InPipe Hydro Electric Project

Hillsboro OREGON

EnergyTrust of Oregon

INPIPE ENERGY

PGE

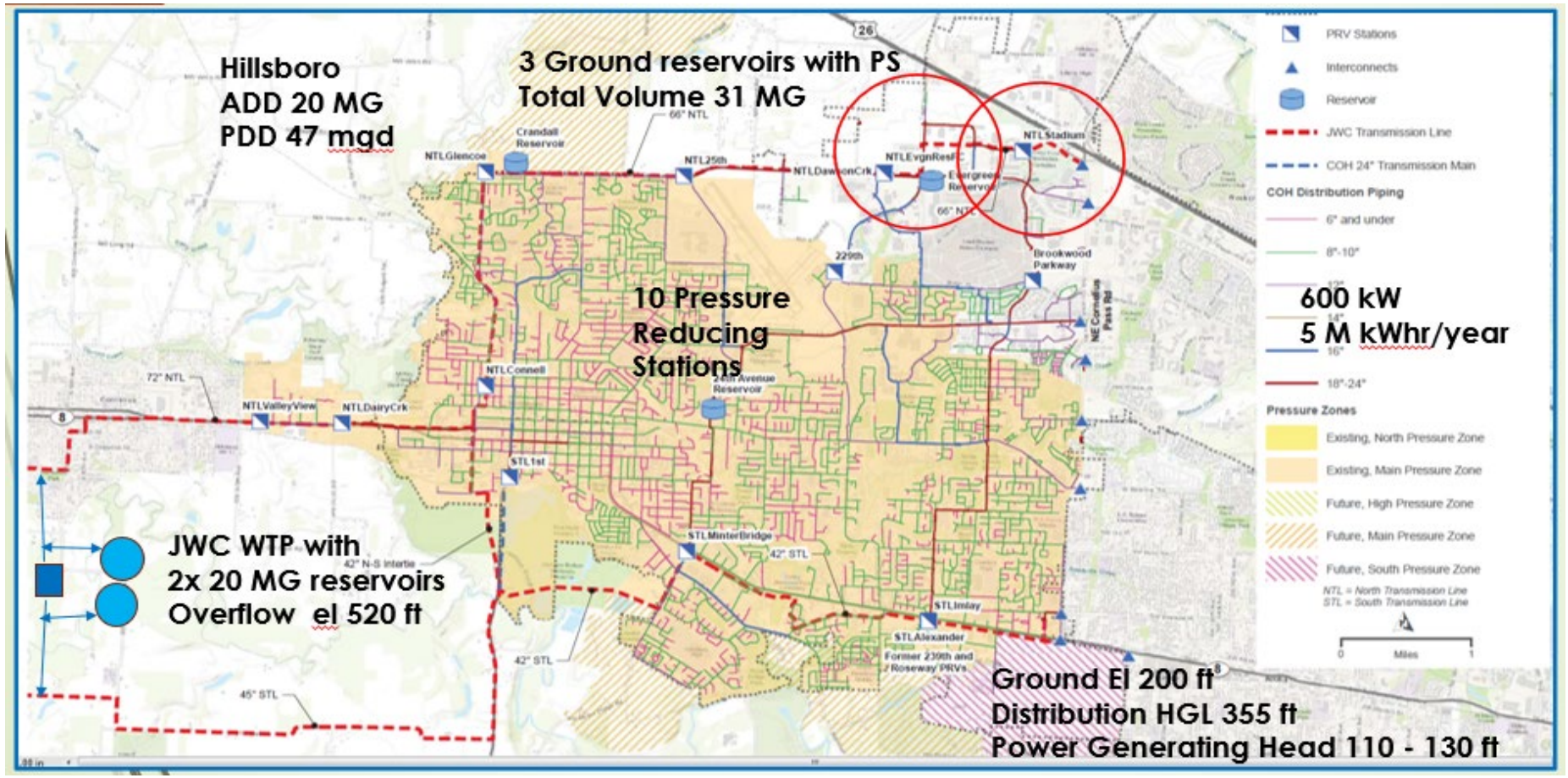
Nesh Mucibabic, PE – Hillsboro Water Department Principal Engineer
Lee Lindsey – Hillsboro Water Senior Program Manager- Financing
Tacy Steele Hillsboro Water Program Manger - Permitting

InPipe Hydro Electric Project - GOALS

- Produce renewable energy
- Offsets carbon emissions otherwise lost with wasted energy
- Lowest cost-of-energy
- Offset PGE Peak Demand
- Do not impact Water System Operations

