



Puget Sound Energy, Inc.
P.O. Box 90868
Bellevue, WA 98009-0868

July 10, 2006

Ms. Carole J. Washburn, Secretary
Washington Utilities and Transportation Commission
P.O. Box 47250
Olympia, WA 98504-7250

Attn: Alan Rathbun, Pipeline Safety Director

Subject: Docket PG-041624 Puget Sound Energy Settlement Agreement – Wrapped Steel Services Assessment Program Data Request

Dear Mr. Rathbun:

Attached to this letter is Puget Sound Energy's (PSE's) response to Staff's data request for the Wrapped Steel Service Assessment Program (WSSAP) submitted to PSE on June 28, 2006.

PSE is committed to continuing to develop and implement the Wrapped Steel Service Assessment Program in a timely and accurate manner and appreciates any input Staff has on the program. Please contact me at 425-462-3974 if you have any questions.

Sincerely,

Duane A. Henderson, P.E.
Director, Engineering and Operations Services

Attachments

- cc: Sue McLain
- Booga Gilbertson
- Jim Hogan
- Kimberly Harris
- Karl Karzmar

Alan R.
Dave L.
Kuang Chen
Rec. c/v

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1000 WEST OLYMPIA AVENUE
OLYMPIA, WA 98501

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**PSE Response to WUTC Data Request
WSSAP Risk Model**

- 1) **A vertical slice of representative services in the pilot area in high, medium and low risk categories. The following information should be provided on an electronic spreadsheet:**
 - a) **For each of the above, the actual model value for each risk factor, mitigation factor and consequences with the final score.**
 - b) **The cut off points between the risk categories (high, medium, low).**
 - c) **The cut off points between the risk categories without consequences (high, medium, low).**
 - d) **Address of each service with a backup spreadsheet with all of the data inputted and with conservative assumptions indicated.**

PSE Response:

See attached spreadsheet Exhibit A-Risk Results, Exhibit B-Scoring Tables and explanation below

METHODOLOGY

The service list was segmented based on threats and consequence. The services were ranked for remediation by inspecting common or overlapping priorities. The threat and consequence drivers for each prioritized segment are used in determining the remedial measures. Assume lowest threat or consequence falls below the average score for that variable. All services with scores above the average for a threat or consequence will be considered for evaluation. The average scores are shown in Table 1. The risk score is the result of the consequence of failure (CoF) multiplied with the probability of failure (PoF). The PoF is calculated from the threat scores. Three threats are considered in the model, time dependent, third party, and geotechnical. The geotechnical threat is constant for the pilot study and therefore not used in the analysis.

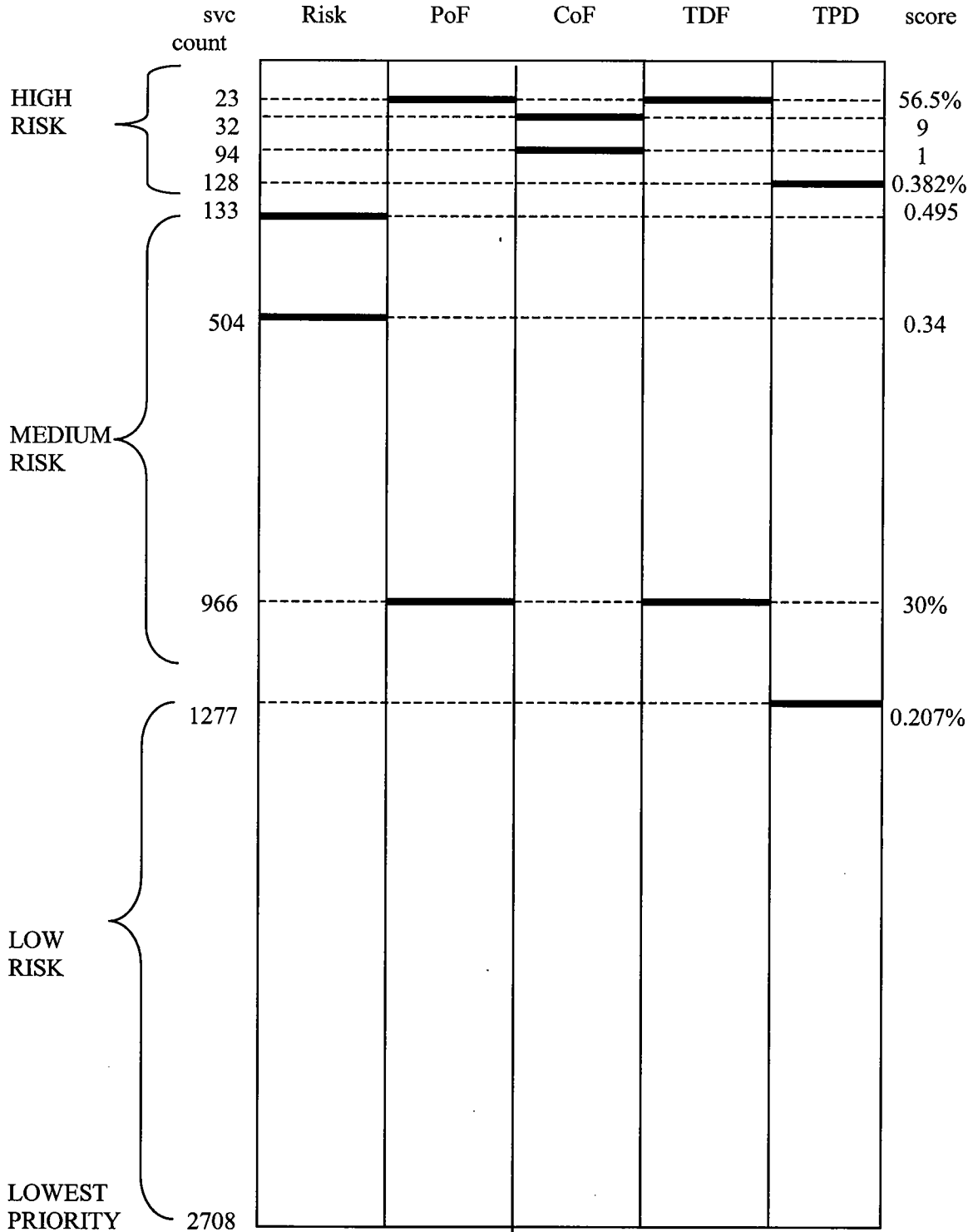
TABLE 1

	Risk	PoF	CoF	TD	TPD
max	10.99	99.9 %	11	99.9 %	0.6 %
avg	0.34	27.2 %	1.26	27.0 %	0.2 %
min	0.04	2.9 %	1	2.9 %	0.0 %

The risk model was sorted separately by five separate fields; risk, PoF, CoF, time dependent failure (TDF), and third party damage (TPD). A boundary line representing the number of services for high score and medium score was drawn for each field. The line was extended through the other fields in dashed form, as shown in Figure 1. The boundary lines were chosen by inspecting each threat ranking for the services. The upper boundary separating the highest from medium risk was chosen by observing an obvious drop in the scores. The lower boundary separating the medium from low risk was chosen by inspecting the average scores for an obvious change. The high risk category represents approximately five percent of the total services in the pilot group.

