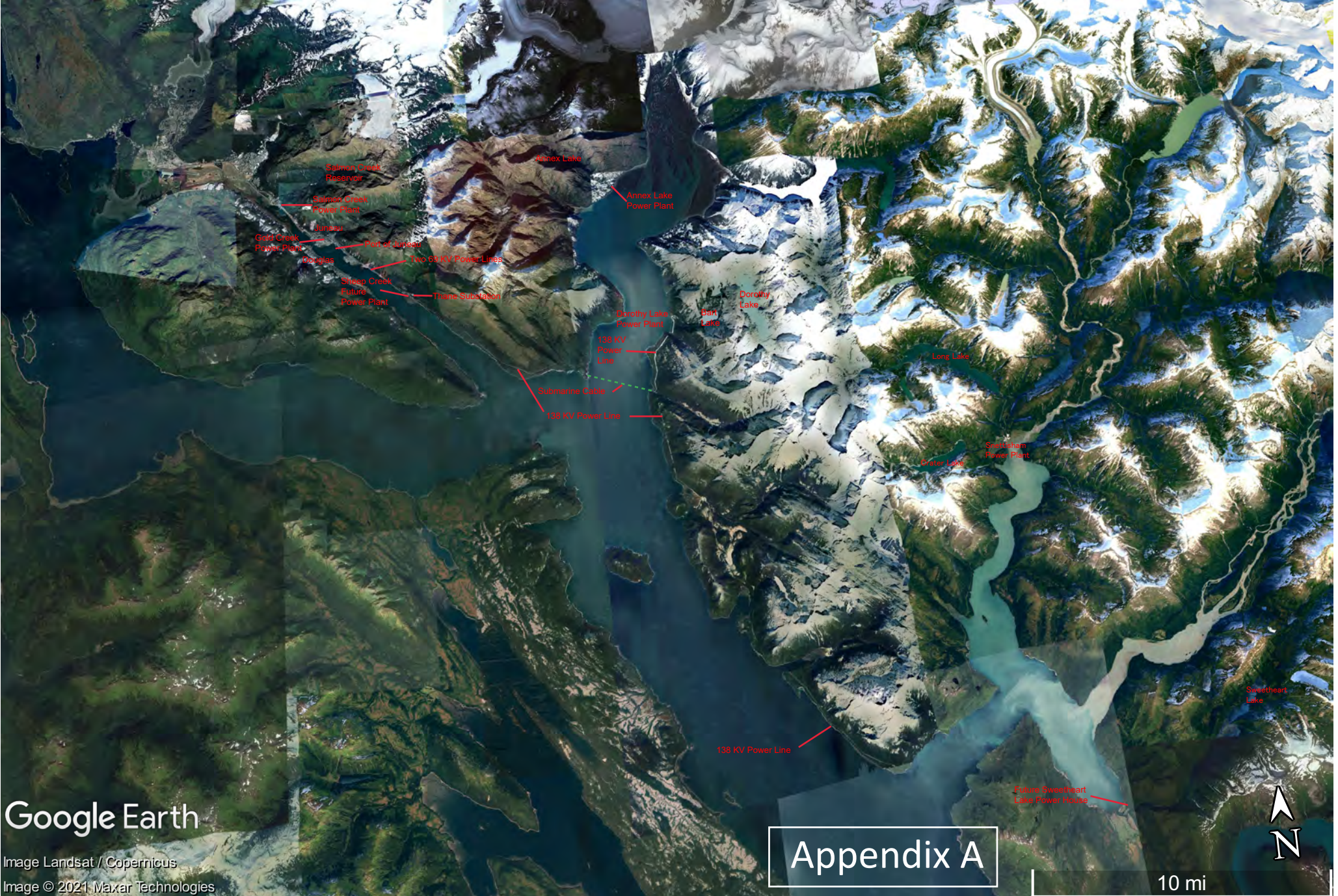

Salmon Creek Reservoir
Salmon Creek Power Plant
Juneau
Gold Creek Power Plant
Port of Juneau
Douglas
Two 69 KV Power Lines
Sheep Creek Future Power Plant
Thane Substation
Annex Lake
Annex Lake Power Plant
Dorothy Lake
Dorothy Lake Power Plant
Bay Lake
138 KV Power Line
Long Lake
Submarine Cable
138 KV Power Line
Snettisham Power Plant
Crater Lake
Sweetheart Lake
138 KV Power Line
Future Sweetheart Lake Power House
Google Earth
Image Landsat / Copernicus
Image © 2021 Maxar Technologies
N
10 mi

