cost of permit fees, and the cost of internal labor. The General Administration factor considers Suburban’s general administrative expenses. The contingency factor accounts for unforeseen construction conflicts and complications that could result in additional project costs.

7. Impact of Deferral

The longer this pipeline replacement is deferred, the older the pipes will become, the likelihood of failure will increase, and the frequency of breaks will increase. The breaks will increasingly cause undesirable service interruptions to customers, and the overall system condition will exponentially worsen.

8. Recommendation

- Alternative #1 is not feasible because it does not resolve the interruptions of service issues to customers and does not prevent the degradation of the integrity of the water system infrastructure in this area.
- Alternative #2 has limitations with making this Alternative lose its cost-benefit and construction efficiency.
- Alternative #3 is recommended because it provides full reliability, quality, and abundance of service to the customer in the area. Suburban recommends Alternative #3.

W-10

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PROJECT DESIGN REPORT

FROM: Engineering Department
DATE: July 29, 2022
DISTRICT: WLM
SUBJECT: Willow Ave. and Alwood St. Pipeline Replacement; CP-503

1. Executive Summary

The existing 4-inch and 6-inch asbestos cement (AC) mains in Willow Avenue and Alwood Street area have experienced many breaks in the past years. They have reached the end of their useful lives and do not provide an adequate level of service to the customers. It is recommended that these 4-inch and 6-inch mains are replaced by approximately 4,160 LF of 6-inch PVC mains to provide a safe and reliable water supply to the customers in the area.

2. Introduction

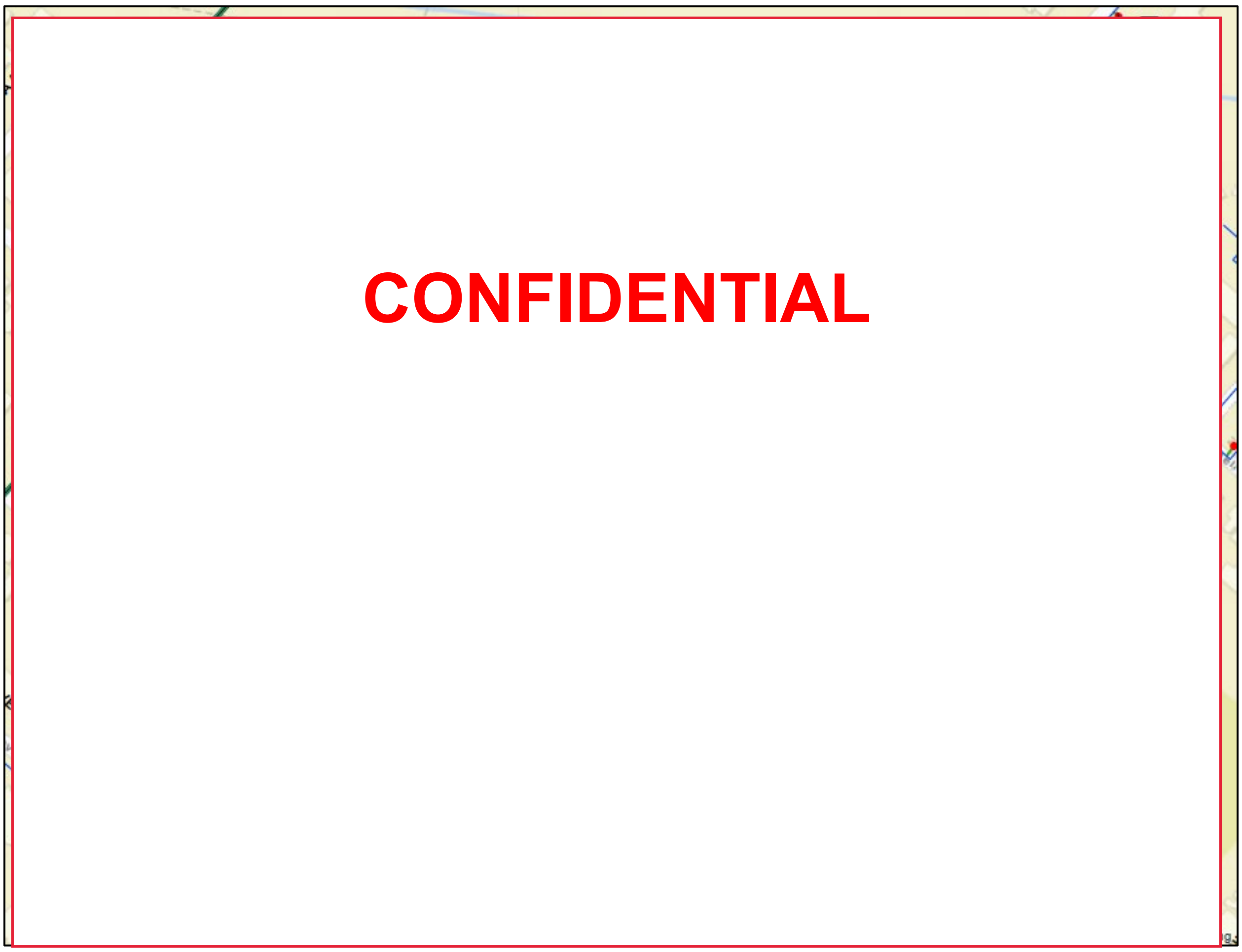
The existing 4-inch and 6-inch AC mains in the City of West Covina on Willow Avenue, Alwood Street, and adjacent streets, in the area west of Willow Avenue, south of Yarnell Street, and north of Alwood, next to the San Jose Charter School, have experienced frequent main breaks. The breaks result in service interruptions and inconvenience to customers. Suburban has made piecemeal repairs to continue to provide service to its customers, but this is not a long-term solution. The water mains have reached the end of their useful lives. It is recommended to replace these existing 4-inch and 6-inch mains with approximately 4,160 LF 6-inch PVC Pipes in the project area to provide a safe and reliable water supply to the customers.

Table 1 demonstrates a summary of the proposed pipeline replacement in this project, and Figure 1 shows the map of the project area. This project has been grouped per the recommendations of the pipeline condition assessment to include all mains that were constructed as part of this tract and are expected to continue to experience breaks. A detailed explanation of the grouping is outlined in Chapter 1 of the "*Suburban Water Systems Water Main Renewal Technical Memorandum, 2022,*" included in Workpaper VOLUME III-E. In addition, an adjacent main is included in this project to abandon a segment in the customer's backyard and reduce future service interceptions.

Table 1. Replacement Schedule

Quantity	**Existing Main**		**Proposed Main**	
(feet)	**Size** (inch)	**Material**	**Size** (inch)	**Material**
2,980	4	AC	6	PVC
1,180	6	AC	6	PVC
4,160				

Figure 1. Project Area and Break Map



3. Project Background

Record drawings (Figure 2, Figure 3) show the existing pipe materials are AC pipes. The pipelines were originally built in 1948 under Drawing Number 053-SK-2 and under Project Number 62-1549 in 1962 for the development of TRACT 25749. Below are the two projects for the pipelines included in this proposed project. They are a part of the distribution system in the 547 Zone in the San Jose Hills District of Suburban.

- Drawing Number: 053-SK-2, built in 1948, Figure 2
- Project Number: 62-1549, TRACT 25749, built in 1962, Figure 3

Figure 2. Record Drawing 1

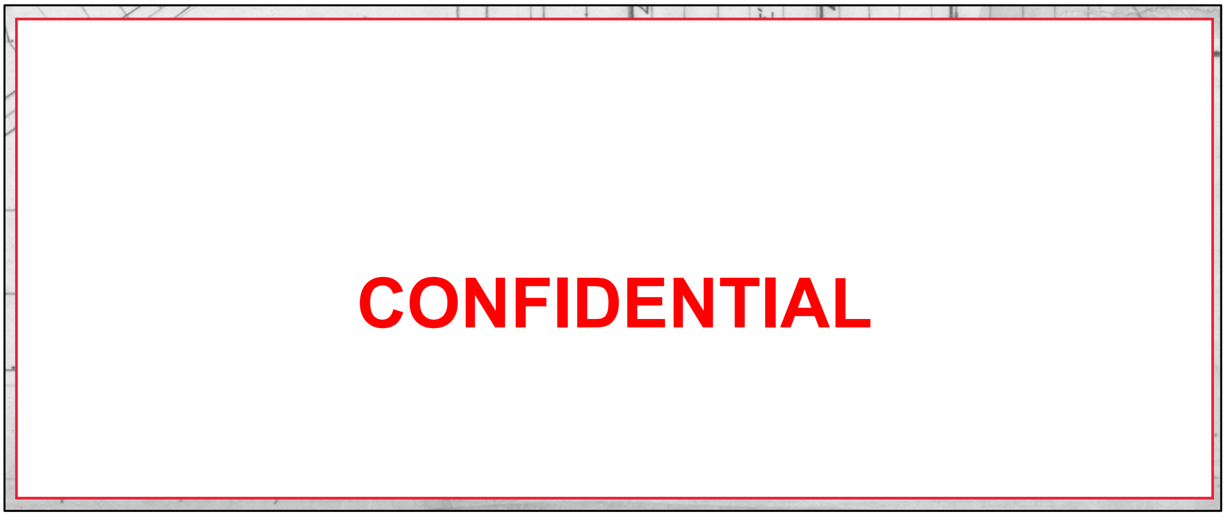
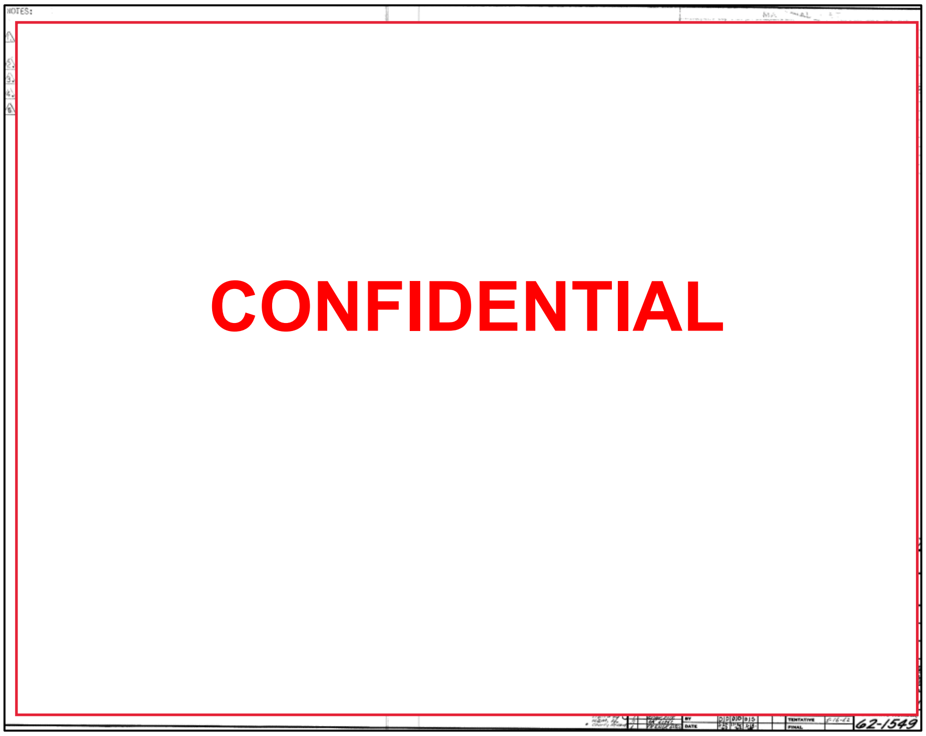


Figure 3. Record Drawing 2



Suburban Water Systems (Suburban) started having water main break data in 1998. All the main breaks for this project from 1998 to 2021 are also shown in Table 2 and illustrated with green dots in Figure 1.

Table 2. Break Record

BREAK TYPE	BREAK DATE	ADDRESS	STREET	CITY
Main	8/13/2007			
Main	10/7/2010			
Main	3/18/2013		CONFIDENTIAL	
Main	4/21/2014			
Main	11/8/2021			
TOTAL				

In the past, Suburban has tested fire flow in the proposed project area twice on Fire Hydrant No. 3514. The fire flow results in Table 3 indicate inadequate fire flow to the customers in this service area. To meet the minimum fire flow requirement at 1,250gpm at 20 psi, the existing 4-inch water mains must be replaced with at least a 6-inch water main.

Table 3. Fire Flow Result

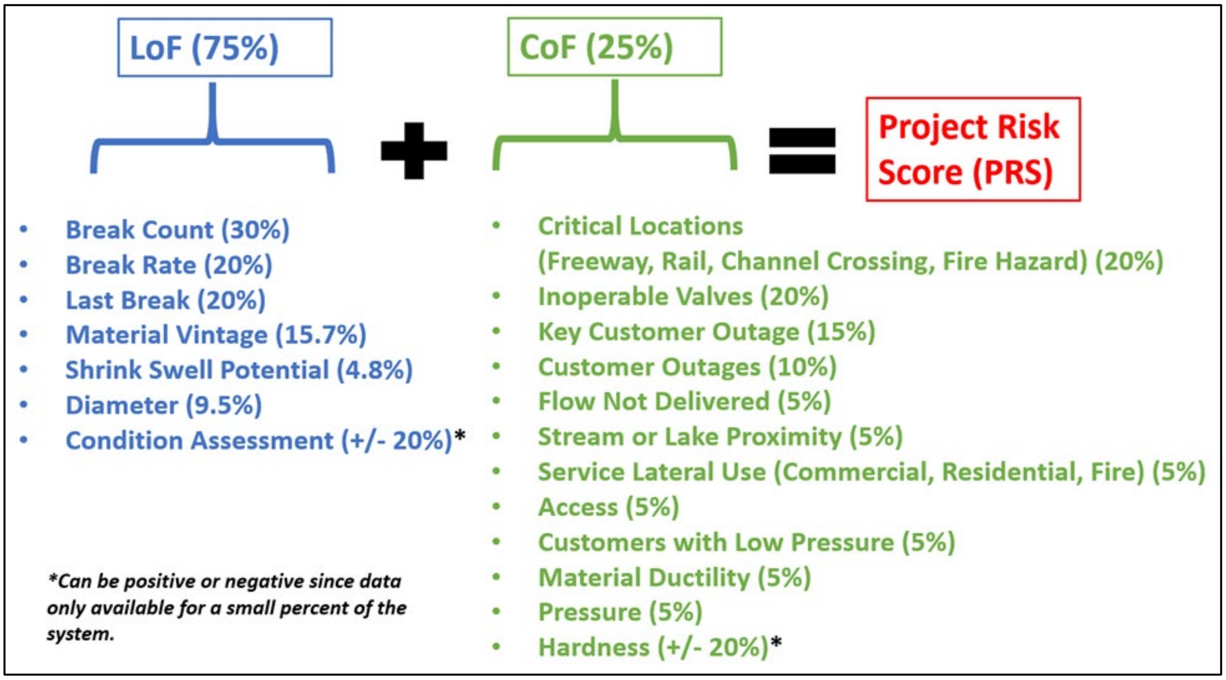
Criteria:- FH Number: 3514

No.	FH No	Date	District	Flow Type	Zone	Government agency	GPM@20psi
1	3514	04-22-2020	SJH	Single	547	WEST COVINA	1065
2	3514	02-10-2022	SJH	Single	547	WEST COVINA	736

4. Project Risk Score (PRS)

In 2018 Suburban engaged HDR to perform an independent condition analysis of the pipeline infrastructure. HDR updated the study in 2022. See HDR's Suburban Water Systems Water Main Renewal Technical Memorandum 2022 included in Workpaper VOLUME III-E (HDR TM). To evaluate the system, HDR developed a Risk Model for pipeline renewal and replacement. This model calculated a Project Risk Score (PRS) to quantify the relative risk of failure from very low to severe. This methodology considers the likelihood of failure (LoF) and the consequence of failure (CoF) of the main. Each of the PRS criterion (LoF and CoF) are made up of many factors. Figure 4 summarizes the PRS calculation methodology.

Figure 4. Risk Calculation Method



4.1 PRS Calculation Methodology

As shown in Figure 4, the LoF weight is 75 percent and the CoF weight is 25 percent. The PRS is on a scale of zero to one hundred, LoF can contribute up to 75 points, and the CoF can contribute up to 25 points. Each factor was scored on a 0 to 10 scale (Factor Score), where 0 represents the lowest risk, and 10 represents the highest risk. A detailed explanation of each factor is explained in chapter 4 of the technical memorandum. Each pipeline segment is calculated separately for its LoF and CoF based on the following equation:

LoF Score = ∑ (LoF Factor Score x 10 x Weight x Criterion Weight)

CoF Score = ∑ (CoF Factor Score x 10 x Weight x Criterion Weight)

The PRS for each segment is the summation of LoF and CoF:

PRS = LoF Score + CoF Score

The final PRS for the entire project is a weighted average of pipe risk score by length:

Final Project Risk Score = ∑ (PRS x Length) ÷ ∑ (Length)

4.2 PRS Calculation Result

Table 4 below summarizes the PRS provided by HDR TM 2022 for this replacement project.

Table 4. Summary of PRS

Project #	Sum of Pipe_Length*	Average of LoF_PRS	Average of CoF_PRS	Average of PRS
053-SK-2	2,923	65.0	1.4	63.7

*****: The pipe length in Table 4 is from the current GIS database. The estimated replacement length is different. It is measured with new alignments, appurtenances, tie-ins, and any line segment within the project boundary but not included in the current GIS under the same Project Number.

Figure 5 is the PRS map for this project from HDR TM 2022.

Figure 5. Project Risk Score Map

5. Improvement Alternative's Summary

Alternative 1 – Do nothing. This alternative continues to use the existing pipelines, resulting in continued repairs when breaks occur. This is an undesirable option because the pipelines will continue to fail, interrupting service customers. This will cause poor customer service and higher costs for repairs and piecemeal replacement.

Alternative 2 – Rehabilitate the existing water main. Three rehabilitation methods were evaluated for this alternative.

- Pipebursting
- Sliplining
- Cured-In-Place Pipe (CIPP)

A detailed description of each rehabilitation method is shown below.

Pipebursting – Pipebursting is a method by which the existing pipe is opened and forced outward by a bursting tool. A hydraulic or pneumatic expansion head (part of the bursting tool) is pulled through the existing pipeline, typically using a cable and winch. As the expansion head is pulled through the existing pipe, it pushes that pipe radially outward until it breaks apart, creating a space for the new pipe. The bursting device also pulls the new pipeline behind it, immediately filling the void created by the old, burst pipe with the new pipe. Pipebursting can be used to replace the existing pipe with a similarly sized or larger pipe.

Pipebursting is not recommended if the existing pipe is asbestos cement because the process leaves broken asbestos pieces in the ground. When the pipe is disturbed, it is considered a waste disposal site and is subject to National Emission Standards for Hazardous Air Pollutants (NESHAP) requirements. Friable asbestos fibers lead to cancer of the lungs, known as mesothelioma. Future maintenance activities such main repairs due to breaks or replacing service lines will be required and may lead to health concerns.

Sliplining – Sliplining is inserting a new pipe by pulling or pushing it into the existing pipe and grouting the annular space. After it is in place, the pipe is grouted to hold the lining in place and for additional rigidity.

Sliplining new pipes will generally have a significantly reduced cross-sectional area. Sliplining is not recommended if maintaining or increasing fire flow in the area is required.

CIPP – A cured-in-place pipe (CIPP) is a trenchless rehabilitation method to repair existing pipelines. It is a jointless, seamless pipelining within an existing pipe. The process of CIPP involves inserting and running a felt lining into a pre-existing pipe that is the subject of repair. The resin within the liner is then exposed to a curing element to make it attach to the inner walls of the pipe. Once fully cured, the lining now acts as a new pipeline.

Like sliplining, CIPP is not recommended if maintaining or increasing fire flow is required because the cross-sectional area of the pipeline after rehabilitation is reduced.

There are some common limitations for all three rehabilitation methods compared with open trench replacement:

1. Rehabilitation methods are used for sewer pipelines. Sewer pipelines are straight and are usually deeper than water lines. Offsets and fittings make using these methods more costly. Open trenching deep sewer mains are also more expensive than water mains installed 42-60 inches deep.
2. Typically, there is only one main in the street that serves customers and cannot be switched to other mains during the construction of a new main. A temporary by-pass system is required to provide continuous service to customers. During summer, water in the by-pass pipe is heated because it is in direct contact with the sun. Driveways are blocked by the above-ground pipe and can easily be damaged.
3. Installation pits are required when horizontal and vertical alignment changes are substantial that the new pipe won’t be able to pull or push through the existing pipe. Most Suburban’s record drawings in the 50s and 60s don’t include profile views of the pipelines, and it is suspected that there are multiple offsets. Offsets are required to avoid underground utilities such as gas, cable, water, and storm drain. Most often, water lines cross these utilities multiple times on a street. Digging pits will result in delays and continuous customer interruptions and increase construction costs.
4. Open trench pipe replacement method minimizes water interruptions to one, eight (8) hour shutdown to connect the new pipeline to the existing system, and one, thirty (30) minute shutdown to switch customer services. Mains must be pressure tested and disinfected. There are occasions when passing bacteriological testing can take several weeks due to positive e-coli results. Open trench replacement allows new mains, valves, and service connections to be pressure tested and disinfected before the final shut down to connect to the existing system. Trenchless rehabilitation of the existing pipelines can only be constructed section by section. Each section requires a much

longer shutdown time for service connection, pressure testing, and disinfection to bring back the service and move on to the next one. Replacing the pipelines using rehabilitation techniques will add more time to the project resulting in more costs.

Rehabilitation methods are good alternatives for specific applications like steep hills, where surfaces cannot be disturbed, and if there are no service connections on the main. Suburban's pipeline contractors have not performed rehabilitation methods on residential streets with services. Health and environmental concerns have not been fully addressed when using them on AC pipes. Additional fittings and offsets require more deep excavation pits and will increase the cost and duration of the project. It is not recommended to rehabilitate neighborhood pipelines and continue replacing pipelines using an open trench method.

Alternative 3 – Replace existing water mains with approximately 7,950 L.F. of 4", 6", and 8" PVC pipes and associated appurtenances, as shown in Table 1. This Alternative will improve the integrity of the distribution system, eliminate service interruptions in this area, and ensure safe and reliable service to the customers.

According to the Association for the Advancement of Cost Engineering, this alternative is Class 3 of Opinion of Probable Construction Cost (OPCC) for constructing the replacement pipelines. The expected accuracy range for Class 3 is between +10% to +30%. Therefore, a 10% contingency is used in the OPCC.

Description	Quantity	Unit	Unit Cost	Cost
Construct 6-inch PVC	4160	L.F.	$120	$499,200
6-inch Gate Valve	9	Each	$1,660	$14,940
6-inch Tie-In	3	Each	$6,550	$19,650
6-inch Fire Hydrant	7	Each	$10,870	$76,090
2-inch Blow-off	2	Each	$5,330	$10,660
4-inch service assembly	1	Each	$21,500	$21,500
1-inch service	80	Each	$2,110	$168,800
AC Removal and Replacement	4160	L.F.	$50	$208,000
Construct Pipeline Offset	17	Each	$3,500	$59,500
Cut, Plug and Abandon of Existing Pipeline	1	LS	$9,034	$9,034
Traffic Rated (H-20) Meter Lids	80	Each	$250	$20,000
Install Test Head Furnishing for Pressure Testing	4	Each	$3,610	$14,440
Landscaping Removal & Replacement	1	LS	$12,644	$12,644
Guard underground services	1	LS	$16,540	$16,540
Line Item Subtotal				$1,150,998
Mobilization			3%	$34,530
De-mobilization			2%	$23,020
Construction Subtotal				**$1,208,548**
Engineering and Inspection			12%	$145,026
Subtotal				$1,353,574
Contingency			10%	$135,357
Subtotal				$1,488,931
General Administration			9%	$134,004
Total				**$1,623,000**

6. Basis for Budgeted Cost

The total OPCC includes Engineering and Inspection, General Administration, and Contingency factors. The Engineering and Inspection factor accounts for the estimated direct cost required to plan, design, and inspect the project, the cost of permit fees, and the cost of internal labor. The General Administration factor considers Suburban's general administrative expenses. The contingency factor accounts for unforeseen construction conflicts and complications that could result in additional project costs.

7. Impact of Deferral

The longer this pipeline replacement is deferred, the older the pipes will become, the likelihood of failure will increase, and the frequency of breaks will increase. The breaks will increasingly cause undesirable service interruptions to customers, and the overall system condition will exponentially worsen.

8. Recommendation

- Alternative #1 is not feasible because it does not resolve the interruptions of service issues to customers and does not prevent the degradation of the integrity of the water system infrastructure in this area.
- Alternative #2 has limitations with making this Alternative lose its cost-benefit and construction efficiency.
- Alternative #3 is recommended because it provides full reliability, quality, and abundance of service to the customer in the area. Suburban recommends Alternative #3.

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PROJECT DESIGN REPORT

FROM: Engineering Department
DATE: July 29, 2022
DISTRICT: WLM
SUBJECT: Painter Ave. and Dittmar Dr. Pipeline Replacement; CP-501

1. Executive Summary

The existing 4-inch, 6-inch, 8-inch asbestos cement (AC) mains, and 6-inch steel main in Painter Avenue and Dittmar Drive area have experienced many breaks in the past years. They have reached the end of their useful lives, and do not provide an adequate level of service to the customers. It is recommended that these 4-inch to 8-inch mains are replaced by approximately 7,950 LF of 4-inch to 8-inch PVC mains to provide a safe and reliable water supply to the customers in the area.

2. Introduction

The existing 4-inch, 6-inch, 8-inch AC mains, and 6-inch steel main in the City of Whittier on Painter Avenue, Dittmar Drive, and adjacent streets, in the area of both sides of Painter Avenue, north of Lambert Road, south of Cullen Street, have experienced frequent main breaks. The breaks result in service interruptions and inconvenience to customers. Suburban has made piecemeal repairs to continue to provide service to its customers, but this is not a long-term solution. The water mains have reached the end of their useful lives. It is recommended to replace these existing 4-inch to 8-inch mains with approximately 7,950 LF 4-inch, 6-inch, and 8-inch PVC Pipes in the project area to provide a safe and reliable water supply to the customers.

Table 1 demonstrates a summary of the proposed pipeline replacement in this project, and Figure 1 shows the map of the project area. This project has been grouped with three severe risk projects per the recommendation of "*Suburban Water Systems Water Main Renewal Technical Memorandum, 2022,*" included in Workpaper VOLUME III-E. These three projects are geographically adjacent to each other in the area where the City of Whittier (the City) is planning to reconstruct streets. The City advises that Suburban replace these water mains before any of the City's street projects.

Table 1. Replacement Schedule

Quantity	**Existing Main**		**Proposed Main**	
(feet)	**Size** (inch)	**Material**	**Size** (inch)	**Material**
1,550	4	AC	4	PVC
940	4	AC	6	PVC
830	6	STL	6	PVC
3,170	6	AC	6	PVC
700	6	AC	8	PVC
760	8	AC	8	PVC
7,950				

Figure 1. Project Area and Break Map

3. Project Background

Record drawings (Figure 2, Figure 3, and Figure 4) show that most existing pipe materials are AC pipes, except the 6-inch main on Bright Avenue is steel pipe. These pipelines were originally built between 1950 to 1953. Below are the three projects for these pipelines included in this proposed project. They are a part of the distribution system in the 340 Zone in the Whittier / La Mirada District of Suburban.

- Project Number: 184-WW-3, TRACT 13969, built in 1950, Figure 2
- Project Number: 470-WW-3, TRACT 18109, built in 1952, Figure 3
- Project Number: 556-WW-2, TRACT 18592, built in 1953, Figure 4

Figure 2. Record Drawing 1, 184-WW-3

Figure 3. Record Drawing 2, 470-WW-3

Figure 4. Record Drawing 4, 556-WW-2

The west side of the proposed project is in the Disadvantage Areas according to SB 535 (see Figure 5).

Figure 5. Project in the SB 535 Disadvantage Areas

Suburban Water Systems (Suburban) started having water main break data in 1998. All the main breaks for this project from 1998 to 2021 are also shown in Table 2 and illustrated with green dots in Figure 1.

Table 2. Break Record

BREAK TYPE	BREAK DATE	ADDRESS	STREET	CITY
Main	3/3/1998	[redacted]	[redacted]	[redacted]
Main	6/18/1998	[redacted]	[redacted]	[redacted]
Main	2/2/1999	[redacted]	[redacted]	[redacted]
Main	10/1/1999	[redacted]	[redacted]	[redacted]
Main	11/4/1999	[redacted]	[redacted]	[redacted]
Main	7/18/2000	[redacted]	[redacted]	[redacted]
Main	7/9/2004	[redacted]	[redacted]	[redacted]

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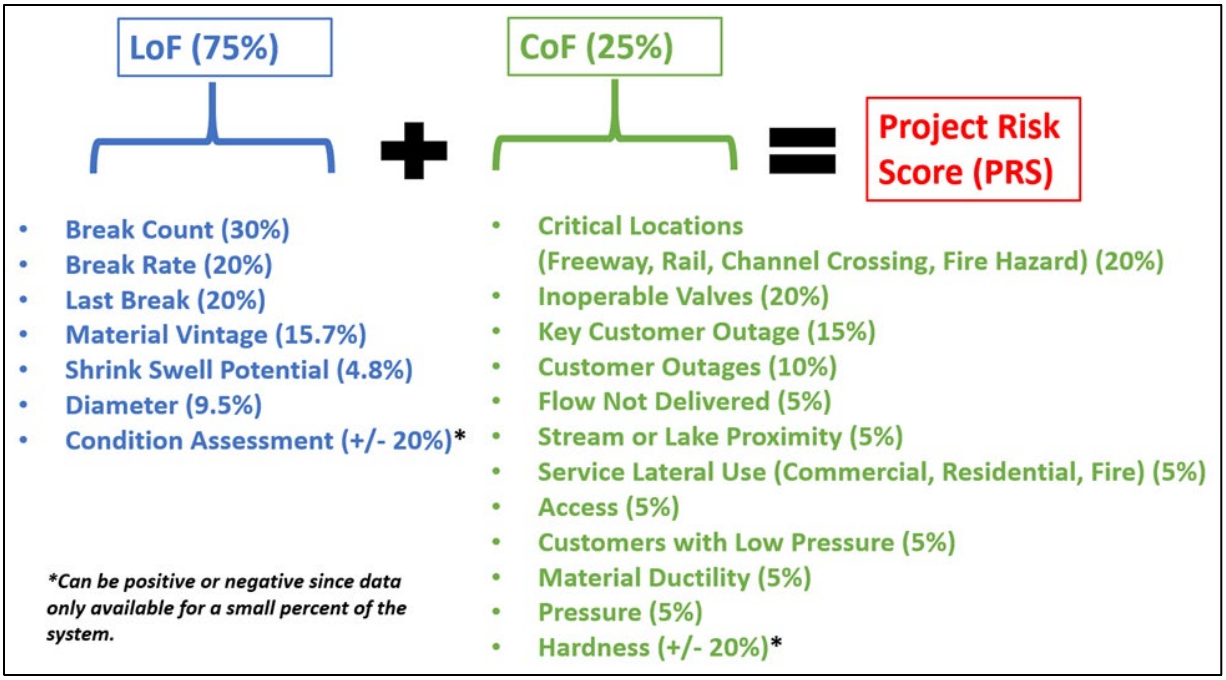
BREAK TYPE	BREAK DATE	ADDRESS	STREET	CITY
Main	10/27/2004			
Main	5/5/2006			
Main	9/23/2010			
Main	1/6/2012			
Main	9/19/2014			
Main	3/25/2015			
Main	5/10/2016	CONFIDENTIAL		
Main	1/6/2020			
Main	3/23/2020			
Main	9/1/2020			
Main	2/18/2021			
Main	3/16/2021			
Main	7/1/2021			
Main	7/13/2021			
TOTAL		21		

4. Project Risk Score (PRS)

In 2018 Suburban engaged HDR to perform an independent condition analysis of the pipeline infrastructure. HDR updated the study in 2022. See HDR's Suburban Water Systems Water Main Renewal Technical Memorandum 2022 included in Workpaper VOLUME III-E (HDR TM). To evaluate the system, HDR developed a Risk Model for pipeline renewal and replacement. This model calculated a Project Risk Score (PRS) to quantify the relative risk of failure from very low to severe. This methodology considers the likelihood of failure (LoF) and the consequence of failure (CoF) of the main. Each of the PRS criterion (LoF and CoF) are made up of many factors. Figure 6 summarizes the PRS calculation methodology.

Figure 6. Risk Calculation Method



4.1 PRS Calculation Methodology

As shown in Figure 6, the LoF weight is 75 percent and the CoF weight is 25 percent. The PRS is on a scale of zero to one hundred, LoF can contribute up to 75 points, and the CoF can contribute up to 25 points. Each factor was scored on a 0 to 10 scale (Factor Score), where 0 represents the lowest risk, and 10 represents the highest risk. A detailed explanation of each factor is explained in chapter 4 of the technical memorandum. Each pipeline segment is calculated separately for its LoF and CoF based on the following equation:

$$\text{LoF Score} = \sum (\text{LoF Factor Score} \times 10 \times \text{Weight} \times \text{Criterion Weight})$$

$$\text{CoF Score} = \sum (\text{CoF Factor Score} \times 10 \times \text{Weight} \times \text{Criterion Weight})$$

The PRS for each segment is the summation of LoF and CoF:

$$\text{PRS} = \text{LoF Score} + \text{CoF Score}$$

The final PRS for the entire project is a weighted average of pipe risk score by length:

$$\textbf{Final Project Risk Score} = \sum \textbf{(PRS x Length)} \div \sum \textbf{(Length)}$$

4.2 PRS Calculation Result

Table 3 below summarizes the PRS provided by HDR TM 2022 for this replacement project.

Table 3. Summary of PRS

Project #	Sum of Pipe_Length*	Average of LoF_PRS	Average of CoF_PRS	Average of PRS
408-WW-3	13,220	67.3	-0.9	66.4

*****: The pipe length in Table 3 is from the current GIS database. The estimated replacement length is different. It is measured with new alignments, appurtenances, tie-ins, and any line segment within the project boundary but not included in the current GIS under the same Project Number.

Figure 7 is the PRS map for this project from HDR TM 2022.

Figure 7. Project Risk Score Map

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5. Improvement Alternative's Summary

Alternative 1 – Do nothing. This alternative continues to use the existing pipelines, resulting in continued repairs when breaks occur. This is an undesirable option because the pipelines will continue to fail, interrupting service customers. This will cause poor customer service and higher costs for repairs and piecemeal replacement.

Alternative 2 – Rehabilitate the existing water main. Three rehabilitation methods were evaluated for this alternative.

- Pipebursting
- Sliplining
- Cured-In-Place Pipe (CIPP)

A detailed description of each rehabilitation method is shown below.

Pipebursting – Pipebursting is a method by which the existing pipe is opened and forced outward by a bursting tool. A hydraulic or pneumatic expansion head (part of the bursting tool) is pulled through the existing pipeline, typically using a cable and winch. As the expansion head is pulled through the existing pipe, it pushes that pipe radially outward until it breaks apart, creating a space for the new pipe. The bursting device also pulls the new pipeline behind it, immediately filling the void created by the old, burst pipe with the new pipe. Pipebursting can be used to replace the existing pipe with a similarly sized or larger pipe.

Pipebursting is not recommended if the existing pipe is asbestos cement because the process leaves broken asbestos pieces in the ground. When the pipe is disturbed, it is considered a waste disposal site and is subject to National Emission Standards for Hazardous Air Pollutants (NESHAP) requirements. Friable asbestos fibers lead to cancer of the lungs, known as mesothelioma. Future maintenance activities such main repairs due to breaks or replacing service lines will be required and may lead to health concerns.

Sliplining – Sliplining is inserting a new pipe by pulling or pushing it into the existing pipe and grouting the annular space. After it is in place, the pipe is grouted to hold the lining in place and for additional rigidity.

Sliplining new pipes will generally have a significantly reduced cross-sectional area. Sliplining is not recommended if maintaining or increasing fire flow in the area is required.

CIPP – A cured-in-place pipe (CIPP) is a trenchless rehabilitation method to repair existing pipelines. It is a jointless, seamless pipelining within an existing pipe. The process of CIPP involves inserting and running a felt lining into a pre-existing pipe that is the subject of repair. The resin within the liner is then exposed to a curing element to make it attach to the inner walls of the pipe. Once fully cured, the lining now acts as a new pipeline.