PSL Response to WUTC Data Request
WSSAP Risk Model

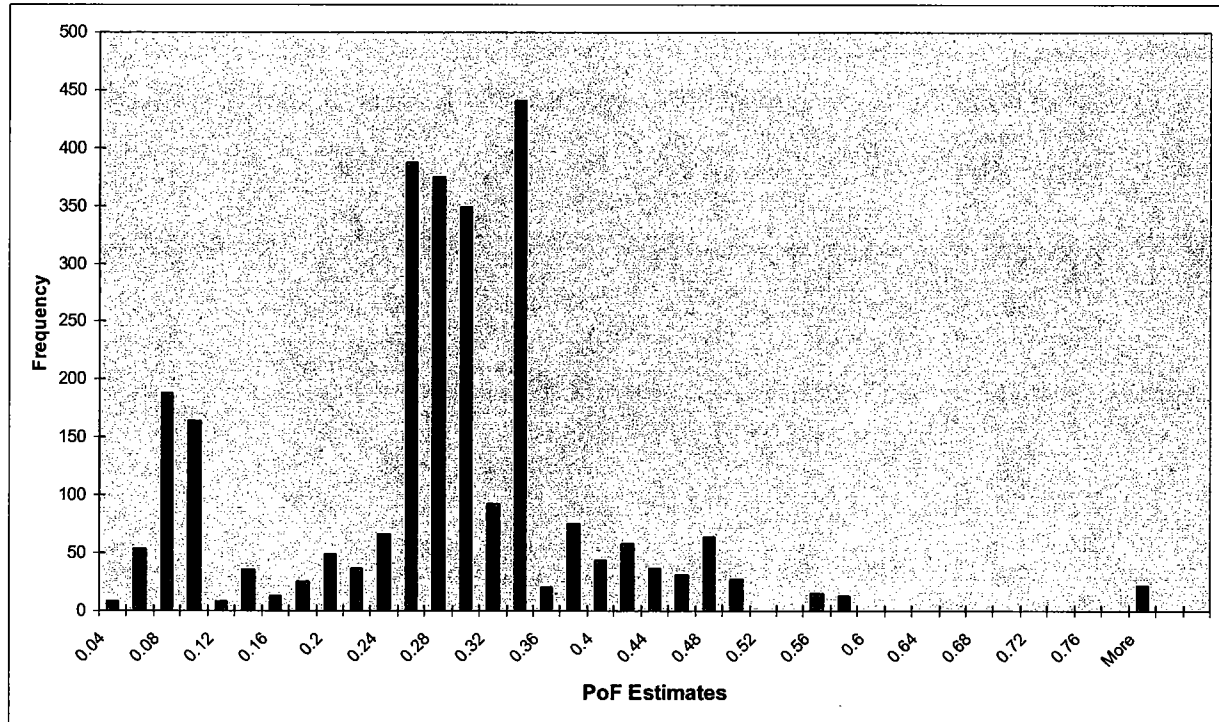
FIGURE 1



PSE Response to WUTC Data Request WSSAP Risk Model

The frequency of risk is shown in Figure 2. The highest risk services are at the right side of the graph. The majority of services are on the left side or lower risk region of the graph.

FIGURE 2



Remediation will be prioritized based on risk. All services with alerts for disbonded coating, leakage, or lack of cathodic protection will be placed in the highest priority for examination.

2) A list of the changes made as a result of input by PSE's subject matter experts.

PSE Response:

PSE provided to WKM Consultancy the specifications and framework for the risk model. This included specifying the threats applicable to this project, the variables, data and scoring mechanisms that would be used for each threat and consequence. WKM Consultancy then built the risk model (supplied the spreadsheet and equations) to PSE's specifications. PSE subject matter experts then evaluated the model built by the consultant to ensure it did meet PSE's specifications and framework. The changes that have occurred to the model were a result of additional clarification by PSE to the consultant regarding the model specifications. Table 2 provides a list of examples of the clarifications that have occurred between PSE and the consultant to ensure the model is functioning as PSE initially specified.

**PSE Response to WUTC Data Request
WSSAP Risk Model**

TABLE 2

Variable/ Algorithm	PSE comments
SMYS	Use 30,000 psi (Grade A) for the SMYS rather than 35,000 psi (Grade B) SMYS
CP System Scoring	Corrosion algorithm was not correctly assessing the cathodic protection mitigation of services that were off of non-cathodically protected mains (bare steel, PE, cast iron, etc.) ensure that the corrosion algorithm properly accounted for the possible lack of cathodic protection on services off of non-cathodically protected mains.
Population Density	Improperly scored, only scoring Business Districts, High Occupancy Structures and Low population density categories. There are two other categories Identified Site and High Occupancy Structure-Identified Site.
Depth of Cover	Defaulting to 12 inches and 24 inches. Should look for EPCR depth data and if no EPCR depth then default should be 12 inches for services not under hard surface and 30 inches for services under hard surface. Assume that if under hard surface minimum cover is 18 inches plus 12 inches additional cover due to protection from hard surface.
Geotech	PSE needs to create scoring mechanism, data and variables to capture soil movement. Once completed WKM will incorporate into risk model.
Third Party Damage	Rescored one-call, public education, and locate variables to show difference between services under hard surface (assumed to be in ROW) vs. services under soft surface (assumed to be on private property). Service on private property means homeowner is less likely to call one-call, locate is less likely to happen and the public education effectiveness is much lower.
EPCR	Only certain data from a main EPCR near a service should affect the service scoring. Not all data from the main EPCR is assumed to be applied to service (i.e. depth of cover should not be used for the service if the EPCR just exists for the main)
Electrical Surveys	PSE to add data tab, scoring mechanism and data to capture results of electrical surveys. The electrical survey results and scoring will then impact the CP score and coating score for services that have been assessed using electrical surveys.
Corrosion Rate	Supplied WKM corrosion rates correlated with soil types appropriate to PSE's service territory and soil types

3) An explanation of how PSE will handle services in the high-risk category, medium-risk category, etc, identifying any risk ranking that will trigger automatically service replacement, repair, mitigation, etc.