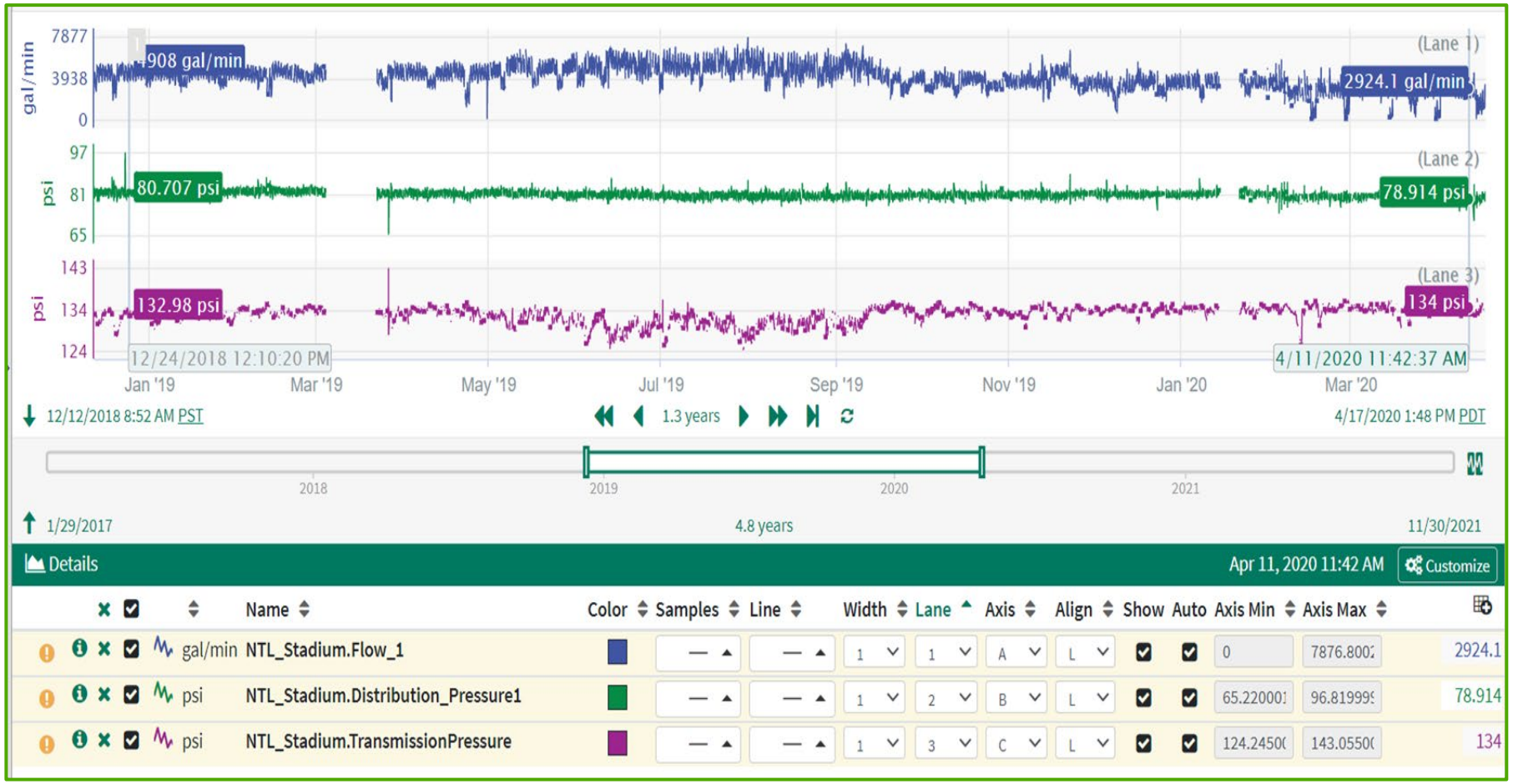
InPipe Hydro Electric Project

City of Hillsboro Water System



InPipe Hydro Electric Project - Selection of Energy Generating Site

- Analyze Available Flows at Different PRVs
- Check Difference in Transmission and Distribution Pressure
- Calculate Potential Power Production



