



Spearhead Engineering

Owned and Operated by  
Colbey Bruney and Ryan Keith

# Wyoming Street Hydraulic Improvements

Colbey Bruney & David Ryan Keith

# Introduction

- ❖ Wyoming Street corridor, Missoula MT
- ❖ Hydraulic improvements design
  - 11 new tie-on locations
- ❖ Brownfields Site
  - Former industrial site with contamination
- ❖ Location of a former sawmill
  - Existing bio-waste
- ❖ Methane remediation
  - Shield water system from intrusion
- ❖ Future design is for residential and commercial redevelopment



# Existing Project Conditions and Facilities



- ❖ Existing water main: 8-inch and 10-inch ductile iron pipe (DIP)
  - Located 7-feet below Wyoming street
- ❖ Flat grassy field with sandy top soil
- ❖ Ditch running along northern quarter of site
  - Methane concentrated north of ditch
  - Methane extends 25-feet down
- ❖ Geotechnical Report filed by Tetra Tech

# Design Criteria

- ❖ Missoula City Water Specs, AWWA, DEQ
- ❖ Pipe Requirements
  - Class 350 Ductile Iron Pipe
  - Minimum 8-inch diameter
  - Minimum 12-inch commercial
- ❖ Pressure Requirements
  - 35-to-80 psi
- ❖ Fire Flow/ Flow Requirements
  - 1,626 gallons/minute for 2 hours
- ❖ Methane Intrusion
  - Prevent methane intrusion
  - 0.005 mg/L maximum concentration



American Water Works  
Association

# Design Constraints

- ❖ Brownfields project status
  - No new wells
- ❖ Traffic control permitting



# Summary of Preliminary Design Analysis

## Flowable fill Trench Plugs

- ❖ Concrete backfill around pipes
  - 3-feet laterally and vertically outside trench
  - Sufficiently shields methane
  - Installed North of Wyoming Street
  - Cost effective



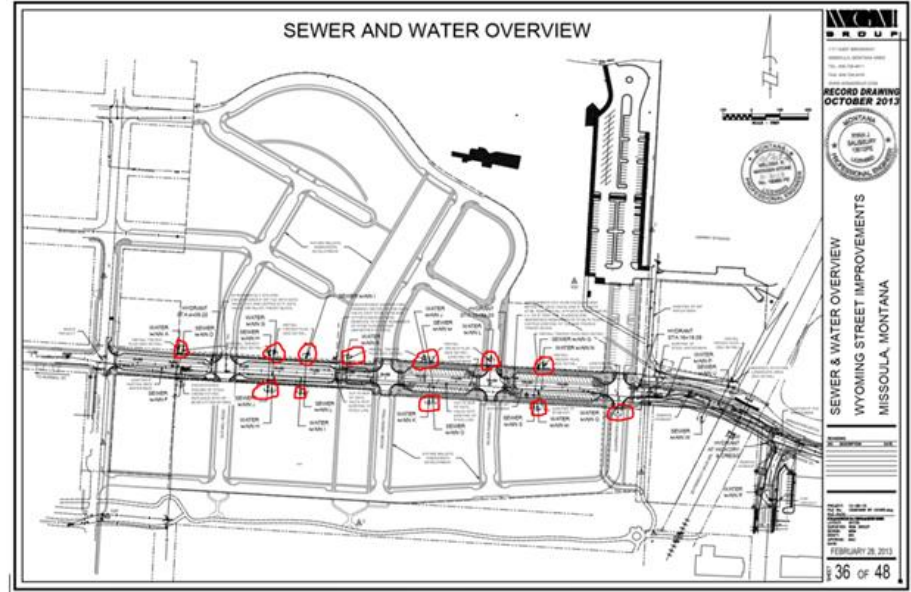
## Cutoff Wall with Geotextile Membrane

- ❖ 25-foot deep cement cutoff wall
  - Placed along Southern border of methane concentration
  - Requires significant excavation
- ❖ Geomembrane liner placed against wall
- ❖ Sufficiently shields methane
- ❖ Would require
  - 5000 CY of excavation
  - 2500 CY of reinforced concrete
  - 3750 square yards of HDPE liner
- ❖ No cost alternative was made for the cutoff wall due to constructability and cost issues.