PSE Response:

PSE has added alerts to the risk model including indications of disbonded coating, no CP, existing leak on the service and if there is an EPCR for the service. The alert of disbonded coating will trigger an automatic service replacement given that there are currently no assessment tools to identify disbonded coating or indicate corrosion beneath disbonded coating. The alert of no CP will trigger electrical surveys and a leak survey. The alert of an existing leak will trigger electrical surveys and a leak survey. Additional remediation for services identified in the high and medium categories may be any of the following:

- Additional records review to validate plat level data for the service or gather additional data for the service
- Replacement of the service
- Electrical surveys
- Leak surveys

PSE Response to WUTC Data Request WSSAP Risk Model

- No further action

Services identified as being in the low risk category will have no further action completed for those services. However, as data is gathered throughout the year during regular O&M activities the risk model will be re-run annually to ensure the affect of new data on the risk score for the service is properly evaluated and addressed if necessary.

- 4) If possible, PSE should run the model on a trial basis with data from services that have already failed (with the data prior to failure) to determine if these services would have been selected as high risk.**

PSE Response:

At this time it is not possible to complete the task for #4 due to resource constraints. However, PSE has considered this and does intend to include this data to help further tune the risk model in the future. PSE will keep Staff updated as to this effort and the results of this activity.

**P&E Response to WUTC Data Request
Exhibit B**

Scoring Look-Up Tables

Table E-1 Soil Corrosivity

Corrosivity Codes:	Score	Soil Resistivity	MPY (mils per year)
Not Corrosive	3	>20,000 Ohm.cm	1
Slightly Corrosive	2	10,000 - 20,000 Ohm.cm	5
Moderately Corrosive	1	3,000 - 10,000 Ohm.cm	10
Very Corrosive	0	< 3,000 Ohm.cm	16

Table E-2

Mainline Coating Type	Score
Scores are assigned to the Mainline Coating Type score as follows:	
Coating Type	Score
Bare	0
Unknown	0
Thermally-insulated without Primary Coating	0
Single-wrap PE Tape (line travel)	4
Asphalt (cold applied)	4
Double-wrap PE Tape Coatings (line travel)	5
Wax Coatings	6
Cold-applied PE tape with primer	6
Coal Tar Enamel (hot applied)	7
Liquid Polyurethane/Moisture cured liquid urethane Coatings	7
Hot Applied Tape (e.g. Tapecoat 20)	7
Cold- applied self priming PE tape	7
Extruded Polyethylene (e.g. Yellow Jacket)	8
Thermally-applied PE Powder	8
Thermally-applied metallic coatings (85% Zn/15% Al)	9
FBE	9
Liquid epoxy coating	9
Thermally-insulated with Primary Coating	9
Three-Layer Polyurethane Coatings	10

Table E-3

Atmospheric Type	Score	mpy
Chemical & Marine	0	10
Chemical & high humidity	0.5	8
Marine, swamp, coastal	0.8	6
High humidity and high temperature	1.2	5
Chemical and low humidity	1.6	3
Low humidity and low temperature	2	1
No exposures	2	0.1

**PSE Response to WUTC Data Request
Exhibit B**

Atmospheric type: Reference Pipeline Risk Management Manual - Third Edition - W. Kent Muhlbauer

Table E-4 Atmospheric Coating Scoring

Installation year	Score
Unknown	0
1956 - 1965	4
1966 - 1972	7
Ref. Steel service history coating specifications	

Measure of performance and reliability of wrap/coating used to prevent corrosion at air/soil interfaces. Date of installation and SME experience used as surrogate for probable effectiveness in corrosion prevention/reduction.

Table E-5

CP System Performance Score by Gas Plat Map (0 - 10)	
Good Performance:	8 - 10
Fair Performance:	5 - 7
Poor Performance:	0 - 4

Table E-7

System Critically Bond Tested:	
20%	
Variable	Score
Yes	2
No	0

Table E-8

Average System CP Level: 30%	
Variable	Score
> -0.950	3
> -0.850 & < -0.950	2
< -0.850	0

Table E-16

Average System Remediation Time: 50%	
Variable	Score
No Remediation Required	5
< 30 days to remediate	3
> 30 & < 90 days to remediate	2
> than 90 days to remediate	0

PGE Response to WUTC Data Request
Exhibit B

Notes (CP system performance):

- 1) Scores for separately protected services (IND/SVC) are penalized: 0.5 X CPS score.
 - 2) All services off STW main and not IND/SVC are assumed to be protected by a CPS.
- All services off ST, PE or CI mains which are not IND/SVC are assumed to have no CP.

Notes:

Criticality of supply: Facilities such as hospitals, prisons, schools assisted care facilities etc...

Air Soil Interface: Based on installation year – quality and direction of tape wrap method at riser

**POE Response to WUTC Data Request
Exhibit B**

E-6

Field Joint/Fitting Coating Type

Scores are assigned to the Field Joint Coating Type score as follows:

Coating Type	Score
Bare or Unknown	0
Thermally-insulated without Primary Coating	0
Single-wrap PE Tape	4
Asphalt (cold applied)	4
Double-wrap PE Tape Coatings	5
Cold-applied Liquid Mastic	6
Wax Coatings	6
Cold-applied PE tape with primer	7
Coal Tar Enamel (hot applied)	7
Liquid Polyurethane Coatings	7
Hot Applied Tape (e.g. Tapecoat 20)	7
Cold- applied self priming PE tape	8
Shrink Sleeves	8
Thermally-applied PE Powder	9
Liquid epoxy coating	9
Thermally-insulated with Primary Coating	9
Thermally-applied metallic coating	9
Field-applied FBE	9
No Oxide	10

Table E-9

Internal Corrosion LP Yes/No
data from MRT main pressure field.
low pressure services (LP) are assumed to be more susceptible to internal corrosion.
0 = LP svc
1 = other than LP svc

EPCR

Exposed Pipe Condition Report Score

Table E-10

The coating condition description score will be assigned on the basis of the information filled out in the "Coating" field of the Exposed Pipe Condition Report, as follows:

Coating Descriptor	Score
Bonded	10
Cracked	8
Not filled out or "N/A"	6
Damaged	6
Missing or None	4
Disbonded	1

**P&E Response to WUTC Data Request
Exhibit B**

Table E-10a

Abrev used	% effective
BON	0.95
DAM	0.1
DIS	0

Table E-11

Pit Description Score

Pit Frequency Descriptor =>	No Pitting	Isolated Pits	Frequent Pits	No Original Surface Left	Assumed depth % of wall
Pit Depth Descriptor (Vertical)					
Not filled out or "N/A"	10	5	3	2	0.3
Surface Rust	10	7	4	3	0.1
Shallow Pits	6	5	3	2	0.3
Deep Pits	4	3	2	1	0.5

Table E-12

The above table was converted to the following to support more absolute quantification of available pipe wall. These values are used in the risk calculations for TTFI

	assumed % thru wall
DP	0.5
non-blank	0.3
SP	0.3
SR	0.1

Table E-13

Pipe wall thickness -

Year	Service Sizes (inches)	Wall Thickness (inches)
1956	3/4	0.113
	1	0.133
	1 1/4	0.14
	1 1/2	0.145
	2	0.154
	3	0.216
	4	0.237
	6	0.25
1960		
1966	1/2	0.109
	3/4	0.113
	1	0.133

**PSE Response to WUTC Data Request
Exhibit B**

	1 1/4	0.14
	1 1/2	0.145
	2	0.154
	4	0.188
1971		
1972	1/2	0.035
	1/2	0.109
	3/4	0.113
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Addresses with multiple sizes used smallest diameter. The ones identified as 5/8 (plastic) the services had unknown size of steel; defaulted to smallest size pipe based on year.