Hillsboro Water

InPipe Hydro Electric Project – Selection of Energy Generating Site

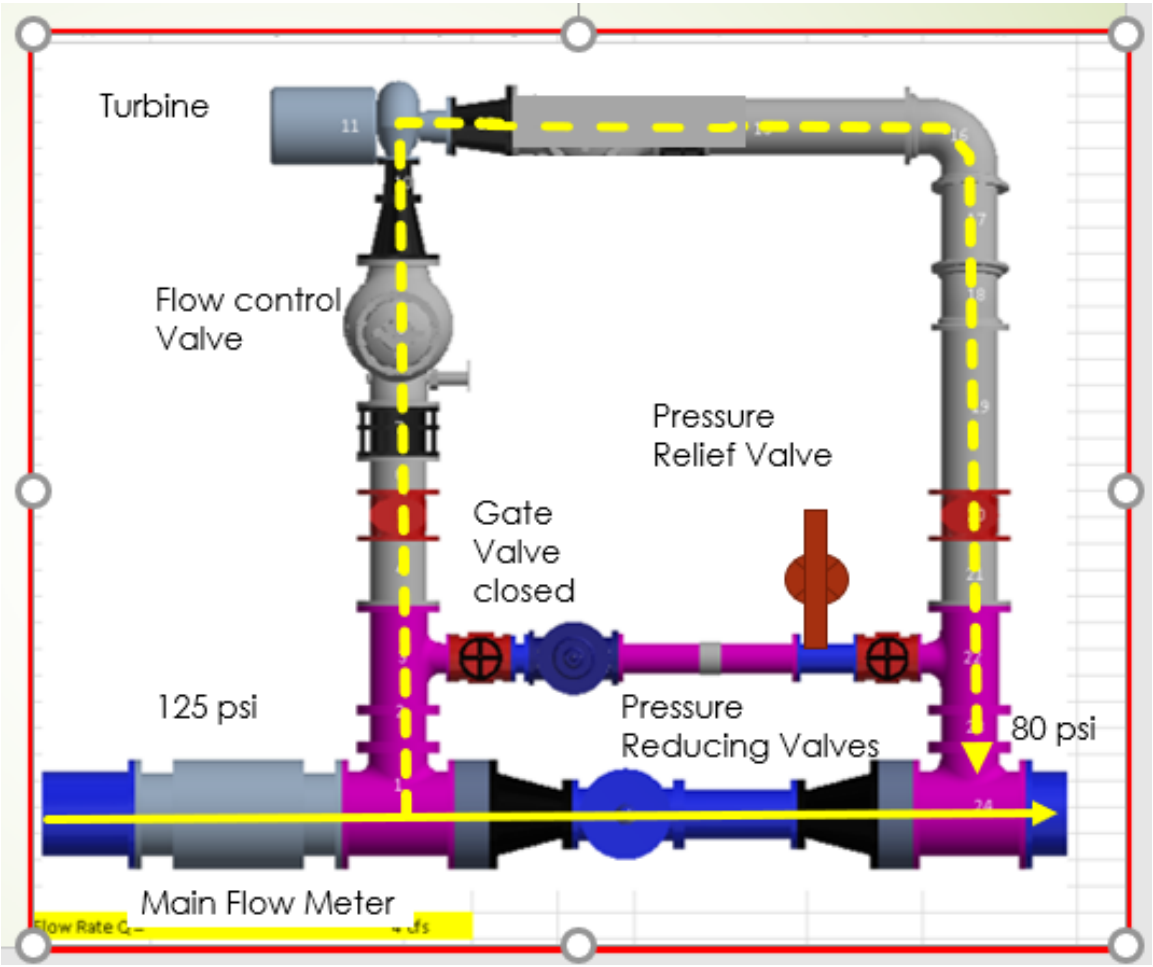
- Potential Power Recipients
- PRV Site Constraints
- PGE Electric Connections and Metering

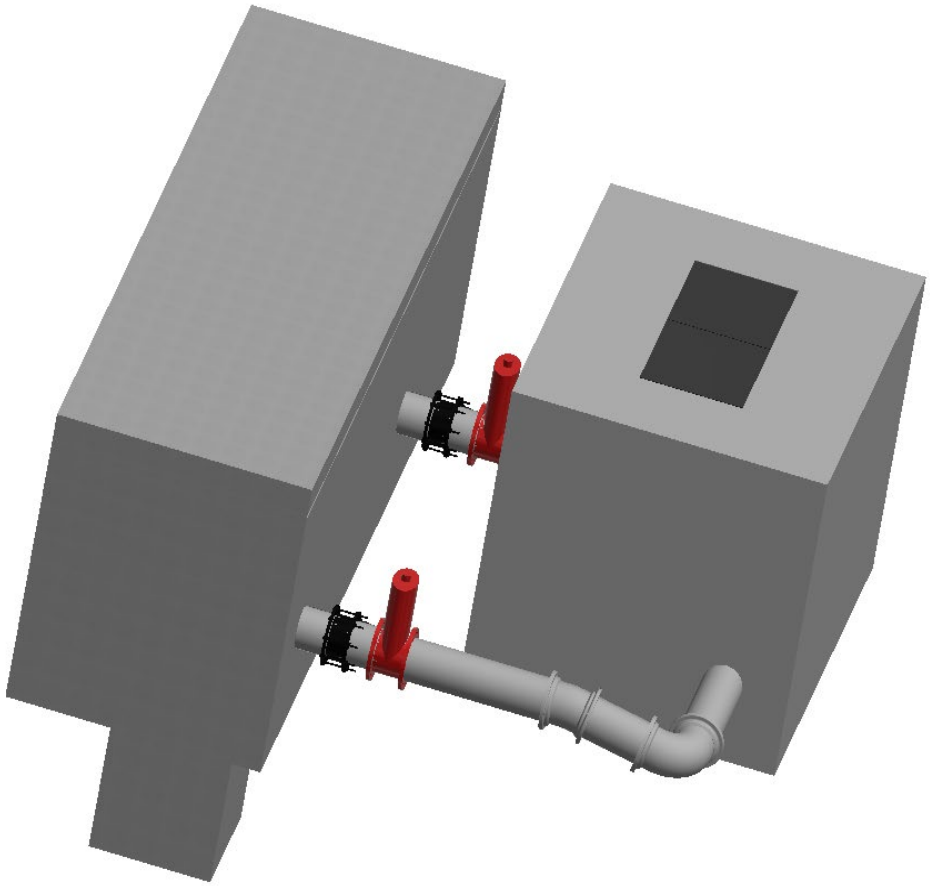
InPipe Hydro Electric Project – Permitting Requirements