Like sliplining, CIPP is not recommended if maintaining or increasing fire flow is required because the cross-sectional area of the pipeline after rehabilitation is reduced.

There are some common limitations for all three rehabilitation methods compared with open trench replacement:

1. Rehabilitation methods are used for sewer pipelines. Sewer pipelines are straight and are usually deeper than water lines. Offsets and fittings make using these methods more costly. Open trenching deep sewer mains are also more expensive than water mains installed 42-60 inches deep.
2. Typically, there is only one main in the street that serves customers and cannot be switched to other mains during the construction of a new main. A temporary by-pass system is required to provide continuous service to customers. During summer, water in the by-pass pipe is heated because it is in direct contact with the sun. Driveways are blocked by the above-ground pipe and can easily be damaged.
3. Installation pits are required when horizontal and vertical alignment changes are substantial that the new pipe won’t be able to pull or push through the existing pipe. Most Suburban’s record drawings in the 50s and 60s don’t include profile views of the pipelines, and it is suspected that there are multiple offsets. Offsets are required to avoid underground utilities such as gas, cable, water, and storm drain. Most often, water lines cross these utilities multiple times on a street. Digging pits will result in delays and continuous customer interruptions and increase construction costs.
4. Open trench pipe replacement method minimizes water interruptions to one, eight (8) hour shutdown to connect the new pipeline to the existing system, and one, thirty (30) minute shutdown to switch customer services. Mains must be pressure tested and disinfected. There are occasions when passing bacteriological testing can take several weeks due to positive e-coli results. Open trench replacement allows new mains, valves, and service connections to be pressure tested and disinfected before the final shut down to connect to the existing system. Trenchless rehabilitation of the existing pipelines can only be constructed section by section. Each section requires a much

longer shutdown time for service connection, pressure testing, and disinfection to bring back the service and move on to the next one. Replacing the pipelines using rehabilitation techniques will add more time to the project resulting in more costs.

Rehabilitation methods are good alternatives for specific applications like steep hills, where surfaces cannot be disturbed, and if there are no service connections on the main. Suburban's pipeline contractors have not performed rehabilitation methods on residential streets with services. Health and environmental concerns have not been fully addressed when using them on AC pipes. Additional fittings and offsets require more deep excavation pits and will increase the cost and duration of the project. It is not recommended to rehabilitate neighborhood pipelines and continue replacing pipelines using an open trench method.

Alternative 3 – Replace existing water mains with approximately 7,950 L.F. of 4", 6", and 8" PVC pipes and associated appurtenances, as shown in Table 1. This Alternative will improve the integrity of the distribution system, eliminate service interruptions in this area, and ensure safe and reliable service to the customers.

According to the Association for the Advancement of Cost Engineering, this alternative is Class 3 of Opinion of Probable Construction Cost (OPCC) for constructing the replacement pipelines. The expected accuracy range for Class 3 is between +10% to +30%. Therefore, a 10% contingency is used in the OPCC.

Description	Quantity	Unit	Unit Cost	Cost
Construct 8-inch PVC	1460	L.F.	$130	$189,800
8-inch Gate Valves	3	Each	$1,960	$5,880
8-inch Tie-In	2	Each	$6,840	$13,680
Construct 6-inch PVC	4940	L.F.	$120	$592,800
6-inch Gate Valve	9	Each	$1,660	$14,940
6-inch Tie-In	4	Each	$6,550	$26,200
Construct 4-inch PVC	1550	L.F.	$110	$170,500
4-inch Gate Valve	4	Each	$1,380	$5,520
4-inch Tie-In	1	Each	$6,660	$6,660
6-inch Fire Hydrant	9	Each	$10,870	$97,830
2-inch Blow-off	7	Each	$5,330	$37,310
2-inch service	3	Each	$4,920	$14,760
1-inch service	162	Each	$2,110	$341,820
AC Removal and Replacement	7950	L.F.	$50	$397,500
Construct Pipeline Offset	32	Each	$3,500	$112,000
Cut, Plug and Abandon of Existing Pipeline	1	LS	$9,034	$9,034
Traffic Rated (H-20) Meter Lids	165	Each	$250	$41,250
Install Test Head Furnishing for Pressure Testing	8	Each	$3,610	$28,880
Landscaping Removal & Replacement	1	LS	$12,644	$12,644
Guard underground services	1	LS	$16,540	$16,540
Line Item Subtotal				$2,135,548
Mobilization			3%	$64,066
De-mobilization			2%	$42,711
Construction Subtotal				**$2,242,325**
Engineering and Inspection			12%	$269,079
Subtotal				$2,511,404
Contingency			10%	$251,140
Subtotal				$2,762,545
General Administration			9%	$248,629
Total				**$3,011,000**

6. Basis for Budgeted Cost

The total OPCC includes Engineering and Inspection, General Administration, and Contingency factors. The Engineering and Inspection factor accounts for the estimated direct cost required to plan, design, and inspect the project, permit fees, and the cost of internal labor. The General Administration factor considers Suburban's general administrative expenses. The contingency factor accounts for unforeseen construction conflicts and complications that could result in additional project costs.

7. Impact of Deferral

The longer this pipeline replacement is deferred, the older the pipes will become, the likelihood of failure will increase, and the frequency of breaks will increase. The breaks will increasingly cause undesirable service interruptions to customers, and the overall system condition will exponentially worsen.

8. Recommendation

- Alternative #1 is not feasible because it does not resolve the interruptions of service issues to customers and does not prevent the degradation of the integrity of the water system infrastructure in this area.
- Alternative #2 has limitations with making this Alternative lose its cost-benefit and construction efficiency.
- Alternative #3 is recommended because it provides full reliability, quality, and abundance of service to the customer in the area. Suburban recommends Alternative #3.

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PROJECT DESIGN REPORT

FROM: Engineering Department
DATE: July 29, 2022
DISTRICT: WLM
SUBJECT: Goldendale Dr. and Tanfield Dr. Pipeline Replacement; CP-505

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1. Executive Summary

The existing 4-inch, 6-inch, 8-inch asbestos cement (AC) mains, and 8-inch steel main in Goldendale Drive and Tanfield Drive area have experienced many breaks in the past years. They have reached the end of their useful lives and do not provide an adequate level of service to the customers. It is recommended that these 4-inch to 8-inch mains are replaced by approximately 4,240 LF of 4-inch, 6-inch, and 8-inch PVC mains to provide a safe and reliable water supply to the customers in the area.

2. Introduction

The existing 4-inch, 6-inch, and 8-inch AC mains in the City of La Mirada on Goldendale Drive and Tanfield Drive, and adjacent streets, in the area east of Milan Creek Channel, west of La Mirada Boulevard, and south of Steprock Drive, and north of Goldendale Drive have experienced frequent main breaks. The breaks result in service interruptions and inconvenience to customers. Suburban has made piecemeal repairs to continue to provide service to its customers, but this is not a long-term solution. The water mains have reached the end of their useful lives. It is recommended to replace these existing 4-inch to 8-inch mains with approximately 4,240 LF of 4-inch, 6-inch, and 8-inch PVC Pipes in the project area to provide a safe and reliable water supply to the customers.

Table 1 demonstrates a summary of the proposed pipeline replacement in this project, and Figure 1 shows the map of the project area. This project has been grouped per the recommendations of the pipeline condition assessment to include all mains that were constructed as part of this tract and are expected to continue to experience breaks. A detailed explanation of the grouping is outlined in Chapter 1 of the "*Suburban Water Systems Water Main Renewal Technical Memorandum, 2022,*" included in Workpaper VOLUME III-E.

Table 1. Replacement Schedule

Quantity	**Existing Main**		**Proposed Main**	
(feet)	**Size** (inch)	**Material**	**Size** (inch)	**Material**
700	4	AC	4	PVC
2,370	6	AC	6	PVC
50	8	STL	8	PVC
1,120	8	AC	8	PVC
4,240				

Figure 1. Project Area and Break Map

3. Project Background

Record drawing (Figure 2) show that most existing pipe materials are AC pipes, except the 8-inch main crossing Milan Creek Channel is steel pipe. These pipelines were originally built in 1956 during the development of TRACT 21413 under Project Number 027-SW-3. They are a part of the distribution system in the 335 Zone in the Whittier / La Mirada District of Suburban.

Figure 2. Record Drawing

Suburban Water Systems (Suburban) started having water main break data in 1998. All the main breaks for this project from 1998 to 2021 are also shown in Table 2 and illustrated with green dots in Figure 1.

Table 2. Break Record

BREAK TYPE	BREAK DATE	ADDRESS	STREET	CITY
Main	2/11/1999			
Main	7/15/2002			
Main	8/14/2006			
Main	7/22/2009			
Main	2/27/2011			
Main	3/17/2011			
Main	2/1/2012			
Main	3/3/2014			
Main	8/25/2017			
Main	3/24/2021			
TOTAL				

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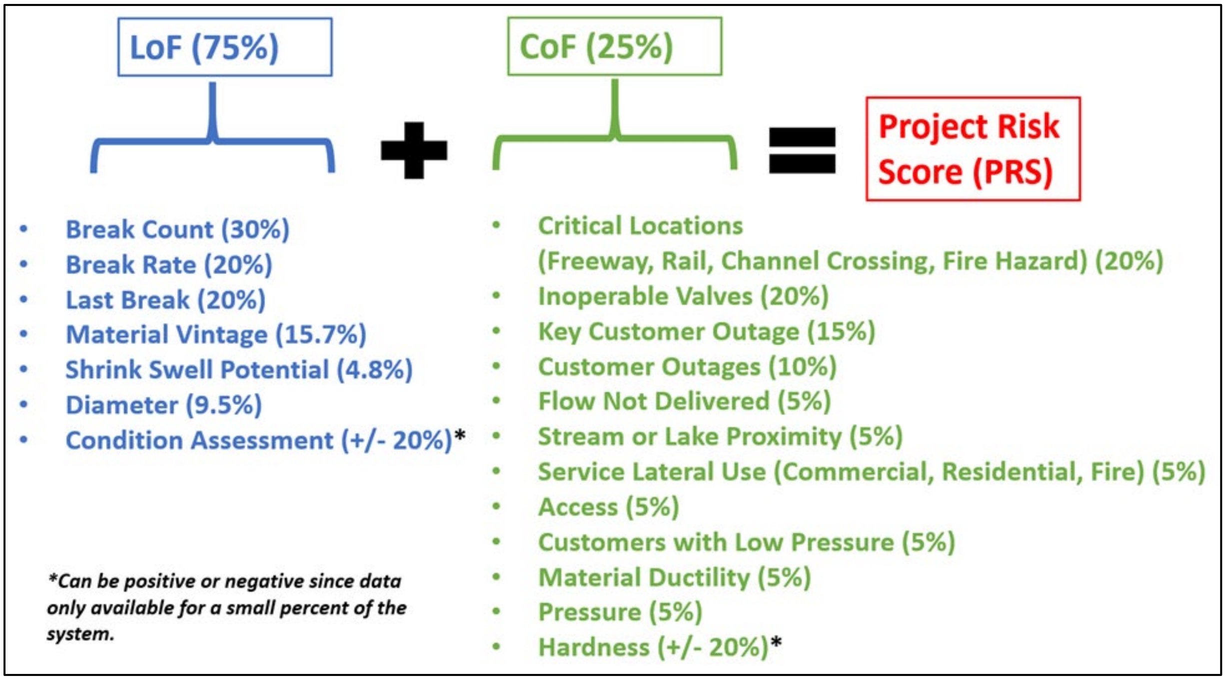
4. Project Risk Score (PRS)

In 2018 Suburban engaged HDR to perform an independent condition analysis of the pipeline infrastructure. HDR updated the study in 2022. See HDR's Suburban Water Systems Water Main Renewal Technical Memorandum 2022 included in Workpaper VOLUME III-E (HDR TM). To evaluate the system, HDR developed a Risk Model for pipeline renewal and replacement. This model calculated a Project Risk Score (PRS) to quantify the relative risk of failure from very low to severe. This methodology considers the likelihood of failure (LoF) and the consequence of failure (CoF) of the main. Each of the PRS criterion (LoF and CoF) are made up of many factors. Figure 3 summarizes the PRS calculation methodology.

Figure 3. Risk Calculation Method



4.1 PRS Calculation Methodology

As shown in Figure 3, the LoF weight is 75 percent and the CoF weight is 25 percent. The PRS is on a scale of zero to one hundred, LoF can contribute up to 75 points, and the CoF can contribute up to 25 points. Each factor was scored on a 0 to 10 scale (Factor Score), where 0 represents the lowest risk, and 10 represents the highest risk. A detailed explanation of each factor is explained in chapter 4 of the technical memorandum. Each pipeline segment is calculated separately for its LoF and CoF based on the following equation:

$$\text{LoF Score} = \sum (\text{LoF Factor Score x 10 x Weight x Criterion Weight})$$

$$\text{CoF Score} = \sum (\text{CoF Factor Score x 10 x Weight x Criterion Weight})$$

The PRS for each segment is the summation of LoF and CoF:

$$\text{PRS} = \text{LoF Score} + \text{CoF Score}$$

The final PRS for the entire project is a weighted average of pipe risk score by length:

$$\textbf{Final Project Risk Score} = \sum \textbf{(PRS x Length)} \div \sum \textbf{(Length)}$$

4.2 PRS Calculation Result

Table 3 below summarizes the PRS provided by HDR TM 2022 for this replacement project.

Table 3. Summary of PRS

Project #	Sum of Pipe_Length*	Average of LoF_PRS	Average of CoF_PRS	Average of PRS
027-SW-3	3,808	58.8	3.0	61.7

*: The pipe length in Table 3 is from the current GIS database. The estimated replacement length is different. It is measured with new alignments, appurtenances, tie-ins, and any line segment within the project boundary but not included in the current GIS under the same Project Number.

Figure 4 is the PRS map for this project from HDR TM 2022.

Figure 4. Project Risk Score Map

5. Improvement Alternative's Summary

Alternative 1 – Do nothing. This alternative continues to use the existing pipelines, resulting in continued repairs when breaks occur. This is an undesirable option because the pipelines will continue to fail, interrupting service customers. This will cause poor customer service and higher costs for repairs and piecemeal replacement.

Alternative 2 – Rehabilitate the existing water main. Three rehabilitation methods were evaluated for this alternative.

- Pipebursting
- Sliplining
- Cured-In-Place Pipe (CIPP)

A detailed description of each rehabilitation method is shown below.

Pipebursting – Pipebursting is a method by which the existing pipe is opened and forced outward by a bursting tool. A hydraulic or pneumatic expansion head (part of the bursting tool) is pulled through the existing pipeline, typically using a cable and winch. As the expansion head is pulled through the existing pipe, it pushes that pipe radially outward until it breaks apart, creating a space for the new pipe. The bursting device also pulls the new pipeline behind it, immediately filling the void created by the old, burst pipe with the new pipe. Pipebursting can be used to replace the existing pipe with a similarly sized or larger pipe.

Pipebursting is not recommended if the existing pipe is asbestos cement because the process leaves broken asbestos pieces in the ground. When the pipe is disturbed, it is considered a waste disposal site and is subject to National Emission Standards for Hazardous Air Pollutants (NESHAP) requirements. Friable asbestos fibers lead to cancer of the lungs, known as mesothelioma. Future maintenance activities such main repairs due to breaks or replacing service lines will be required and may lead to health concerns.

Sliplining – Sliplining is inserting a new pipe by pulling or pushing it into the existing pipe and grouting the annular space. After it is in place, the pipe is grouted to hold the lining in place and for additional rigidity.

Sliplining new pipes will generally have a significantly reduced cross-sectional area. Sliplining is not recommended if maintaining or increasing fire flow in the area is required.

CIPP – A cured-in-place pipe (CIPP) is a trenchless rehabilitation method to repair existing pipelines. It is a jointless, seamless pipelining within an existing pipe. The process of CIPP involves inserting and running a felt lining into a pre-existing pipe that is the subject of repair. The resin within the liner is then exposed to a curing element to make it attach to the inner walls of the pipe. Once fully cured, the lining now acts as a new pipeline.

Like sliplining, CIPP is not recommended if maintaining or increasing fire flow is required because the cross-sectional area of the pipeline after rehabilitation is reduced.

There are some common limitations for all three rehabilitation methods compared with open trench replacement:

1. Rehabilitation methods are used for sewer pipelines. Sewer pipelines are straight and are usually deeper than water lines. Offsets and fittings make using these methods more costly. Open trenching deep sewer mains are also more expensive than water mains installed 42-60 inches deep.

2. Typically, there is only one main in the street that serves customers and cannot be switched to other mains during the construction of a new main. A temporary by-pass system is required to provide continuous service to customers. During summer, water in the by-pass pipe is heated because it is in direct contact with the sun. Driveways are blocked by the above-ground pipe and can easily be damaged.
3. Installation pits are required when horizontal and vertical alignment changes are substantial that the new pipe won't be able to pull or push through the existing pipe. Most Suburban's record drawings in the 50s and 60s don't include profile views of the pipelines, and it is suspected that there are multiple offsets. Offsets are required to avoid underground utilities such as gas, cable, water, and storm drain. Most often, water lines cross these utilities multiple times on a street. Digging pits will result in delays and continuous customer interruptions and increase construction costs.
4. Open trench pipe replacement method minimizes water interruptions to one, eight (8) hour shutdown to connect the new pipeline to the existing system, and one, thirty (30) minute shutdown to switch customer services. Mains must be pressure tested and disinfected. There are occasions when passing bacteriological testing can take several weeks due to positive e-coli results. Open trench replacement allows new mains, valves, and service connections to be pressure tested and disinfected before the final shut down to connect to the existing system. Trenchless rehabilitation of the existing pipelines can only be constructed section by section. Each section requires a much longer shutdown time for service connection, pressure testing, and disinfection to bring back the service and move on to the next one. Replacing the pipelines using rehabilitation techniques will add more time to the project resulting in more costs.

Rehabilitation methods are good alternatives for specific applications like steep hills, where surfaces cannot be disturbed, and if there are no service connections on the main. Suburban's pipeline contractors have not performed rehabilitation methods on residential streets with services. Health and environmental concerns have not been fully addressed when using them on AC pipes. Additional fittings and offsets require more deep excavation pits and will increase the cost and duration of the project. It is not recommended to rehabilitate neighborhood pipelines and continue replacing pipelines using an open trench method.

Alternative 3 – Replace existing water mains with approximately 4,240 L.F. of 4", 6", and 8" PVC pipes and associated appurtenances, as shown in Table 1. This Alternative will improve the integrity of the distribution system, eliminate service interruptions in this area, and ensure safe and reliable service to the customers.

According to the Association for the Advancement of Cost Engineering, this alternative is Class 3 of Opinion of Probable Construction Cost (OPCC) for constructing the replacement pipelines. The expected accuracy range for Class 3 is between +10% to +30%. Therefore, a 10% contingency is used in the OPCC.

Description	**Quantity**	**Unit**	**Unit Cost**	**Cost**
Construct 8-inch PVC	1,120	L.F.	$130	$145,600
Construct 8-inch STL	50	L.F.	$600	$30,000
8-inch Gate Valves	4	Each	$1,960	$7,840
8-inch Tie-In	2	Each	$6,840	$13,680
Construct 6-inch PVC	2,370	L.F.	$120	$284,400
6-inch Gate Valve	7	Each	$1,660	$11,620
6-inch Tie-In	3	Each	$6,550	$19,650
Construct 4-inch PVC	700	L.F.	$110	$77,000
4-inch Gate Valve	4	Each	$1,380	$5,520
6-inch Fire Hydrant	9	Each	$10,870	$97,830
2-inch Blow-off	5	Each	$5,330	$26,650
2-inch Air Release Valve	1	Each	$6,560	$6,560
1-inch service	101	Each	$2,110	$213,110
AC Removal and Replacement	4,240	L.F.	$50	$212,000
Construct Pipeline Offset	17	Each	$3,500	$59,500
Cut, Plug and Abandon of Existing Pipeline	1	LS	$9,034	$9,034
Traffic Rated (H-20) Meter Lids	101	Each	$250	$25,250
Install Test Head Furnishing for Pressure Testing	4	Each	$3,610	$14,440
Landscaping Removal & Replacement	1	LS	$12,644	$12,644
Guard underground services	1	LS	$16,540	$16,540
Line Item Subtotal				$1,143,268
Mobilization			3%	$34,298
De-mobilization			2%	$22,865
Construction Subtotal				**$1,200,431**
Engineering and Inspection			12%	$144,052
Subtotal				$1,344,483
Contingency			10%	$134,448
Subtotal				$1,478,931
General Administration			9%	$133,104
Total				**$1,612,000**

6. Basis for Budgeted Cost

The total OPCC includes Engineering and Inspection, General Administration, and Contingency factors. The Engineering and Inspection factor accounts for the estimated direct cost required to plan, design, and inspect the project, the cost of permit fees, and the cost of internal labor. The General Administration factor considers Suburban's general administrative expenses. The contingency factor accounts for unforeseen construction conflicts and complications that could result in additional project costs.

7. Impact of Deferral

The longer this pipeline replacement is deferred, the older the pipes will become, the likelihood of failure will increase, and the frequency of breaks will increase. The breaks will increasingly cause undesirable service interruptions to customers, and the overall system condition will exponentially worsen.

8. Recommendation

- Alternative #1 is not feasible because it does not resolve the interruptions of service issues to customers and does not prevent the degradation of the integrity of the water system infrastructure in this area.
- Alternative #2 has limitations with making this Alternative lose its cost-benefit and construction efficiency.
- Alternative #3 is recommended because it provides full reliability, quality, and abundance of service to the customer in the area. Suburban recommends Alternative #3.

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PROJECT DESIGN REPORT

FROM: Engineering Department

DATE: April 13, 2022

DISTRICT: WLM

SUBJECT: Falstone Avenue and Gale Avenue Pipeline Replacement; CP-405

---

1. Executive Summary

The existing 4-inch, 6-inch, and 8-inch asbestos cement (AC) mains on Falstone Avenue and Gale Avenue area have experienced many breaks in the past years. They have reached the end of their useful lives and do not provide an adequate level of service to the customers. It is recommended that these 4-inch to 8-inch existing mains be replaced by approximately 8,050 LF of 6-inch to 8-inch PVC mains to provide a safe and reliable water supply to the customers in the area.

2. Project Description

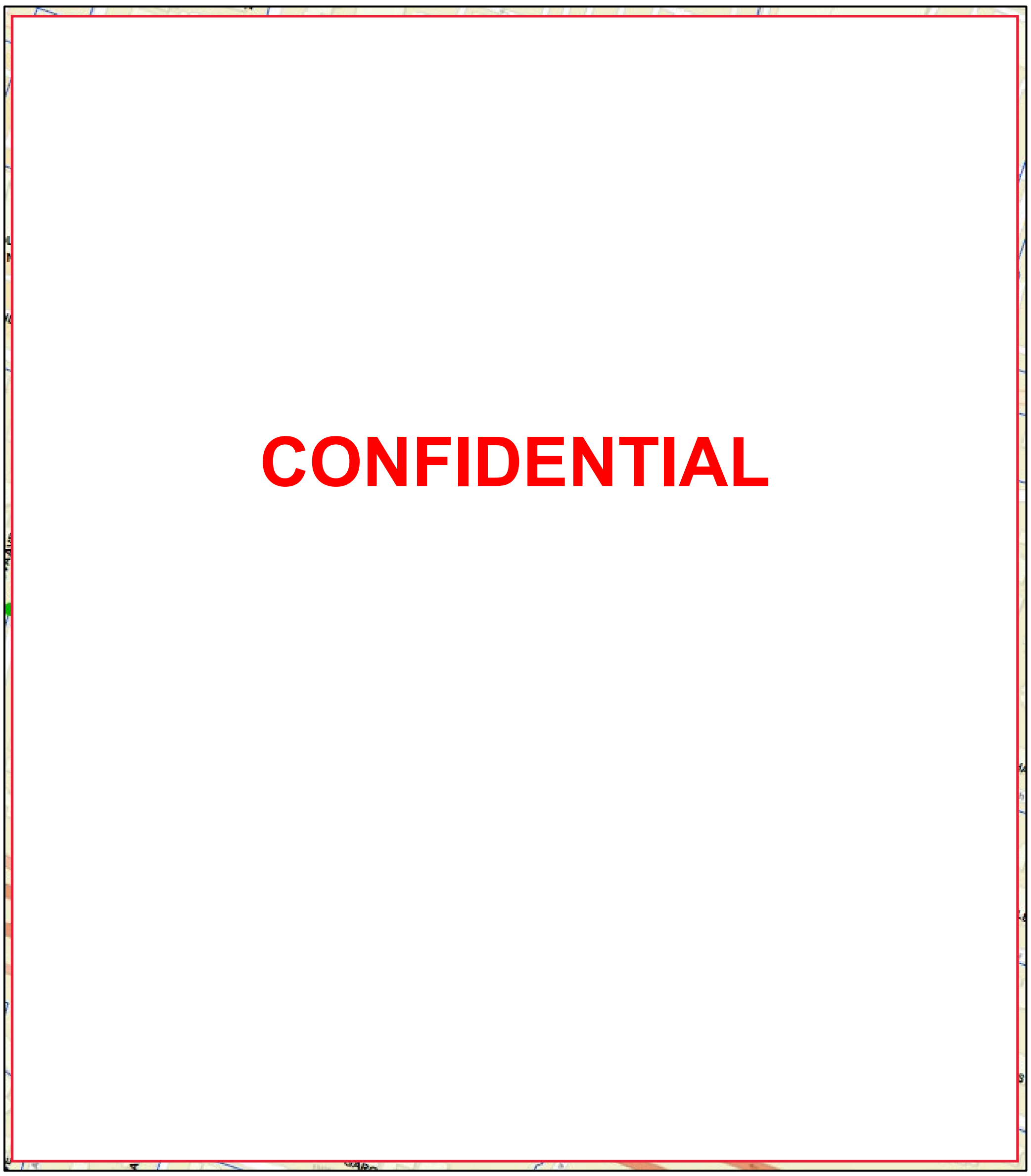
The existing 4-inch, 6-inch, and 8-inch AC mains in the area west of Stimson Avenue, east of Falstone Avenue, north of Binney Street, and south of Gale Avenue in un-incorporated Los Angele County, have experienced frequent main breaks in the past years causing service interruptions and inconvenience to customers. Suburban has made piecemeal repairs to continue to provide service to its customers, but this is not a long-term solution. The water mains have reached the end of their useful lives. It is recommended to replace these existing 2-inch to 8-inch mains with approximately 8,050 LF 6-inch and 8-inch PVC Pipes in the project area to provide a safe and reliable water supply to the customers.

Table 1 presents a summary of pipeline replacement in this project, and Figure 1 shows the map of the project area. This project has been grouped per the recommendations of the pipeline condition assessment to include all mains that were constructed as part of this tract and are expected to continue to experience breaks. A detailed explanation of the grouping is outlined in Chapter 1 of the "*Suburban Water Systems Water Main Renewal Technical Memorandum, 2022,*" included in Workpaper VOLUME III-E.

Table 1. Replacement Schedule

Quantity	**Existing Main**		**Proposed Main**	
(feet)	**Size** (inch)	**Material**	**Size** (inch)	**Material**
900	4	AC	6	PVC
4020	6	AC	8	PVC
3130	8	AC	8	PVC
8,050				

Figure 1. Project Area Map



3. Project Background

Record drawing (Figure 2) shows the existing pipe materials are 4-inch to 8-inch AC pipes. These pipelines were originally built in 1955 during the development of TRACT 20159. They are a part of the distribution system in the 520 Zone in the San Jose Hills District of Suburban. This project is in the Disadvantage Areas according to SB 535 (see Figure 3).

Figure 2. Record Drawing

Figure 3. Project in the SB 535 Disadvantage Areas

Suburban Water Systems (Suburban) started to collect water main break data since 1998. All the main breaks for this project from 1998 to 2021 are also shown in Table 2 and illustrated with green dots in Figure 1.

Table 2. Break Record

BREAK TYPE	BREAK DATE	ADDRESS	STREET	CITY
Main	10/22/1999			
Main	10/30/2000			
Main	1/16/2001			
Main	7/18/2001			
Main	4/30/2004			
Main	3/31/2006			
Main	8/14/2006			

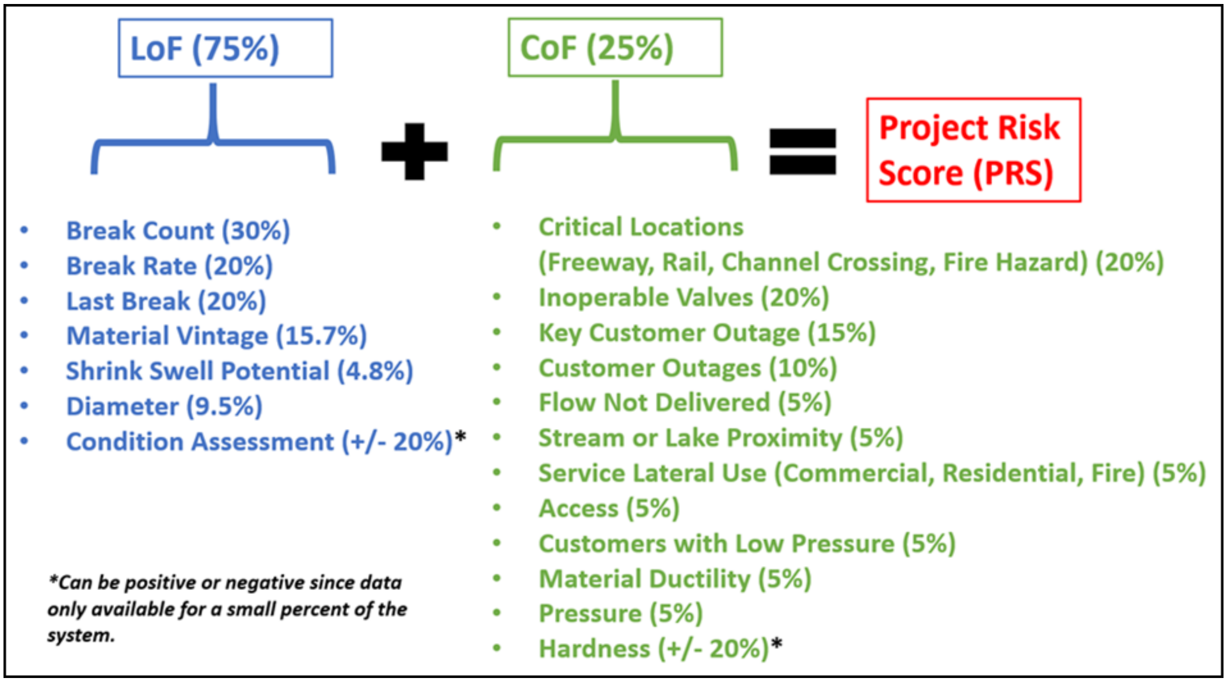
CONFIDENTIAL

BREAK TYPE	BREAK DATE	ADDRESS	STREET	CITY
in	6/28/2007			
Main	10/20/2007			
Main	4/10/2008			
Main	8/24/2010			
Main	7/26/2013			
Main	8/26/2013		CONFIDENTIAL	
Main	11/12/2014			
Main	8/10/2015			
Main	10/29/2020			
Main	8/16/2021			
TOTAL				

4. Project Risk Score (PRS)

In 2018 Suburban engaged HDR to perform an independent condition analysis of the pipeline infrastructure. HDR updated the study in 2022. See HDR's Suburban Water Systems Water Main Renewal Technical Memorandum 2022 included in Workpaper VOLUME III-E (HDR TM). To evaluate the system, HDR developed a Risk Model for pipeline renewal and replacement. This model calculated a Project Risk Score (PRS) to quantify the relative risk of failure from very low to severe. This methodology considers the likelihood of failure (LoF) and the consequence of failure (CoF) of the main. Each of the PRS criterion (LoF and CoF) are made up of many factors. Figure 4 summarizes the PRS calculation methodology.

Figure 4. Risk Calculation Method



4.1 PRS Calculation Methodology

As shown in Figure 4, the LoF weight is 75 percent and the CoF weight is 25 percent. The PRS is on a scale of zero to one hundred, LoF can contribute up to 75 points, and the CoF can contribute up to 25 points. Each factor was scored on a 0 to 10 scale (Factor Score), where 0 represents the lowest risk, and 10 represents the highest risk. A detailed explanation of each factor is explained in chapter 4 of the technical memorandum. Each pipeline segment is calculated separately for its LoF and CoF based on the following equation:

$$\text{LoF Score} = \sum (\text{LoF Factor Score} \times 10 \times \text{Weight} \times \text{Criterion Weight})$$

$$\text{CoF Score} = \sum (\text{CoF Factor Score} \times 10 \times \text{Weight} \times \text{Criterion Weight})$$

The PRS for each segment is the summation of LoF and CoF:

$$\text{PRS} = \text{LoF Score} + \text{CoF Score}$$

The final PRS for the entire project is a weighted average of pipe risk score by length:

$$\textbf{Final Project Risk Score} = \sum (\textbf{PRS x Length}) \div \sum (\textbf{Length})$$

4.2 PRS Calculation Result

Table 3 below summarizes the PRS provided by HDR TM 2022 for this replacement project.

Table 3. Summary of PRS

Project #	Sum of Pipe_Length*	Average of LoF_PRS	Average of CoF_PRS	Average of PRS
843-SK-2	6,109	59.2	1.4	60.6

*****: The pipe length in Table 3 is from the current GIS database. The estimated replacement length is different. It is measured with new alignments, appurtenances, tie-ins, and any line segment within the project boundary but not included in the current GIS under the same Project Number.

Figure 5 is the PRS map for this project from HDR TM 2022.

Figure 5. Project Risk Score Map

5. Improvement Alternative's Summary

Alternative 1 – Do nothing. This alternative continues to use the existing pipelines, resulting in continued repairs when breaks occur. This is an undesirable option because the pipelines will continue to fail, interrupting service customers. This will cause poor customer service and higher costs for repairs and piecemeal replacement.

Alternative 2 – Rehabilitate the existing water main. Three rehabilitation methods were evaluated for this alternative.

- Pipebursting
- Sliplining
- Cured-In-Place Pipe (CIPP)

A detailed description of each rehabilitation method is shown below.

Pipebursting – Pipebursting is a method by which the existing pipe is opened and forced outward by a bursting tool. A hydraulic or pneumatic expansion head (part of the bursting tool) is pulled through the existing pipeline, typically using a cable and winch. As the expansion head is pulled through the existing pipe, it pushes that pipe radially outward until it breaks apart, creating a space for the new pipe. The bursting device also pulls the new pipeline behind it, immediately filling the void created by the old, burst pipe with the new pipe. Pipebursting can be used to replace the existing pipe with a similarly sized or larger pipe.

Pipebursting is not recommended if the existing pipe is asbestos cement because the process leaves broken asbestos pieces in the ground. When the pipe is disturbed, it is considered a waste disposal site and is subject to National Emission Standards for Hazardous Air Pollutants (NESHAP) requirements. Friable asbestos fibers lead to cancer of the lungs, known as mesothelioma. Future maintenance activities such main repairs due to breaks or replacing service lines will be required and may lead to health concerns.

Sliplining – Sliplining is inserting a new pipe by pulling or pushing it into the existing pipe and grouting the annular space. After it is in place, the pipe is grouted to hold the lining in place and for additional rigidity.

Sliplining new pipes will generally have a significantly reduced cross-sectional area. Sliplining is not recommended if maintaining or increasing fire flow in the area is required.

CIPP – A cured-in-place pipe (CIPP) is a trenchless rehabilitation method to repair existing pipelines. It is a jointless, seamless pipelining within an existing pipe. The process of CIPP involves inserting and running a felt lining into a pre-existing pipe that is the subject of repair. The resin within the liner is then exposed to a curing element to make it attach to the inner walls of the pipe. Once fully cured, the lining now acts as a new pipeline.

Like sliplining, CIPP is not recommended if maintaining or increasing fire flow is required because the cross-sectional area of the pipeline after rehabilitation is reduced.