Table E-14

Cover Attributes Hard surface
data from Business District Leak
Survey.

attribute	condition	default depth cover	
In Business District (wall to wall paving)	yes	30	override if EPCR svc depth avail
not in Business District	no	12	override if EPCR svc depth avail

Consequence Variables

Table E-15

Population Density

factor	score
LOW=Low population density	10
IDS=Identified Site	6
HOS=High Occupancy Structure	3

**PSE Response to WUTC Data Request
Exhibit B**

HOS-IDS=High Occupancy Identified Site	2
BD=Business District	0

These values are subtracted from 11 since the model requires higher consequences to be higher numerical values.

Excerpt from 6-12-06 Dickison email:

Population Density (BD/HOS/IDS/HOS-IDS/LOW): This score is based on the high occupancy structure (HOS) leak survey database, the business district (BD) database, and the critical service valve inspection database. Where an HOS is defined as a building or outside area that is occupied by 20 or more persons on at least 5 days a week for 10 weeks in any 12-month period. A critical service valve is defined as a service to facilities occupied by persons who are confined, are of impaired mobility, or would be difficult to evacuate, this is noted in this column as IDS (identified site). An HOS-IDS score in this column indicates that the service is to a structure that meets the definition of both HOS and critical service valve. LOW in this column indicates lower population density typically for residential areas and low occupancy structures.

Table E-17

Third Party Mitigation

One-call effectiveness; locate; pub ed				
hard surface	one-call	locate	pub ed	
yes	0.7	0.7	0.8	permits required
no	0.2	0.2	0.2	

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avg	0.34	27.2%	1.26	27.0%	0.2%
min	0.04	2.9%	1	2.9%	0.0%

Risk	PoF	CoF	TIF-PoF	Thd Ply	Geotech	ID	Plat	Service Type	House No	Street Address	Long/Short	Service Size
low	3.66E-02	3.7%	1	3.5%	0.010%	189089-1124 156TH AVE NE	189089	STW Service	1124	156TH AVE NE	L	34
	4.05E-02	4.1%	1	3.8%	0.010%	190088-15233 NE 6TH ST	190088	STW Service	15233	NE 6TH ST	L	12
	4.05E-02	4.1%	1	3.8%	0.010%	190088-15239 NE 6TH ST	190088	STW Service	15239	NE 6TH ST	S	12
	4.14E-02	4.1%	1	3.9%	0.010%	190088-122 154TH PL NE	190088	STW Service	122	154TH PL NE	L	34
	4.19E-02	4.2%	1	3.8%	0.010%	88089-16202 NORTHUP WAY	188089	STW Service	16202	NORTHUP WAY	L	34
	4.58E-02	4.6%	1	4.2%	0.010%	189087-14618 NE 10TH ST	189087	STW Service	14618	NE 10TH ST	L	12
	4.70E-02	4.7%	1	4.4%	0.010%	189087-14411 NE 10TH PL	189087	STW Service	14411	NE 10TH PL	S	34
	5.04E-02	5.0%	1	4.8%	0.010%	191086-13630 SE 1ST ST	191086	STW Service	13630	SE 1ST ST	L	12
	5.04E-02	5.0%	1	4.8%	0.010%	191086-13808 SE 1ST ST	191086	STW Service	13808	SE 1ST ST	S	12
	5.10E-02	5.1%	1	4.8%	0.010%	189091-1321 176TH AVE NE	189091	STW Service	1321	176TH AVE NE	L	12
	5.17E-02	5.2%	1	5.0%	0.010%	189086-13244 NE 16TH ST	189086	STW Service	13244	NE 16TH ST	S	34
	5.21E-02	5.2%	1	4.8%	0.010%	189087-14401 NE 10TH PL	189087	STW Service	14401	NE 10TH PL	L	12
	5.21E-02	5.2%	1	4.8%	0.010%	189087-14406 NE 11TH PL	189087	STW Service	14406	NE 11TH PL	L	12
	9.51E-01	8.6%	11	8.4%	0.010%	188087-14230 NE 20TH PL	188087	STW Service	14230	NE 20TH PL	S	2
med	2.80E-01	28.0%	1	27.9%	0.010%	189090-1200 172ND AVE NE	189090	STW Service	1200	172ND AVE NE	L	34
	3.18E-01	31.8%	1	31.7%	0.010%	191090-20 165TH AVE SE	191090	STW Service	20	165TH AVE SE	L	34
	3.18E-01	31.8%	1	31.7%	0.010%	191090-26 165TH AVE SE	191090	STW Service	26	165TH AVE SE	S	34
	3.18E-01	31.8%	1	31.7%	0.010%	191090-27 165TH AVE SE	191090	STW Service	27	165TH AVE SE	L	34
	3.18E-01	31.8%	1	31.7%	0.010%	191090-41 165TH AVE SE	191090	STW Service	41	165TH AVE SE	S	34
	3.18E-01	31.8%	1	31.7%	0.010%	191090-51 165TH AVE SE	191090	STW Service	51	165TH AVE SE	S	34
	3.23E-01	32.3%	1	32.2%	0.010%	188090-2103 169TH AVE NE	188090	STW Service	2103	169TH AVE NE	L	34
	3.23E-01	32.3%	1	32.2%	0.010%	188090-2225 169TH AVE NE	188090	STW Service	2225	169TH AVE NE	L	34
	3.23E-01	32.3%	1	32.2%	0.010%	188090-16818 NE 19TH PL	188090	STW Service	16818	NE 19TH PL	L	34
	3.27E-01	32.7%	1	32.5%	0.010%	190086-221 140TH AVE SE	190086	STW Service	221	140TH AVE SE	S	34
	3.46E-01	34.6%	1	34.6%	0.010%	190088-15204 NE 6TH PL	190088	STW Service	15204	NE 6TH PL	L	34
	3.47E-01	34.7%	1	34.6%	0.010%	190088-15405 NE 6TH PL	190088	STW Service	15405	NE 6TH PL	S	34
	3.50E-01	35.0%	1	35.0%	0.010%	190086-13656 MAIN ST	190086	STW Service	13656	MAIN ST	S	34
	3.65E-01	36.5%	1	36.4%	0.010%	190091-17241 NE 8TH ST	190091	STW Service	17241	NE 8TH ST	S	34