- Oregon Water Resources Department: Permit to Develop Hydroelectric Use as Part of Existing Certified Water Rights (max 5 cfs)
- Federal Energy Regulatory Commission (FERC) Exemption of Small Conduit Hydroelectric Facility (Confederated Tribes and Cultural Resources Concerns)
- Portland General Electric Agreement for Net Metering Level 2 Interconnection
- City of Hillsboro Electric Permit Applications
- CoH Parks and Other Agreements

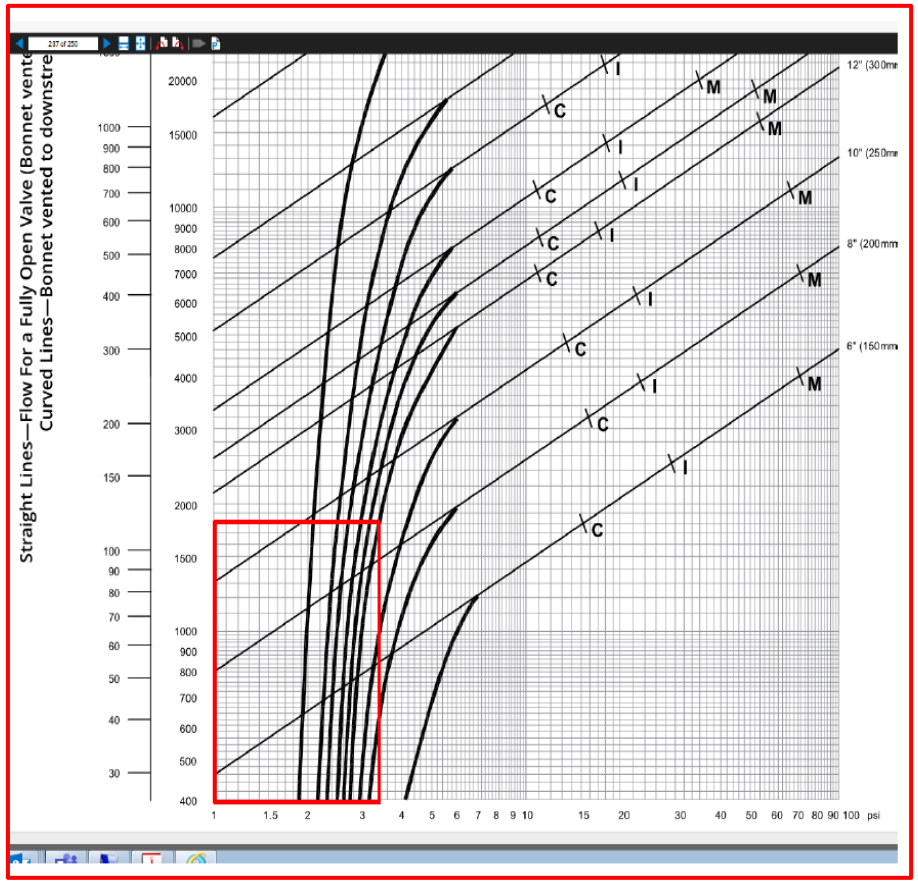
InPipe Hydro Electric Project – NTL Stadium PRV