There are some common limitations for all three rehabilitation methods compared with open trench replacement:

1. Rehabilitation methods are used for sewer pipelines. Sewer pipelines are straight and are usually deeper than water lines. Offsets and fittings make using these methods more costly. Open trenching deep sewer mains are also more expensive than water mains installed 42-60 inches deep.
2. Typically, there is only one main in the street that serves customers and cannot be switched to other mains during the construction of a new main. A temporary by-pass system is required to provide continuous service to customers. During summer, water in the by-pass pipe is heated because it is in direct contact with the sun. Driveways are blocked by the above-ground pipe and can easily be damaged.
3. Installation pits are required when horizontal and vertical alignment changes are substantial that the new pipe won’t be able to pull or push through the existing pipe. Most Suburban’s record drawings in the 50s and 60s don’t include profile views of the pipelines, and it is suspected that there are multiple offsets. Offsets are required to avoid underground utilities such as gas, cable, water, and storm drain. Most often, water lines cross these utilities multiple times on a street. Digging pits will result in delays and continuous customer interruptions and increase construction costs.
4. Open trench pipe replacement method minimizes water interruptions to one, eight (8) hour shutdown to connect the new pipeline to the existing system, and one, thirty (30) minute shutdown to switch customer services. Mains must be pressure tested and disinfected. There are occasions when passing bacteriological testing can take several weeks due to positive e-coli results. Open trench replacement allows new mains, valves, and service connections to be pressure tested and disinfected before the final shut down to connect to the existing system. Trenchless rehabilitation of the existing pipelines can only be constructed section by section. Each section requires a much

longer shutdown time for service connection, pressure testing, and disinfection to bring back the service and move on to the next one. Replacing the pipelines using rehabilitation techniques will add more time to the project resulting in more costs.

Rehabilitation methods are good alternatives for specific applications like steep hills, where surfaces cannot be disturbed, and if there are no service connections on the main. Suburban's pipeline contractors have not performed rehabilitation methods on residential streets with services. Health and environmental concerns have not been fully addressed when using them on AC pipes. Additional fittings and offsets require more deep excavation pits and will increase the cost and duration of the project. It is not recommended to rehabilitate neighborhood pipelines and continue replacing pipelines using an open trench method.

Alternative 3 – Replace existing water mains with approximately 8,050 L.F. of 6" and 8" PVC pipes and associated appurtenances as shown in Table 1. This Alternative will improve the integrity of the distribution system, eliminate service interruptions in this area, and ensure safe and reliable service to the customers.

According to the Association for the Advancement of Cost Engineering, this alternative is Class 3 of Opinion of Probable Construction Cost (OPCC) for constructing the replacement pipelines. The expected accuracy range for Class 3 is between +10% to +30%. Therefore, a 10% contingency is used in the OPCC.

Description	Quantity	Unit	Unit Cost	Cost
Construct 8-inch PVC	7150	L.F.	$130	$929,500
8-inch Gate Valves	15	Each	$1,960	$29,400
8-inch Tie-In	5	Each	$6,840	$34,200
Construct 6-inch PVC	900	L.F.	$120	$108,000
6-inch Gate Valve	2	Each	$1,660	$3,320
6-inch Fire Hydrant	11	Each	$10,870	$119,570
2-inch Blow-off	3	Each	$5,330	$15,990
1-inch service	163	Each	$2,110	$343,930
AC Removal and Replacement	8050	L.F.	$50	$402,500
Construct Pipeline Offset	33	Each	$3,500	$115,500
Cut, Plug and Abandon of Existing Pipeline	1	LS	$9,034	$9,034
Traffic Rated (H-20) Meter Lids	163	Each	$250	$40,750
Install Test Head Furnishing for Pressure Testing	8	Each	$3,610	$28,880
Landscaping Removal & Replacement	1	LS	$12,644	$12,644
Guard underground services	1	LS	$16,540	$16,540
Line Item Subtotal				$2,209,758
Mobilization			3%	$66,293
De-mobilization			2%	$44,195
Construction Subtotal				**$2,320,246**
Engineering and Inspection			12%	$278,430
Subtotal				$2,598,675
Contingency			10%	$259,868
Subtotal				$2,858,543
General Administration			9%	$257,269
Total				**$3,116,000**

6. Basis for Budgeted Cost

The total OPCC includes Engineering and Inspection, General Administration, and Contingency factors. The Engineering and Inspection factor accounts for the estimated direct cost required to plan, design, and inspect the project, permit fees, and the cost of internal labor. The General Administration factor considers Suburban's general administrative expenses. The contingency factor accounts for unforeseen construction conflicts and complications that could result in additional project costs.

7. Impact of Deferral

The longer this pipeline replacement is deferred, the older the pipes will become, the likelihood of failure will increase, and the frequency of breaks will increase. The breaks will increasingly cause undesirable service interruptions to customers, and the overall system condition will exponentially worsen.

8. Recommendation

- Alternative #1 is not feasible because it does not resolve the interruptions of service issues to customers and does not prevent the degradation of the integrity of the water system infrastructure in this area.
- Alternative #2 has limitations with making this Alternative lose its cost-benefit and construction efficiency.
- Alternative #3 is a better solution because it provides full reliability, quality, and abundance of service to the customer in the area. Suburban recommends Alternative #3.

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PROJECT DESIGN REPORT

FROM: Engineering Department

DATE: April 20, 2022

DISTRICT: SJH

SUBJECT: 20-inch Transmission Main on Glendora Avenue Replacement; CP-101

---

1. Executive Summary

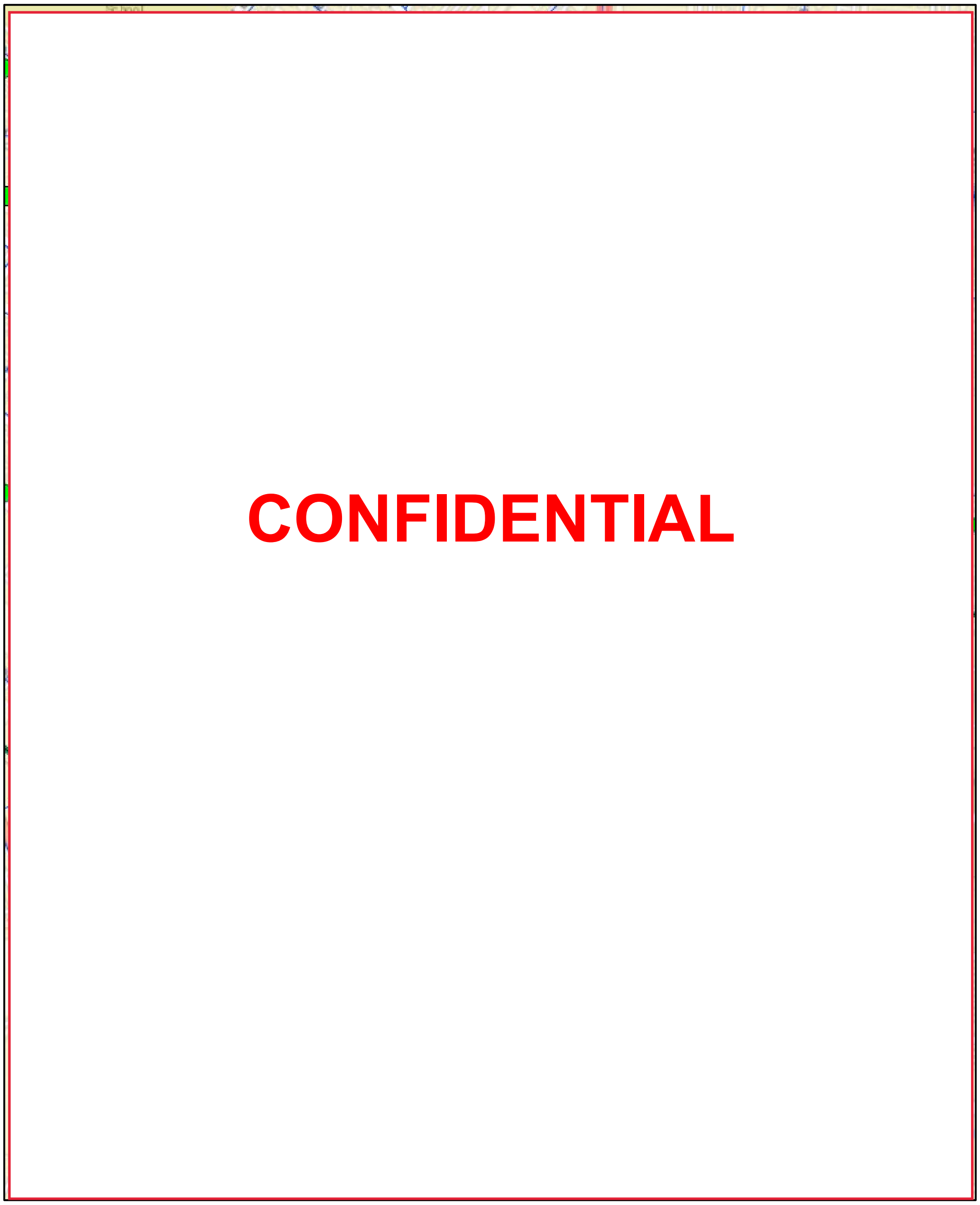
The existing 20-inch PVC transmission main on Glendora Avenue has experienced many breaks over the past few years. Breaks on this main have severe consequences for the Hacienda Height area. It is recommended that this existing 20-inch PVC transmission main be replaced by approximately 6,100 LF of 20-inch DI main to provide a safe and reliable water supply to the customers in Hacienda Heights.

2. Introduction

The existing 20-inch PVC transmission main on Glendora Avenue from Plant 128 to Valley Boulevard has experienced frequent breaks in the past years, causing service interruptions, street flooding, costly street paving damage, and traffic disruptions. Suburban has made piecemeal repairs to continue to provide service to its customers, but this is not a long-term solution. The PVC main has reached the end of its useful life. It is recommended to replace the existing 20-inch PVC transmission main with approximately 6,100 LF 20-inch Ductile Iron (DI) pipe to provide a safe and reliable water supply.

Figure 1 shows the map of the project area. This project has been grouped per the recommendations of the pipeline condition assessment. All mains constructed as part of this project are expected to experience breaks. A detailed explanation of the grouping is outlined in Chapter 1 of the "*Suburban Water Systems Water Main Renewal Technical Memorandum, 2022,*" included in Workpaper VOLUME III-E.

Figure 1. Project Area and Break Map



3. Project Background

Record drawings (see Appendix 1) of the existing pipe show it was built in 1987 for transmission from Plant 128 to Hacienda Heignts in Project 87-1100. This pipe is 20-inch Plastic DR-25 as shown on the record drawing. DR is Diameter to Radius ratio. The bigger the number the thinner the wall. A DR-25 pipe has the pressure rating of 165 psi. Suburban's current pressure rating for pressure pipe is a minimum of 305 psi. A pressure surge is suspected of a longitudinal break from joint to joint that occurred on February

2015. A higher pressure rated pipe will reduce these types of breaks. Pressurized pipes of this size should be metallic such as steel or ductile iron as recommended by industry experts, because they are much stronger than plastic. Plastic pipe deforms into an oval shape due to external loads that lead to pipe failures. Pipe deformation was observed during a pipe break on April 2019 on this same pipe. This transmission is part of the San Jose Hills District of Suburban distribution system supplying water from 547 Zone to 520 Zone.

Part of the proposed project goes through the Disadvantage Areas according to SB 535. The major part of service area receiving the water supply from this transmission line is alos in the Disadvantage Areas (see Figure 2).

Figure 2. Project in the SB 535 Disadvantage Areas

Suburban Water Systems (Suburban) water main break data is available from 1998. All the main breaks for this project on record from 1998 to 2021 are also shown in Table 1 and illustrated with green dots in Figure 1.

Table 1. Break Record

BREAK TYPE	BREAK DATE	STREET	CROSS STREET	CITY
Main	4/18/2000	GLENDORA AVE	STAFFORD ST	LA PUENTE
Main	7/24/2000	GLENDORA AVE	TEMPLE AVE	LA PUENTE
Main	3/7/2003	GLENDORA AVE	VALLEY BLVD	LA PUENTE
Main	3/9/2006	GLENDORA AVE	MENTZ AVE	LA PUENTE
Main	7/2/2007	GLENDORA AVE	NELSON AVE	LA PUENTE
Main	2/23/2015	GLENDORA AVE	STAFFORD ST	LA PUENTE
Main	10/29/2019	GLENDORA AVE	TEMPLE AVE	LA PUENTE
Main	6/3/2022	GLENDORA AVE	STAFFORD	LA PUENTE
TOTAL	**7**			

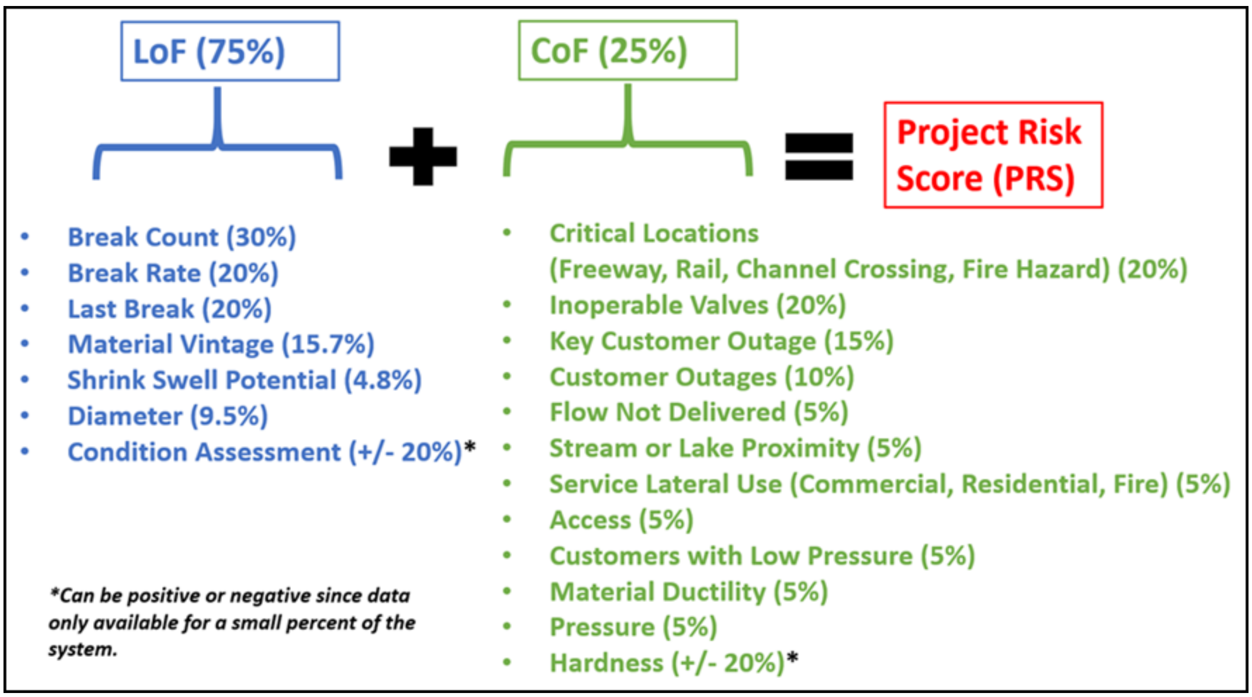
The lbreak on 06/03/2022 (see the break location in Figure 2) and it took seven days to repair and put this transmission main back to service. The results would have been catastrophic if this break occurred during a wildfire event.

Figure 3. Main Break on 06/06/2022

4. Project Risk Score (PRS)

In 2018 Suburban engaged HDR to perform an independent condition analysis of the pipeline infrastructure. HDR updated the study in 2022. See HDR's Suburban Water Systems Water Main Renewal Technical Memorandum 2022 included in Workpaper VOLUME III-E (HDR TM). HDR developed a Risk Model for pipeline renewal and replacement to evaluate the system. This model calculated a Project Risk Score (PRS) to quantify the relative risk of failure from very low to severe. This methodology considers the likelihood of failure (LoF) and the consequence of failure (CoF) of the main. Each of the PRS criterion (LoF and CoF) are made up of many factors. Figure 3 summarizes the PRS calculation methodology.

Figure 4. Risk Calculation Method



4.1 PRS Calculation Methodology

As shown in Figure 3, the LoF weight is 75 percent and the CoF weight is 25 percent. The PRS is on a scale of zero to one hundred, LoF can contribute up to 75 points, and the CoF can contribute up to 25 points. Each factor was scored on a 0 to 10 scale (Factor Score), where 0 represents the lowest risk, and 10 represents the highest risk. A detailed explanation of each factor is explained in chapter 4 of the technical memorandum. Each pipeline segment is calculated separately for its LoF and CoF based on the following equation:

$$\text{LoF Score} = \sum(\text{LoF Factor Score} \times 10 \times \text{Weight} \times \text{Criterion Weight})$$

$$\text{CoF Score} = \sum(\text{CoF Factor Score} \times 10 \times \text{Weight} \times \text{Criterion Weight})$$

The PRS for each segment is the summation of LoF and CoF:

$$\text{PRS} = \text{LoF Score} + \text{CoF Score}$$

The final PRS for the entire project is a weighted average of pipe risk score by length:

$$\textbf{Final Project Risk Score} = \sum(\textbf{PRS x Length}) \div \sum(\textbf{Length})$$

4.2 PRS Calculation Results

Table 2 below summarizes the PRS provided by HDR TM 2022 for this replacement project.

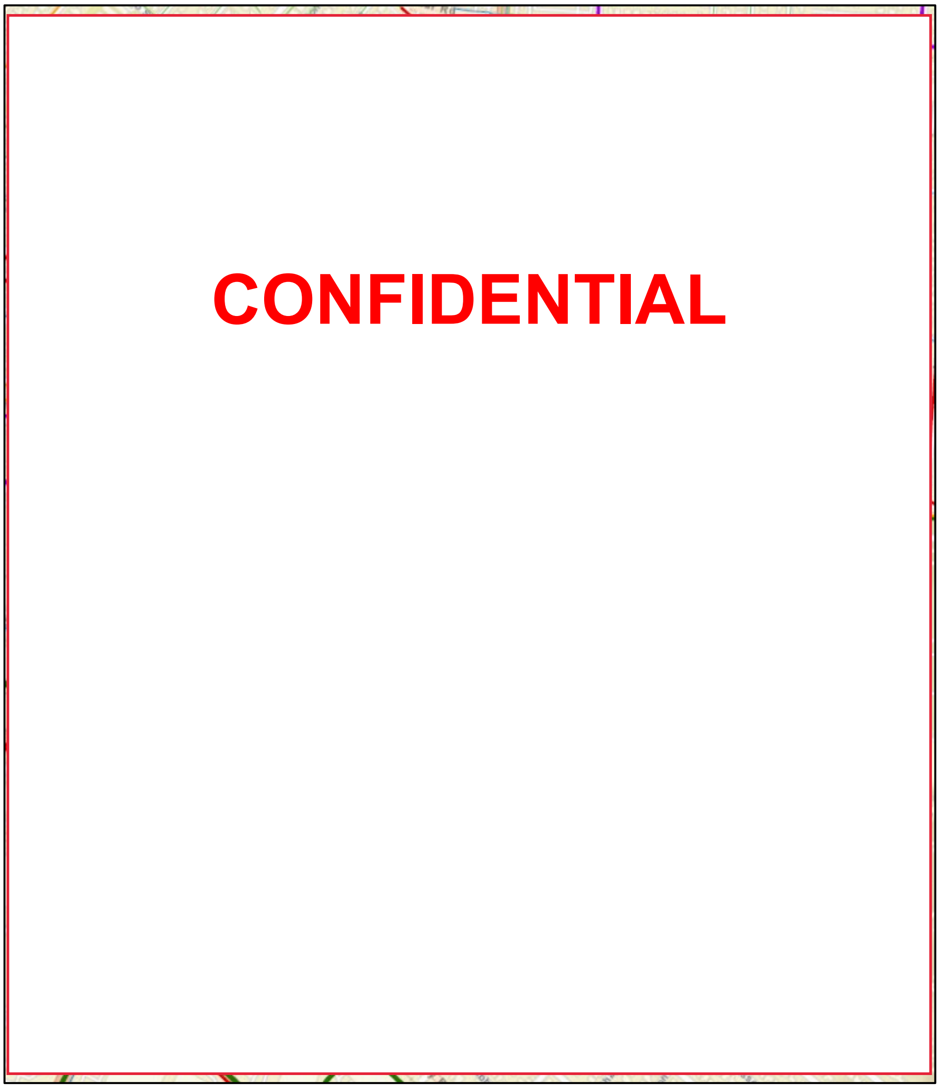
Table 2. Summary of PRS

Project #	Sum of Pipe_Length*	Average of LoF_PRS	Average of CoF_PRS	Average of PRS
87-1100	6,344	54.6	12.1	66.7

*****: The pipe length in Table 2 is from the current GIS database. The estimated replacement length is different. It is measured with new alignments, appurtenances, tie-ins, and any line segment within the project boundary but not included in the current GIS under the same Project Number.

Figure 4 is the PRS map for this project from HDR TM 2022.

Figure 5. Project Risk Score Map



5. Improvement Alternative's Summary

Alternative 1 – Do nothing. This alternative continues to use the existing pipelines which result in continued repairs when breaks occur. This is an undesirable option because the pipelines will continue to fail, interrupting service customers. This will cause poor customer service and higher costs for repairs and piecemeal replacement.

Alternative 2 – Rehabilitate the existing water main. Three rehabilitation methods were evaluated for this alternative.

- Pipebursting
- Sliplining

- Cured-In-Place Pipe (CIPP)

A detailed description of each rehabilitation method is shown below.

Pipebursting – Pipebursting is a method by which the existing pipe is opened and forced outward by a bursting tool. A hydraulic or pneumatic expansion head (part of the bursting tool) is pulled through the existing pipeline, typically using a cable and winch. As the expansion head is pulled through the existing pipe, it pushes that pipe radially outward until it breaks apart, creating a space for the new pipe. The bursting device also pulls the new pipeline behind it, immediately filling the void created by the old, burst pipe with the new pipe. Pipebursting can be used to replace the existing pipe with a similarly sized or larger pipe.

Pipebursting is not recommended if the existing pipe is asbestos cement because the process leaves broken asbestos pieces in the ground. When the pipe is disturbed, it is considered a waste disposal site and is subject to National Emission Standards for Hazardous Air Pollutants (NESHAP) requirements. Friable asbestos fibers lead to cancer of the lungs, known as mesothelioma. Future maintenance activities such main repairs due to breaks or replacing service lines will be required and may lead to health concerns.

Sliplining – Sliplining is inserting a new pipe by pulling or pushing it into the existing pipe and grouting the annular space. After it is in place, the pipe is grouted to hold the lining in place and for additional rigidity.

Sliplining new pipes will generally have a significantly reduced cross-sectional area. Sliplining is not recommended if maintaining or increasing fire flow in the area is required.

CIPP – A cured-in-place pipe (CIPP) is a trenchless rehabilitation method to repair existing pipelines. It is a jointless, seamless pipelining within an existing pipe. The process of CIPP involves inserting and running a felt lining into a pre-existing pipe that is the subject of repair. The resin within the liner is then exposed to a curing element to make it attach to the inner walls of the pipe. Once fully cured, the lining now acts as a new pipeline.

Like sliplining, CIPP is not recommended if maintaining or increasing fire flow is required because the cross-sectional area of the pipeline after rehabilitation is reduced.

There are some common limitations for all three rehabilitation methods compared with open trench replacement for this project:

1. The existing transmission is the primary source of water supply to Hacienda Heights. Taking the pipe out of service for an extended period to rehabilitate this main is challenging. A temporary above ground by-pass system for distributions pipes is sometimes recommended to provide continuous service to customers but not feasible for this application. During summer, water in the by-pass line is heated because it is in direct contact with the sun. This pipe travels in wide street with driveways to businesses and schools. Blocking driveways with the above-ground pipe is not possible. The above-ground pipe can easily be damaged due to its large diameter.

2. Installation pits are required when horizontal and vertical alignment changes are substantial that the new pipe won't be able to pull or push through the existing pipe. Based on the record drawing (see Appendix 1), the existing main has many ups and downs as well as horizontal turns. Many installation pits are required to rehabilitate. Digging pits will result in delays, traffic interruptions, and an increase in construction costs.

3. Open trench pipe replacement method minimizes water interruptions to one, eight (8) hour shutdown to connect the new pipeline to the existing system. Mains must be pressure tested and disinfected. There are occasions when passing bacteriological testing can take several weeks due to positive e-coli results. Open trench replacement allows new mains, valves, and service connections to be pressure tested and disinfected before the final shutdown to connect to the existing system. Trenchless rehabilitation of the existing pipelines can only be constructed section by section. Each section requires a much longer shutdown time for tie-ins, pressure testing, and disinfection to bring back the service and move on to the next one. Replacing the pipelines using rehabilitation techniques will add more time to the project resulting in more costs.

Rehabilitation methods are good alternatives for specific applications like steep hills, where surfaces cannot be disturbed. Suburban's pipeline contractors have not performed rehabilitation methods on busy streets like where this pipeline is located. Suburban reached out to a local vendor specializing in CIPP for this project and provided all the information required for a feasibility study. However, Suburban never got back a response even after multiple follow-up emails. It is believed that the vendor did not feel that this would be an application for rehabilitation. It is not recommended to use any rehabilitation method for this project. Suburban will replace the existing 20-inch transmission using an open trench method.

Alternative 3 – Replace the existing water main with approximately 6,100 LF 20-inch DI pipes and associated appurtenances. This Alternative will improve the integrity of the distribution system, eliminate service interruptions in this area, and ensure safe and reliable service to the customers.

According to the Association for the Advancement of Cost Engineering, this alternative is Class 3 of Opinion of Probable Construction Cost (OPCC) for constructing the replacement pipelines. The expected accuracy range for Class 3 is between +10% to +30%. Therefore, a 10% contingency is used in the OPCC.

Line Item	Quantity	Units	Unit Cost	Cost
Construct 20-inch DI	6000	L.F.	$270	$1,620,000
Install 20-inch Fusible PVC inside the existing 28-inch Steel Casing at RR Crossing	100	L.F.	$250	$25,000
Install 20-inch Butterfly Valves	4	Ea.	$6,650	$26,600
Construct 20-inch Tie-in	2	Ea.	$11,240	$22,480
Instal 2-inch air release assy.	2	Ea.	$6,980	$13,960
Fill 20-inch PVC Pipe with cement sand slurry	6000	L.F.	$40	$240,000
AC Removal and Replacement	6000	L.F.	$50	$300,000
Construct Pipeline Offset	24	Each	$3,500	$84,000
Cut, Plug and Abandon of Existing Pipeline	1	LS	$9,034	$9,034
Install Test Head Furnishing for Pressure Testing	6	Each	$3,610	$21,660
Landscaping Removal & Replacement	1	LS	$12,644	$12,644
Guard underground services	1	LS	$16,540	$16,540
Line Item Subtotal				$2,391,918
Mobilization			3%	$71,758
De-mobilization			2%	$47,838
Construction Subtotal				**$2,511,514**
Engineering and Inspection			12%	$301,382
Subtotal				$2,812,896
Contingency			10%	$281,289.56
Subtotal				$3,094,185
General Administration			9%	$278,476.66
Total				**$3,373,000**

6. Basis for Budgeted Cost

The total OPCC includes Engineering and Inspection, General Administration, and Contingency factors. The Engineering and Inspection factor accounts for the estimated direct cost required to plan, design, and inspect the project, permit fees, and the cost of internal labor. The

General Administration factor considers Suburban’s general administrative expenses. The contingency factor accounts for unforeseen construction conflicts and complications that could result in additional project costs.

7. Impact of Deferral

The longer this pipeline replacement is deferred, the older the pipes will become, the likelihood of failure will increase, and the frequency of breaks will increase. The breaks will increasingly cause undesirable service interruptions to customers, and the overall system condition will exponentially worsen.

8. Recommendation

- Alternative #1 is not feasible because it does not resolve the interruptions of service issues to customers and does not prevent the degradation of the integrity of the water system infrastructure in this area.
- Alternative #2 has limitations with making this Alternative lose its cost-benefit and construction efficiency.
- Alternative #3 is a better solution because it provides full reliability, quality, and abundance of service to the customer in the area. Suburban recommends Alternative #3.

9. Appendix 1

- Recording Drawing 87-1100

CONFIDENTIAL

FINAL AS BUILT 10-28-87 R.B.A.

100'± 12" P.V.C. C-200 | 100'± 20" STL. | 625'± 20" PLASTIC DR-25

CONFIDENTIAL

N.T.S.

10/72 DIETERICH-POST CLEARPRINT 1000

Garnier Routing R/W Dept.	BY
	DATE
TENTATIVE	
FINAL	

87-1100

FINAL AS BUILT 10-28-87 RBA

1200'± 20" PLASTIC DR-25

℄ TEMPLE AVE

CONFIDENTIAL

Routing	BY	TENTATIVE
R/W Dept.	DATE	FINAL

87-1100

FINAL AS BUILT 10-28-87 R.B.A.

10/72 DIETERICH-POST CLEARPRINT 1020

1,000'± 20" PLASTIC DR-25

℄ HILL ST

CONFIDENTIAL

87-1100

FINAL AS BUILT 10-28-87 R.B.A.

10/72 DIETERICH-POST CLEARPRINT 1020

1,000'± 20" PLASTIC DR-25

CONFIDENTIAL

10/72 DIETERICH-POST CLEARPRINT 1000

FINAL AS BUILT 10-28-87 R.B.A.

950'± 20" PLASTIC DR-25

CONFIDENTIAL

87-1100

FINAL AS BUILT 10-28-87 R.B.A.

36/72 DIETERICH-POST CLEARPRINT 1000

330'± 20" PLASTIC DR-25

CONFIDENTIAL

R/W Dept. | DATE | FINAL

FINAL AS BUILT 10-28-87 R.B.A.

805'± 20" PLASTIC DR-25

CONFIDENTIAL

FINAL AS BUILT 10-28-87 R.B.A.

W-15

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PROJECT DESIGN REPORT

FROM: Engineering Department

DATE: March 23, 2022

DISTRICT: SJH

SUBJECT: Valinda Avenue Pipeline Replacement; CP-416

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1. Executive Summary

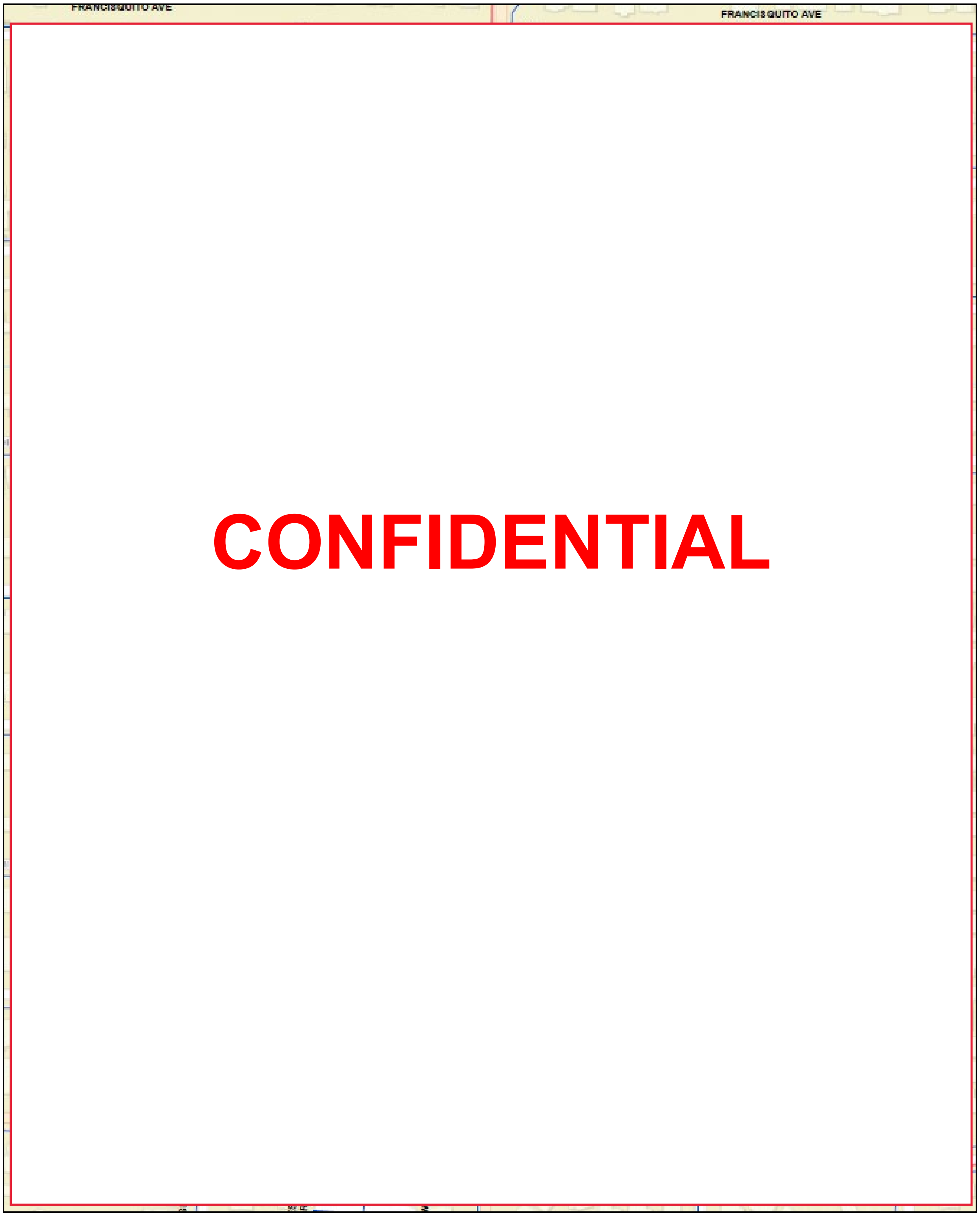
The existing 12-inch asbestos cement (AC) mains on Valinda Avenue between Maplegrove Street on the south and Holton Street on the north have experienced many breaks in the past years, reached the end of their useful lives, and do not provide an adequate level of service to the customers. It is recommended that this 12-inch existing AC main be replaced by approximately 2,100 LF of 12-inch PVC main to provide a safe and reliable water supply to the customers in the area.

2. Introduction

The existing 12-inch AC main on Valinda Avenue between Maplegrove Street and Fellowship Street in the unincorporated Los Angeles County has experienced frequent main breaks in the past years causing service interruptions and inconvenience to customers. Suburban has made piecemeal repairs to continue to provide service to its customers, but this is not a long-term solution. The water mains have reached the end of their useful lives. It is recommended to replace this existing 12-inch AC main with approximately 2,100 LF 12-inch PVC Pipe in the project area to provide a safe and reliable water supply to the customers.

Figure 1 shows the project area. This project has been grouped per the recommendations of the pipeline condition assessment to include all mains that were constructed as part of this tract and are expected to continue to experience breaks. A detailed explanation of the grouping is outlined in Chapter 1 of the "Suburban Water Systems Water Main Renewal Technical Memorandum, 2022," included in Workpaper VOLUME III-E.

Figure 1. Project Area and Break Map



3. Project Background

No record drawing is available for the existing 12-inch AC main from Maplegrove St. to Doublegrove St. The record drawing from Doublegrove St. to Francisquito Ave. is shown below in Figure 2 under Drawing # 378-SJ-2 with the development of TRACT No. 16460. This part of the 12-inch AC main was installed in 1951 and was tie-in on the south to the existing 12-inch C-100 AC main as shown on the record drawing. With this information, it is safe to assume that the southern part of the 12-inch AC main was installed no later than 1951.

Figure 2. Record Drawing

Suburban Water Systems (Suburban) started to collect water main break data in 1998. All the main breaks for this project from 1998 to 2021 are also shown in Table 1 and illustrated with green dots in Figure 1.