3.67E-01	36.7%	1	36.7%	0.0121%	0.010%	191088-15211 SE 1ST ST	191088	STW Service	15211	SE 1ST ST	L	34
3.68E-01	36.8%	1	36.7%	0.0362%	0.010%	191088-212 153RD PL SE	191088	STW Service	212	153RD PL SE	S	34
3.68E-01	36.8%	1	36.7%	0.0941%	0.010%	189088-1302 151ST PL NE	189088	STW Service	1302	151ST PL NE	L	34
3.97E-01	39.7%	1	39.6%	0.1570%	0.010%	189086-13240 NE 8TH ST	189086	STW Service	13240	NE 8TH ST	L	34
4.09E-01	40.9%	1	40.7%	0.3140%	0.010%	191-621 W LAKE SAMMAMISH	190091	STW Service	621	LAKE SAMMAMISH	L	34
4.95E-01	49.5%	1	49.4%	0.1570%	0.010%	191089-123 164TH AVE SE	191089	STW Service	123	164TH AVE SE	S	34
4.95E-01	49.5%	1	49.4%	0.1570%	0.010%	191089-131 164TH AVE SE	191089	STW Service	131	164TH AVE SE	L	34
4.95E-01	49.5%	1	49.4%	0.1570%	0.010%	191089-139 164TH AVE SE	191089	STW Service	139	164TH AVE SE	S	34
4.95E-01	49.5%	1	49.4%	0.1570%	0.010%	191089-147 164TH AVE SE	191089	STW Service	147	164TH AVE SE	L	34
4.95E-01	49.5%	1	49.4%	0.1570%	0.010%	191089-169 164TH AVE SE	191089	STW Service	169	164TH AVE SE	S	34
3.96E+00	49.5%	8	49.4%	0.1570%	0.010%	191089-211 164TH AVE SE	191089	STW Service	211	164TH AVE SE	L	34
4.95E-01	49.5%	1	49.4%	0.1570%	0.010%	191089-219 164TH AVE SE	191089	STW Service	219	164TH AVE SE	S	34
4.95E-01	49.5%	1	49.4%	0.1570%	0.010%	191089-225 164TH AVE SE	191089	STW Service	225	164TH AVE SE	L	34
4.95E-01	49.5%	1	49.4%	0.1570%	0.010%	191089-233 164TH AVE SE	191089	STW Service	233	164TH AVE SE	S	34
4.95E-01	49.5%	1	49.4%	0.1570%	0.010%	191089-411 164TH AVE SE	191089	STW Service	411	164TH AVE SE	L	34
4.95E-01	49.5%	1	49.4%	0.1570%	0.010%	191089-413 164TH AVE SE	191089	STW Service	413	164TH AVE SE	S	34
4.95E-01	49.5%	1	49.4%	0.1570%	0.010%	191089-421 164TH AVE SE	191089	STW Service	421	164TH AVE SE	L	34
4.95E-01	49.5%	1	49.4%	0.1570%	0.010%	191089-422 156TH AVE SE	191089	STW Service	422	156TH AVE SE	S	34
4.95E-01	49.5%	1	49.4%	0.1570%	0.010%	191089-444 156TH AVE SE	191089	STW Service	444	156TH AVE SE	L	34
4.95E-01	49.5%	1	49.4%	0.1570%	0.010%	191089-448 156TH AVE SE	191089	STW Service	448	156TH AVE SE	S	34
4.95E-01	49.5%	1	49.4%	0.1570%	0.010%	191089-456 156TH AVE SE	191089	STW Service	456	156TH AVE SE	L	34
4.95E-01	49.5%	1	49.4%	0.1570%	0.010%	191089-504 156TH AVE SE	191089	STW Service	504	156TH AVE SE	S	34
4.95E-01	49.5%	1	49.4%	0.1570%	0.010%	191089-584 156TH AVE SE	191089	STW Service	584	156TH AVE SE	L	34
4.95E-01	49.5%	1	49.4%	0.1570%	0.010%	191089-605 163RD AVE SE	191089	STW Service	605	163RD AVE SE	S	34
4.95E-01	49.5%	1	49.4%	0.1570%	0.010%	191089-703 164TH AVE SE	191089	STW Service	703	164TH AVE SE	S	34
4.95E-01	49.5%	1	49.4%	0.1570%	0.010%	191089-705 156TH AVE SE	191089	STW Service	705	156TH AVE SE	S	34
4.95E-01	49.5%	1	49.4%	0.1570%	0.010%	191089-717 164TH AVE SE	191089	STW Service	717	164TH AVE SE	L	34
4.95E-01	49.5%	1	49.4%	0.1570%	0.010%	191089-16315 SE 4TH ST	191089	STW Service	16315	SE 4TH ST	L	34
4.95E-01	49.5%	1	49.4%	0.1570%	0.010%	191089-16320 SE 4TH ST	191089	STW Service	16320	SE 4TH ST	S	34
4.42E+00	55.3%	8	55.2%	0.1570%	0.010%	191089-550 156TH AVE SE	191089	STW Service	550	156TH AVE SE	L	34
5.53E-01	55.3%	1	55.2%	0.2512%	0.010%	190088-55 151ST PL NE	190088	STW Service	55	151ST PL NE	L	34
4.43E+00	55.3%	8	55.2%	0.2198%	0.010%	191087-100 140TH AVE SE	191087	STW Service	100	140TH AVE SE	L	34
5.65E-01	56.5%	1	56.5%	0.0628%	0.010%	191088-153 152ND PL SE	191088	STW Service	153	152ND PL SE	L	34
5.65E-01	56.5%	1	56.5%	0.0628%	0.010%	191088-207 152ND PL SE	191088	STW Service	207	152ND PL SE	S	34
5.65E-01	56.5%	1	56.5%	0.0628%	0.010%	191088-431 154TH AVE SE	191088	STW Service	431	154TH AVE SE	L	34
5.65E-01	56.5%	1	56.5%	0.0628%	0.010%	191088-437 154TH AVE SE	191088	STW Service	437	154TH AVE SE	L	34
5.65E-01	56.5%	1	56.5%	0.0628%	0.010%	191088-445 154TH AVE SE	191088	STW Service	445	154TH AVE SE	L	34