InPipe Hydro Electric Project – Power Generating Station Arrangment





InPipe Hydro Electric Project



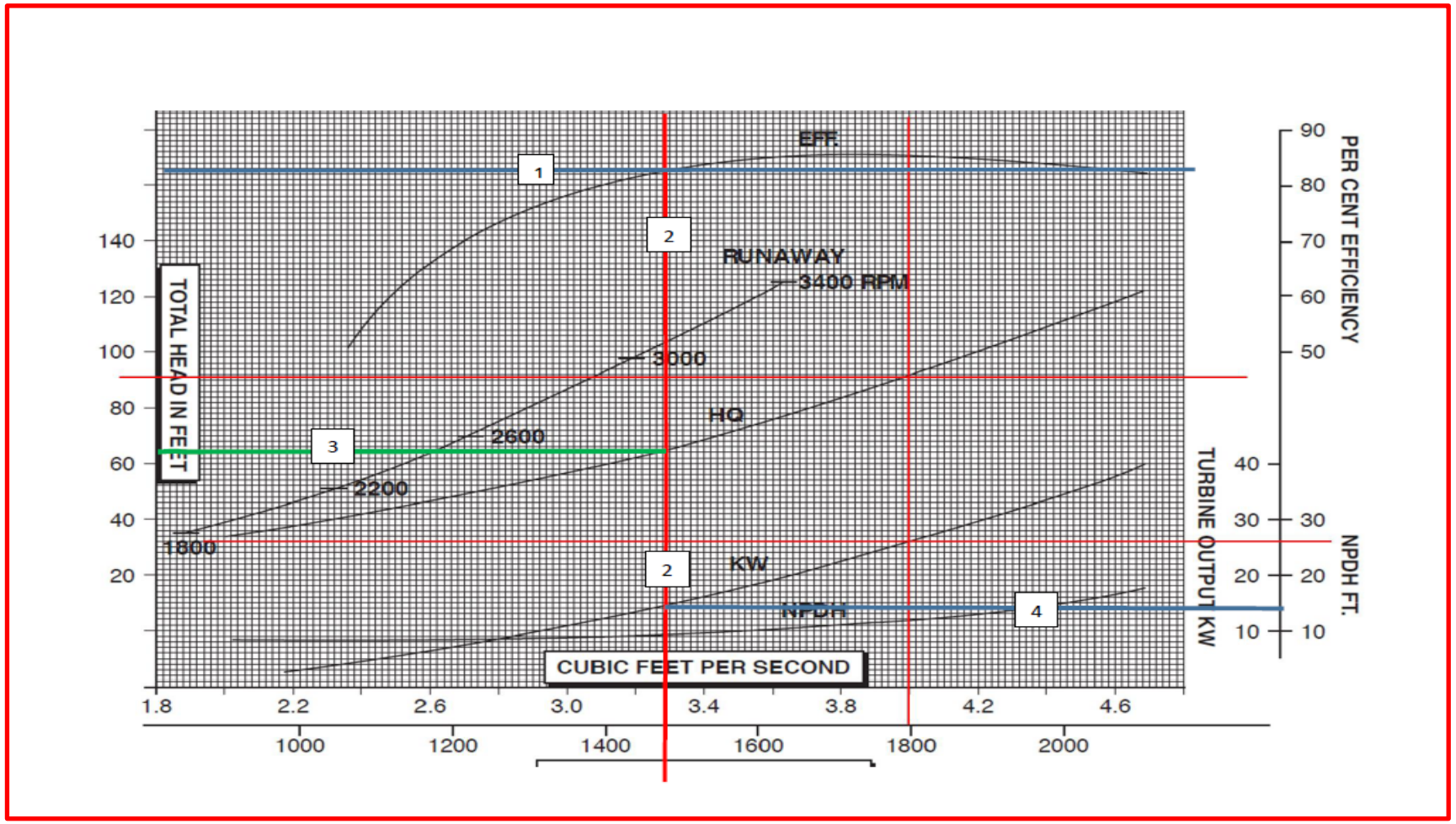
Flow Rate Q = 3.33 cfs

Component Number	Description	K value	Diameter (in)	Velocity (ft/s)	friction factor (from Moody Diagram)	component head loss (ft)	
1	18x12 reducing tee	0.75	12	4.2		0.21	
2	12 inch pipe section. L = 8.5 in		12	4.2	0.0195	0.00	
3	12x6 inch reducing tee	0.3	6	17.0		1.34	
4	12 inch pipe section. L = 15 in		12	4.2	0.0195	0.01	
5	12 inch gate valve (MJxMJ with	0.3	12	4.2		0.08	
6	12 inch pipe section. L = 7.5 in		12	4.2	0.0195	0.00	
7	12 inch dismantling joint. L = 11.5 inche:		12	4.2	0.0195	0.01	
8	12 inch PGM Flow Control Valve		12	4.2		4.00	Friction losses through FCV. No
9	12-6 inch reducer	0.065	6	17.0		0.29	
10	6-5 inch reducer	0.06	5	24.4		0.56	
11	STR5-A Turbine						Will use all remaining pressure
12	12-8 inch reducer		8	9.5		0.28	
13	12 inch PGM PRV		12	4.2		5.00	Note: This is not a head loss. Th
14	12 inch dismantling joint. L = 10.5 inche:		12	4.2	0.0195	0.00	A 10psi pressure differential is r
15	12 inch pipe section. L = 46.5 in		12	4.2	0.0195	0.02	
16	12 inch 90 bend (MJxMJ)	0.25	12	4.2		0.07	
17	12 inch pipe section. L = 18 in		12	4.2	0.0195	0.01	
18	12 inch 11.25 degree bend. MJx	0.1	12	4.2		0.03	
19	12 inch pipe section. L = 37 in		12	4.2	0.0195	0.02	
20	12 inch gate valve (MJxMJ with	0.3	12	4.2		0.08	
21	12 inch pipe section. L = 15 in		12	4.2	0.0195	0.01	
22	12x6 inch reducing tee	0.3	6	17.0		1.34	
23	12 inch pipe section. L = 8.5 in		12	4.2	0.0195	0.00	
24	18x12 reducing tee	0.75	12	4.2		0.21	
					Total head loss:	13.57 ft	