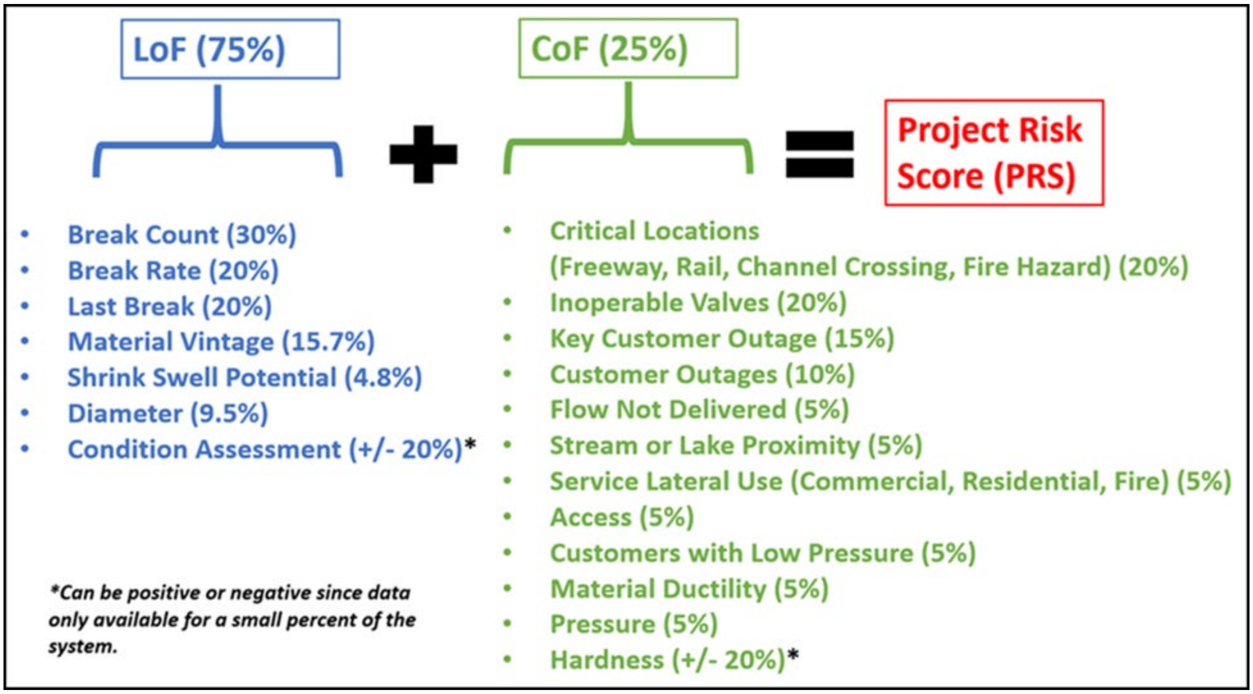
Table 1. Break Record

BREAK TYPE	BREAK DATE	STREET	ADDRESS	CITY
Main	3/7/2002			
Main	8/20/2002			
Main	7/14/2003			
Main	3/24/2005			
Main	9/13/2007			
Main	6/19/2013			
Main	5/5/2017			
Main	7/5/2017		CONFIDENTIAL	
Main	10/9/2017			
Main	9/9/2020			
Main	12/11/2020			
Main	6/23/2021			
TOTAL BREAK				

4. Project Risk Score (PRS)

In 2018 Suburban engaged HDR to perform an independent condition analysis of the pipeline infrastructure. HDR updated the study in 2022. See HDR's Suburban Water Systems Water Main Renewal Technical Memorandum 2022 included in Workpaper VOLUME III-E (HDR TM). To evaluate the system, HDR developed a Risk Model for pipeline renewal and replacement. This model calculated a Project Risk Score (PRS) to quantify the relative risk of failure from very low to severe. This methodology considers the likelihood of failure (LoF) and the consequence of failure (CoF) of the main. Each of the PRS criterion (LoF and CoF) are made up of many factors. Figure 3 summarizes the PRS calculation methodology.

Figure 3. Risk Calculation Method



4.1. PRS Calculation Methodology

As shown in Figure 3, the LoF weight is 75 percent and the CoF weight is 25 percent. The PRS is on a scale of zero to one hundred, LoF can contribute up to 75 points, and the CoF can contribute up to 25 points. Each factor was scored on a 0 to 10 scale (Factor Score), where 0 represents the lowest risk, and 10 represents the highest risk. A detailed explanation of each factor is explained in chapter 4 of the technical memorandum. Each pipeline segment is calculated separately for its LoF and CoF based on the following equation:

LoF Score = ∑ (LoF Factor Score x 10 x Weight x Criterion Weight)

CoF Score = ∑ (CoF Factor Score x 10 x Weight x Criterion Weight)

The PRS for each segment is the summation of LoF and CoF:

PRS = LoF Score + CoF Score

The final PRS for the entire project is a weighted average of pipe risk score by length:

Final Project Risk Score = ∑ (PRS x Length) ÷ ∑ (Length)

4.2. PRS Calculation Results

Table 2 below summarizes the PRS provided by HDR TM 2022 for this replacement project.

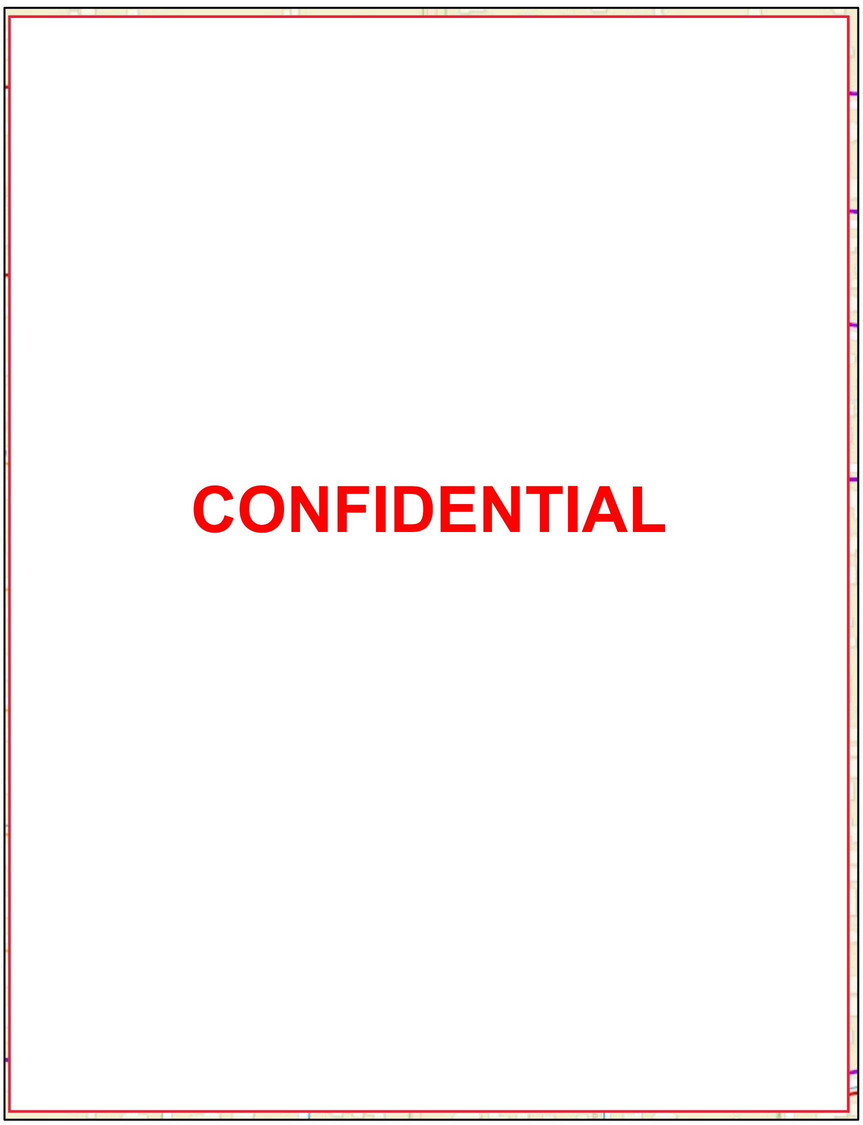
Table 2. Summary of PRS

Project #	Sum of Pipe_Length*	Average of LoF_PRS	Average of CoF_PRS	Average of PRS
SJH_80_91_1946	1,955	55.2	5.4	60.5

*****: The pipe length in Table 2 is from the current GIS database. The estimated replacement length is different. It is measured with new alignments, appurtenances, tie-ins, and any line segment within the project boundary but not included in the current GIS under the same Project Number.

Figure 4 is the PRS map for this project FROM HDR TM 2022.

Figure 4. Project Risk Score Map



5. Improvement Alternative's Summary

Alternative 1 – Do nothing. This alternative continues to use the existing pipelines, resulting in continued repairs when breaks occur. This is an undesirable option because the pipelines will continue to fail, interrupting service customers. This will cause poor customer service and higher costs for repairs and piecemeal replacement.

Alternative 2 – Rehabilitate the existing water main. Three rehabilitation methods were evaluated for this alternative.

- Pipebursting
- Sliplining
- Cured-In-Place Pipe (CIPP)

A detailed description of each rehabilitation method is shown below.

Pipebursting – Pipebursting is a method by which the existing pipe is opened and forced outward by a bursting tool. A hydraulic or pneumatic expansion head (part of the bursting tool) is pulled through the existing pipeline, typically using a cable and winch. As the expansion head is pulled through the existing pipe, it pushes that pipe radially outward until it breaks apart, creating a space for the new pipe. The bursting device also pulls the new pipeline behind it, immediately filling the void created by the old, burst pipe with the new pipe. Pipebursting can be used to replace the existing pipe with a similarly sized or larger pipe.

Pipebursting is not recommended if the existing pipe is asbestos cement because the process leaves broken asbestos pieces in the ground. When the pipe is disturbed, it is considered a waste disposal site and is subject to National Emission Standards for Hazardous Air Pollutants (NESHAP) requirements. Friable asbestos fibers lead to cancer of the lungs, known as mesothelioma. Future maintenance activities such main repairs due to breaks or replacing service lines will be required and may lead to health concerns.

Sliplining – Sliplining is inserting a new pipe by pulling or pushing it into the existing pipe and grouting the annular space. After it is in place, the pipe is grouted to hold the lining in place and for additional rigidity.

Sliplining new pipes will generally have a significantly reduced cross-sectional area. Sliplining is not recommended if maintaining or increasing fire flow in the area is required.

CIPP – A cured-in-place pipe (CIPP) is a trenchless rehabilitation method to repair existing pipelines. It is a jointless, seamless pipelining within an existing pipe. The process of CIPP involves inserting and running a felt lining into a pre-existing pipe that is the subject of repair. The resin within the liner is then exposed to a curing element to make it attach to the inner walls of the pipe. Once fully cured, the lining now acts as a new pipeline.

Like sliplining, CIPP is not recommended if maintaining or increasing fire flow is required because the cross-sectional area of the pipeline after rehabilitation is reduced.

There are some common limitations for all three rehabilitation methods compared with open trench replacement:

1. Rehabilitation methods are used for sewer pipelines. Sewer pipelines are straight and are usually deeper than water lines. Offsets and fittings make using these methods more costly. Open trenching deep sewer mains are also more expensive than water mains installed 42-60 inches deep.
2. Typically, there is only one main in the street that serves customers and cannot be switched to other mains during the construction of a new main. A temporary by-pass system is required to provide continuous service to customers. During summer, water in the by-pass pipe is heated because it is in direct contact with the sun. Driveways are blocked by the above-ground pipe and can easily be damaged.
3. Installation pits are required when horizontal and vertical alignment changes are substantial that the new pipe won't be able to pull or push through the existing pipe. Most Suburban's record drawings in the 50s and 60s don't include profile views of the pipelines, and it is suspected that there are multiple offsets. Offsets are required to avoid underground utilities such as gas, cable, water, and storm drain. Most often, water lines cross these utilities multiple times on a street. Digging pits will result in delays and continuous customer interruptions and increase construction costs.
4. Open trench pipe replacement method minimizes water interruptions to one, eight (8) hour shutdown to connect the new pipeline to the existing system, and one, thirty (30) minute shutdown to switch customer services. Mains must be pressure tested and disinfected. There are occasions when passing bacteriological testing can take several weeks due to positive e-coli results. Open trench replacement allows new mains, valves, and service connections to be pressure tested and disinfected before the final shut down to connect to the existing system. Trenchless rehabilitation of the existing pipelines can only be constructed section by section. Each section requires a much

longer shutdown time for service connection, pressure testing, and disinfection to bring back the service and move on to the next one. Replacing the pipelines using rehabilitation techniques will add more time to the project resulting in more costs.

Rehabilitation methods are good alternatives for specific applications like steep hills, where surfaces cannot be disturbed, and if there are no service connections on the main. Suburban's pipeline contractors have not performed rehabilitation methods on residential streets with services. Health and environmental concerns have not been fully addressed when using them on AC pipes. Additional fittings and offsets require more deep excavation pits and will increase the cost and duration of the project. It is not recommended to rehabilitate neighborhood pipelines and continue replacing pipelines using an open trench method.

Alternative 3 – Replace the existing water main with approximately 2,100 LF 12-inch PVC pipes and associated appurtenances. This Alternative will improve the integrity of the distribution system, eliminate service interruptions in this area, and ensure safe and reliable service to the customers.

According to the Association for the Advancement of Cost Engineering, this alternative is Class 3 of Opinion of Probable Construction Cost (OPCC) for constructing the replacement pipelines. The expected accuracy range for Class 3 is between +10% to +30%. Therefore, a 10% contingency is used in the OPCC.

Description	Quantity	Unit	Unit Cost	Cost
Construct 12-inch PVC	2100	L.F.	$190	$399,000
12-inch Butterfly Valves	5	Each	$4,050	$20,250
12-inch Tie-In	5	Each	$8,900	$44,500
6-inch Fire Hydrant	3	Each	$10,870	$32,610
Instal 2-inch air release assy.	1	Ea.	$6,890	$6,890
1-inch service	20	Each	$2,110	$42,200
AC Removal and Replacement	2100	L.F.	$50	$105,000
Construct Pipeline Offset	9	Each	$3,500	$31,500
Cut, Plug and Abandon of Existing Pipeline	1	LS	$9,034	$9,034
Traffic Rated (H-20) Meter Lids	20	Each	$250	$5,000
Install Test Head Furnishing for Pressure Testing	2	Each	$3,610	$7,220
Landscaping Removal & Replacement	1	LS	$12,644	$12,644
Guard underground services	1	LS	$16,540	$16,540
Line Item Subtotal				$732,388
Mobilization			3%	$21,972
De-mobilization			2%	$14,648
Construction Subtotal				**$769,007**
Engineering and Inspection			12%	$92,281
Subtotal				$861,288
Contingency			10%	$86,129
Subtotal				$947,417
General Administration			9%	$85,268
Total				**$1,033,000**

6. Basis for Budgeted Cost

The total OPCC includes Engineering and Inspection, General Administration, and Contingency factors. The Engineering and Inspection factor accounts for the estimated direct cost required to plan, design, and inspect the project, permit fees, and the cost of internal labor. The General Administration factor considers Suburban's general administrative expenses. The contingency factor accounts for unforeseen construction conflicts and complications that could result in additional project costs.

7. Impact of Deferral

The longer this pipeline replacement is deferred, the older the pipes will become, the likelihood of failure will increase, and the frequency of breaks will increase. The breaks will increasingly cause undesirable service interruptions to customers, and the overall system condition will exponentially worsen.

8. Recommendation

- Alternative #1 is not feasible because it does not resolve the interruptions of service issue to customers and does not prevent the degradation of the integrity of the water system infrastructure in this area.
- Alternative #2 has limitations with making this Alternative lose its cost-benefit and construction efficiency.
- Alternative #3 is a better solution because it provides full reliability, quality and abundance of service to the customer in the area. Suburban recommends Alternative #3.

W-16

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PROJECT DESIGN REPORT

FROM: Engineering Department

DATE: July 28, 2022

DISTRICT: SJH

SUBJECT: Sunkist Avenue Pipeline Replacement; CP-299

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1. Executive Summary

The existing 4-inch steel main on Sunkist Avenue has experienced many breaks in the past years, reached the end of its useful life, and does not provide an adequate level of service to the customers. It is recommended to replace this water main to provide a safe and reliable water supply to the customers in the area.

2. Introduction

The existing 4-inch steel main on Sunkist Avenue in the City of West Covina, have experienced frequent main breaks. The breaks result in service interruptions and inconvenience to customers. Suburban has made piecemeal repairs to continue to provide service to its customers, but this is not a long-term solution. The water mains have reached the end of their useful lives. It is recommended to replace this existing 4-inch main with approximately 1,100 LF 6-inch PVC Pipes in the project area to provide a safe and reliable water supply to the customers.

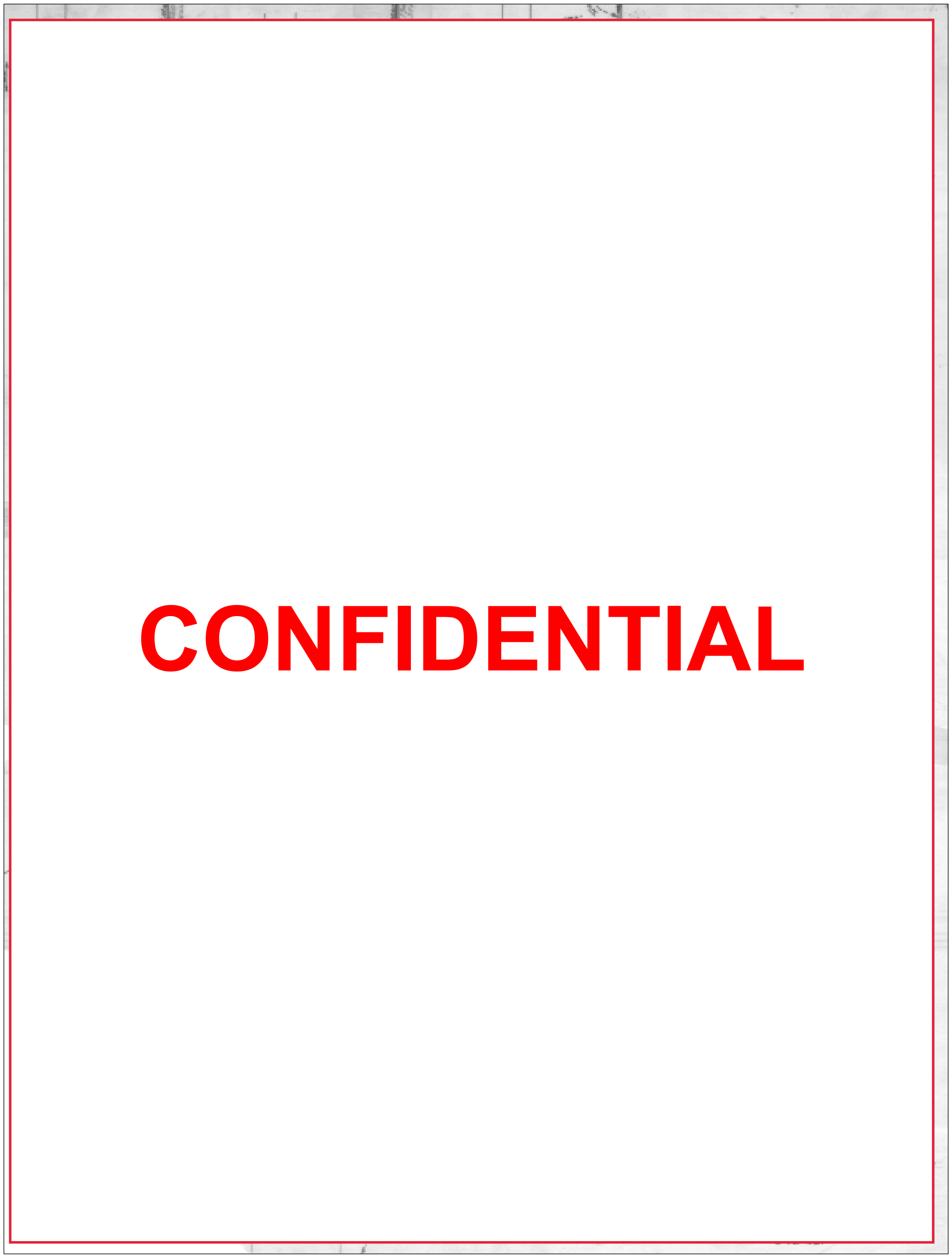
Figure 1 shows the map of the project area. This project has been grouped per the recommendations of the pipeline condition assessment to include all mains that were constructed as part of this tract and are expected to continue to experience breaks. A detailed explanation of the grouping is outlined in Chapter 1 of the "*Suburban Water Systems Water Main Renewal Technical Memorandum, 2022,*" included in Workpaper VOLUME III-E.

Figure 1. Project Area and Break Map

3. Justification

Record drawing (Figure 2) show the most existing pipe materials is steel. This pipeline was originally built in 1946 by Sunkist Water Company during the development of TRACT 13865 under the Project Number 052-SK-2. They are a part of the distribution system in the 547 Zone in the San Jose Hills District of Suburban.

Figure 2. Record Drawing



The proposed project is in the Disadvantage Areas according to SB 535 (see Figure 3).

Figure 3. Project in the SB 535 Disadvantage Areas

Suburban Water Systems (Suburban) started having water main break data in 1998. All the main breaks for this project from 1998 to 2021 are also shown in Table 1 and illustrated with green dots in Figure 1.

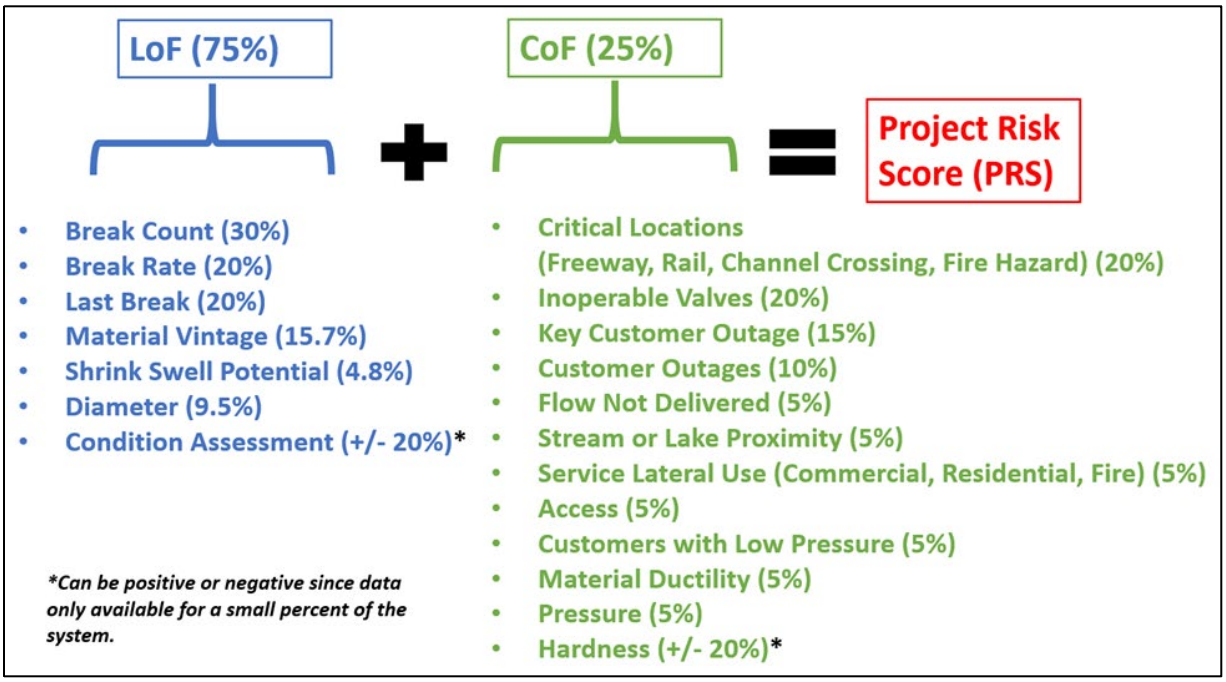
Table 1. Break Record

BREAK TYPE	BREAK DATE	ADDRESS	STREET	CITY
Main	8/24/2000			
Main	1/16/2008			
Main	6/27/2008			
Main	3/20/2017			
Main	10/22/2018		CONFIDENTIAL	
Main	3/4/2019			
Main	3/23/2020			
TOTAL				

4. Project Risk Score (PRS)

In 2018 Suburban engaged HDR to perform an independent condition analysis of the pipeline infrastructure. HDR updated the study in 2022. See HDR's Suburban Water Systems Water Main Renewal Technical Memorandum 2022 included in Workpaper VOLUME III-E (HDR TM). To evaluate the system, HDR developed a Risk Model for pipeline renewal and replacement. This model calculated a Project Risk Score (PRS) to quantify the relative risk of failure from very low to severe. This methodology considers the likelihood of failure (LoF) and the consequence of failure (CoF) of the main. Each of the PRS criterion (LoF and CoF) are made up of many factors. Figure 4 summarizes the PRS calculation methodology.

Figure 4. Risk Calculation Method



4.1 PRS Calculation Methodology

As shown in Figure 4, the LoF weight is 75 percent and the CoF weight is 25 percent. The PRS is on a scale of zero to one hundred, LoF can contribute up to 75 points, and the CoF can contribute up to 25 points. Each factor was scored on a 0 to 10 scale (Factor Score), where 0 represents the lowest risk, and 10 represents the highest risk. A detailed explanation of each factor is explained in chapter 4 of the technical memorandum. Each pipeline segment is calculated separately for its LoF and CoF based on the following equation:

$$\text{LoF Score} = \sum (\text{LoF Factor Score} \times 10 \times \text{Weight} \times \text{Criterion Weight})$$

$$\text{CoF Score} = \sum (\text{CoF Factor Score} \times 10 \times \text{Weight} \times \text{Criterion Weight})$$

The PRS for each segment is the summation of LoF and CoF:

$$\text{PRS} = \text{LoF Score} + \text{CoF Score}$$

The final PRS for the entire project is a weighted average of pipe risk score by length:

$$\textbf{Final Project Risk Score} = \sum (\textbf{PRS x Length}) \div \sum (\textbf{Length})$$

4.2 PRS Calculation Result

Table 2 below summarizes the PRS provided by HDR TM 2022 for this replacement project.

Table 2. Summary of PRS

Project #	Sum of Pipe_Length*	Average of LoF_PRS	Average of CoF_PRS	Average of PRS
053-SK-2	1,067	65.0	1.4	63.7

*: The pipe length in Table 2 is from the current GIS database. The estimated replacement length is different. It is measured with new alignments, appurtenances, tie-ins, and any line segment within the project boundary but not included in the current GIS under the same Project Number.

Figure 5 is the PRS map for this project from HDR TM 2022.

Figure 5. Project Risk Score Map

5. Improvement Alternative's Summary

Alternative 1 – Do nothing. This alternative continues to use the existing pipelines, resulting in continued repairs when breaks occur. This is an undesirable option because the pipelines will continue to fail, interrupting service customers. This will cause poor customer service and higher costs for repairs and piecemeal replacement.

Alternative 2 – Rehabilitate the existing water main. Three rehabilitation methods were evaluated for this alternative.

- Pipebursting
- Sliplining
- Cured-In-Place Pipe (CIPP)

A detailed description of each rehabilitation method is shown below.

Pipebursting – Pipebursting is a method by which the existing pipe is opened and forced outward by a bursting tool. A hydraulic or pneumatic expansion head (part of the bursting tool) is pulled through the existing pipeline, typically using a cable and winch. As the expansion head is pulled through the existing pipe, it pushes that pipe radially outward until it breaks apart, creating a space for the new pipe. The bursting device also pulls the new pipeline behind it, immediately filling the void created by the old, burst pipe with the new pipe. Pipebursting can be used to replace the existing pipe with a similarly sized or larger pipe.

Pipebursting is not recommended if the existing pipe is asbestos cement because the process leaves broken asbestos pieces in the ground. When the pipe is disturbed, it is considered a waste disposal site and is subject to National Emission Standards for Hazardous Air Pollutants (NESHAP) requirements. Friable asbestos fibers lead to cancer of the lungs, known as mesothelioma. Future maintenance activities such main repairs due to breaks or replacing service lines will be required and may lead to health concerns.

Sliplining – Sliplining is inserting a new pipe by pulling or pushing it into the existing pipe and grouting the annular space. After it is in place, the pipe is grouted to hold the lining in place and for additional rigidity.

Sliplining new pipes will generally have a significantly reduced cross-sectional area. Sliplining is not recommended if maintaining or increasing fire flow in the area is required.

CIPP – A cured-in-place pipe (CIPP) is a trenchless rehabilitation method to repair existing pipelines. It is a jointless, seamless pipelining within an existing pipe. The process of CIPP involves inserting and running a felt lining into a pre-existing pipe that is the subject of repair. The resin within the liner is then exposed to a curing element to make it attach to the inner walls of the pipe. Once fully cured, the lining now acts as a new pipeline.

Like sliplining, CIPP is not recommended if maintaining or increasing fire flow is required because the cross-sectional area of the pipeline after rehabilitation is reduced.

There are some common limitations for all three rehabilitation methods compared with open trench replacement:

1. Rehabilitation methods are used for sewer pipelines. Sewer pipelines are straight and are usually deeper than water lines. Offsets and fittings make using these methods more costly. Open trenching deep sewer mains are also more expensive than water mains installed 42-60 inches deep.
2. Typically, there is only one main in the street that serves customers and cannot be switched to other mains during the construction of a new main. A temporary by-pass system is required to provide continuous service to customers. During summer, water in the by-pass pipe is heated because it is in direct contact with the sun. Driveways are blocked by the above-ground pipe and can easily be damaged.
3. Installation pits are required when horizontal and vertical alignment changes are substantial that the new pipe won’t be able to pull or push through the existing pipe. Most Suburban’s record drawings in the 50s and 60s don’t include profile views of the pipelines, and it is suspected that there are multiple offsets. Offsets are required to avoid underground utilities such as gas, cable, water, and storm drain. Most often, water lines cross these utilities multiple times on a street. Digging pits will result in delays and continuous customer interruptions and increase construction costs.
4. Open trench pipe replacement method minimizes water interruptions to one, eight (8) hour shutdown to connect the new pipeline to the existing system, and one, thirty (30) minute shutdown to switch customer services. Mains must be pressure tested and disinfected. There are occasions when passing bacteriological testing can take several weeks due to positive e-coli results. Open trench replacement allows new mains, valves, and service connections to be pressure tested and disinfected before the final shut down to connect to the existing system. Trenchless rehabilitation of the existing pipelines can only be constructed section by section. Each section requires a much

longer shutdown time for service connection, pressure testing, and disinfection to bring back the service and move on to the next one. Replacing the pipelines using rehabilitation techniques will add more time to the project resulting in more costs.

Rehabilitation methods are good alternatives for specific applications like steep hills, where surfaces cannot be disturbed, and if there are no service connections on the main. Suburban's pipeline contractors have not performed rehabilitation methods on residential streets with services. Health and environmental concerns have not been fully addressed when using them on AC pipes. Additional fittings and offsets require more deep excavation pits and will increase the cost and duration of the project. It is not recommended to rehabilitate neighborhood pipelines and continue replacing pipelines using an open trench method.

Alternative 3 – Replace existing water main with approximately 1,100 L.F. of 6" PVC pipe and associated appurtenances. This Alternative will improve the integrity of the distribution system, eliminate service interruptions in this area, and ensure safe and reliable service to the customers.

According to the Association for the Advancement of Cost Engineering, this alternative is Class 3 of Opinion of Probable Construction Cost (OPCC) for constructing the replacement pipelines. The expected accuracy range for Class 3 is between +10% to +30%. Therefore, a 10% contingency is used in the OPCC.

Description	Quantity	Unit	Unit Cost	Cost
Construct 6-inch PVC	1100	L.F.	$120	$132,000
6-inch Gate Valve	2	Each	$1,660	$3,320
6-inch Tie-In	2	Each	$6,550	$13,100
6-inch Fire Hydrant	1	Each	$10,870	$10,870
1-inch service	26	Each	$2,110	$54,860
AC Removal and Replacement	1100	L.F.	$50	$55,000
Construct Pipeline Offset	2	Each	$3,500	$7,000
Cut, Plug and Abandon of Existing Pipeline	1	LS	$9,034	$9,034
Traffic Rated (H-20) Meter Lids	26	Each	$250	$6,500
Install Test Head Furnishing for Pressure Te	1	Each	$3,610	$3,610
Landscaping Removal & Replacement	1	LS	$12,644	$12,644
Guard underground services	1	LS	$16,540	$16,540
Line Item Subtotal				$324,478
Mobilization			3%	$9,734
De-mobilization			2%	$6,490
Construction Subtotal				**$340,702**
Engineering and Inspection			12%	$40,884
Subtotal				$381,586
Contingency			10%	$38,159
Subtotal				$419,745
General Administration			9%	$37,777
Total				**$458,000**

6. Basis for Budgeted Cost

The total OPCC includes Engineering and Inspection, General Administration, and Contingency factors. The Engineering and Inspection factor accounts for the estimated direct cost required to plan, design, and inspect the project, the cost of permit fees, and the cost of internal labor. The General Administration factor considers Suburban's general administrative expenses. The contingency factor accounts for unforeseen construction conflicts and complications that could result in additional project costs.

7. Impact of Deferral

The longer this pipeline replacement is deferred, the older the pipes will become, the likelihood of failure will increase, and the frequency of breaks will increase. The breaks will increasingly cause undesirable service interruptions to customers, and the overall system condition will exponentially worsen.

8. Recommendation

- Alternative #1 is not feasible because it does not resolve the interruptions of service issues to customers and does not prevent the degradation of the integrity of the water system infrastructure in this area.
- Alternative #2 has limitations with making this Alternative lose its cost-benefit and construction efficiency.
- Alternative #3 is recommended because it provides full reliability, quality, and abundance of service to the customer in the area. Suburban recommends Alternative #3.

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PROJECT DESIGN REPORT

FROM: Engineering Department
DATE: March 29, 2022
DISTRICT: WLM
SUBJECT: Ashgrove Drive and Watkins Drive Pipeline Replacement; CP-465

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1. Executive Summary

The existing 2-inch, 4-inch, and 8-inch steel water mains in Ashgrove Drive and Watkins Drive area have experienced many breaks in the past years. They have reached the end of their useful lives and do not provide an adequate level of service to the customers. It is recommended that these 2-inch to 8-inch existing mains be replaced by approximately 12,660 LF of 4-inch to 8-inch PVC mains to provide a safe and reliable water supply to the customers in the area.

2. Introduction

The existing 2-inch, 4-inch, and 8-inch steel (STL) water mains in the area of Ashgrove Drive and Watkins Drive, west of Rayfield Drive, east of Watkins Drive, north of Stanbrook Drive, and south of Formby Drive, have experienced frequent main breaks in the past years causing service interruptions and inconvenience to customers. Suburban has made piecemeal repairs to continue to provide service to its customers, but this is not a long-term solution. The water mains have reached the end of their useful lives. It is recommended to replace the existing 2-inch, 4-inch, and 8-inch STL mains with approximately 12,660 LF 4-inch to 12-inch PVC pipes in the project area to provide a safe and reliable water supply to the customers.

Figure 1 shows the project area and Table 1 presents a summary of pipeline replacement in this project. This project has been grouped per the recommendations of the pipeline condition assessment to include all mains that were constructed as part of this tract and are expected to continue to experience breaks. A detailed explanation of the grouping is outlined in Chapter 1 of the "*Suburban Water Systems Water Main Renewal Technical Memorandum, 2022,*" included in Workpaper VOLUME III-E.