high

5.65E-01	56.5%	1	56.5%	0.0628%	0.010%	191088-451	154TH AVE SE	191088	STW_Service	451	154TH AVE SE	L	34
5.65E-01	56.5%	1	56.5%	0.0628%	0.010%	191088-601	154TH AVE SE	191088	STW_Service	601	154TH AVE SE	L	34
5.65E-01	56.5%	1	56.5%	0.0628%	0.010%	191088-607	154TH AVE SE	191088	STW_Service	607	154TH AVE SE	L	34
5.65E-01	56.5%	1	56.5%	0.0628%	0.010%	191088-621	154TH AVE SE	191088	STW_Service	621	154TH AVE SE	L	34
5.65E-01	56.5%	1	56.5%	0.0628%	0.010%	191088-15150	SE 4TH ST	191088	STW_Service	15150	SE 4TH ST	L	34
9.99E-01	99.9%	1	99.9%	0.3454%	0.010%	188089-1732	162ND AVE NE	188089	STW_Service	1732	162ND AVE NE	S	34
9.99E-01	99.9%	1	99.9%	0.3454%	0.010%	188089-1816	162ND AVE NE	188089	STW_Service	1816	162ND AVE NE	L	34
9.99E-01	99.9%	1	99.9%	0.1884%	0.010%	188090-2222	167TH AVE NE	188090	STW_Service	2222	167TH AVE NE	L	34
9.99E-01	99.9%	1	99.9%	0.1884%	0.010%	188090-2225	166TH PL NE	188090	STW_Service	2225	166TH PL NE	L	34
5.00E+00	99.9%	5	99.9%	0.0034%	0.010%	189088-825	156TH AVE NE	189088	STW_Service	825	156TH AVE NE	L	12
7.99E+00	99.9%	8	99.9%	0.0033%	0.010%	189088-1299	156TH AVE NE	189088	STW_Service	1299	156TH AVE NE	S	34
9.99E-01	99.9%	1	99.9%	0.2826%	0.010%	189088-15008	NE 16TH ST	189088	STW_Service	15008	NE 16TH ST	L	34
9.99E-01	99.9%	1	99.9%	0.1725%	0.010%	189090-1505	168TH AVE NE	189090	STW_Service	1505	168TH AVE NE	S	12
9.99E-01	99.9%	1	99.9%	0.2512%	0.010%	189091-824	179TH CT NE	189091	STW_Service	824	179TH CT NE	S	34
9.99E-01	99.9%	1	99.9%	0.2512%	0.010%	190087-467	145TH PL NE	190087	STW_Service	467	145TH PL NE	S	34
9.99E-01	99.9%	1	99.9%	0.2512%	0.010%	190088-15232	NE 3RD PL	190088	STW_Service	15232	NE 3RD PL	S	34
9.99E-01	99.9%	1	99.9%	0.2826%	0.010%	190090-108	164TH AVE NE	190090	STW_Service	108	164TH AVE NE	S	34
9.99E-01	99.9%	1	99.9%	0.0018%	0.010%	191089-555	156TH AVE SE	191089	STW_Service	555	156TH AVE SE	S	34
9.99E-01	99.9%	1	99.9%	0.0628%	0.010%	191088-204	154TH PL SE	191088	STW_Service	204	154TH PL SE	S	34
9.99E-01	99.9%	1	99.9%	0.0628%	0.010%	191088-460	155TH AVE SE	191088	STW_Service	460	155TH AVE SE	L	34
9.99E-01	99.9%	1	99.9%	0.1570%	0.010%	191089-155	164TH AVE SE	191089	STW_Service	155	164TH AVE SE	S	34
9.99E-01	99.9%	1	99.9%	0.1570%	0.010%	191089-163	164TH AVE SE	191089	STW_Service	163	164TH AVE SE	L	34
9.99E-01	99.9%	1	99.9%	0.1570%	0.010%	191089-406	156TH AVE SE	191089	STW_Service	406	156TH AVE SE	S	34
9.99E-01	99.9%	1	99.9%	0.1570%	0.010%	191089-819	164TH AVE SE	191089	STW_Service	819	164TH AVE SE	S	34
9.99E-01	99.9%	1	99.9%	0.1570%	0.010%	191090-238	164TH AVE SE	191090	STW_Service	238	164TH AVE SE	S	34

Service Year	Main Size	Main Material	Main Pressure	Main Date	X	Y	Pipe Wall Thickness (inch/mills)	Coating Type Score	Soil Corrosivity Score	Soil Movement Potential (slide area, yes/no)	Atmospheric Type Score	Criticality of supply Yes/No	IND/SVC (yes/no)	CP System scoring	Third Party Damages (hits per plat map)
1971	6	STW	IP	1967	47.6202399	-122.13196	0.113	7	1	No	1.4	No	No	5	4
1971	2	STW	IP	1971	47.6146686	-122.13642	0.109	7	1	No	1.4	No	No	5	7
1971	2	STW	IP	1971	47.6149284	-122.13643	0.109	7	1	No	1.4	No	No	5	7
1970	2	STW	IP	1960	47.6110672	-122.13411	0.113	7	1	No	1.4	No	No	5	7
1969	2	STW	IP	1964	47.6253155	-122.12374	0.113	7	1	No	1.4	No	No	5	10
1969	114	STW	IP	1967	47.6190534	-122.14533	0.109	7	1	No	1.4	No	No	5	10
1968	1	STW	IP	1966	47.6191286	-122.1478	0.113	7	1	No	1.4	No	No	5	10
1969	2	STW	IP	1962	47.6092072	-122.15745	0.109	7	1	No	1.4	No	No	5	5
1969	2	STW	IP	1962	47.6091915	-122.15578	0.109	7	1	No	1.4	No	No	5	5
1970	2	STW	IP	1963	47.6213341	-122.10527	0.109	7	1	No	1.4	No	No	5	7
1969	2	STW	IP	1969	47.6240225	-122.16407	0.113	7	1	No	1.4	No	No	5	4
1968	1	STW	IP	1966	47.6190812	-122.14799	0.109	7	1	No	1.4	No	No	5	10
1968	114	STW	IP	1966	47.6203343	-122.14787	0.109	7	1	No	1.4	No	No	5	10
1968	2	STW	IP	1966	47.625957	-122.14968	0.125	7	1	No	1.4	No	No	5	9
1964	2	STW	IP	1962	47.6203231	-122.11134	0.113	4	1	No	1.4	No	Yes	5	4
1961	2	STW	IP	1960	47.6095188	-122.1196	0.113	4	1	No	1.4	No	No	5	4
1961	2	STW	IP	1960	47.6093998	-122.11953	0.113	4	1	No	1.4	No	No	5	4
1961	2	STW	IP	1960	47.6090495	-122.11973	0.113	4	1	No	1.4	No	No	5	4
1961	2	STW	IP	1960	47.6088993	-122.11963	0.113	4	1	No	1.4	No	No	5	4
1961	2	STW	IP	1960	47.6086635	-122.11965	0.113	4	1	No	1.4	No	No	5	4
1963	2	STW	IP	1963	47.6289949	-122.11475	0.113	4	1	No	1.4	No	No	5	5
1963	2	STW	IP	1963	47.6301963	-122.11476	0.113	4	1	No	1.4	No	No	5	5
1963	2	STW	IP	1963	47.6276803	-122.11566	0.113	4	1	No	1.4	No	No	5	5
1965	114	STW	IP	1965	47.6123833	-122.15698	0.113	4	1	No	1.4	No	Yes	5	9
1963	2	STW	IP	1962	47.6161025	-122.13696	0.113	4	1	No	1.4	No	No	5	7
1962	2	STW	IP	1962	47.6154124	-122.13414	0.113	4	1	No	1.4	No	No	5	7
1960	2	STW	IP	1959	47.6101648	-122.1564	0.113	4	1	No	1.4	No	No	5	9
1961	6	STW	IP	1961	47.6165781	-122.11078	0.113	4	1	No	1.4	No	No	5	9