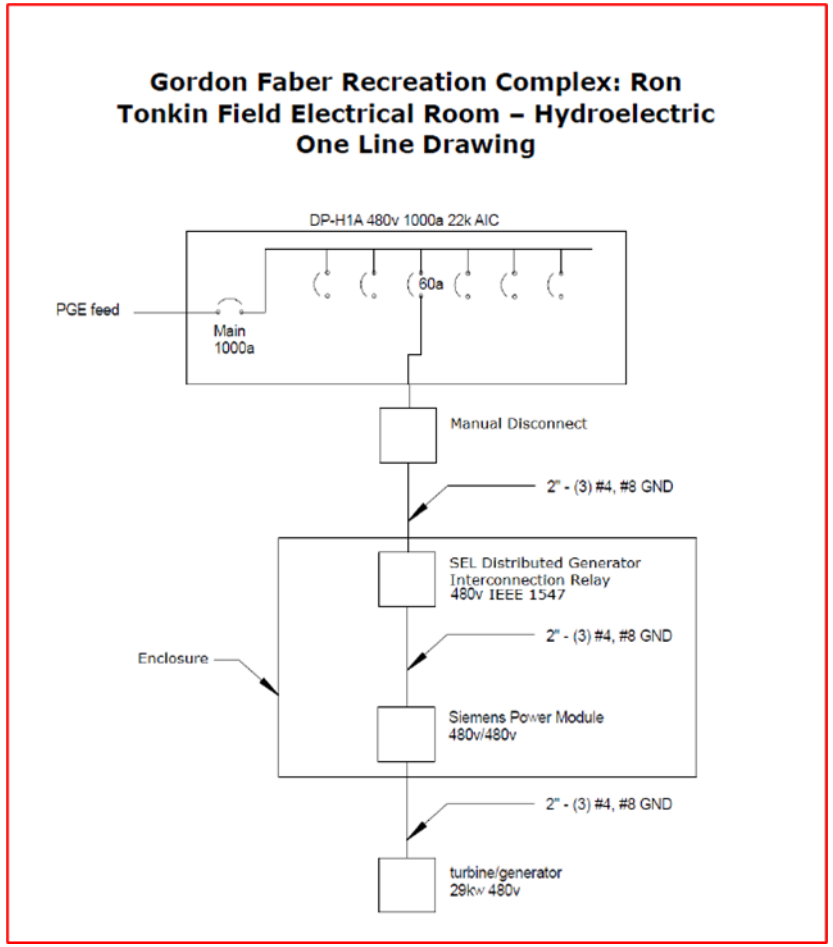
Review Comments
Please provide a chart to show Frictction Losses through 12" PGM Control vale and PGM PRV for design flow