Figure 1. Project Area and Break Map

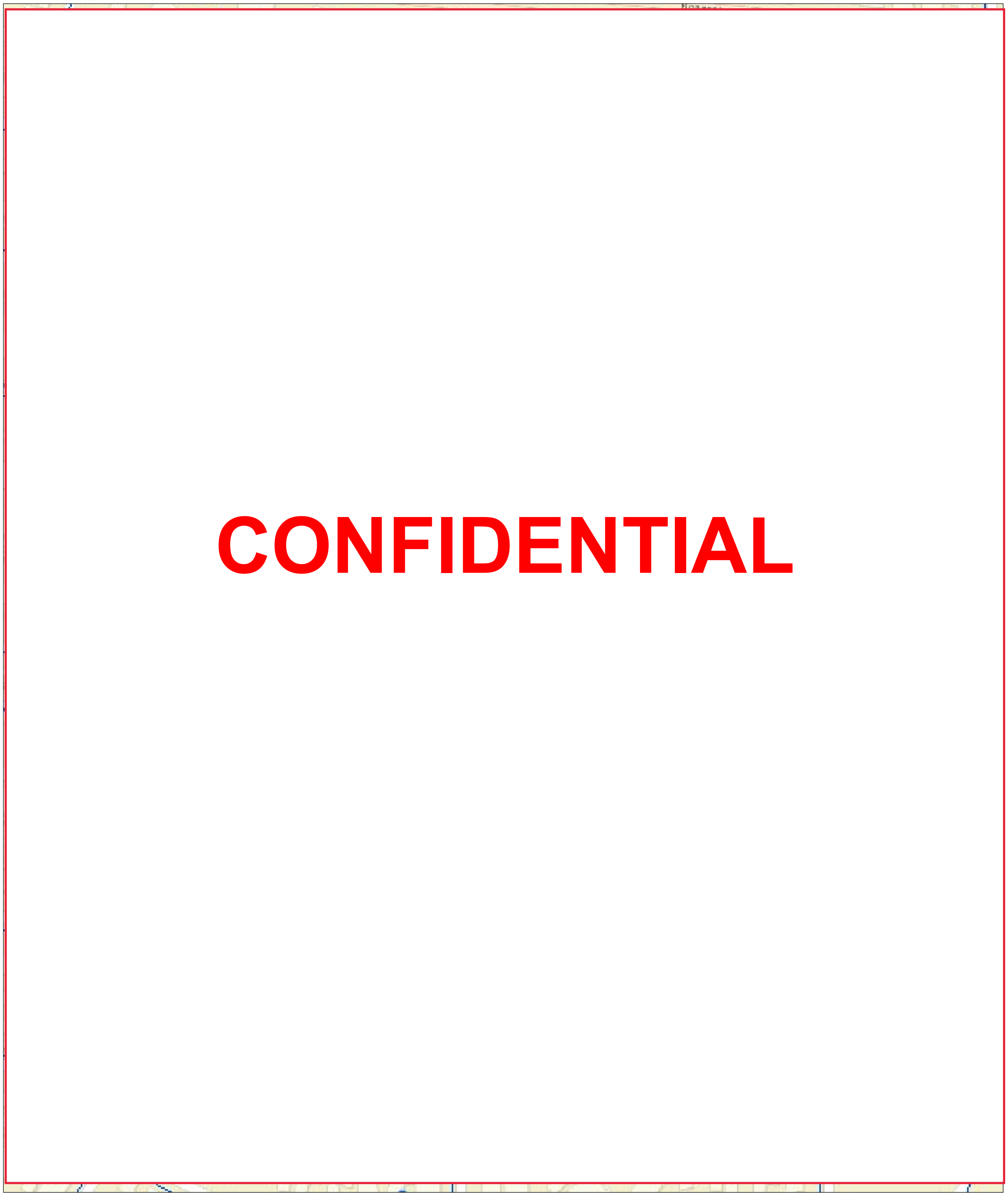


Table 1. Replacement Schedule

Quantity	**Existing Main**		**Proposed Main**	
(feet)	**Size** (inch)	**Material**	**Size** (inch)	**Material**
380	2	STL	4	PVC
260	2	STL	6	PVC
130	4	STL	4	PVC
1980	4	STL	6	PVC
1800	4	STL	8	PVC
2680	4	STL	12	PVC
4880	8	STL	8	PVC
550	8	STL	12	PVC
12,660				

3. Project Background

Record drawing (Figure 2) shows the existing pipes were originally installed in 1957 with the development of TRACT 20943 under Project Number LM-13 in the City of La Mirada. No pipe materials were shown in the record drawing. Other documents and previous main repair works indicated that they are steel pipes from 2-inch to 8-inch water mains. They are a part of the distribution system in the 335 Zone in the Whittier/La Mirada District of Suburban.

Figure 2. Record Drawing

CONFIDENTIAL

Suburban Water Systems (Suburban) water main break data is available from 1998. All the main breaks for this project on record from 1998 to 2021 are also shown in Table 2 and illustrated with blue dots on Figure 1.

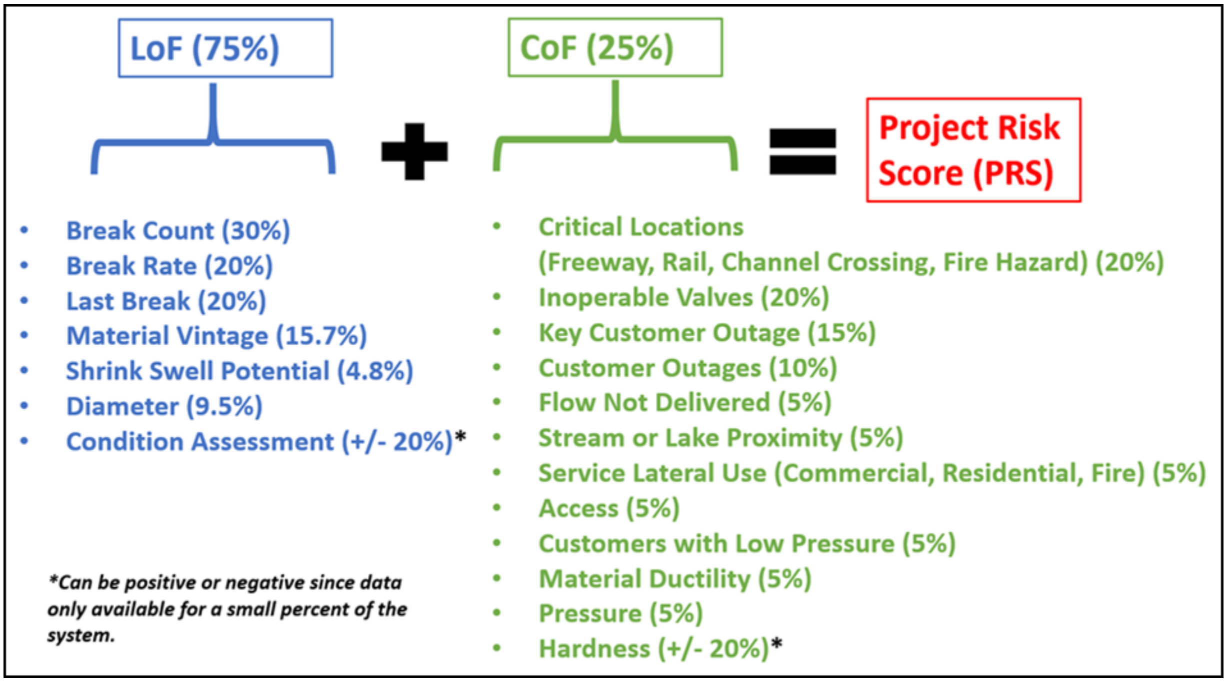
Table 2. Break Record

BREAK TYPE	BREAK DATE	ADDRESS	STREET	CROSS STREET	CITY
Main	5/20/1998				
Main	12/23/1998				
Main	5/31/2002				
Main	12/18/2004				
Main	7/14/2005				
Main	10/5/2011				
Main	1/2/2013				
Main	12/12/2014				
Main	11/21/2016		CONFIDENTIAL		
Main	12/28/2016				
Main	5/30/2017				
Main	12/29/2017				
Main	12/2/2019				
TOTAL BREAK					

4. Project Risk Score (PRS)

In 2018 Suburban engaged HDR to perform an independent condition analysis of the pipeline infrastructure. HDR updated the study in 2022. See HDR's Suburban Water Systems Water Main Renewal Technical Memorandum 2022 included in Workpaper VOLUME III-E (HDR TM). To evaluate the system, HDR developed a Risk Model for pipeline renewal and replacement. This model calculated a Project Risk Score (PRS) to quantify the relative risk of failure from very low to severe. This methodology considers the likelihood of failure (LoF) and the consequence of failure (CoF) of the main. Each of the PRS criterion (LoF and CoF) are made up of many factors. Figure 3 summarizes the PRS calculation methodology.

Figure 3. Risk Calculation Method



4.1. PRS Calculation Methodology

As shown in Figure 3, the LoF weight is 75 percent and the CoF weight is 25 percent. The PRS is on a scale of zero to one hundred, LoF can contribute up to 75 points, and the CoF can contribute up to 25 points. Each factor was scored on a 0 to 10 scale (Factor Score), where 0 represents the lowest risk, and 10 represents the highest risk. A detailed explanation of each factor is explained in chapter 4 of the technical memorandum. Each pipeline segment is calculated separately for its LoF and CoF based on the following equation:

LoF Score = ∑ (LoF Factor Score x 10 x Weight x Criterion Weight)

CoF Score = ∑ (CoF Factor Score x 10 x Weight x Criterion Weight)

The PRS for each segment is the summation of LoF and CoF:

PRS = LoF Score + CoF Score

The final PRS for the entire project is a weighted average of pipe risk score by length:

Final Project Risk Score = ∑ (PRS x Length) ÷ ∑ (Length)

4.2. PRS Calculation Result

Table 3 below summarizes the PRS provided by HDR TM 2022 for this replacement project.

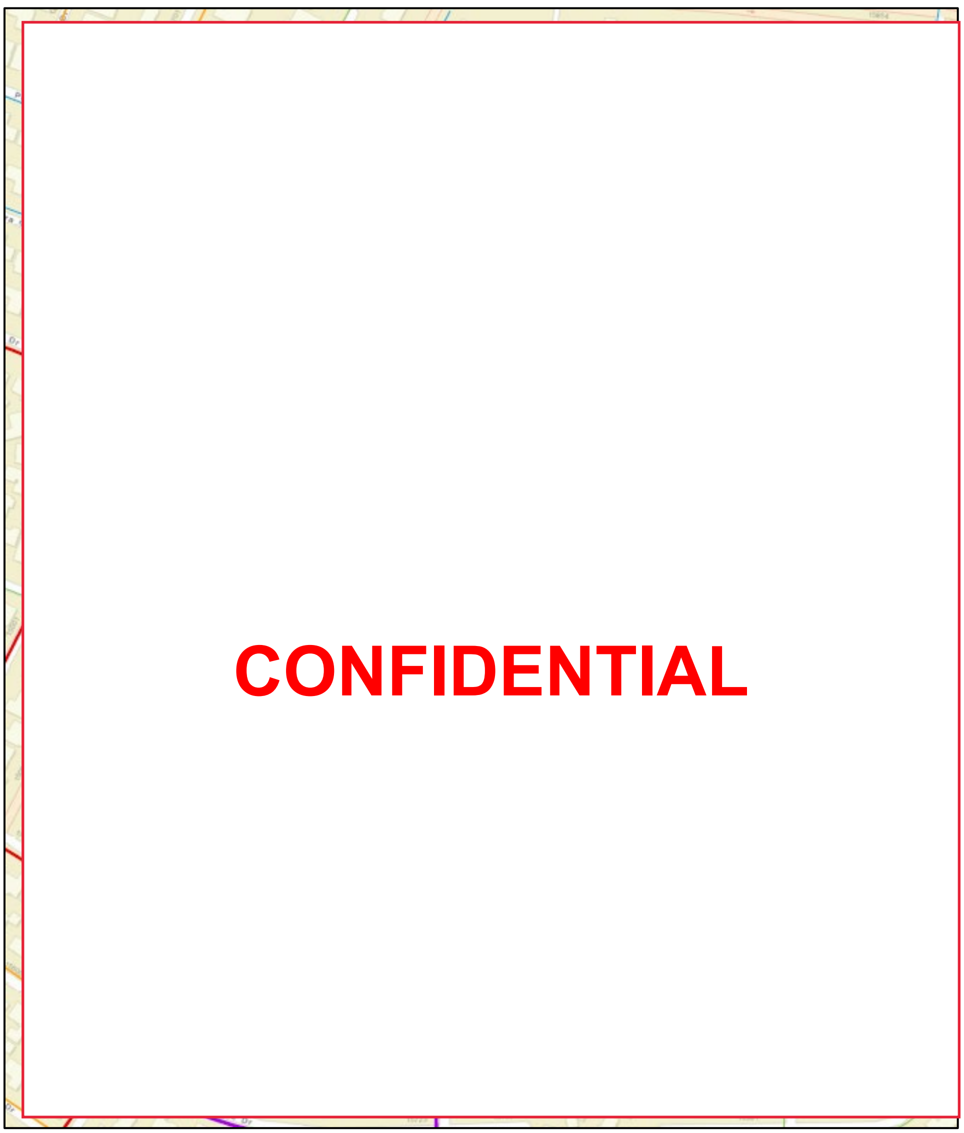
Table 3. Summary of PRS

Project #	Sum of Pipe_Length*	Average of LoF_PRS	Average of CoF_PRS	Average of PRS
LM-13	12,150	56.8	3.5	60.3

*****: The pipe length in Table 3 is from the current GIS database. The estimated replacement length is different. It is measured with new alignments, appurtenances, tie-ins, and any line segment within the project boundary but not included in the current GIS under the same Project Number.

Figure 4 is the PRS map for this project from HDR TM 2022.

Figure 4. Project Risk Score Map



5. Improvement Alternative's Summary

Alternative 1 – Do nothing. This alternative continues to use the existing pipelines, resulting in continued repairs when breaks occur. This is an undesirable option because the pipelines will continue to fail, interrupting service customers. This will cause poor customer service and higher costs for repairs and piecemeal replacement.

Alternative 2 – Rehabilitate the existing water main. Three rehabilitation methods were evaluated for this alternative.

- Pipebursting
- Sliplining
- Cured-In-Place Pipe (CIPP)

A detailed description of each rehabilitation method is shown below.

Pipebursting – Pipebursting is a method by which the existing pipe is opened and forced outward by a bursting tool. A hydraulic or pneumatic expansion head (part of the bursting tool) is pulled through the existing pipeline, typically using a cable and winch. As the expansion head is pulled through the existing pipe, it pushes that pipe radially outward until it breaks apart, creating a space for the new pipe. The bursting device also pulls the new pipeline behind it, immediately filling the void created by the old, burst pipe with the new pipe. Pipebursting can be used to replace the existing pipe with a similarly sized or larger pipe.

Pipebursting is not recommended if the existing pipe is asbestos cement because the process leaves broken asbestos pieces in the ground. When the pipe is disturbed, it is considered a waste disposal site and is subject to National Emission Standards for Hazardous Air Pollutants (NESHAP) requirements. Friable asbestos fibers lead to cancer of the lungs, known as mesothelioma. Future maintenance activities such main repairs due to breaks or replacing service lines will be required and may lead to health concerns.

Sliplining – Sliplining is inserting a new pipe by pulling or pushing it into the existing pipe and grouting the annular space. After it is in place, the pipe is grouted to hold the lining in place and for additional rigidity.

Sliplining new pipes will generally have a significantly reduced cross-sectional area. Sliplining is not recommended if maintaining or increasing fire flow in the area is required.

CIPP – A cured-in-place pipe (CIPP) is a trenchless rehabilitation method to repair existing pipelines. It is a jointless, seamless pipelining within an existing pipe. The process of CIPP involves inserting and running a felt lining into a pre-existing pipe that is the subject of repair. The resin within the liner is then exposed to a curing element to make it attach to the inner walls of the pipe. Once fully cured, the lining now acts as a new pipeline.

Like sliplining, CIPP is not recommended if maintaining or increasing fire flow is required because the cross-sectional area of the pipeline after rehabilitation is reduced.

There are some common limitations for all three rehabilitation methods compared with open trench replacement:

1. Rehabilitation methods are used for sewer pipelines. Sewer pipelines are straight and are usually deeper than water lines. Offsets and fittings make using these methods more costly. Open trenching deep sewer mains are also more expensive than water mains installed 42-60 inches deep.

2. Typically, there is only one main in the street that serves customers and cannot be switched to other mains during the construction of a new main. A temporary by-pass system is required to provide continuous service to customers. During summer, water in the by-pass pipe is heated because it is in direct contact with the sun. Driveways are blocked by the above-ground pipe and can easily be damaged.

3. Installation pits are required when horizontal and vertical alignment changes are substantial that the new pipe won't be able to pull or push through the existing pipe. Most Suburban's record drawings in the 50s and 60s don't include profile views of the pipelines, and it is suspected that there are multiple offsets. Offsets are required to avoid underground utilities such as gas, cable, water, and storm drain. Most often, water lines cross these utilities multiple times on a street. Digging pits will result in delays and continuous customer interruptions and increase construction costs.

4. Open trench pipe replacement method minimizes water interruptions to one, eight (8) hour shutdown to connect the new pipeline to the existing system, and one, thirty (30) minute shutdown to switch customer services. Mains must be pressure tested and disinfected. There are occasions when passing bacteriological testing can take several weeks due to positive e-coli results. Open trench replacement allows new mains, valves, and service connections to be pressure tested and disinfected before the final shut down to connect to the existing system. Trenchless rehabilitation of the existing pipelines can only be constructed section by section. Each section requires a much

longer shutdown time for service connection, pressure testing, and disinfection to bring back the service and move on to the next one. Replacing the pipelines using rehabilitation techniques will add more time to the project resulting in more costs.

Rehabilitation methods are good alternatives for specific applications like steep hills, where surfaces cannot be disturbed, and if there are no service connections on the main. Suburban's pipeline contractors have not performed rehabilitation methods on residential streets with services. Health and environmental concerns have not been fully addressed when using them on AC pipes. Additional fittings and offsets require more deep excavation pits and will increase the cost and duration of the project. It is not recommended to rehabilitate neighborhood pipelines and continue replacing pipelines using an open trench method.

Alternative 3 – Replace the existing water mains with 4-inch to 12-inch PVC pipes and associated appurtenances as shown in Table 1. This Alternative will improve the integrity of the distribution system, eliminate service interruptions in this area, and ensure safe and reliable service to the customers.

According to the Association for the Advancement of Cost Engineering, this alternative is Class 3 of Opinion of Probable Construction Cost (OPCC) for constructing the replacement pipelines. The expected accuracy range for Class 3 is between +10% to +30%. Therefore, a 10% contingency is used in the OPCC.

Description	Quantity	Unit	Unit Cost	Cost
Construct 12-inch PVC	3230	L.F.	$190	$613,700
12-inch Butterfly Valves	5	Each	$4,050	$20,250
12-inch Tie-In	2	Each	$8,900	$17,800
Construct 8-inch PVC	6680	L.F.	$130	$868,400
8-inch Gate Valves	14	Each	$1,960	$27,440
8-inch Tie-In	5	Each	$6,840	$34,200
Construct 6-inch PVC	2240	L.F.	$120	$268,800
6-inch Gate Valve	5	Each	$1,660	$8,300
6-inch Tie-In	1	Each	$6,650	$6,650
Construct 4-inch PVC	510	L.F.	$110	$56,100
4-inch Gate Valve	2	Each	$1,380	$2,760
6-inch Fire Hydrant	22	Each	$10,870	$239,140
2-inch Blow-off	2	Each	$5,330	$10,660
4-inch Meter Assembly	1	Each	$21,500	$21,500
1-inch service	260	Each	$2,110	$548,600
AC Removal and Replacement	12660	L.F.	$50	$633,000
Construct Pipeline Offset	51	Each	$3,500	$178,500
Cut, Plug and Abandon of Existing Pipeline	1	LS	$9,034	$9,034
Traffic Rated (H-20) Meter Lids	260	Each	$250	$65,000
Install Test Head Furnishing for Pressure Testing	13	Each	$3,610	$46,930
Landscaping Removal & Replacement	1	LS	$12,644	$12,644
Guard underground services	1	LS	$16,540	$16,540
Line Item Subtotal				$3,705,948
Mobilization			3%	$111,178
De-mobilization			2%	$74,119
Construction Subtotal				**$3,891,245**
Engineering and Inspection			12%	$466,949
Subtotal				$4,358,195
Contingency			10%	$435,819
Subtotal				$4,794,014
General Administration			9%	$431,461
Total				**$5,225,000**

6. Basis for Budgeted Cost

The total estimated project cost includes Engineering and Inspection, General Administration, and Contingency factors. The Engineering and Inspection factor accounts for the estimated direct cost required to plan, design and inspect the project, permit fees, and cost of internal labor. The General Administration factor considers Suburban's general administrative costs. The contingency factor accounts for unforeseen construction conflicts and complications that could result in additional project costs.

7. Impact of Deferral

The longer this pipeline replacement is deferred, the older the pipes will become and the likelihood of failure will increase, and the frequency of breaks will increase. The breaks will increasingly cause undesirable interruptions of service to customers and the overall system condition will exponentially worsen.

8. Recommendation

- Alternative #1 is not feasible because it does not resolve the interruptions of service issues to customers and does not prevent the degradation of the integrity of the water system infrastructure in this area.
- Alternative #2 has limitations with making this Alternative lose its cost-benefit and construction efficiency.
- Alternative #3 is a better solution because it provides full reliability, quality, and abundance of service to the customer in the area. Suburban recommends Alternative #3.

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PROJECT DESIGN REPORT

FROM: Engineering Department

DATE: March 30, 2022

DISTRICT: WLM

SUBJECT: Mulberry Drive and Calmada Avenue Pipeline Replacement; CP-455

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1. Executive Summary

The existing 4-inch, 6-inch, and 8-inch asbestos cement (AC) mains and Cast Iron (CI) mains in Mulberry Drive and Calmada Avenue area have experienced many breaks in the past years, reached the end of their useful lives, and do not provide an adequate level of service to the customers. It is recommended that these 4-inch to 8-inch existing mains be replaced by approximately 22,210 LF 8-inch PVC mains to provide a safe and reliable water supply to the customers in the area.

2. Introduction

The existing 4-inch, 6-inch AC and CI mains, 8-inch AC mains, and 8-inch double dipped and wrapped steel (ST DDW) mains in the un-incorporated Los Angele County on Mulberry Drive and Calmada Avenue area, south of Mulberry Drive, north of Mystic Street, east of Badminton Avenue, and west of Gunn Avenue, have experienced frequent main breaks in the past years causing service interruptions and inconvenience to customers. Suburban has made piecemeal repairs to continue to provide service to its customers, but this is not a long-term solution. The water mains have reached the end of their useful lives. It is recommended to replace the existing 4-inch, 6-inch AC and CI mains, 8-inch AC mains, and 8-inch double dipped and wrapped steel (ST DDW) main with approximately 22,210 LF 8-inch PVC pipes in the project area to provide a safe and reliable water supply to the customers.

Table 1 present a summary of pipeline replacement in this project and as Figure 1 shows the project area. This project has been grouped per the recommendations of the pipeline condition assessment to include all mains that were constructed as part of this tract and are expected to continue to experience breaks. A detailed explanation of the grouping is outlined in Chapter

1 of the "*Suburban Water Systems Water Main Renewal Technical Memorandum, 2022,*" included in Workpaper VOLUME III-E.

Table 1. Replacement Schedule

Quantity	Existing Main		Proposed Main	
(feet)	**Size** (inch)	**Material**	**Size** (inch)	**Material**
8660	4	AC/CI	8	PVC
8,520	6	AC/CI	8	PVC
4,880	8	AC	8	PVC
150	8	ST DDW	8	PVC
22,210				

Figure 1. Project Area and Break Map

3. Project History

Record drawings (Figures 2 - 6) show the existing pipelines were originally built in 1951 with the development of Tract 16878 under Project Number 277-WW-3. The materials of these pipelines are AC and CI pipes for the sizes of 4-inch and 6-inch, and AC for 8-inch pipes. Approximately 150 L.F. of 8-inch double dipped and wrapped steel mains built in 1966 at the north boundary of this project area on Calmada Avenue will be added to this project scope for replacement. These pipelines are a part of the distribution system in 265 Zone in the Whittier/La Mirada District of Suburban.

Figure 2. Record Drawing 1

Figure 3. Record Drawing 2

Figure 4. Record Drawing 3

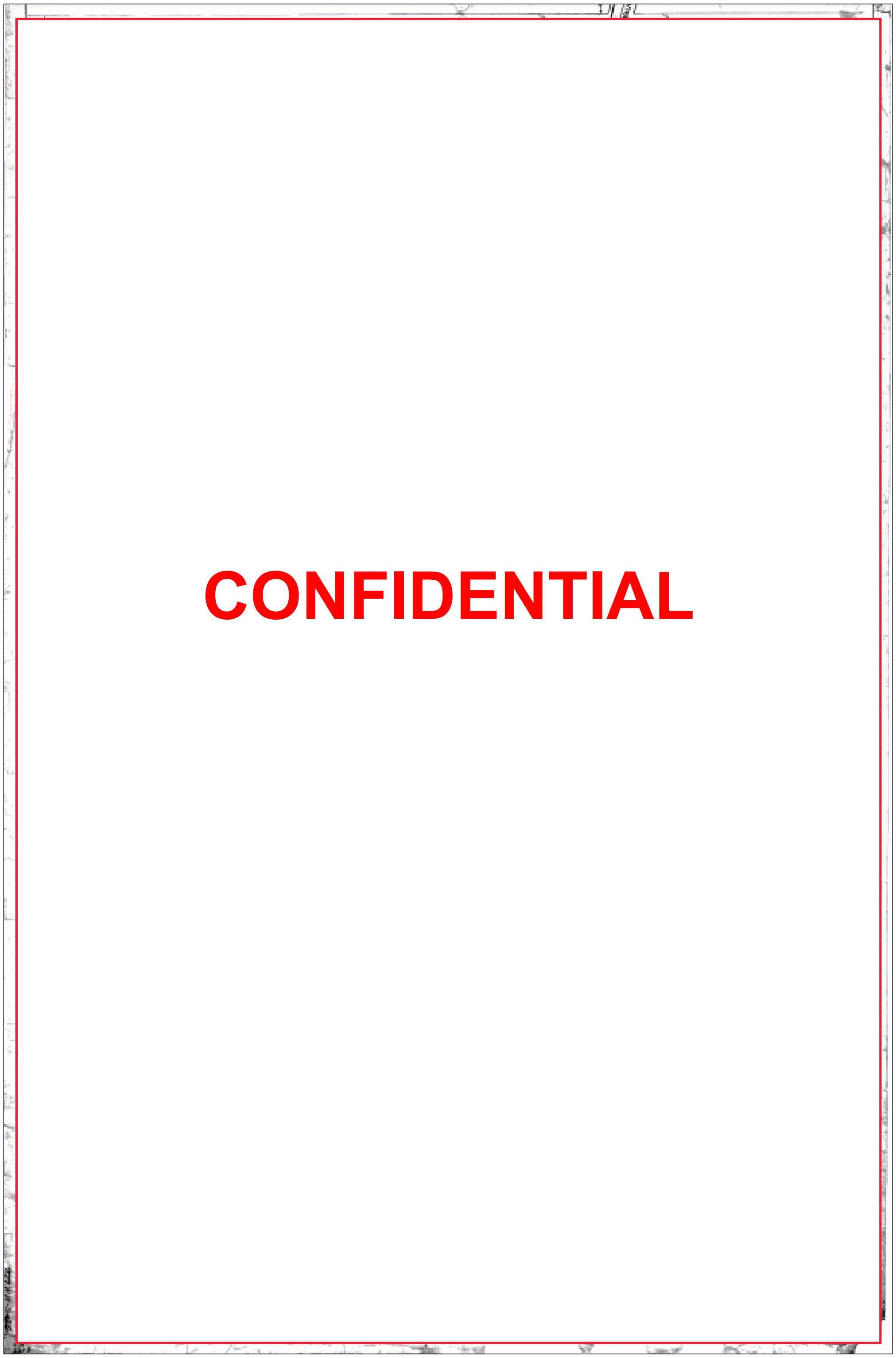


Figure 5. Record Drawing 4

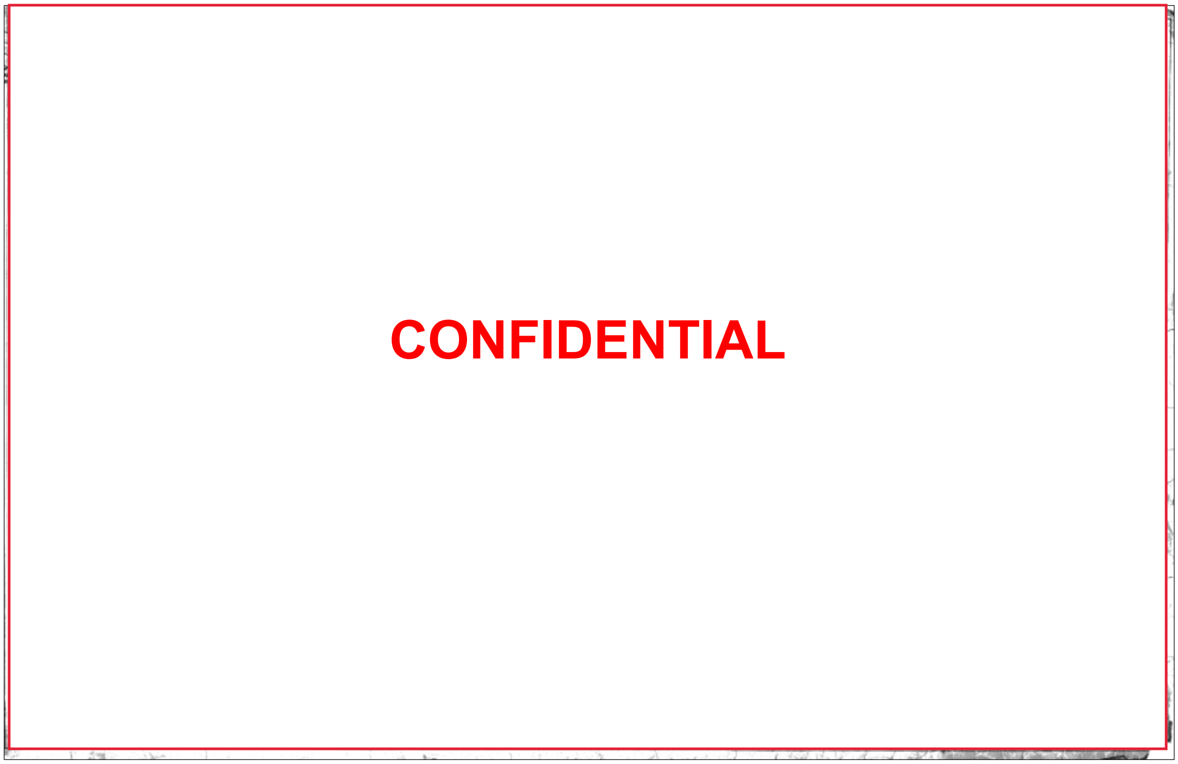
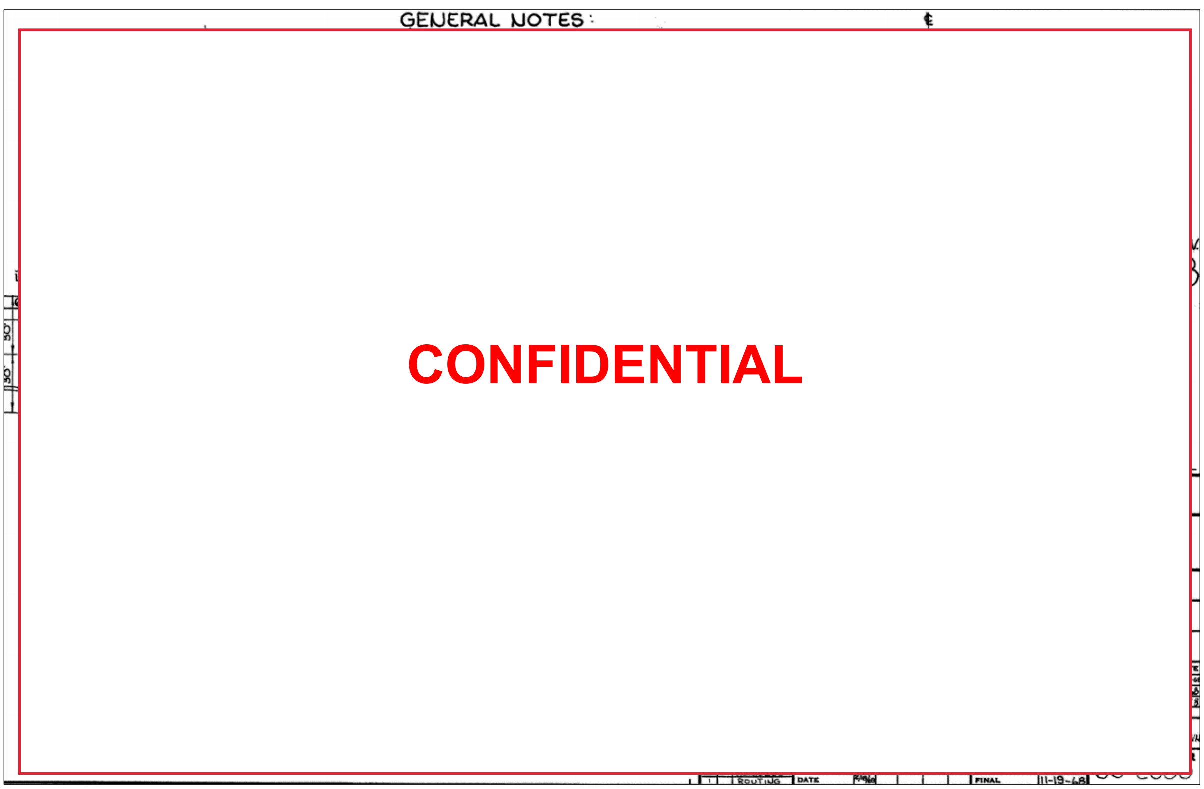


Figure 6. Record Drawing 5



Suburban Water Systems (Suburban) started having water main break data in 1998. All the main breaks for this project from 1998 to 2021 are also shown in Table 2 and illustrated with blue dots in Figure 1.

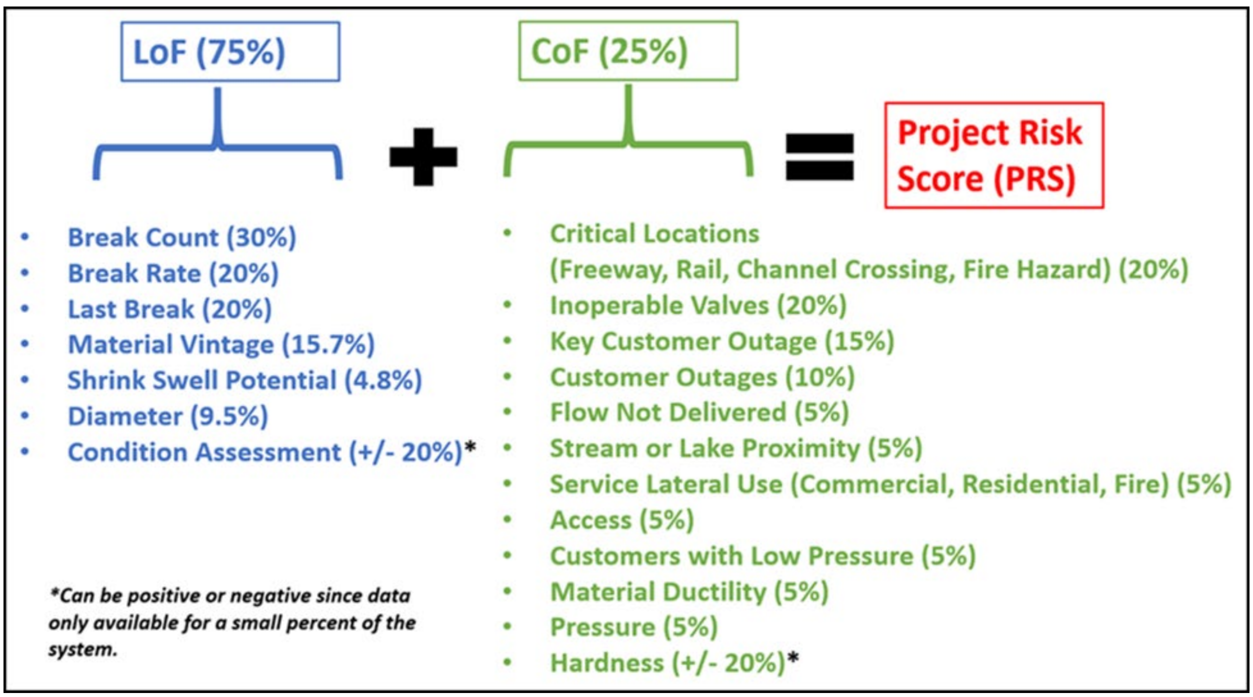
Table 2. Break Record

BREAK TYPE	BREAK DATE	ADDRESS	STREET	CITY
Main	1/1/1997			
Main	1/1/1997			
Main	5/6/1998			
Main	12/17/1998			
Main	2/9/1999			
Main	7/26/1999			
Main	8/13/1999			
Main	8/3/2000			
Main	8/14/2000			
Main	10/25/2001			
Main	9/19/2003			
Main	10/20/2003			
Main	2/3/2004		CONFIDENTIAL	
Main	9/10/2004			
Main	11/17/2005			
Main	4/9/2009			
Main	10/19/2009			
Main	11/30/2009			
Main	7/5/2010			
Main	3/3/2011			
Main	8/16/2011			
Main	7/25/2013			
Main	9/7/2017			
Main	9/12/2017			
Main	9/13/2017			
Main	10/17/2017			
Main	11/29/2017			
Main	8/5/2019			
Main	11/2/2020			
Main	8/4/2021			
TOTAL	**30**			

4. Project Risk Score (PRS)

In 2018 Suburban engaged HDR to perform an independent condition analysis of the pipeline infrastructure. HDR updated the study in 2022. See HDR's Suburban Water Systems Water Main Renewal Technical Memorandum 2022 included in Workpaper VOLUME III-E (HDR TM). To evaluate the system, HDR developed a Risk Model for pipeline renewal and replacement. This model calculated a Project Risk Score (PRS) to quantify the relative risk of failure from very low to severe. This methodology considers the likelihood of failure (LoF) and the consequence of failure (CoF) of the main. Each of the PRS criterion (LoF and CoF) are made up of many factors. Figure 7 summarizes the PRS calculation methodology.