1962	2	STW	IP	1960	47.6091455	-122.13642	0.113	4	1	No	1.4	No	No	5	1
1962	2	STW	IP	1960	47.6081305	-122.13529	0.113	4	1	No	1.4	No	No	5	1
1964	2	STW	IP	1964	47.6215535	-122.13818	0.113	4	1	No	1.4	No	No	5	8
1961	2	PE	IP	1962	47.617549	-122.16335	0.113	4	1	No	1.4	No	No	5	4
1964	2	PE	IP	1978	47.6151348	-122.10372	0.113	4	1	No	1.4	No	Yes	0	9
1958	4	STW	IP	1958	47.60905	-122.12162	0.113	4	1	No	1.4	No	No	0	4
1958	4	STW	IP	1958	47.6088456	-122.12163	0.113	4	1	No	1.4	No	No	0	4
1958	4	STW	IP	1958	47.6086645	-122.12161	0.113	4	1	No	1.4	No	No	0	4
1958	4	STW	IP	1958	47.608439	-122.12162	0.113	4	1	No	1.4	No	No	0	4
1958	4	STW	IP	1958	47.6078122	-122.12163	0.113	4	1	No	1.4	No	No	0	4
1958	4	STW	IP	1957	47.60719	-122.12163	0.113	4	1	No	1.4	No	No	0	4
1958	4	STW	IP	1957	47.6068906	-122.12159	0.113	4	1	No	1.4	No	No	0	4
1958	4	STW	IP	1957	47.6067228	-122.12163	0.113	4	1	No	1.4	No	No	0	4
1958	4	STW	IP	1957	47.6064979	-122.12158	0.113	4	1	No	1.4	No	No	0	4
1958	4	STW	IP	1957	47.6055648	-122.12161	0.113	4	1	No	1.4	No	No	0	4
1957	4	STW	IP	1957	47.6046106	-122.12161	0.113	4	1	No	1.4	No	No	0	4
1957	4	STW	IP	1957	47.6042821	-122.12166	0.113	4	1	No	1.4	No	No	0	4
1958	6	STW	IP	1958	47.6065394	-122.13184	0.113	4	1	No	1.4	No	No	0	4
1958	6	STW	IP	1958	47.6058441	-122.13186	0.113	4	1	No	1.4	No	No	0	4
1958	6	STW	IP	1958	47.6055917	-122.1318	0.113	4	1	No	1.4	No	No	0	4
1959	6	STW	IP	1958	47.6053341	-122.1316	0.113	4	1	No	1.4	No	No	0	4
1960	6	STW	IP	1958	47.6052192	-122.13154	0.113	4	1	No	1.4	No	No	0	4
1959	6	STW	IP	1958	47.604019	-122.13083	0.113	4	1	No	1.4	No	No	0	4
1956	6	STW	IP	1956	47.6042709	-122.12372	0.113	4	1	No	1.4	No	No	0	4
1957	2	STW	IP	1957	47.6036656	-122.12179	0.113	4	1	No	1.4	No	No	0	4
1956	4	STW	IP	1956	47.6030857	-122.13094	0.113	4	1	No	1.4	No	No	0	4
1957	4	STW	IP	1957	47.6034732	-122.12191	0.113	4	1	No	1.4	No	No	0	4
1958	4	STW	IP	1957	47.6059262	-122.12159	0.113	4	1	No	1.4	No	No	0	4
1958	4	STW	IP	1957	47.6063366	-122.12157	0.113	4	1	No	1.4	No	No	0	4
1959	6	STW	IP	1958	47.6038547	-122.13068	0.113	4	1	No	1.4	No	No	0	4
1966	2	STW	IP	1966	47.6113508	-122.1386	0.113	7	1	No	1.4	No	No	5	7
1959	4	STW	IP	1959	47.6088073	-122.15314	0.113	4	1	No	1.4	No	Yes	5	6
1962	2	STW	IP	1960	47.6081009	-122.13737	0.113	4	0	No	1.4	No	No	0	1
1962	2	STW	IP	1960	47.6077552	-122.13736	0.113	4	0	No	1.4	No	No	0	1
1961	2	STW	IP	1960	47.6051989	-122.13643	0.113	4	0	No	1.4	No	No	0	1
1961	2	STW	IP	1960	47.6050667	-122.13639	0.113	4	0	No	1.4	No	No	0	1
1961	2	STW	IP	1960	47.6048169	-122.13628	0.113	4	0	No	1.4	No	No	0	1

1961	2	STW	IP	1960	47.6047035	-122.13616	0.113	4	0	No	1.4	No	No	0	1
1961	2	STW	IP	1960	47.6044727	-122.1361	0.113	4	0	No	1.4	No	No	0	1
1961	2	STW	IP	1960	47.6043364	-122.13603	0.113	4	0	No	1.4	No	No	0	1
1961	2	STW	IP	1960	47.6039752	-122.13588	0.113	4	0	No	1.4	No	No	0	1
1962	2	STW	IP	1960	47.6065902	-122.13732	0.113	4	0	No	1.4	No	No	0	1
1965	2	STW	IP	1964	47.6254221	-122.12378	0.113	4	1	No	1.4	No	No	5	10
1966	2	STW	IP	1964	47.6265513	-122.12356	0.113	7	1	No	1.4	No	No	5	10
1965	2	STW	IP	1965	47.6301916	-122.11747	0.113	4	1	No	1.4	No	No	5	5
1966	2	STW	IP	1965	47.6303374	-122.11861	0.113	7	1	No	1.4	No	No	5	5
1967	6	STW	IP	1967	47.6183013	-122.13338	0.109	7	1	No	1.4	No	No	0	8
1968	6	STW	IP	1967	47.621176	-122.13272	0.113	7	1	No	1.4	No	No	5	8
1965	2	STW	IP	1965	47.6240051	-122.1405	0.113	4	1	No	1.4	No	No	5	8
1968	2	STW	IP	1967	47.6230835	-122.11702	0.109	7	1	No	1.4	No	No	5	4
1966	2	STW	IP	1963	47.6176428	-122.10074	0.113	7	1	No	1.4	No	No	5	7
1964	2	STW	IP	1963	47.6141657	-122.14658	0.113	4	1	No	1.4	No	No	5	7
1962	2	STW	IP	1960	47.6130959	-122.1364	0.113	4	1	No	1.4	No	No	5	7
1959	4	STW	IP	1959	47.6109352	-122.12107	0.113	4	1	No	1.4	No	No	5	8
1959	6	STW	IP	1958	47.6042346	-122.13189	0.113	4	1	No	1.4	No	No	0	4
1962	2	STW	IP	1960	47.6076243	-122.13424	0.113	4	1	No	1.4	No	No	5	1
1961	2	STW	IP	1960	47.6055451	-122.13306	0.113	4	1	No	1.4	No	No	5	1
1958	4	STW	IP	1958	47.6082358	-122.12159	0.113	4	1	No	1.4	No	No	0	4
1958	4	STW	IP	1958	47.6079153	-122.1216	0.113	4	1	No	1.4	No	No	0	4
1958	6	STW	IP	1958	47.6069454	-122.13182	0.113	4	1	No	1.4	No	No	5	4
1957	4	STW	IP	1957	47.6025375	-122.1216	0.113	4	1	No	1.4	No	No	5	4
1957	4	STW	IP	1957	47.6064941	-122.12098	0.113	4	1	No	1.4	No	No	0	4