# Design Alternative (pipes)

## Pipe Size Options

- ❖ 8 inch
  - Satisfies flow demands
  - Not cost effective
- ❖ 10, 8, 6 inch combo
  - Satisfies flow demands
  - Cost effective
  - Design approved by Missoula city Water



# Recommended Alternative Description

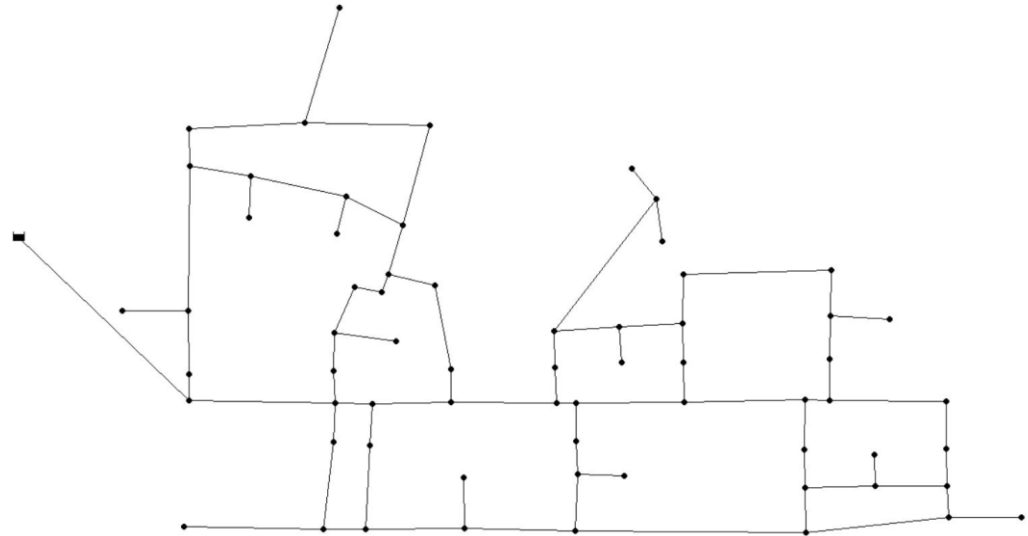
- ❖ Mixed 10, 8, and 6-inch DIP
  - Satisfies fire flow requirements
  - Approved by Missoula City Water
  - Cheapest pipe option
- ❖ Flowable fill trench plugs
  - Sufficient protection against methane intrusion
  - Cheapest option
  - Ease of constructability





# Technical Evaluation

- ❖ System Modeled in EPANET
- ❖ Models future development flow requirements
  - Verifies pipe size functionality
- ❖ Ran a model for each pipe size alternative
- ❖ Input
  - Pipe properties: diameter, length, Friction Coefficient.
  - Water demand
- ❖ Output
  - Pipe flows: sum of all flow equals zero
  - Node pressures: system pressure is approximately 70 psi.
  
- ❖ Flowable backfill trench plug mix design in accordance with ASTM D4380.



# Cost Evaluation

## Pipe Alternatives

	8" DIP	Mixed DIP
Total	\$202,289	\$199,839

## Methane Alternatives

Trench Plugs					
Item Num	Description	Quantity	Unit	Unit Price	Total
1	Water Main Trench Plug	6	EA	800	4,800.00

- ❖ No cost alternative was made for the cutoff wall due to constructability and cost issues.
  - 5000 CY of excavation
  - 2500 CY of reinforced concrete
  - 3750 square yards of HDPE liner

# Environmental and Societal Impacts

## Benefits

- ❖ Shield methane intrusion
  - Clean drinking water
- ❖ 11 new tie-in locations
  - Allows future development

## Negative Impacts

- ❖ Dust\* and noise pollution
- ❖ Significant traffic control needed
  - Wyoming Street is an arterial route
  - Construction inhibits baseball park access

Missoula Mill Site Redevelopment Project  
Park & Common Area Map

Land Uses Summary			
Land Use	%	Sq. Ft.	Acres
Parcel Area	32.3%	797,038	18.30
Common Area	3.5%	132,860	3.01
Park Area	31.1%	691,719	14.80
Right-of-Way	21.8%	438,051	10.08
<b>Total</b>		<b>2,059,668</b>	<b>46.99</b>
Park Acquisition Requirement	11%	37,978	0.87

Area	Designation	Common Area (Ac)	Park Area (Ac)
P1	Blair Park	1.28	14.52
C1	Central Common	0.87	
C2	Welcome Creek	0.53	
C3	Welcome Creek	0.11	
C4	Mill Pond	0.13	
C5	Missoua Creek	0.14	
C6	Entrance	0.14	
C7	Mill Trail Con.	0.14	
C8	Mill Trail Con.	0.21	
	<b>Subtotal</b>	<b>3.46</b>	<b>14.80</b>
	<b>Total</b>	<b>17.85</b>	
C10	Parking Common	0.12	
C11	Parking Common	0.16	
	<b>Total</b>	<b>0.27</b>	

Note: Parking Commons Not Included in Park/Common area provided project.



\*Dust pollution will be controlled with water as stipulated by the Montana DEQ

# Sustainable Options

- ❖ Flowable Backfill Trench Plugs provide sustainability
  - An alternative to crushed aggregate course backfill
  - Surrounds pipe with concrete
  - Prevents rust
  - Shields against methane intrusion
- ❖ Strict Missoula City standards restrict design options
  - Regulated by city and state organizations

# Conclusion

Questions?