Figure 7. Risk Calculation Method



4.1. PRS Calculation Methodology

As shown in Figure 7, the LoF weight is 75 percent and the CoF weight is 25 percent. The PRS is on a scale of zero to one hundred, LoF can contribute up to 75 points, and the CoF can contribute up to 25 points. Each factor was scored on a 0 to 10 scale (Factor Score), where 0 represents the lowest risk, and 10 represents the highest risk. A detailed explanation of each factor is explained in chapter 4 of the technical memorandum. Each pipeline segment is calculated separately for its LoF and CoF based on the following equation:

LoF Score = ∑ (LoF Factor Score x 10 x Weight x Criterion Weight)

CoF Score = ∑ (CoF Factor Score x 10 x Weight x Criterion Weight)

The PRS for each segment is the summation of LoF and CoF:

PRS = LoF Score + CoF Score

The final PRS for the entire project is a weighted average of pipe risk score by length:

Final Project Risk Score = ∑ (PRS x Length) ÷ ∑ (Length)

4.2. PRS Calculation Results

Table 3 below summarizes the PRS provided by HDR TM 2022 for this replacement project.

Table 3. Summary of PRS

Project #	Sum of Pipe_Length*	Average of LoF_PRS	Average of CoF_PRS	Average of PRS
277-WW-3	19,403	58.8	1.4	60.2

*: The pipe length in Table 3 is from the current GIS database. The estimated replacement length is different. It is measured with new alignments, appurtenances, tie-ins, and any line segment within the project boundary but not included in the current GIS under the same Project Number.

Figure 8 is the PRS map for this project from HDR TM 2022.

Figure 8. Project Risk Score Map

5. Improvement Alternative's Summary

Alternative 1 – Do nothing. This alternative continues to use the existing pipelines, resulting in continued repairs when breaks occur. This is an undesirable option because the pipelines will continue to fail, interrupting service customers. This will cause poor customer service and higher costs for repairs and piecemeal replacement.

Alternative 2 – Rehabilitate the existing water main. Three rehabilitation methods were evaluated for this alternative.

- Pipebursting
- Sliplining
- Cured-In-Place Pipe (CIPP)

A detailed description of each rehabilitation method is shown below.

Pipebursting – Pipebursting is a method by which the existing pipe is opened and forced outward by a bursting tool. A hydraulic or pneumatic expansion head (part of the bursting tool) is pulled through the existing pipeline, typically using a cable and winch. As the expansion head is pulled through the existing pipe, it pushes that pipe radially outward until it breaks apart, creating a space for the new pipe. The bursting device also pulls the new pipeline behind it, immediately filling the void created by the old, burst pipe with the new pipe. Pipebursting can be used to replace the existing pipe with a similarly sized or larger pipe.

Pipebursting is not recommended if the existing pipe is asbestos cement because the process leaves broken asbestos pieces in the ground. When the pipe is disturbed, it is considered a waste disposal site and is subject to National Emission Standards for Hazardous Air Pollutants (NESHAP) requirements. Friable asbestos fibers lead to cancer of the lungs, known as mesothelioma. Future maintenance activities such main repairs due to breaks or replacing service lines will be required and may lead to health concerns.

Sliplining – Sliplining is inserting a new pipe by pulling or pushing it into the existing pipe and grouting the annular space. After it is in place, the pipe is grouted to hold the lining in place and for additional rigidity.

Sliplining new pipes will generally have a significantly reduced cross-sectional area. Sliplining is not recommended if maintaining or increasing fire flow in the area is required.

CIPP – A cured-in-place pipe (CIPP) is a trenchless rehabilitation method to repair existing pipelines. It is a jointless, seamless pipelining within an existing pipe. The process of CIPP involves inserting and running a felt lining into a pre-existing pipe that is the subject of repair. The resin within the liner is then exposed to a curing element to make it attach to the inner walls of the pipe. Once fully cured, the lining now acts as a new pipeline.

Like sliplining, CIPP is not recommended if maintaining or increasing fire flow is required because the cross-sectional area of the pipeline after rehabilitation is reduced.

There are some common limitations for all three rehabilitation methods compared with open trench replacement:

1. Rehabilitation methods are used for sewer pipelines. Sewer pipelines are straight and are usually deeper than water lines. Offsets and fittings make using these methods

more costly. Open trenching deep sewer mains are also more expensive than water mains installed 42-60 inches deep.

2. Typically, there is only one main in the street that serves customers and cannot be switched to other mains during the construction of a new main. A temporary by-pass system is required to provide continuous service to customers. During summer, water in the by-pass pipe is heated because it is in direct contact with the sun. Driveways are blocked by the above-ground pipe and can easily be damaged.

3. Installation pits are required when horizontal and vertical alignment changes are substantial that the new pipe won't be able to pull or push through the existing pipe. Most Suburban's record drawings in the 50s and 60s don't include profile views of the pipelines, and it is suspected that there are multiple offsets. Offsets are required to avoid underground utilities such as gas, cable, water, and storm drain. Most often, water lines cross these utilities multiple times on a street. Digging pits will result in delays and continuous customer interruptions and increase construction costs.

4. Open trench pipe replacement method minimizes water interruptions to one, eight (8) hour shutdown to connect the new pipeline to the existing system, and one, thirty (30) minute shutdown to switch customer services. Mains must be pressure tested and disinfected. There are occasions when passing bacteriological testing can take several weeks due to positive e-coli results. Open trench replacement allows new mains, valves, and service connections to be pressure tested and disinfected before the final shut down to connect to the existing system. Trenchless rehabilitation of the existing pipelines can only be constructed section by section. Each section requires a much longer shutdown time for service connection, pressure testing, and disinfection to bring back the service and move on to the next one. Replacing the pipelines using rehabilitation techniques will add more time to the project resulting in more costs.

Rehabilitation methods are good alternatives for specific applications like steep hills, where surfaces cannot be disturbed, and if there are no service connections on the main. Suburban's pipeline contractors have not performed rehabilitation methods on residential streets with services. Health and environmental concerns have not been fully addressed when using them on AC pipes. Additional fittings and offsets require more deep excavation pits and will increase the cost and duration of the project. It is not recommended to rehabilitate neighborhood pipelines and continue replacing pipelines using an open trench method.

Alternative 3 – Replace the existing water main with approximately 22,210 LF 8-inch PVC pipes and associated appurtenances as shown in Table 1. This Alternative will improve the integrity of the distribution system, eliminate service interruptions in this area, and ensure safe and reliable service to the customers.

According to the Association for the Advancement of Cost Engineering, this alternative is Class 3 of Opinion of Probable Construction Cost (OPCC) for constructing the replacement pipelines. The expected accuracy range for Class 3 is between +10% to +30%. Therefore, a 10% contingency is used in the OPCC.

Description	**Quantity**	**Unit**	**Unit Cost**	**Cost**
Construct 8-inch PVC	22,210	L.F.	$130	$2,887,300
8-inch Gate Valves	45	Each	$1,960	$88,200
8-inch Tie-In	16	Each	$6,840	$109,440
6-inch Fire Hydrant	28	Each	$10,870	$304,360
1-inch service	429	Each	$2,110	$905,190
AC Removal and Replacement	22,210	L.F.	$50	$1,110,500
Construct Pipeline Offset	89	Each	$3,050	$271,450
Cut, Plug and Abandon of Existing Pipeline	1	LS	$9,034	$9,034
Traffic Rated (H-20) Meter Lids	429	Each	$250	$107,250
Install Test Head Furnishing for Pressure Testing	22	Each	$3,610	$79,420
Landscaping Removal & Replacement	1	LS	$12,644	$12,644
Guard underground services	1	LS	$16,540	$16,540
Line Item Subtotal				$5,901,328
Mobilization			3%	$177,040
De-mobilization			2%	$118,027
Construction Subtotal				**$6,196,394**
Engineering and Inspection			12%	$743,567
Subtotal				$6,939,962
Contingency			10%	$693,996
Subtotal				$7,633,958
General Administration			9%	$687,056
Total				**$8,321,000**

6. Basis for Budgeted Cost

The total estimated project cost includes Engineering and Inspection, General Administration, and Contingency factors. The Engineering and Inspection factor accounts for the estimated direct cost required to plan, design, and inspect the project, permit fees, and the cost of internal labor. The General Administration factor considers Suburban's general administrative expenses. The contingency factor accounts for unforeseen construction conflicts and complications that could result in additional project costs.

7. Impact of Deferral

The longer this pipeline replacement is deferred, the older the pipes will become, the likelihood of failure will increase, and the frequency of breaks will increase. The breaks will increasingly cause undesirable service interruptions to customers, and the overall system condition will exponentially worsen.

8. Recommendation

- Alternative #1 is not feasible because it does not resolve the interruptions of service issues to customers and does not prevent the degradation of the integrity of the water system infrastructure in this area.
- Alternative #2 has limitations with making this Alternative lose its cost-benefit and construction efficiency.
- Alternative #3 is a better solution because it provides full reliability, quality, and abundance of service to the customer in the area. Suburban recommends Alternative #3.

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PROJECT DESIGN REPORT

FROM: Engineering Department
DATE: July 29, 2022
DISTRICT: WLM
SUBJECT: Alaska St. and Donna Beth Ave. Pipeline Replacement; CP-504

1. Executive Summary

The existing 4-inch and 8-inch asbestos cement (AC) mains in Alaska Street and Donna Beth Avenue area have experienced many breaks in the past years. They have reached the end of their useful lives and do not provide an adequate level of service to the customers. It is recommended that these 4-inch and 8-inch mains are replaced by approximately 1,370 LF of 4-inch and 8-inch PVC mains to provide a safe and reliable water supply to the customers in the area.

2. Introduction

The existing 4-inch and 8-inch AC mains in the City of West Covina on Alaska Street, Donna Beth Avenue, and Cajon Avenue east of Azusa Avenue, ave experienced frequent main breaks. The breaks result in service interruptions and inconvenience to customers. Suburban has made piecemeal repairs to continue to provide service to its customers, but this is not a long-term solution. The water mains have reached the end of their useful lives. It is recommended to replace these existing 4-inch and 8-inch mains with approximately 1,370 LF 4-inch and 8-inch PVC Pipes in the project area to provide a safe and reliable water supply to the customers.

Table 1 demonstrates a summary of the proposed pipeline replacement in this project, and Figure 1 shows the map of the project area. This project has been grouped per the recommendations of the pipeline condition assessment to include all mains that were constructed as part of this tract and are expected to continue to experience breaks. A detailed explanation of the grouping is outlined in Chapter 1 of the "*Suburban Water Systems Water Main Renewal Technical Memorandum, 2022,*" included in Workpaper VOLUME III-E. In addition, an adjacent main is included in this project to abandon a segment in the customer's backyard and reduce future service interceptions.

Table 1. Replacement Schedule

Quantity	**Existing Main**		**Proposed Main**	
(feet)	**Size** (inch)	**Material**	**Size** (inch)	**Material**
350	4	AC	4	PVC
1,020	8	AC	8	PVC
1,370				

Figure 1. Project Area and Break Map

3. Project Background

Record drawing (Figure 2) show the existing pipe materials are AC pipes. These pipelines were built in 1960 with the development of TRACT 22004 under Project Number 1299-SJ-2. The pipelines are a part of the distribution system in the 660 Zone in the San Jose Hills District of Suburban.

Figure 2. Record Drawing

Suburban Water Systems (Suburban) started having water main break data in 1998. All the main breaks for this project from 1998 to 2021 are also shown in Table 2 and illustrated with green dots in Figure 1.

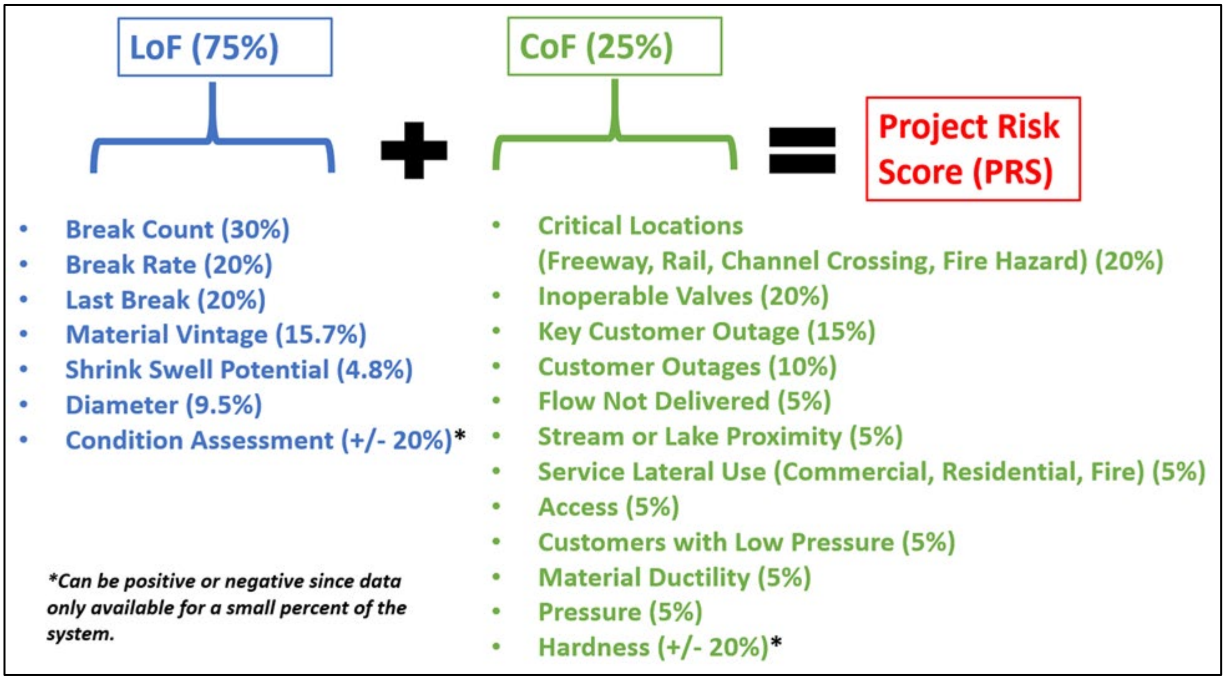
Table 2. Break Record

BREAK TYPE	BREAK DATE	ADDRESS	STREET	CITY
Main	11/19/2018	CONFIDENTIAL		
Main	2/10/2021			
TOTAL				

4. Project Risk Score (PRS)

In 2018 Suburban engaged HDR to perform an independent condition analysis of the pipeline infrastructure. HDR updated the study in 2022. See HDR's Suburban Water Systems Water Main Renewal Technical Memorandum 2022 included in Workpaper VOLUME III-E (HDR TM). To evaluate the system, HDR developed a Risk Model for pipeline renewal and replacement. This model calculated a Project Risk Score (PRS) to quantify the relative risk of failure from very low to severe. This methodology considers the likelihood of failure (LoF) and the consequence of failure (CoF) of the main. Each of the PRS criterion (LoF and CoF) are made up of many factors. Figure 3 summarizes the PRS calculation methodology.

Figure 3. Risk Calculation Method



4.1 PRS Calculation Methodology

As shown in Figure 3, the LoF weight is 75 percent and the CoF weight is 25 percent. The PRS is on a scale of zero to one hundred, LoF can contribute up to 75 points, and the CoF can contribute up to 25 points. Each factor was scored on a 0 to 10 scale (Factor Score), where 0 represents the lowest risk, and 10 represents the highest risk. A detailed explanation of each factor is explained in chapter 4 of the technical memorandum. Each pipeline segment is calculated separately for its LoF and CoF based on the following equation:

$$\text{LoF Score} = \sum (\text{LoF Factor Score} \times 10 \times \text{Weight} \times \text{Criterion Weight})$$

$$\text{CoF Score} = \sum (\text{CoF Factor Score} \times 10 \times \text{Weight} \times \text{Criterion Weight})$$

The PRS for each segment is the summation of LoF and CoF:

$$\text{PRS} = \text{LoF Score} + \text{CoF Score}$$

The final PRS for the entire project is a weighted average of pipe risk score by length:

Final Project Risk Score = ∑ **(PRS x Length)** ÷ ∑ **(Length)**

4.2 PRS Calculation Result

Table 3 below summarizes the PRS provided by HDR TM 2022 for this replacement project.

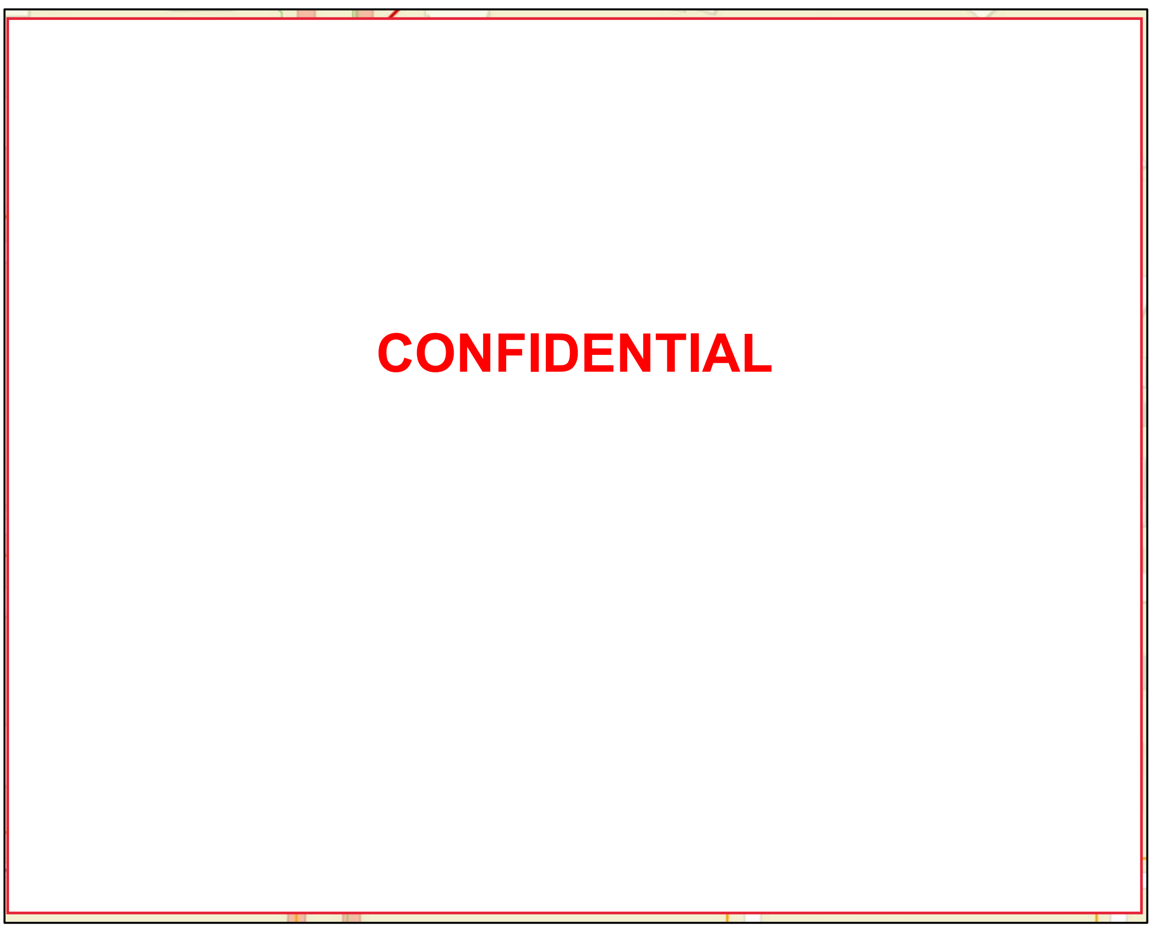
Table 3. Summary of PRS

Project #	Sum of Pipe_Length*	Average of LoF_PRS	Average of CoF_PRS	Average of PRS
1299-SW-2	1,274	55.6	4.1	59.8

*****: The pipe length in Table 3 is from the current GIS database. The estimated replacement length is different. It is measured with new alignments, appurtenances, tie-ins, and any line segment within the project boundary but not included in the current GIS under the same Project Number.

Figure 4 is the PRS map for this project from HDR TM 2022.

Figure 4. Project Risk Score Map



5. Improvement Alternative's Summary

Alternative 1 – Do nothing. This alternative continues to use the existing pipelines, resulting in continued repairs when breaks occur. This is an undesirable option because the pipelines will continue to fail, interrupting service customers. This will cause poor customer service and higher costs for repairs and piecemeal replacement.

Alternative 2 – Rehabilitate the existing water main. Three rehabilitation methods were evaluated for this alternative.

- Pipebursting
- Sliplining
- Cured-In-Place Pipe (CIPP)

A detailed description of each rehabilitation method is shown below.

Pipebursting – Pipebursting is a method by which the existing pipe is opened and forced outward by a bursting tool. A hydraulic or pneumatic expansion head (part of the bursting tool) is pulled through the existing pipeline, typically using a cable and winch. As the expansion head is pulled through the existing pipe, it pushes that pipe radially outward until it breaks apart, creating a space for the new pipe. The bursting device also pulls the new pipeline behind it, immediately filling the void created by the old, burst pipe with the new pipe. Pipebursting can be used to replace the existing pipe with a similarly sized or larger pipe.

Pipebursting is not recommended if the existing pipe is asbestos cement because the process leaves broken asbestos pieces in the ground. When the pipe is disturbed, it is considered a waste disposal site and is subject to National Emission Standards for Hazardous Air Pollutants (NESHAP) requirements. Friable asbestos fibers lead to cancer of the lungs, known as mesothelioma. Future maintenance activities such main repairs due to breaks or replacing service lines will be required and may lead to health concerns.

Sliplining – Sliplining is inserting a new pipe by pulling or pushing it into the existing pipe and grouting the annular space. After it is in place, the pipe is grouted to hold the lining in place and for additional rigidity.

Sliplining new pipes will generally have a significantly reduced cross-sectional area. Sliplining is not recommended if maintaining or increasing fire flow in the area is required.

CIPP – A cured-in-place pipe (CIPP) is a trenchless rehabilitation method to repair existing pipelines. It is a jointless, seamless pipelining within an existing pipe. The process of CIPP involves inserting and running a felt lining into a pre-existing pipe that is the subject of repair. The resin within the liner is then exposed to a curing element to make it attach to the inner walls of the pipe. Once fully cured, the lining now acts as a new pipeline.

Like sliplining, CIPP is not recommended if maintaining or increasing fire flow is required because the cross-sectional area of the pipeline after rehabilitation is reduced.

There are some common limitations for all three rehabilitation methods compared with open trench replacement:

1. Rehabilitation methods are used for sewer pipelines. Sewer pipelines are straight and are usually deeper than water lines. Offsets and fittings make using these methods more costly. Open trenching deep sewer mains are also more expensive than water mains installed 42-60 inches deep.
2. Typically, there is only one main in the street that serves customers and cannot be switched to other mains during the construction of a new main. A temporary by-pass system is required to provide continuous service to customers. During summer, water in the by-pass pipe is heated because it is in direct contact with the sun. Driveways are blocked by the above-ground pipe and can easily be damaged.
3. Installation pits are required when horizontal and vertical alignment changes are substantial that the new pipe won’t be able to pull or push through the existing pipe. Most Suburban’s record drawings in the 50s and 60s don’t include profile views of the pipelines, and it is suspected that there are multiple offsets. Offsets are required to avoid underground utilities such as gas, cable, water, and storm drain. Most often, water lines cross these utilities multiple times on a street. Digging pits will result in delays and continuous customer interruptions and increase construction costs.
4. Open trench pipe replacement method minimizes water interruptions to one, eight (8) hour shutdown to connect the new pipeline to the existing system, and one, thirty (30) minute shutdown to switch customer services. Mains must be pressure tested and disinfected. There are occasions when passing bacteriological testing can take several weeks due to positive e-coli results. Open trench replacement allows new mains, valves, and service connections to be pressure tested and disinfected before the final shut down to connect to the existing system. Trenchless rehabilitation of the existing pipelines can only be constructed section by section. Each section requires a much

longer shutdown time for service connection, pressure testing, and disinfection to bring back the service and move on to the next one. Replacing the pipelines using rehabilitation techniques will add more time to the project resulting in more costs.

Rehabilitation methods are good alternatives for specific applications like steep hills, where surfaces cannot be disturbed, and if there are no service connections on the main. Suburban's pipeline contractors have not performed rehabilitation methods on residential streets with services. Health and environmental concerns have not been fully addressed when using them on AC pipes. Additional fittings and offsets require more deep excavation pits and will increase the cost and duration of the project. It is not recommended to rehabilitate neighborhood pipelines and continue replacing pipelines using an open trench method.

Alternative 3 – Replace existing water mains with approximately 1,370 L.F. of 4" and 8" PVC pipes and associated appurtenances, as shown in Table 1. This Alternative will improve the integrity of the distribution system, eliminate service interruptions in this area, and ensure safe and reliable service to the customers.

According to the Association for the Advancement of Cost Engineering, this alternative is Class 3 of Opinion of Probable Construction Cost (OPCC) for constructing the replacement pipelines. The expected accuracy range for Class 3 is between +10% to +30%. Therefore, a 10% contingency is used in the OPCC.

Description	**Quantity**	**Unit**	**Unit Cost**	**Cost**
Construct 8-inch PVC	1,020	L.F.	$130	$132,600
8-inch Gate Valves	3	Each	$1,960	$5,880
8-inch Tie-In	2	Each	$6,840	$13,680
Construct 4-inch PVC	350	L.F.	$110	$38,500
4-inch Gate Valve	1	Each	$1,380	$1,380
6-inch Fire Hydrant	3	Each	$10,870	$32,610
2-inch Blow-off	1	Each	$5,330	$5,330
1-inch service	33	Each	$2,110	$69,630
AC Removal and Replacement	1,370	L.F.	$50	$68,500
Construct Pipeline Offset	6	Each	$3,500	$21,000
Cut, Plug and Abandon of Existing Pipeline	1	LS	$9,034	$9,034
Traffic Rated (H-20) Meter Lids	33	Each	$250	$8,250
Install Test Head Furnishing for Pressure Testing	1	Each	$3,610	$3,610
Landscaping Removal & Replacement	1	LS	$12,644	$12,644
Guard underground services	1	LS	$16,540	$16,540
Line Item Subtotal				$439,188
Mobilization			3%	$13,176
De-mobilization			2%	$8,784
Construction Subtotal				**$461,147**
Engineering and Inspection			12%	$55,338
Subtotal				$516,485
Contingency			10%	$51,648.51
Subtotal				$568,134
General Administration			9%	$51,132
Total				**$619,000**

6. Basis for Budgeted Cost

The total OPCC includes Engineering and Inspection, General Administration, and Contingency factors. The Engineering and Inspection factor accounts for the estimated direct cost required to plan, design, and inspect the project, the cost of permit fees, and the cost of internal labor. The General Administration factor considers Suburban's general administrative expenses. The contingency factor accounts for unforeseen construction conflicts and complications that could result in additional project costs.

7. Impact of Deferral

The longer this pipeline replacement is deferred, the older the pipes will become, the likelihood of failure will increase, and the frequency of breaks will increase. The breaks will increasingly cause undesirable service interruptions to customers, and the overall system condition will exponentially worsen.

8. Recommendation

- Alternative #1 is not feasible because it does not resolve the interruptions of service issues to customers and does not prevent the degradation of the integrity of the water system infrastructure in this area.
- Alternative #2 has limitations with making this Alternative lose its cost-benefit and construction efficiency.
- Alternative #3 is recommended because it provides full reliability, quality, and abundance of service to the customer in the area. Suburban recommends Alternative #3.

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PROJECT DESIGN REPORT

FROM: Engineering Department

DATE: April 14, 2022

DISTRICT: SJH

SUBJECT: Lark Ellen Ave. and Harvest Moon St. Pipeline Replacement; CP-485

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1. Executive Summary

The existing 4-inch, 8-inch, and 12-inch asbestos cement (AC) pipelines at Lark Ellen Avenue and Harvest Moon Street area have experienced many breaks in the past years. They have reached the end of their useful lives and do not provide an adequate level of service to the customers. It is recommended that these 8-inch and 12-inch existing mains be replaced by approximately 4,430 LF of 6-inch, 8-inch, and 12-inch PVC mains to provide a safe and reliable water supply to the customers in the area.

2. Introduction

The existing 4-inch, 8-inch, and 12-inch asbestos cement (AC) pipelines on Avington Avenue, Maplegrove Street, Lark Ellen Avenue, and Harvest Moon Street, east of Lark Ellen Avenue in the City of West Covina, have experienced frequent main breaks in the past years causing service interruptions and inconvenience to customers. Suburban has made piecemeal repairs to continue to provide service to its customers, but this is not a long-term solution. The water mains have reached the end of their useful lives. It is recommended to replace these existing 8-inch to 12-inch mains with approximately 4,430 LF 6-inch, 8-inch, and 12-inch PVC Pipes in the project area to provide a safe and reliable water supply to the customers.

Figure 1 shows the map of the project area and Table 1 presents a summary of pipeline replacement in this project. This project has been grouped with two severe risk projects and one high risk project geographically connected to each other and constructed around the same time per the recommendations of the pipeline condition assessment. A detailed explanation of the grouping is outlined in Chapter 1 of the "*Suburban Water Systems Water Main Renewal Technical Memorandum, 2022,*" included in Workpaper VOLUME III-E.

Figure 1. Project Area Map

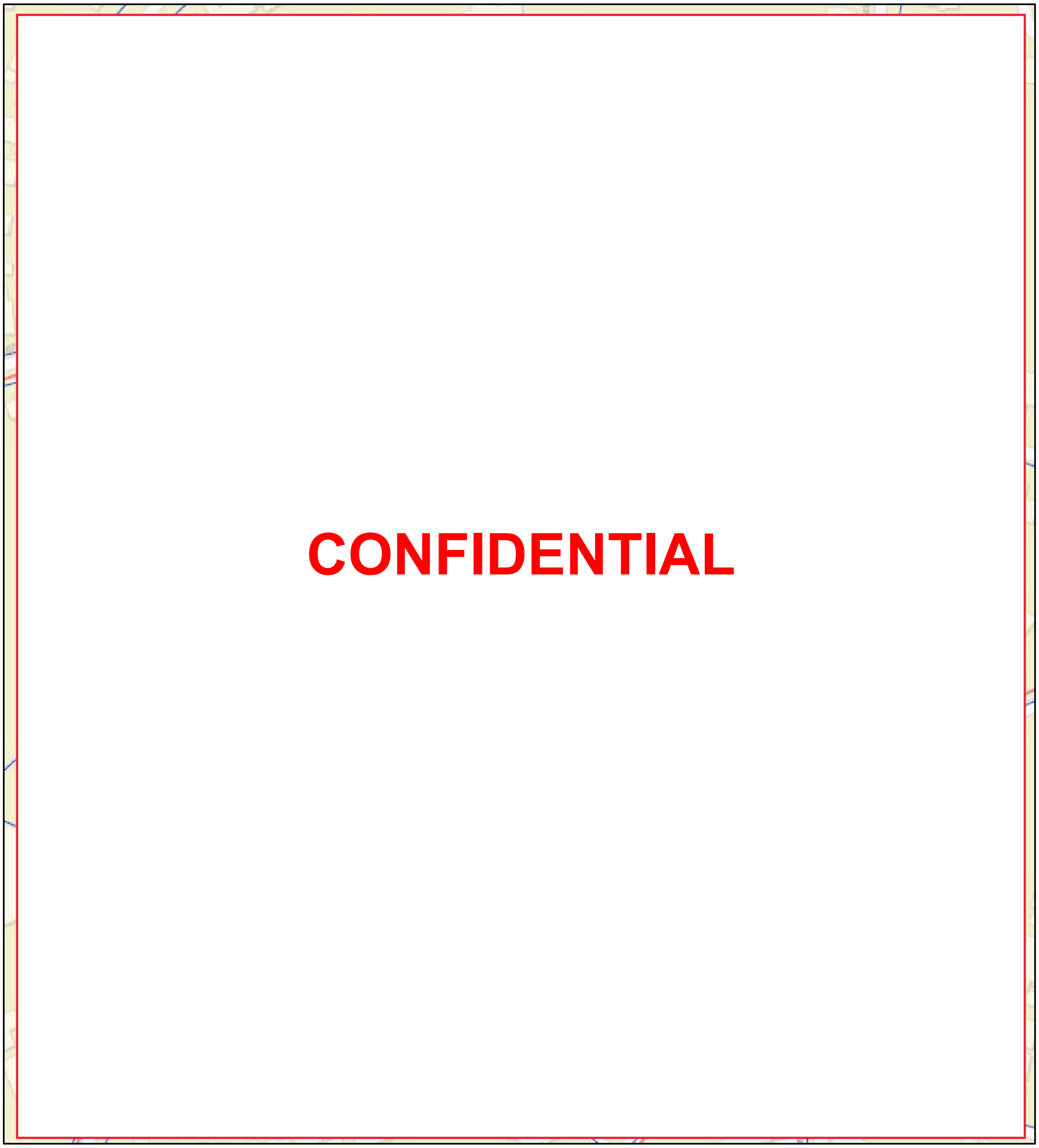


Table 1. Replacement Schedule

Quantity	Existing Main		Proposed Main	
(feet)	**Size** (inch)	**Material**	**Size** (inch)	**Material**
730	4	AC	6	PVC
1,100	8	AC	8	PVC
660	8	AC	12	PVC
1300	12	AC	8	PVC
640	12	AC	12	PVC
4,430				

3. Project Background

Record drawings (Figures 2 to 4) show the most existing pipeline materials in the project area are Asbestos Cement Pipe (AC). These pipelines were originally built in the projects listed below:

- 1039-SJ-2, development of TRACT 18730, 1955.
- 774-SJ-3, development of TRACT 19135, 1954.
- 767-SJ-2, development of TRACT 19056, 1955.

These pipelines are a part of the distribution system in the 730 Zone in the San Jose Hills District of Suburban.

Figure 2. Record Drawing 1

CONFIDENTIAL

Figure 3. Record Drawing 2

CONFIDENTIAL

Figure 4. Record Drawing 3

CONFIDENTIAL

Suburban Water Systems (Suburban) started to collect water main break data in 1998. All the main breaks for this project from 1998 to 2021 are also shown in Table 2 and illustrated with green dots in Figure 1.