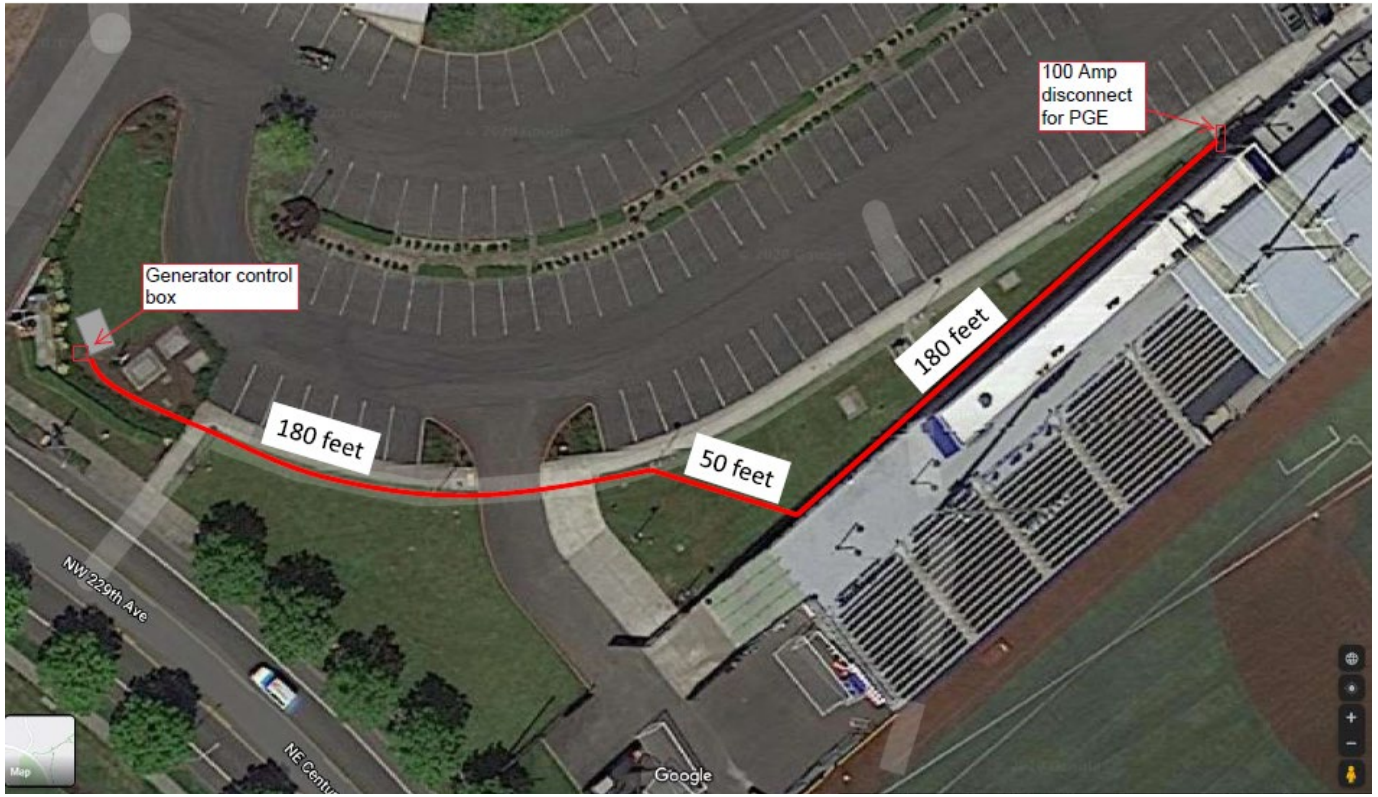
Hydraulic Calculations

InPipe Hydro Electric Project – Connell Turbine Selection



InPipe Hydro Electric Project – One Line Diagram & Conduit Connection





InPipe Hydro Electric Project

InPipe Hydro Electric Project – Stadium Generator Report

Weekly Parameters	3/21/2022 - 3/28/2022
Average Inlet Pressure	130.82 psi
Average Transmission Pressure	131.60 psi
Average Outlet Pressure	79.66 psi
Average Generator Flow	1,866.3 gal/min
Average Stadium Flow	4,235.9 gal/min
Average Power Output	26.93 kW
Average Valve Position	39.5
Total kWh Produced	4466.1 kWh
Total Generator Runtime	168 h
Total Flow Volume	18.83 Mgal

Data for Calendar Year 2022

Total kWh Produced	56512 kWh
Total Generator Runtime	2070.9 h
Total Flow Volume	233.39 Mgal
Average Daily kWh	652.38 kWh/d

Data since Inception (October 7, 2020)

Total kWh Produced	304053 kWh
Total Generator Runtime	11207 h
Total Flow Volume	1261.6 Mgal
Average Daily kWh	566.55 kWh/d

InPipe Hydro Electric Project – Project Cost

Design & Construction

Design Built Contract Between City of Hillsboro and In-pipe Energy Incorporated

Total Project Cost $ 500,000 including:

Grant Applications $ 15,000

Design and Engineering $ 50,000

Construction Cost $ 420,000

Permitting and other costs $ 15,000

InPipe Hydro Electric Project – Budget Provide by

- Energy Trust of Oregon
- Portland General Electric Renewable Development Fund
- Other Sources: US Bureau of Reclamation, US EPA, Economic development funds, etc

InPipe Hydro Electric Project

Hillsboro Hydroelectric Project Budget	2018 Budget	2020 Budget
PGE Renewable Development Grant	263,500	268,500
Energy Trust of Oregon Grant	85,000	85,000
Sustainability Grant	25,000	
DOE Section 242		
Grant Funding	**373,500**	**353,500**
Project costs	28,562	30,462
Easement - Parks and Recreation		100,000
Water Department Funding	**28,562**	**130,462**
Total Budget	**402,062**	**483,962**

InPipe Hydro Electric Project

- Grant Application Requirements:
  - Construction budget
  - Operations and Maintenance budget
  - Multiyear pro forma spreadsheet
  - Details of contractor, engineer, etc.
  - Engineering report of generator “curve”
  - Engineering feasibility

InPipe Hydro Electric Project

- Grant Contract Requirements:
  - Attend grant webinar
  - Quarterly reports
  - Closeout report
  - Actual electricity production requirement
  - Grant recognition signage and education information
  - Publicity
  - Celebration (COVID modified)
  - Website with energy production data
  - Site tours (COVID modified)

InPipe Hydro Electric Project

- Grant Contract Requirements:
  - Grant provided funds for publicity, wrap, etc.
  - Grant agencies
    - PGE Renewable Development Grant and Energy Trust of Oregon Grant – Target about 85% combined
    - Sustainability Grant – Water Dept. applied for a different use
    - DOE Section 242 – Provides $.019 per kilowatt hour produced
  - "Private" grants are more flexible. Grantors worked with us on COVID impacts, interpreting requirements, etc. Appreciated detailed quarterly reports.