Cover Attributes Hard surface Yes/No	Depth of Cover (Default 12')	Population Density	Active Service Leak Yes/No	Air-Soil Interface Yes/No	Repaired Corrosion service Leaks by plat map	Repaired service leak, Yes/No	Atmospheric Protection	Coating Condition	Internal Corrosion LP Yes/No	Prior Atmospheric condition rating	Current Atmospheric condition rating	EPCR Coating Condition Code
0	12	10	No	No	1	No	2.5	NA	No	NA	NA	
0	12	10	No	No	1	No	2.5	NA	No	NA	NA	
0	12	10	No	No	1	No	2.5	NA	No	NA	NA	
0	12	10	No	No	1	No	2.5	NA	No	NA	NA	
0	12	10	No	No	0	No	2.5	NA	No	NA	NA	
0	12	10	No	No	0	No	2.5	NA	No	NA	NA	
0	12	10	No	No	0	No	2.5	NA	No	NA	NA	
0	12	10	No	No	1	No	2.5	NA	No	NA	NA	
0	12	10	No	No	1	No	2.5	NA	No	NA	NA	
0	12	10	No	No	2	No	2.5	NA	No	NA	NA	
0	12	10	No	No	2	No	2.5	NA	No	NA	NA	
0	12	10	No	No	0	No	2.5	NA	No	NA	NA	
0	12	10	No	No	0	No	2.5	NA	No	NA	NA	
0	12	10	No	No	0	No	2.5	NA	No	NA	NA	
0	12	10	No	No	1	No	2.5	NA	No	NA	NA	
0	12	10	No	No	1	No	2.5	NA	No	NA	NA	
0	12	10	No	No	2	No	2.5	NA	No	NA	NA	
0	12	10	No	No	2	No	2.5	NA	No	NA	NA	
0	12	10	No	No	0	No	2.5	NA	No	NA	NA	
0	12	10	No	No	0	No	2.5	NA	No	NA	NA	
0	12	10	No	No	1	No	2.5	NA	No	NA	NA	
0	12	0	No	No	1	No	2.5	NA	No	NA	NA	
0	12	10	No	Yes	8	No	2.5	NA	No	NA	NA	BON
0	12	10	No	Yes	15	No	2.5	NA	No	NA	NA	
0	12	10	No	Yes	15	No	2.5	NA	No	NA	NA	
0	12	10	No	Yes	15	No	2.5	NA	No	NA	NA	
0	12	10	No	Yes	15	No	2.5	NA	No	NA	NA	
0	12	10	No	Yes	15	No	2.5	NA	No	NA	NA	
0	12	10	No	Yes	16	No	2.5	NA	No	NA	NA	
0	12	10	No	Yes	16	No	2.5	NA	No	NA	NA	
0	12	10	No	Yes	16	No	2.5	NA	No	NA	NA	
0	12	10	No	Yes	2	No	2.5	NA	No	NA	NA	BON
0	28	10	No	Yes	1	No	2.5	NA	No	NA	NA	BON
0	18	10	No	Yes	1	No	2.5	NA	No	NA	NA	BON
0	36	10	No	Yes	2	No	2.5	NA	No	NA	NA	BON
0	18	10	No	Yes	6	No	2.5	NA	No	NA	NA	BON

0	No	12	10	No	Yes	7	No	2.5	NA	No	NA	NA		
0	No	12	10	No	Yes	7	No	2.5	NA	No	NA	NA		
0	No	12	10	No	Yes	7	No	2.5	NA	No	NA	NA		
0	No	12	10	No	Yes	7	No	2.5	NA	No	NA	NA		
0	No	12	10	No	Yes	7	No	2.5	NA	No	NA	NA		
0	No	12	10	Yes	Yes	0	No	2.5	NA	No	NA	NA		
0	No	12	10	Yes	No	0	No	2.5	NA	No	NA	NA		
0	No	12	10	Yes	Yes	16	No	2.5	NA	No	NA	NA		
0	No	12	10	Yes	No	16	No	2.5	NA	No	NA	NA		
0	Yes	30	6	Yes	No	7	No	2.5	NA	No	NA	NA		
0	Yes	30	3	Yes	No	7	No	2.5	NA	No	NA	NA		
0	No	12	10	Yes	Yes	7	No	2.5	NA	No	NA	NA		
0	No	12	10	Yes	No	8	No	2.5	NA	No	NA	NA		
0	No	12	10	Yes	No	2	No	2.5	NA	No	NA	NA		
0	No	12	10	Yes	Yes	4	No	2.5	NA	No	NA	NA		
0	No	12	10	Yes	Yes	1	No	2.5	NA	No	NA	NA		
0	No	12	10	Yes	Yes	24	No	2.5	NA	No	NA	NA		
0	Yes	30	10	Yes	Yes	42	No	2.5	NA	No	NA	NA		
0	No	12	10	Yes	Yes	7	No	2.5	NA	No	NA	NA		
0	No	12	10	Yes	Yes	7	No	2.5	NA	No	NA	NA		
0	No	12	10	Yes	Yes	42	No	2.5	NA	No	NA	NA		
0	No	12	10	Yes	Yes	42	No	2.5	NA	No	NA	NA		
0	No	12	10	Yes	Yes	42	No	2.5	NA	No	NA	NA		
0	No	12	10	Yes	Yes	42	No	2.5	NA	No	NA	NA		
0	No	12	10	Yes	Yes	15	No	2.5	NA	No	NA	NA		