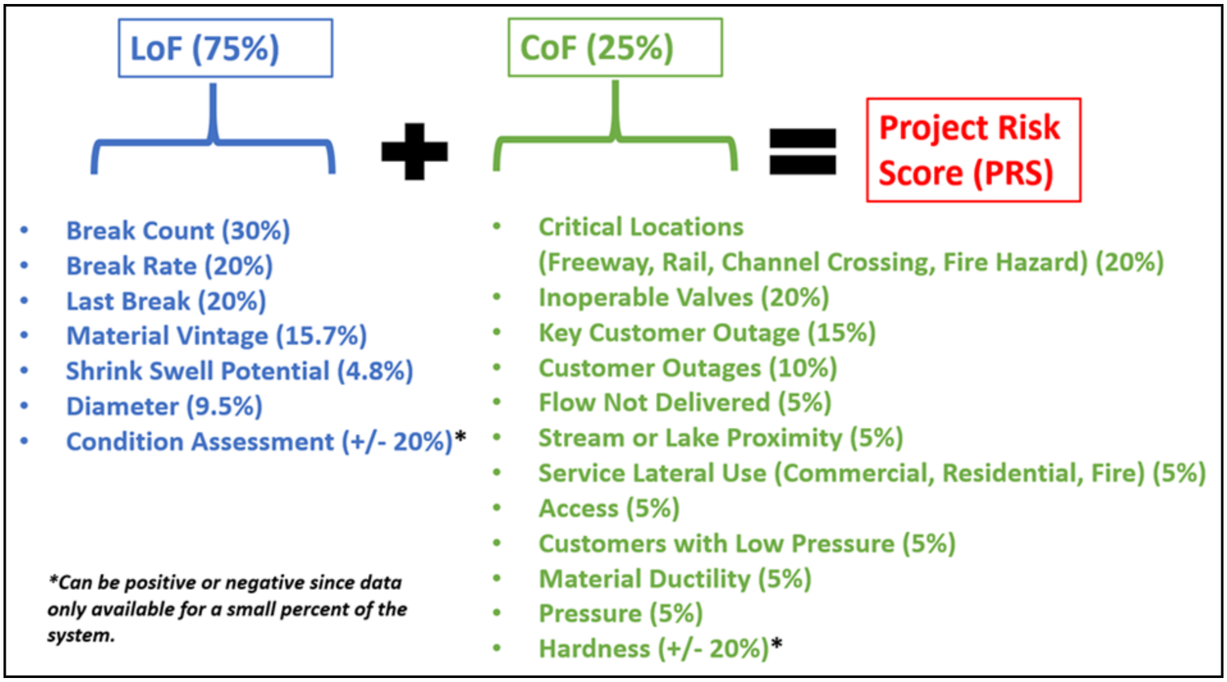
Table 2. Break Record

BREAK TYPE	BREAK DATE	ADDRESS	STREET	CITY
Main	11/13/2002			
Main	1/12/2004			
Main	4/12/2007			
Main	9/16/2008			
Main	6/2/2009			
Main	9/24/2010			
Main	11/5/2010			
Main	9/20/2012			
Main	9/28/2012			
Main	12/18/2012			
Main	5/14/2014			
Main	1/31/2017		CONFIDENTIAL	
Main	8/23/2017			
Main	11/8/2017			
Main	2/26/2018			
Main	3/23/2018			
Main	1/16/2019			
Main	1/28/2019			
Main	6/28/2019			
Main	6/7/2020			
Main	7/23/2020			
Main	11/8/2020			
Main	6/28/2021			
TOTAL				

4. Project Risk Score (PRS)

In 2018 Suburban engaged HDR to perform an independent condition analysis of the pipeline infrastructure. HDR updated the study in 2022. See HDR's Suburban Water Systems Water Main Renewal Technical Memorandum 2022 included in Workpaper VOLUME III-E (HDR TM). To evaluate the system, HDR developed a Risk Model for pipeline renewal and replacement. This model calculated a Project Risk Score (PRS) to quantify the relative risk of failure from very low to severe. This methodology considers the likelihood of failure (LoF) and the consequence of failure (CoF) of the main. Each of the PRS criterion (LoF and CoF) are made up of many factors. Figure 5 summarizes the PRS calculation methodology.

Figure 5. Risk Calculation Method



4.1 PRS Calculation

As shown in Figure 5, the LoF weight is 75 percent and the CoF weight is 25 percent. The PRS is on a scale of zero to one hundred, LoF can contribute up to 75 points, and the CoF can contribute up to 25 points. Each factor was scored on a 0 to 10 scale (Factor Score), where 0 represents the lowest risk, and 10 represents the highest risk. A detailed explanation of each factor is explained in chapter 4 of the technical memorandum. Each pipeline segment is calculated separately for its LoF and CoF based on the following equation:

$$\text{LoF Score} = \sum (\text{LoF Factor Score} \times 10 \times \text{Weight} \times \text{Criterion Weight})$$

$$\text{CoF Score} = \sum (\text{CoF Factor Score} \times 10 \times \text{Weight} \times \text{Criterion Weight})$$

The PRS for each segment is the summation of LoF and CoF:

$$\text{PRS} = \text{LoF Score} + \text{CoF Score}$$

The final PRS for the entire project is a weighted average of pipe risk score by length:

Final Project Risk Score $= \sum$ **(PRS x Length)** $\div \sum$ **(Length)**

4.2 PRS Calculation Results

Table 3 below summarizes the PRS provided by HDR TM 2022 for this replacement project.

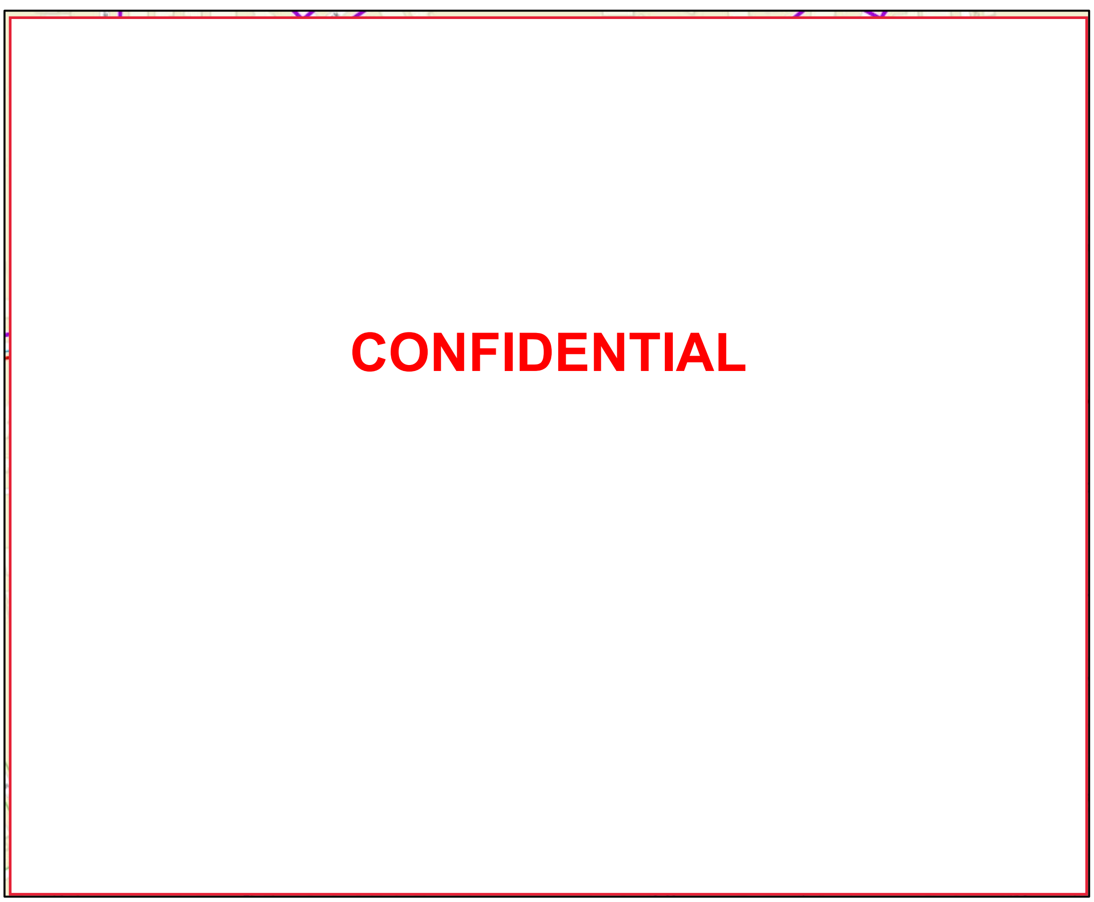
Table 3. Summary of PRS

Project #	Sum of Pipe_Length*	Average of LoF_PRS	Average of CoF_PRS	Average of PRS
1039-SJ-2	2,389	56.9	1.6	58.6
774-SJ-3	552	56.4	1.6	58.0
767-SJ-2	1,450	33.4	1.3	34.7

*: The pipe length in Table 3 is from the current GIS database. The estimated replacement length is different. It is measured with new alignments, appurtenances, tie-ins, and any line segment within the project boundary but not included in the current GIS under the same Project Number.

Figure 6 is the PRS map for this project from HDR TM 2022.

Figure 6. Project Risk Score Map



5. Improvement Alternative's Summary

Alternative 1 – Do nothing. This alternative continues to use the existing pipelines, resulting in continued repairs when breaks occur. This is an undesirable option because the pipelines will continue to fail, interrupting service customers. This will cause poor customer service and higher costs for repairs and piecemeal replacement.

Alternative 2 – Rehabilitate the existing water main. Three rehabilitation methods were evaluated for this alternative.

- Pipebursting
- Sliplining
- Cured-In-Place Pipe (CIPP)

A detailed description of each rehabilitation method is shown below.

Pipebursting – Pipebursting is a method by which the existing pipe is opened and forced outward by a bursting tool. A hydraulic or pneumatic expansion head (part of the bursting tool) is pulled through the existing pipeline, typically using a cable and winch. As the expansion head is pulled through the existing pipe, it pushes that pipe radially outward until it breaks apart, creating a space for the new pipe. The bursting device also pulls the new pipeline behind it, immediately filling the void created by the old, burst pipe with the new pipe. Pipebursting can be used to replace the existing pipe with a similarly sized or larger pipe.

Pipebursting is not recommended if the existing pipe is asbestos cement because the process leaves broken asbestos pieces in the ground. When the pipe is disturbed, it is considered a waste disposal site and is subject to National Emission Standards for Hazardous Air Pollutants (NESHAP) requirements. Friable asbestos fibers lead to cancer of the lungs, known as mesothelioma. Future maintenance activities such main repairs due to breaks or replacing service lines will be required and may lead to health concerns.

Sliplining – Sliplining is inserting a new pipe by pulling or pushing it into the existing pipe and grouting the annular space. After it is in place, the pipe is grouted to hold the lining in place and for additional rigidity.

Sliplining new pipes will generally have a significantly reduced cross-sectional area. Sliplining is not recommended if maintaining or increasing fire flow in the area is required.

CIPP – A cured-in-place pipe (CIPP) is a trenchless rehabilitation method to repair existing pipelines. It is a jointless, seamless pipelining within an existing pipe. The process of CIPP involves inserting and running a felt lining into a pre-existing pipe that is the subject of repair. The resin within the liner is then exposed to a curing element to make it attach to the inner walls of the pipe. Once fully cured, the lining now acts as a new pipeline.

Like sliplining, CIPP is not recommended if maintaining or increasing fire flow is required because the cross-sectional area of the pipeline after rehabilitation is reduced.

There are some common limitations for all three rehabilitation methods compared with open trench replacement:

1. Rehabilitation methods are used for sewer pipelines. Sewer pipelines are straight and are usually deeper than water lines. Offsets and fittings make using these methods more costly. Open trenching deep sewer mains are also more expensive than water mains installed 42-60 inches deep.
2. Typically, there is only one main in the street that serves customers and cannot be switched to other mains during the construction of a new main. A temporary by-pass system is required to provide continuous service to customers. During summer, water in the by-pass pipe is heated because it is in direct contact with the sun. Driveways are blocked by the above-ground pipe and can easily be damaged.
3. Installation pits are required when horizontal and vertical alignment changes are substantial that the new pipe won’t be able to pull or push through the existing pipe. Most Suburban’s record drawings in the 50s and 60s don’t include profile views of the pipelines, and it is suspected that there are multiple offsets. Offsets are required to avoid underground utilities such as gas, cable, water, and storm drain. Most often, water lines cross these utilities multiple times on a street. Digging pits will result in delays and continuous customer interruptions and increase construction costs.
4. Open trench pipe replacement method minimizes water interruptions to one, eight (8) hour shutdown to connect the new pipeline to the existing system, and one, thirty (30) minute shutdown to switch customer services. Mains must be pressure tested and disinfected. There are occasions when passing bacteriological testing can take several weeks due to positive e-coli results. Open trench replacement allows new mains, valves, and service connections to be pressure tested and disinfected before the final shut down to connect to the existing system. Trenchless rehabilitation of the existing pipelines can only be constructed section by section. Each section requires a much

longer shutdown time for service connection, pressure testing, and disinfection to bring back the service and move on to the next one. Replacing the pipelines using rehabilitation techniques will add more time to the project resulting in more costs.

Rehabilitation methods are good alternatives for specific applications like steep hills, where surfaces cannot be disturbed, and if there are no service connections on the main. Suburban's pipeline contractors have not performed rehabilitation methods on residential streets with services. Health and environmental concerns have not been fully addressed when using them on AC pipes. Additional fittings and offsets require more deep excavation pits and will increase the cost and duration of the project. It is not recommended to rehabilitate neighborhood pipelines and continue replacing pipelines using an open trench method.

Alternative 3 – Replace existing water mains with approximately 4,430 L.F. of 6-inch, 8-inch, and 12-inch PVC pipes and associated appurtenances, as shown in Table 1. This Alternative will improve the integrity of the distribution system, eliminate service interruptions in this area, and ensure safe and reliable service to the customers.

According to the Association for the Advancement of Cost Engineering, this alternative is Class 3 of Opinion of Probable Construction Cost (OPCC) for constructing the replacement pipelines. The expected accuracy range for Class 3 is between +10% to +30%, therefore, a 10% contingency is used in the OPCC.

Description	Quantity	Unit	Unit Cost	Cost
Construct 12-inch PVC	1300	L.F.	$190	$247,000
12-inch Butterfly Valves	4	Each	$4,050	$16,200
12-inch Tie-In	2	Each	$8,900	$17,800
Construct 8-inch PVC	2400	L.F.	$130	$312,000
8-inch Gate Valves	5	Each	$1,960	$9,800
8-inch Tie-In	3	Each	$6,840	$20,520
Construct 6-inch PVC	730	L.F.	$120	$87,600
6-inch Gate Valve	1	Each	$1,660	$1,660
6-inch Tie-In	1	Each	$6,550	$6,550
6-inch Fire Hydrant	6	Each	$10,870	$65,220
2-inch Blow-off	2	Each	$5,330	$10,660
1-inch service	90	Each	$2,110	$189,900
AC Removal and Replacement	4430	L.F.	$50	$221,500
Construct Pipeline Offset	18	Each	$3,050	$54,900
Cut, Plug and Abandon of Existing Pipeline	1	LS	$9,034	$9,034
Traffic Rated (H-20) Meter Lids	90	Each	$250	$22,500
Install Test Head Furnishing for Pressure Testing	4	Each	$3,610	$14,440
Landscaping Removal & Replacement	1	LS	$12,644	$12,644
Guard underground services	1	LS	$16,540	$16,540
Line Item Subtotal				$1,336,468
Mobilization			3%	$40,094
De-mobilization			2%	$26,729
Construction Subtotal				**$1,403,291**
Engineering and Inspection			12%	$168,395
Subtotal				$1,571,686
Contingency			10%	$157,169
Subtotal				$1,728,855
General Administration			9%	$155,597
Total				**$1,884,000**

6. Basis for Budgeted Cost

The total OPCC includes Engineering and Inspection, General Administration, and Contingency factors. The Engineering and Inspection factor accounts for the estimated direct cost required to plan, design, and inspect the project, the cost of permit fees, and the cost of internal labor. The General Administration factor considers Suburban's general administrative expenses. The contingency factor accounts for unforeseen construction conflicts and complications that could result in additional project costs.

7. Impact of Deferral

The longer this pipeline replacement is deferred, the older the pipes will become, the likelihood of failure will increase, and the frequency of breaks will increase. The breaks will increasingly cause undesirable service interruptions to customers, and the overall system condition will exponentially worsen.

8. Recommendation

- Alternative #1 is not feasible because it does not resolve the interruptions of service issues to customers and does not prevent the degradation of the integrity of the water system infrastructure in this area.
- Alternative #2 has limitations with making this Alternative lose its cost-benefit and construction efficiency.
- Alternative #3 is a better solution because it provides full reliability, quality, and abundance of service to the customer in the area. Suburban recommends Alternative #3.

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PROJECT DESIGN REPORT

FROM: Engineering Department

DATE: April 12, 2022

DISTRICT: SJH

SUBJECT: Glenhope Drive and Ruthcrest Avenue Pipeline Replacement; CP-361

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1. Executive Summary

The existing 4-inch, 6-inch, 8-inch, and 14-inch asbestos cement (AC) mains in Glenhope Drive and Ruthcrest Avenue area have experienced many breaks in the past years. They have reached the end of their useful lives and do not provide an adequate level of service to the customers. It is recommended that these 4-inch to 12-inch existing mains be replaced by approximately 7,500 LF of 6-inch to 12-inch PVC mains to provide a safe and reliable water supply to the customers in the area.

2. Introduction

The existing 4-inch, 6-inch, 8-inch, and 14-inch AC mains, on Glenhope Drive, Ranlett Avenue, Frandale Avenue, and Ruthcrest Avenue in the area south of Puente Creek, north of Temple Avenue, and east of Workman High School in the unincorporated Los Angele County, have experienced frequent main breaks in the past years causing service interruptions and inconvenience to customers. Suburban has made piecemeal repairs to continue to provide service to its customers, but this is not a long-term solution. The water mains have reached the end of their useful lives. It is recommended to replace the existing 4-inch to 14-inch AC mains with approximately 7,500 LF 6-inch to 12-inch PVC Pipes in the project area to provide a safe and reliable water supply to the customers.

Figure 1 shows the project area and Table 1 is the summary of pipeline replacement in this project. This project has been grouped per the recommendations of the pipeline condition assessment to include all mains that were constructed as part of this tract and are expected to continue to experience breaks. A detailed explanation of the grouping is outlined in Chapter

1 of the "*Suburban Water Systems Water Main Renewal Technical Memorandum, 2022,*" included in Workpaper VOLUME III-E.

Figure 1. Project Map

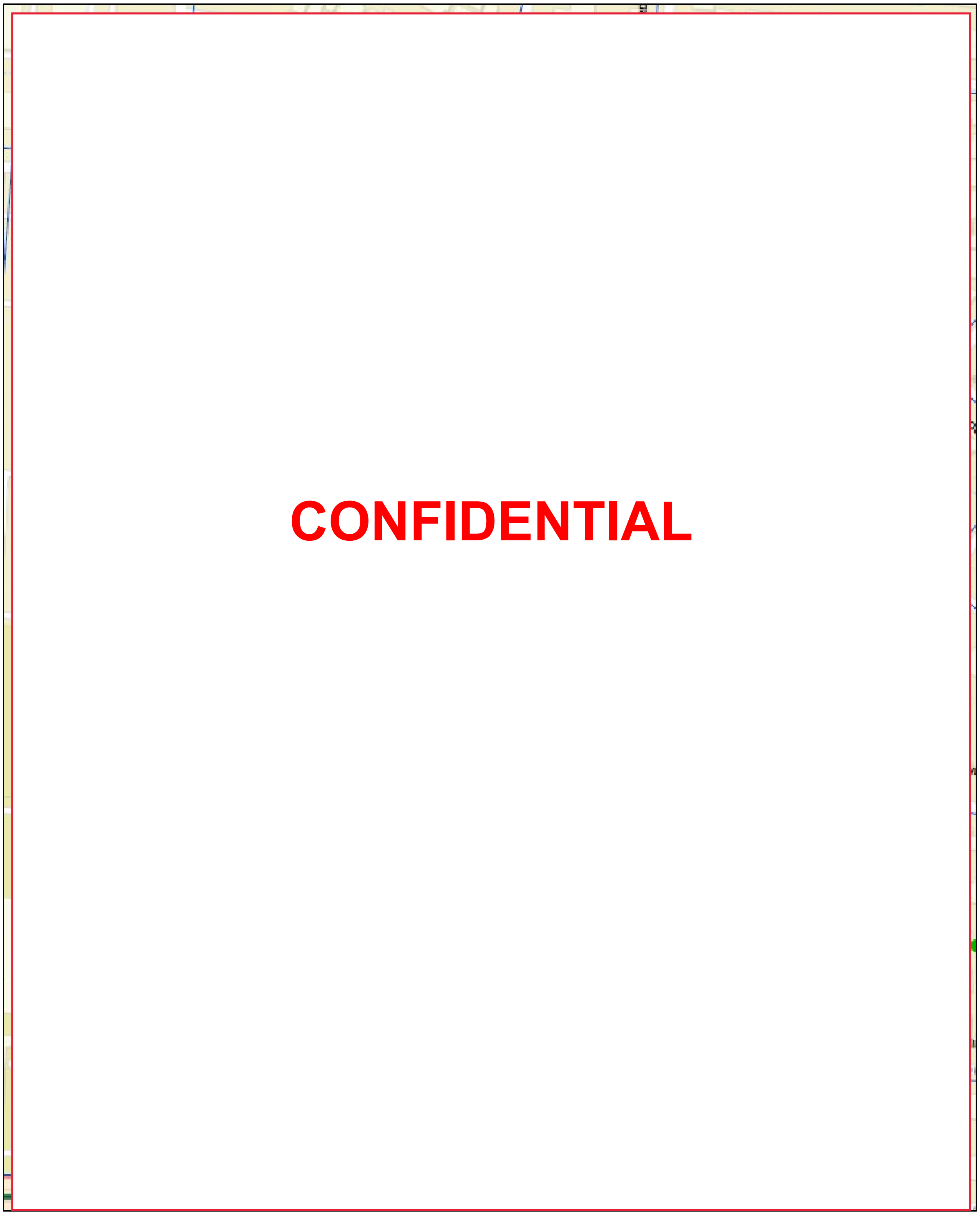


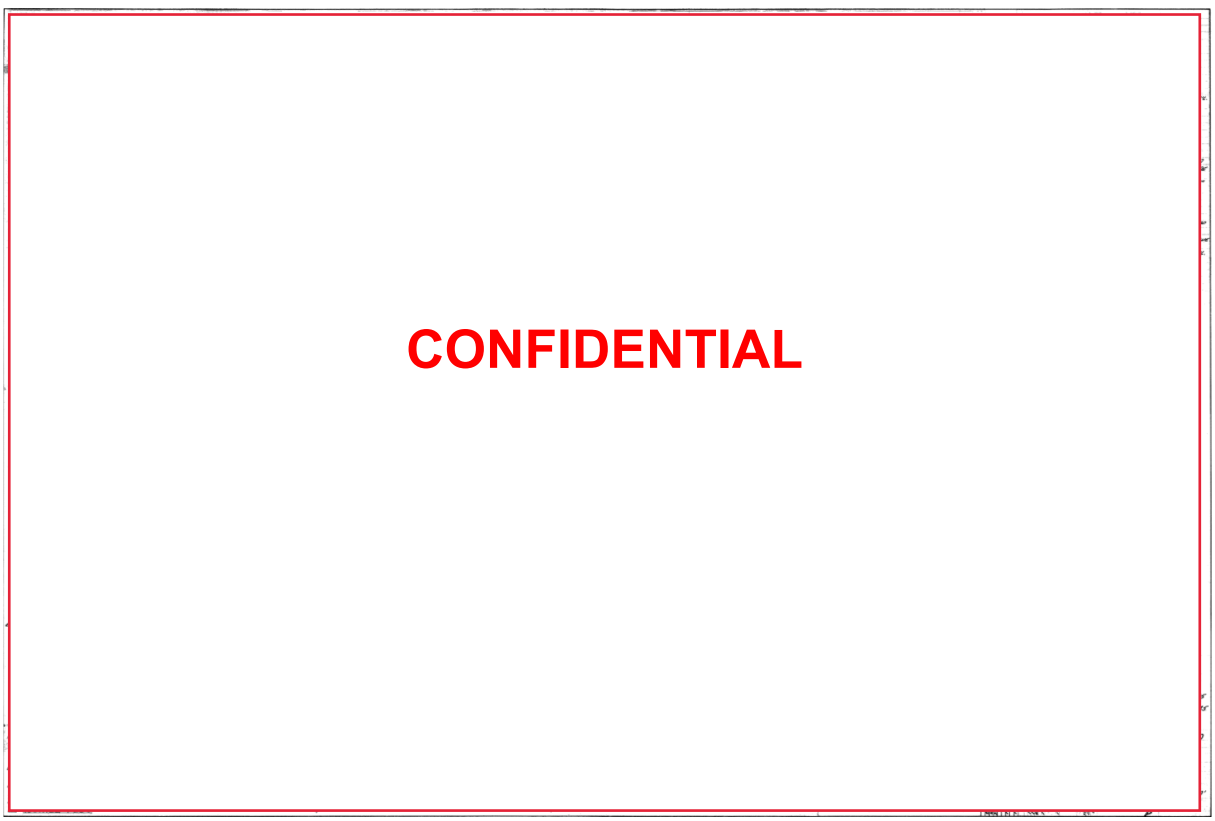
Table 1. Replacement Schedule

Quantity (feet)	**Existing Main**		**Proposed Main**	
	Size (inch)	**Material**	**Size** (inch)	**Material**
400	4	AC	6	PVC
400	6	AC	6	PVC
2,800	6	AC	8	PVC
1,600	8	AC	8	PVC
2,300	14	AC	12	PVC

3. Project Background

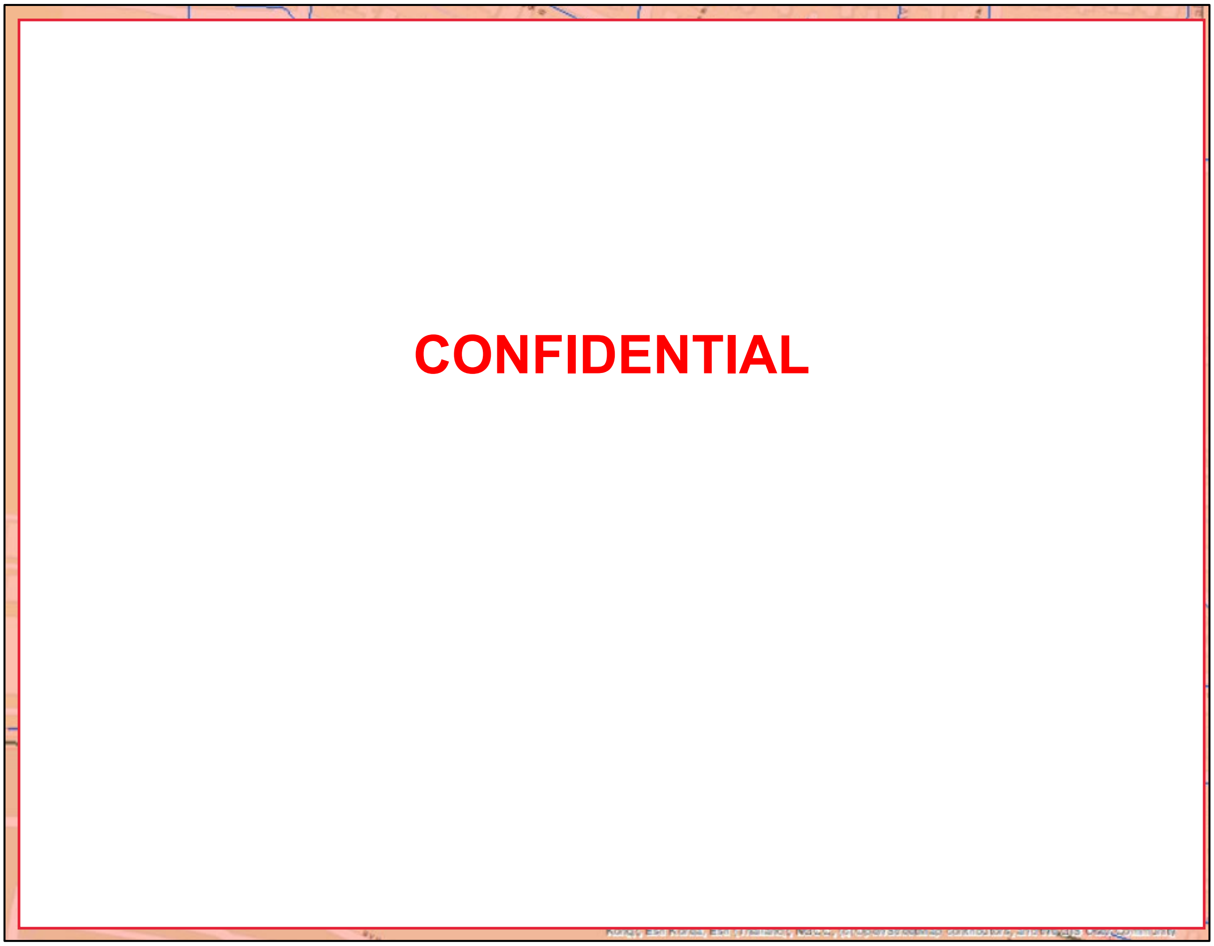
The available record drawing (Figure 2) shows the existing pipe materials are Asbestos Cement pipes (AC). These pipelines were originally built in 1959 during the development of TRACT 24507 under Project Number 1712-SJ-3. They are a part of the distribution system in the 547 Zone in the San Jose Hills District of Suburban.

Figure 2. Record Drawing



This project is in the Disadvantage Areas according to SB 535 (see Figure 3).

Figure 3. Project in the SB 535 Disadvantage Areas



Suburban Water Systems (Suburban) water main break data is available from 1998. All the main breaks for this project on record from 1998 to 2021 are also shown in Table 2 and illustrated with blue dots in Figure 1.

Table 2. Break Record

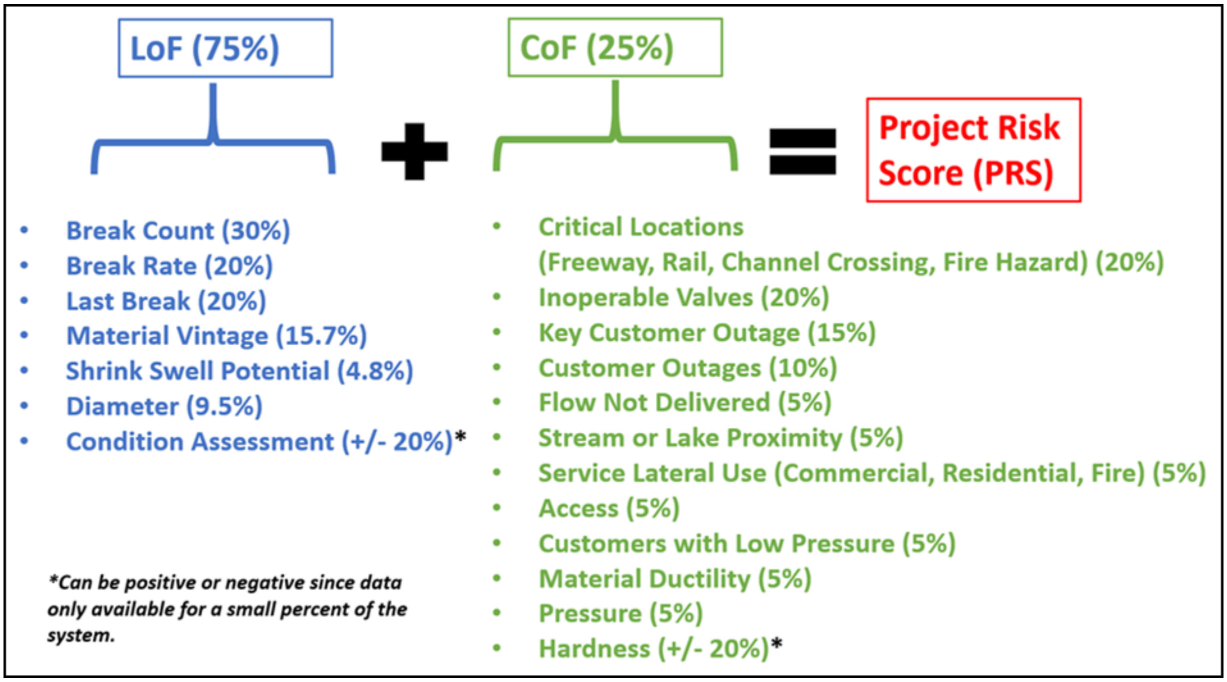
BREAK TYPE	BREAK DATE	ADDRESS	STREET	CITY
Main	11/15/2001			
Main	10/18/2004			
Main	1/5/2007			
Main	1/25/2007			
Main	7/19/2007			
Main	8/16/2007			
Main	10/6/2008			
Main	6/4/2009			
Main	7/18/2011			
Main	8/1/2011			
Main	9/19/2014			
Main	11/21/2014			
Main	9/11/2015			
Main	7/8/2016			
Main	8/16/2018			
Main	10/9/2018			
Main	10/12/2018			
Main	9/30/2019			
TOTAL				

CONFIDENTIAL

4. Project Risk Score (PRS)

In 2018 Suburban engaged HDR to perform an independent condition analysis of the pipeline infrastructure. HDR updated the study in 2022. See HDR's Suburban Water Systems Water Main Renewal Technical Memorandum 2022 included in Workpaper VOLUME III-E (HDR TM). To evaluate the system, HDR developed a Risk Model for pipeline renewal and replacement. This model calculated a Project Risk Score (PRS) to quantify the relative risk of failure from very low to severe. This methodology considers the likelihood of failure (LoF) and the consequence of failure (CoF) of the main. Each of the PRS criterion (LoF and CoF) are made up of many factors. Figure 4 summarizes the PRS calculation methodology.

Figure 4. Risk Calculation Method



4.1 PRS Calculation Methodology

As shown in Figure 4, the LoF weight is 75 percent and the CoF weight is 25 percent. The PRS is on a scale of zero to one hundred, LoF can contribute up to 75 points, and the CoF can contribute up to 25 points. Each factor was scored on a 0 to 10 scale (Factor Score), where 0 represents the lowest risk, and 10 represents the highest risk. A detailed explanation of each factor is explained in chapter 4 of the technical memorandum. Each pipeline segment is calculated separately for its LoF and CoF based on the following equation:

$$\text{LoF Score} = \sum (\text{LoF Factor Score} \times 10 \times \text{Weight} \times \text{Criterion Weight})$$

$$\text{CoF Score} = \sum (\text{CoF Factor Score} \times 10 \times \text{Weight} \times \text{Criterion Weight})$$

The PRS for each segment is the summation of LoF and CoF:

$$\text{PRS} = \text{LoF Score} + \text{CoF Score}$$

The final PRS for the entire project is a weighted average of pipe risk score by length:

$$\textbf{Final Project Risk Score} = \sum (\textbf{PRS x Length}) \div \sum (\textbf{Length})$$

4.2 PRS Calculation Result

Table 3 below summarizes the PRS provided by HDR TM 2022 for this replacement project.