InPipe Hydro Electric Project – Net Metering

Details of this month's charges

Meter [redacted], Schedule 38, SPID [redacted]

Basic Charge	30.00
Off-Peak Usage (4,160.000 kWh x $0.0457)	190.11
On-Peak Usage (1,280.000 kWh x $0.0607)	77.70
Transmission Charge (5,440.000 kWh x $0.00171)	9.30
Distribution Charge (5,440.000 kWh x $0.07036)	382.76
Subtotal - Energy Charges	**689.87**
105 Regulatory Adjustments (5,440.000 kWh x $-0.00063)	3.43 CR
109 Energy Efficiency Funding Adj (5,440.000 kWh x $0.00408)	22.20
110 Energy Efficiency Customer Svc (5,440.000 kWh x $0.00009)	0.49
112 Customer Engagement Transformation Adjustment (5,440.000 kWh x $0.00039)	2.12
122 Renewable Resource Adjustment (5,440.000 kWh x $0.0012)	6.53
123 Decoupling Adjustment (5,440.000 kWh x $0.0001)	0.54
125 Annual Power Cost Update (5,440.000 kWh x $0.0049)	26.66
135 Demand Response (5,440.000 kWh x $0.00069)	3.75
136 Community Solar Cost Recovery (5,440.000 kWh x $0.00005)	0.27
137 Solar Payment Option Cost Recov (5,440.000 kWh x $0.00044)	2.39
145 Boardman Decommissioning Adj (5,440.000 kWh x $0.0001)	0.54
Subtotal - Adjusting Schedules	**62.06**
	751.93
Oregon Commercial Activities Tax Recovery (0.436%)	3.18
Metro Supportive Housing Services Tax Recovery (0.153%)	1.12
Subtotal - Other Charges/Credits	**4.30**
Low Income Assistance	3.75
Public Purpose Charge (3%)	21.99
Subtotal - Taxes and Fees	**25.74**
Current Energy Charges	**781.97**

Hillsboro Water

InPipe Hydro Electric Project – Net Metering

- Hydroelectric system meter <u>only</u> provides electricity produced, not the cost savings.
- Billing meter only shows the net charges.
- There is no “clean” way to see the exact dollar savings due to complex electric bill with peak/off peak charges.
- Due to COVID, a few months billed at “Minimum charge”; Excess electricity is provided “free” to the grid.

- Major improvement would be to somehow integrate the hydroelectric system meter with the billing meter to include dollar savings on the electricity bill.

InPipe Hydro Electric Project

- Water Rights: FERC and State approval required.
  - No blanket waiver for hydroelectric in municipal utility finished water pipeline.
  - FERC approval is not necessary if the project is under the threshold

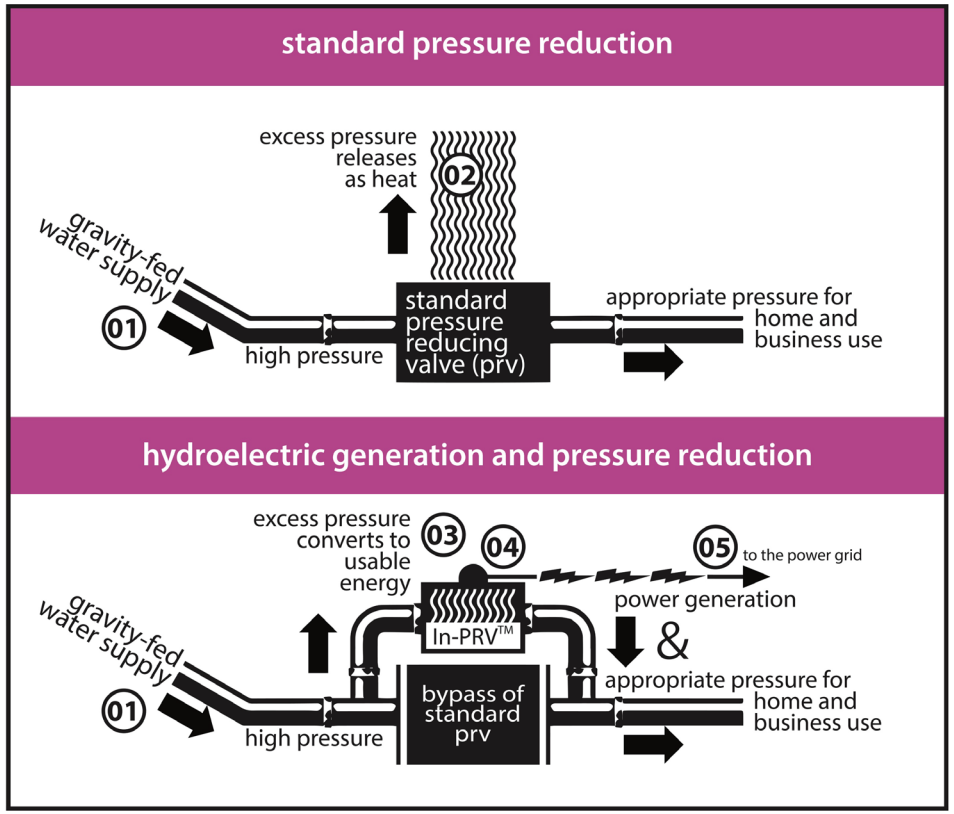
- Hillsboro Water developing engineering standards for future hydroelectric installations.

Hillsboro's In-pipe Innovation Promotion

- Celebrating in Covid Times
  - Wrapped Box
  - Publications (Local, Regional, and National)
  - Informational Graphic at Site
  - Video
  - No Live Events (due to Covid)

https://www.youtube.com/watch?v=n2yTJQsAptw&t=128s

Informational Signage



QUESTIONS ?