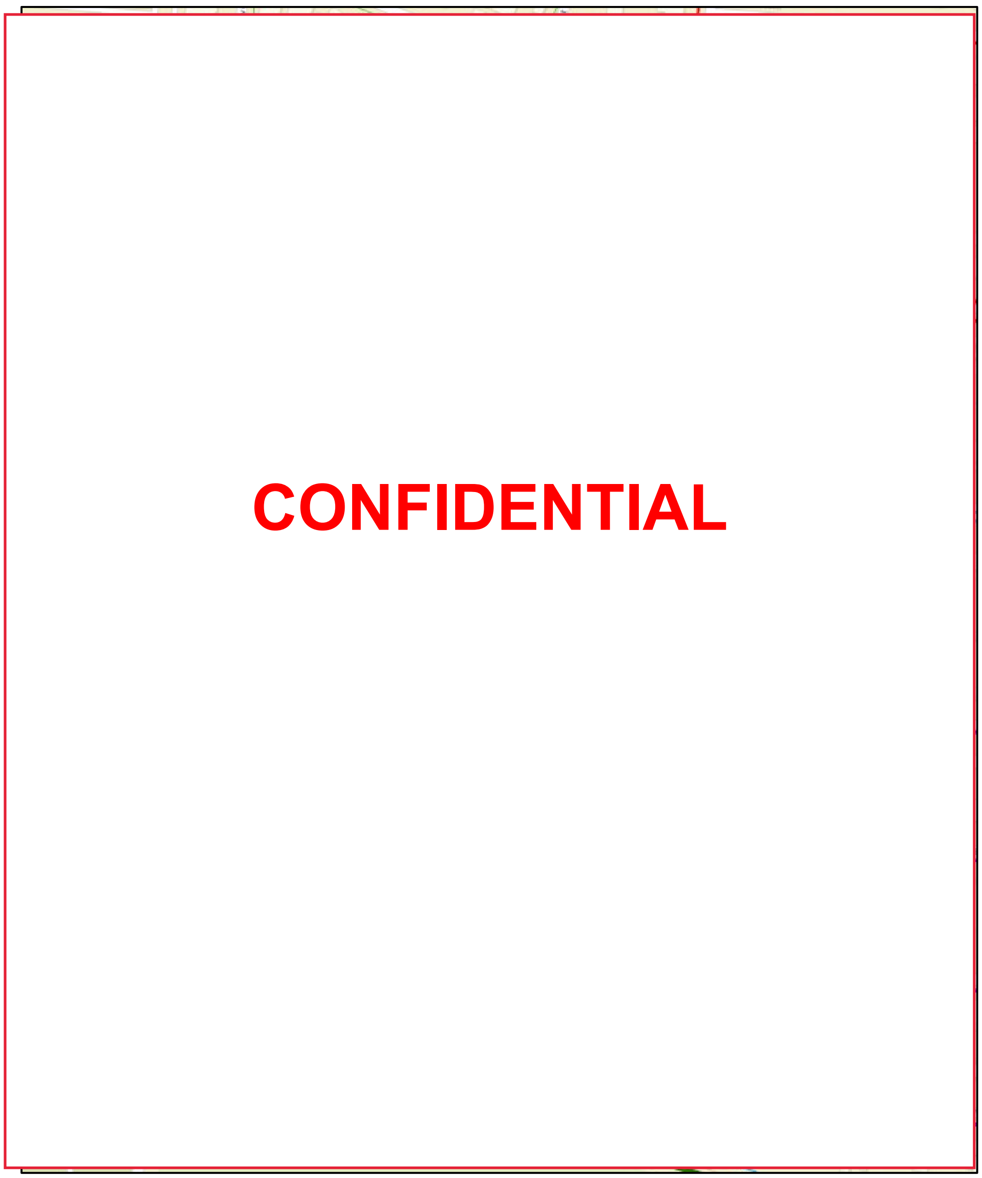
Table 3. Summary of PRS

Project #	Sum of Pipe_Length*	Average of LoF_PRS	Average of CoF_PRS	Average of PRS
1712-SJ-3	7,243	53.3	1.9	55.2

*****: The pipe length in Table 3 is from the current GIS database. The estimated replacement length is different. It is measured with new alignments, appurtenances, tie-ins, and any line segment within the project boundary but not included in the current GIS under the same Project Number.

Figure 5 is the PRS map for this project from HDR TM 2022.

Figure 5. Project Risk Score Map



5. Improvement Alternative's Summary

Alternative 1 – Don't do anything. This alternative continues to use the existing pipelines, resulting in continued repairs when breaks occur. This is an undesirable option because the pipelines will continue to fail, interrupting service customers. This will cause poor customer service and higher costs for repairs and piecemeal replacement.

Alternative 2 – Rehabilitate the existing water main. Three rehabilitation methods were evaluated for this alternative.

- Pipebursting
- Sliplining
- Cured-In-Place Pipe (CIPP)

A detailed description of each rehabilitation method is shown below.

Pipebursting – Pipebursting is a method by which the existing pipe is opened and forced outward by a bursting tool. A hydraulic or pneumatic expansion head (part of the bursting tool) is pulled through the existing pipeline, typically using a cable and winch. As the expansion head is pulled through the existing pipe, it pushes that pipe radially outward until it breaks apart, creating a space for the new pipe. The bursting device also pulls the new pipeline behind it, immediately filling the void created by the old, burst pipe with the new pipe. Pipebursting can be used to replace the existing pipe with a similarly sized or larger pipe.

Pipebursting is not recommended if the existing pipe is asbestos cement because the process leaves broken asbestos pieces in the ground. When the pipe is disturbed, it is considered a waste disposal site and is subject to National Emission Standards for Hazardous Air Pollutants (NESHAP) requirements. Friable asbestos fibers lead to cancer of the lungs, known as mesothelioma. Future maintenance activities such main repairs due to breaks or replacing service lines will be required and may lead to health concerns.

Sliplining – Sliplining is inserting a new pipe by pulling or pushing it into the existing pipe and grouting the annular space. After it is in place, the pipe is grouted to hold the lining in place and for additional rigidity.

Sliplining new pipes will generally have a significantly reduced cross-sectional area. Sliplining is not recommended if maintaining or increasing fire flow in the area is required.

CIPP – A cured-in-place pipe (CIPP) is a trenchless rehabilitation method to repair existing pipelines. It is a jointless, seamless pipelining within an existing pipe. The process of CIPP involves inserting and running a felt lining into a pre-existing pipe that is the subject of repair. The resin within the liner is then exposed to a curing element to make it attach to the inner walls of the pipe. Once fully cured, the lining now acts as a new pipeline.

Like sliplining, CIPP is not recommended if maintaining or increasing fire flow is required because the cross-sectional area of the pipeline after rehabilitation is reduced.

There are some common limitations for all three rehabilitation methods compared with open trench replacement:

1. Rehabilitation methods are used for sewer pipelines. Sewer pipelines are straight and are usually deeper than water lines. Offsets and fittings make using these methods more costly. Open trenching deep sewer mains are also more expensive than water mains installed 42-60 inches deep.
2. Typically, there is only one main in the street that serves customers and cannot be switched to other mains during the construction of a new main. A temporary by-pass system is required to provide continuous service to customers. During summer, water in the by-pass pipe is heated because it is in direct contact with the sun. Driveways are blocked by the above-ground pipe and can easily be damaged.
3. Installation pits are required when horizontal and vertical alignment changes are substantial that the new pipe won't be able to pull or push through the existing pipe. Most Suburban's record drawings in the 50s and 60s don't include profile views of the pipelines, and it is suspected that there are multiple offsets. Offsets are required to avoid underground utilities such as gas, cable, water, and storm drain. Most often, water lines cross these utilities multiple times on a street. Digging pits will result in delays and continuous customer interruptions and increase construction costs.
4. Open trench pipe replacement method minimizes water interruptions to one, eight (8) hour shutdown to connect the new pipeline to the existing system, and one, thirty (30) minute shutdown to switch customer services. Mains must be pressure tested and disinfected. There are occasions when passing bacteriological testing can take several weeks due to positive e-coli results. Open trench replacement allows new mains, valves, and service connections to be pressure tested and disinfected before the final shut down to connect to the existing system. Trenchless rehabilitation of the existing pipelines can only be constructed section by section. Each section requires a much

longer shutdown time for service connection, pressure testing, and disinfection to bring back the service and move on to the next one. Replacing the pipelines using rehabilitation techniques will add more time to the project resulting in more costs.

Rehabilitation methods are good alternatives for specific applications like steep hills, where surfaces cannot be disturbed, and if there are no service connections on the main. Suburban's pipeline contractors have not performed rehabilitation methods on residential streets with services. Health and environmental concerns have not been fully addressed when using them on AC pipes. Additional fittings and offsets require more deep excavation pits and will increase the cost and duration of the project. It is not recommended to rehabilitate neighborhood pipelines and continue replacing pipelines using an open trench method.

Alternative 3 – Replace existing water mains with approximately 7,500 LF 6-inch to 12-inch PVC pipes and associated appurtenances as shown in Table 1. This Alternative will improve the integrity of the distribution system, eliminate service interruptions in this area, and ensure safe and reliable service to the customers.

According to the Association for the Advancement of Cost Engineering, this alternative is Class 3 of Opinion of Probable Construction Cost (OPCC) for constructing the replacement pipelines. The expected accuracy range for Class 3 is between +10% to +30%. Therefore, a 10% contingency is used in the OPCC.

Description	Quantity	Unit	Unit Cost	Cost
Construct 12-inch PVC	2,300	L.F.	$190	$437,000
12-inch BFV	5	Each	$4,050	$20,250
12-inch Tie-In	3	Each	$8,900	$26,700
Construct 8-inch PVC	4,400	L.F.	$130	$572,000
8-inch Gate Valves	10	Each	$2,050	$20,500
8-inch Tie-In	2	Each	$6,810	$13,620
Construct 6-inch PVC	800	L.F.	$120	$96,000
6-inch Gate Valves	2	Each	$1,660	$3,320
6-inch Fire Hydrant	12	Each	$10,870	$130,440
2-inch BO	2	Each	$5,330	$10,660
1-inch service	200	Each	$2,110	$422,000
AC Removal and Replacement	7,500	L.F.	$50	$375,000
Construct Pipeline Offset	30	Each	$3,500	$105,000
Cut, Plug and Abandon of Existing Pipeline	1	LS	$9,034	$9,034
Traffic Rated (H-20) Meter Lids	200	Each	$250	$50,000
Install Test Head Furnishing for Pressure Testing	8	Each	$3,610	$28,880
Landscaping Removal & Replacement	1	LS	$12,644	$12,644
Guard underground services	1	LS	$16,540	$16,540
Line Item Subtotal				$2,349,588
Mobilization			3%	$70,488
De-mobilization			2%	$46,992
Construction Subtotal				**$2,467,067**
Engineering and Inspection			12%	$296,048
Subtotal				$2,763,115
Contingency			10%	$276,312
Subtotal				$3,039,427
General Administration			9%	$273,548
Total				**$3,313,000**

6. Basis for Budgeted Cost

The total estimated project cost includes Engineering and Inspection, General Administration, and Contingency factors. The Engineering and Inspection factor accounts for the estimated direct cost required to plan, design, and inspect the project, permit fees, and cost of internal labor. The General Administration factor considers Suburban's general administrative expenses. The contingency factor accounts for unforeseen construction conflicts and complications that could result in additional project costs.

7. Impact of Deferral

The longer this pipeline replacement is deferred, the older the pipes will become, the likelihood of failure will increase, and the frequency of breaks will increase. The breaks will increasingly cause undesirable service interruptions to customers, and the overall system condition will exponentially worsen.

8. Recommendation

- Alternative #1 is not feasible because it does not resolve the interruptions of service issues to customers and does not prevent the degradation of the integrity of the water system infrastructure in this area.
- Alternative #2 has limitations with making this Alternative lose its cost-benefit and construction efficiency.
- Alternative #3 is a better solution because it provides full reliability, quality, and abundance of service to the customer in the area. Suburban recommends Alternative #3.

W-22

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PROJECT DESIGN REPORT

FROM: Engineering Department
DATE: March 30, 2022
DISTRICT: WLM
SUBJECT: Manzanares Road and Pastrana Drive Pipeline Replacement; CP-451

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1. Executive Summary

The existing 2-inch, 4-inch, 8-inch asbestos cement (AC) mains, gray plastic (GP) mains, steel (ST) mains, and some unknown material (NOS) mains in Manzanares Road and Pastrana Drive area have experienced many main breaks in the past years. They have reached the end of their useful lives, and do not provide an adequate level of service to the customers. It is recommended that these 4-inch to 8-inch existing mains be replaced by approximately 11,180 LF of 4-inch to 8-inch PVC mains to provide a safe and reliable water supply to the customers in the area.

2. Introduction

The existing 2-inch, 4-inch, 8-inch asbestos cement (AC) mains, gray plastic (GP) mains, steel (ST) mains, and some unknown material (NOS) mains in the area of Manzanares Road and Pastrana Drive, west of Pastrana Drive, east of La Mirada Boulevard, north of Rosecrans Avenue, and south of Alicante Road, have experienced frequent main breaks in the past years causing service interruptions and inconvenience to customers. Suburban has made piecemeal repairs to continue to provide service to its customers but this is not a long-term solution. It is recommended to replace these existing mains with approximately 11,180 LF 4-inch, 6-inch, and 8-inch PVC Pipes in the project area to provide a safe and reliable water supply to the customers.

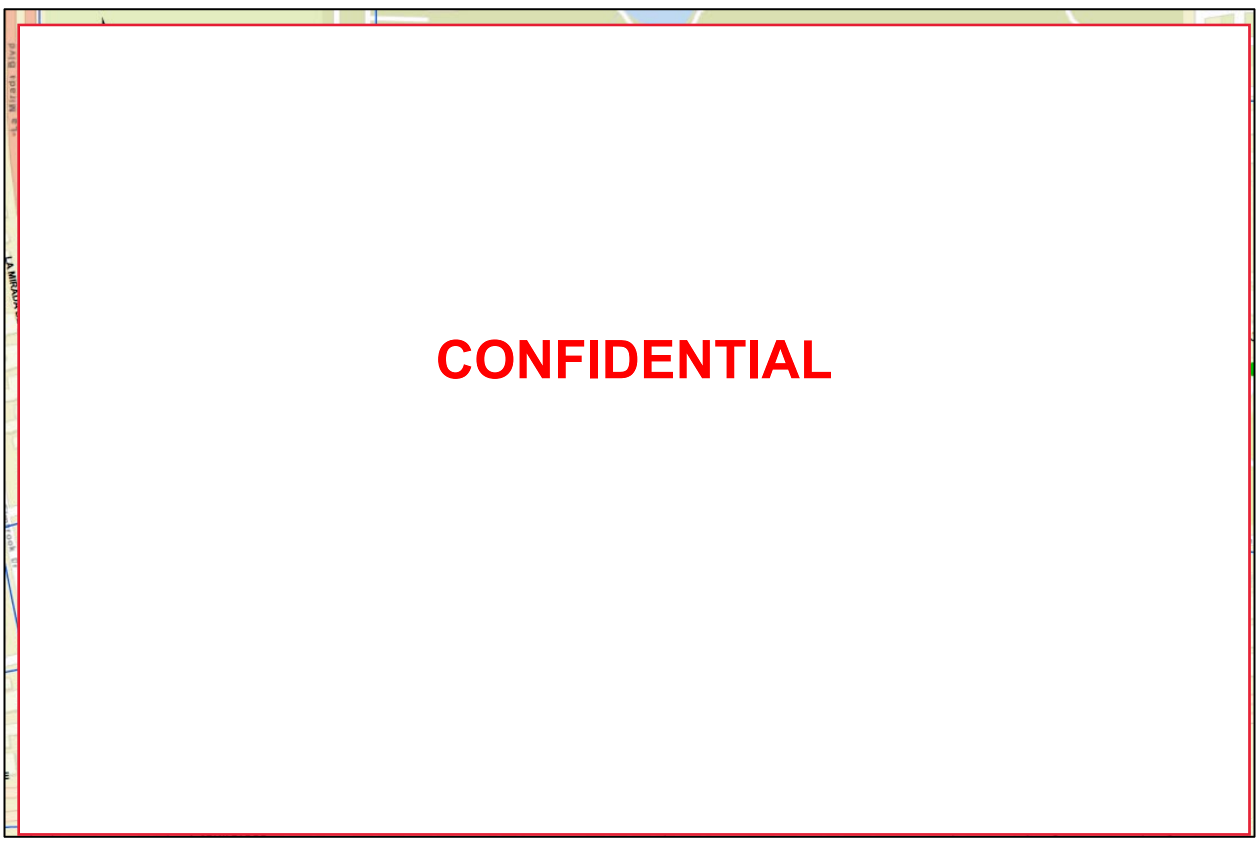
Table 1 present a summary of pipeline replacement in this project and Figure 1 shows the project area. This project has been grouped per the recommendations of the pipeline condition assessment to include all mains that were constructed as part of this tract and are expected to continue to experience breaks. A detailed explanation of the grouping is outlined in Chapter

1 of the "*Suburban Water Systems Water Main Renewal Technical Memorandum, 2022,*" included in Workpaper VOLUME III-E.

Table 1. Replacement Schedule

Quantity	**Existing Main**		**Proposed Main**	
(feet)	**Size** (inch)	**Material**	**Size** (inch)	**Material**
610	2	AC/GP	4	PVC
3970	4	AC/GP	6	PVC
3220	6	AC/NOS/ST	8	PVC
3,380	8	AC/NOS/ST	8	PVC
11,180				

Figure 1. Project Area and Break Map

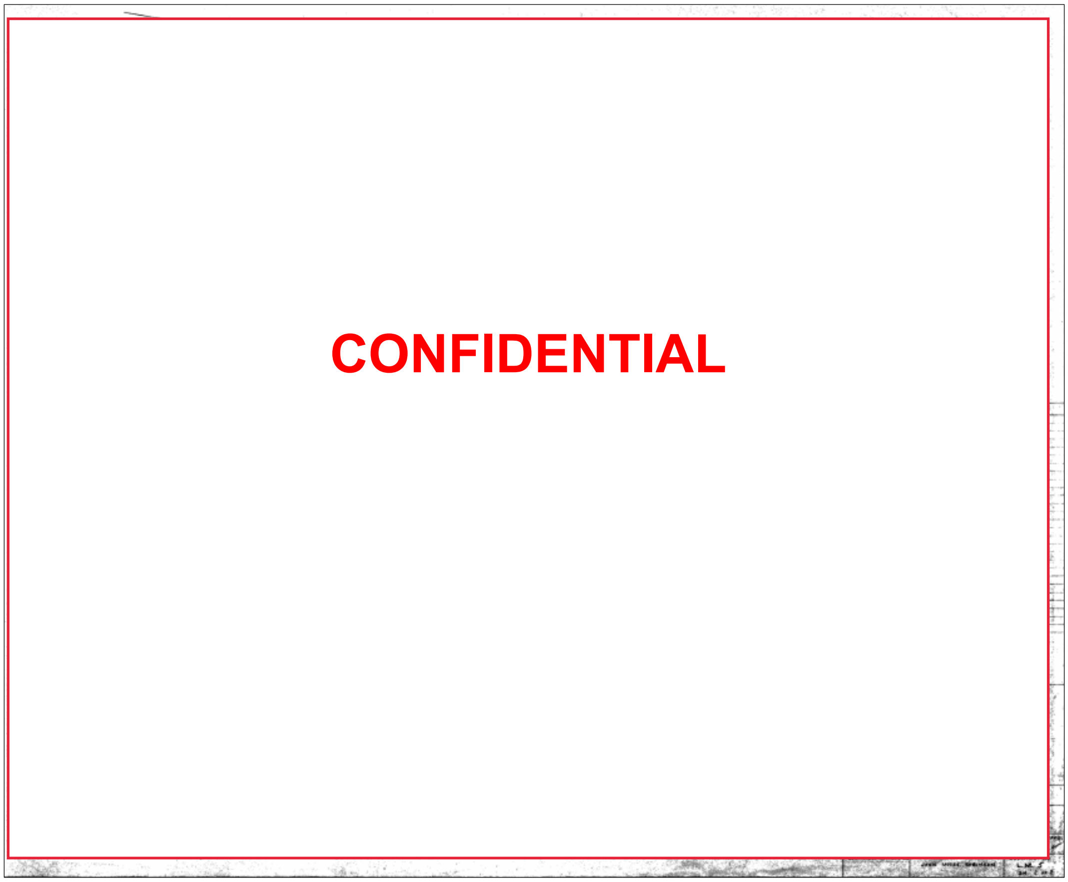


3. Project Background

Record drawings (Figures 2 & 3) show the existing mains were originally built in 1955 during the development of TRACT 18503 under the Project Number LM-5-55 in the City of La Mirada. No information on pipe materials is shown on the record drawings. Based on the previous repair records, the materials of these pipelines are mainly AC and gray plastic with a small portion of steel and other unknown material. They are a part of the distribution system in the 335 Zone in the Whittier/La Mirada District of Suburban.

Figure 2. Record Drawing 1

Figure 3. Record Drawing 2



Suburban Water Systems (Suburban) water main break data is available from 1998. All the main breaks for this project on record from 1998 to 2021 are also shown in Table 2 and illustrated with green dots in Figure 1.

Table 2. Break Record

BREAK TYPE	BREAK DATE	ADDRESS	STREET	CITY
Main	7/29/1998			
Main	7/25/2000			
Main	8/21/2003			
Main	6/6/2007			
Main	4/1/2008			
Main	7/13/2009			
Main	11/5/2009			
Main	8/30/2011			
Main	7/10/2014			

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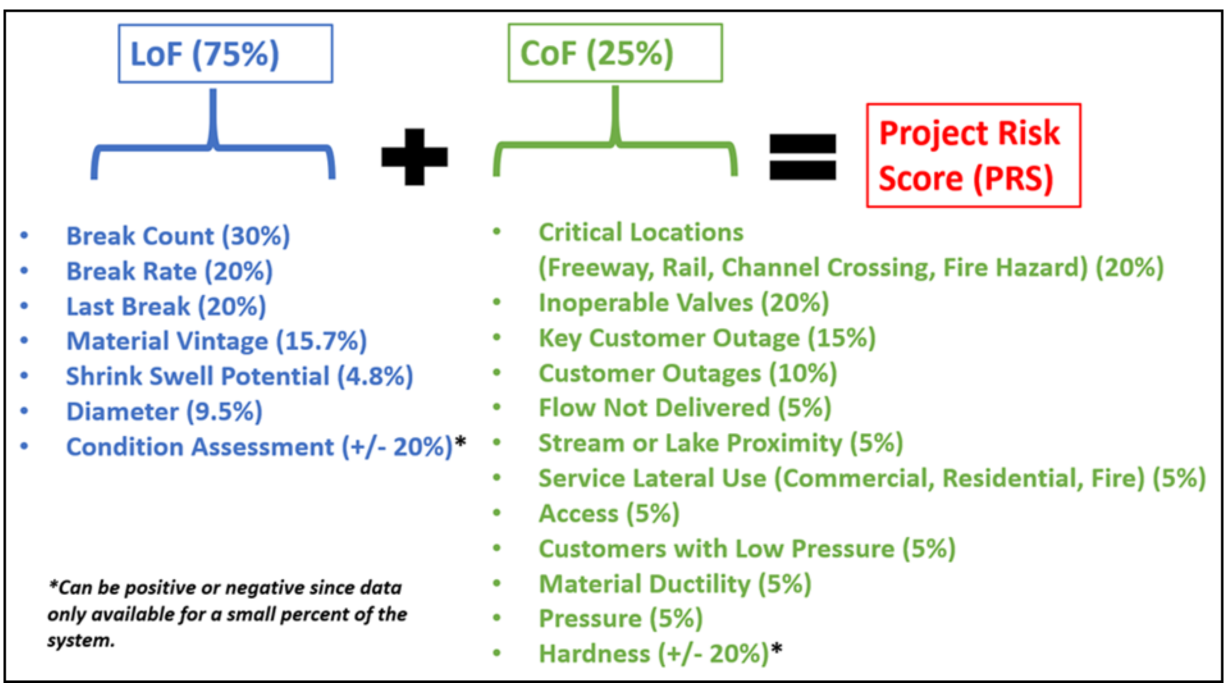
BREAK TYPE	BREAK DATE	ADDRESS	STREET	CITY
Main	8/3/2015			
Main	1/16/2017			
Main	11/21/2017			
Main	9/10/2018		CONFIDENTIAL	
Main	9/27/2019			
TOTAL				

4. Project Risk Score (PRS)

In 2018 Suburban engaged HDR to perform an independent condition analysis of the pipeline infrastructure. HDR updated the study in 2022. See HDR's Suburban Water Systems Water Main Renewal Technical Memorandum 2022 included in Workpaper VOLUME III-E (HDR TM). To evaluate the system, HDR developed a Risk Model for pipeline renewal and replacement. This model calculated a Project Risk Score (PRS) to quantify the relative risk of failure from very low to severe. This methodology considers the likelihood of failure (LoF) and the consequence of failure (CoF) of the main. Each of the PRS criterion (LoF and CoF) are made up of many factors. Figure 4 summarizes the PRS calculation methodology.

Figure 4. Risk Calculation Method



4.1. PRS Calculation Methodology

As shown in Figure 4, the LoF weight is 75 percent and the CoF weight is 25 percent. The PRS is on a scale of zero to one hundred, LoF can contribute up to 75 points, and the CoF can contribute up to 25 points. Each factor was scored on a 0 to 10 scale (Factor Score), where 0 represents the lowest risk, and 10 represents the highest risk. A detailed explanation of each factor is explained in chapter 4 of the technical memorandum. Each pipeline segment is calculated separately for its LoF and CoF based on the following equation:

$$\text{LoF Score} = \sum (\text{LoF Factor Score} \times 10 \times \text{Weight} \times \text{Criterion Weight})$$

$$\text{CoF Score} = \sum (\text{CoF Factor Score} \times 10 \times \text{Weight} \times \text{Criterion Weight})$$

The PRS for each segment is the summation of LoF and CoF:

$$\text{PRS} = \text{LoF Score} + \text{CoF Score}$$

The final PRS for the entire project is a weighted average of pipe risk score by length:

$$\textbf{Final Project Risk Score} = \sum (\textbf{PRS x Length}) \div \sum (\textbf{Length})$$

4.2. PRS Calculation Result

Table 3 below summarizes the PRS provided by HDR TM 2022 for this replacement project.

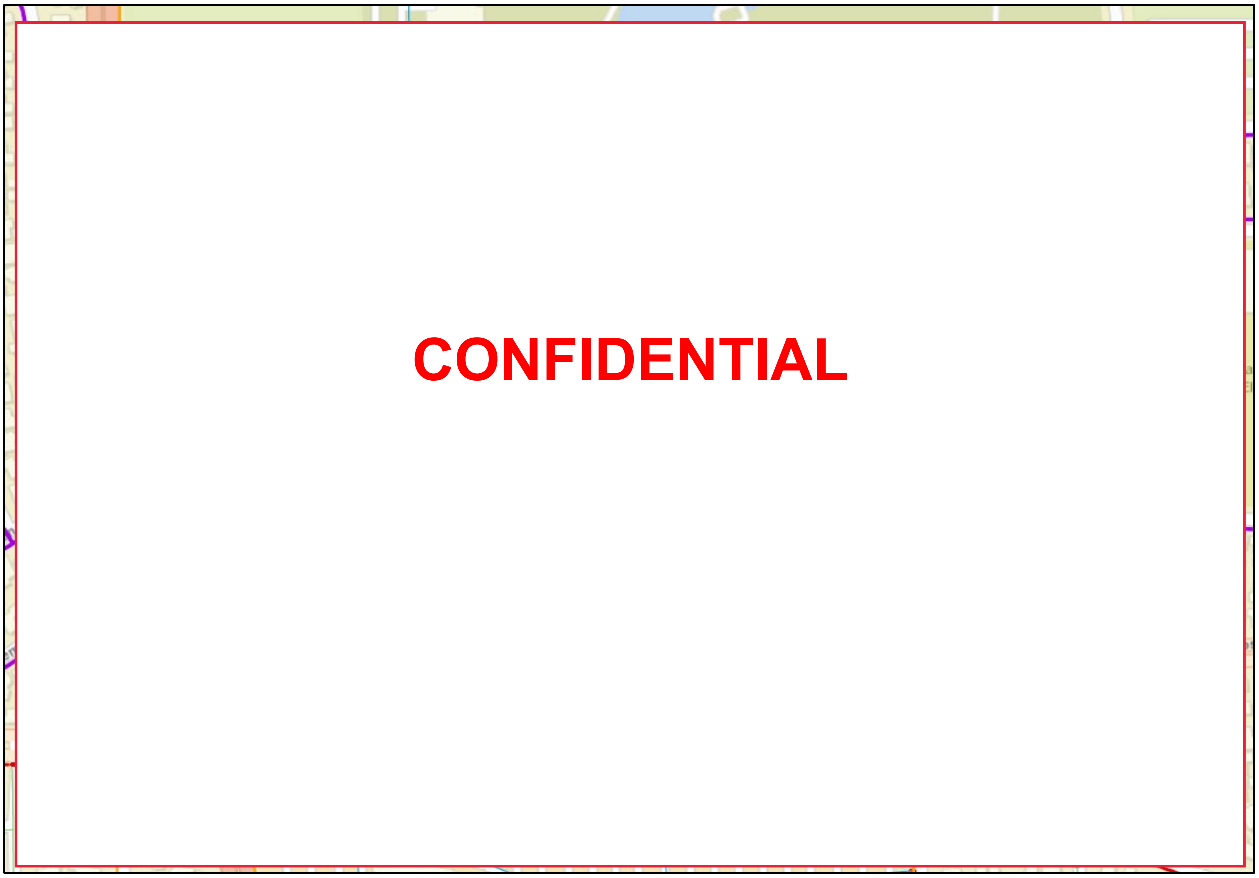
Table 3. Summary of PRS

Project #	Sum of Pipe_Length*	Average of LoF_PRS	Average of CoF_PRS	Average of PRS
LM-5-55	10,550	53.3	1.3	54.6

*: The pipe length in Table 3 is from the current GIS database. The estimated replacement length is different. It is measured with new alignments, appurtenances, tie-ins, and any line segment within the project boundary but not included in the current GIS under the same Project Number.

Figure 5 is the PRS map for this project from HDR TM 2022.

Figure 5. Project Risk Score Map



5. Improvement Alternative's Summary

Alternative 1 – Do nothing. This alternative continues to use the existing pipelines, resulting in continued repairs when breaks occur. This is an undesirable option because the pipelines will continue to fail, interrupting service customers. This will cause poor customer service and higher costs for repairs and piecemeal replacement.

Alternative 2 – Rehabilitate the existing water main. Three rehabilitation methods were evaluated for this alternative.

- Pipebursting
- Sliplining
- Cured-In-Place Pipe (CIPP)

A detailed description of each rehabilitation method is shown below.

Pipebursting – Pipebursting is a method by which the existing pipe is opened and forced outward by a bursting tool. A hydraulic or pneumatic expansion head (part of the bursting tool) is pulled through the existing pipeline, typically using a cable and winch. As the expansion head is pulled through the existing pipe, it pushes that pipe radially outward until it breaks apart, creating a space for the new pipe. The bursting device also pulls the new pipeline behind it, immediately filling the void created by the old, burst pipe with the new pipe. Pipebursting can be used to replace the existing pipe with a similarly sized or larger pipe.

Pipebursting is not recommended if the existing pipe is asbestos cement because the process leaves broken asbestos pieces in the ground. When the pipe is disturbed, it is considered a waste disposal site and is subject to National Emission Standards for Hazardous Air Pollutants (NESHAP) requirements. Friable asbestos fibers lead to cancer of the lungs, known as mesothelioma. Future maintenance activities such main repairs due to breaks or replacing service lines will be required and may lead to health concerns.

Sliplining – Sliplining is inserting a new pipe by pulling or pushing it into the existing pipe and grouting the annular space. After it is in place, the pipe is grouted to hold the lining in place and for additional rigidity.

Sliplining new pipes will generally have a significantly reduced cross-sectional area. Sliplining is not recommended if maintaining or increasing fire flow in the area is required.

CIPP – A cured-in-place pipe (CIPP) is a trenchless rehabilitation method to repair existing pipelines. It is a jointless, seamless pipelining within an existing pipe. The process of CIPP involves inserting and running a felt lining into a pre-existing pipe that is the subject of repair. The resin within the liner is then exposed to a curing element to make it attach to the inner walls of the pipe. Once fully cured, the lining now acts as a new pipeline.

Like sliplining, CIPP is not recommended if maintaining or increasing fire flow is required because the cross-sectional area of the pipeline after rehabilitation is reduced.

There are some common limitations for all three rehabilitation methods compared with open trench replacement:

1. Rehabilitation methods are used for sewer pipelines. Sewer pipelines are straight and are usually deeper than water lines. Offsets and fittings make using these methods

more costly. Open trenching deep sewer mains are also more expensive than water mains installed 42-60 inches deep.

2. Typically, there is only one main in the street that serves customers and cannot be switched to other mains during the construction of a new main. A temporary by-pass system is required to provide continuous service to customers. During summer, water in the by-pass pipe is heated because it is in direct contact with the sun. Driveways are blocked by the above-ground pipe and can easily be damaged.

3. Installation pits are required when horizontal and vertical alignment changes are substantial that the new pipe won't be able to pull or push through the existing pipe. Most Suburban's record drawings in the 50s and 60s don't include profile views of the pipelines, and it is suspected that there are multiple offsets. Offsets are required to avoid underground utilities such as gas, cable, water, and storm drain. Most often, water lines cross these utilities multiple times on a street. Digging pits will result in delays and continuous customer interruptions and increase construction costs.

4. Open trench pipe replacement method minimizes water interruptions to one, eight (8) hour shutdown to connect the new pipeline to the existing system, and one, thirty (30) minute shutdown to switch customer services. Mains must be pressure tested and disinfected. There are occasions when passing bacteriological testing can take several weeks due to positive e-coli results. Open trench replacement allows new mains, valves, and service connections to be pressure tested and disinfected before the final shut down to connect to the existing system. Trenchless rehabilitation of the existing pipelines can only be constructed section by section. Each section requires a much longer shutdown time for service connection, pressure testing, and disinfection to bring back the service and move on to the next one. Replacing the pipelines using rehabilitation techniques will add more time to the project resulting in more costs.

Rehabilitation methods are good alternatives for specific applications like steep hills, where surfaces cannot be disturbed, and if there are no service connections on the main. Suburban's pipeline contractors have not performed rehabilitation methods on residential streets with services. Health and environmental concerns have not been fully addressed when using them on AC pipes. Additional fittings and offsets require more deep excavation pits and will increase the cost and duration of the project. It is not recommended to rehabilitate neighborhood pipelines and continue replacing pipelines using an open trench method.

Alternative 3 – Replace the existing water main with approximately 11,180 LF 4-inch, 6-inch, and 8-inch PVC pipes and associated appurtenances as shown in Table 1. This Alternative will improve the integrity of the distribution system, eliminate service interruptions in this area, and ensure safe and reliable service to the customers.

According to the Association for the Advancement of Cost Engineering, this alternative is Class 3 of Opinion of Probable Construction Cost (OPCC) for constructing the replacement pipelines. The expected accuracy range for Class 3 is between +10% to +30%. Therefore, a 10% contingency is used in the OPCC.

Description	Quantity	Unit	Unit Cost	Cost
Construct 8-inch PVC	6600	L.F.	$130	$858,000
8-inch Gate Valves	24	Each	$1,960	$47,040
8-inch Tie-In	8	Each	$6,840	$54,720
Construct 6-inch PVC	3970	L.F.	$120	$476,400
6-inch Gate Valve	4	Each	$1,660	$6,640
Construct 4-inch PVC	610	L.F.	$110	$67,100
4-inch Gate Valve	3	Each	$1,380	$4,140
6-inch Fire Hydrant	18	Each	$10,870	$195,660
2-inch Blow-off	3	Each	$5,330	$15,990
1-inch service	240	Each	$2,110	$506,400
AC Removal and Replacement	11180	L.F.	$50	$559,000
Construct Pipeline Offset	45	Each	$3,050	$137,250
Cut, Plug and Abandon of Existing Pipeline	1	LS	$9,034	$9,034
Traffic Rated (H-20) Meter Lids	240	Each	$250	$60,000
Install Test Head Furnishing for Pressure Testing	11	Each	$3,610	$39,710
Landscaping Removal & Replacement	1	LS	$12,644	$12,644
Guard underground services	1	LS	$16,540	$16,540
Line Item Subtotal				$3,066,268
Mobilization			3%	$91,988
De-mobilization			2%	$61,325
Construction Subtotal				**$3,219,581**
Engineering and Inspection			12%	$386,350
Subtotal				$3,605,931
Contingency			10%	$360,593
Subtotal				$3,966,524
General Administration			9%	$356,987
Total				**$4,324,000**

6. Basis for Budgeted Cost

The total estimated project cost includes Engineering and Inspection, General Administration, and Contingency factors. The Engineering and Inspection factor accounts for the estimated direct cost required to plan, design and inspect the project, permit fees, and cost of internal labor. The General Administration factor considers Suburban's general administrative costs. The contingency factor accounts for unforeseen construction conflicts and complications that could result in additional project costs.

7. Impact of Deferral

The longer this pipeline replacement is deferred, the older the pipes will become, the likelihood of failure will increase, and the frequency of breaks will increase. The breaks will increasingly cause undesirable service interruptions to customers, and the overall system condition will exponentially worsen.

8. Recommendation

- Alternative #1 is not feasible because it does not resolve the interruptions of service issues to customers and does not prevent the degradation of the integrity of the water system infrastructure in this area.
- Alternative #2 has limitations with making this Alternative lose its cost-benefit and construction efficiency.
- Alternative #3 is a better solution because it provides full reliability, quality, and abundance of service to the customer in the area. Suburban recommends Alternative #3.