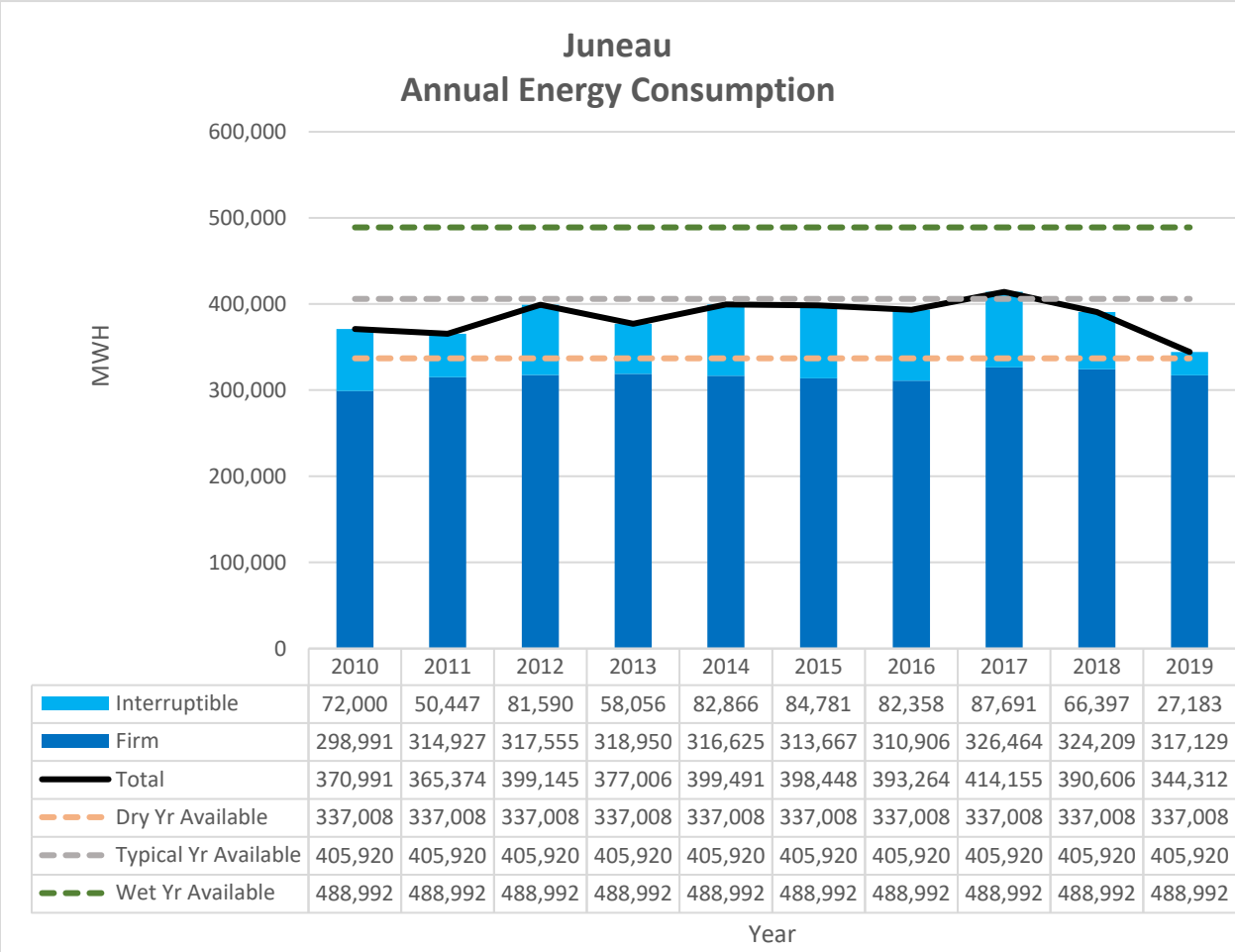
Appendix A

CRUISE SHIP PROFILES

August 2021

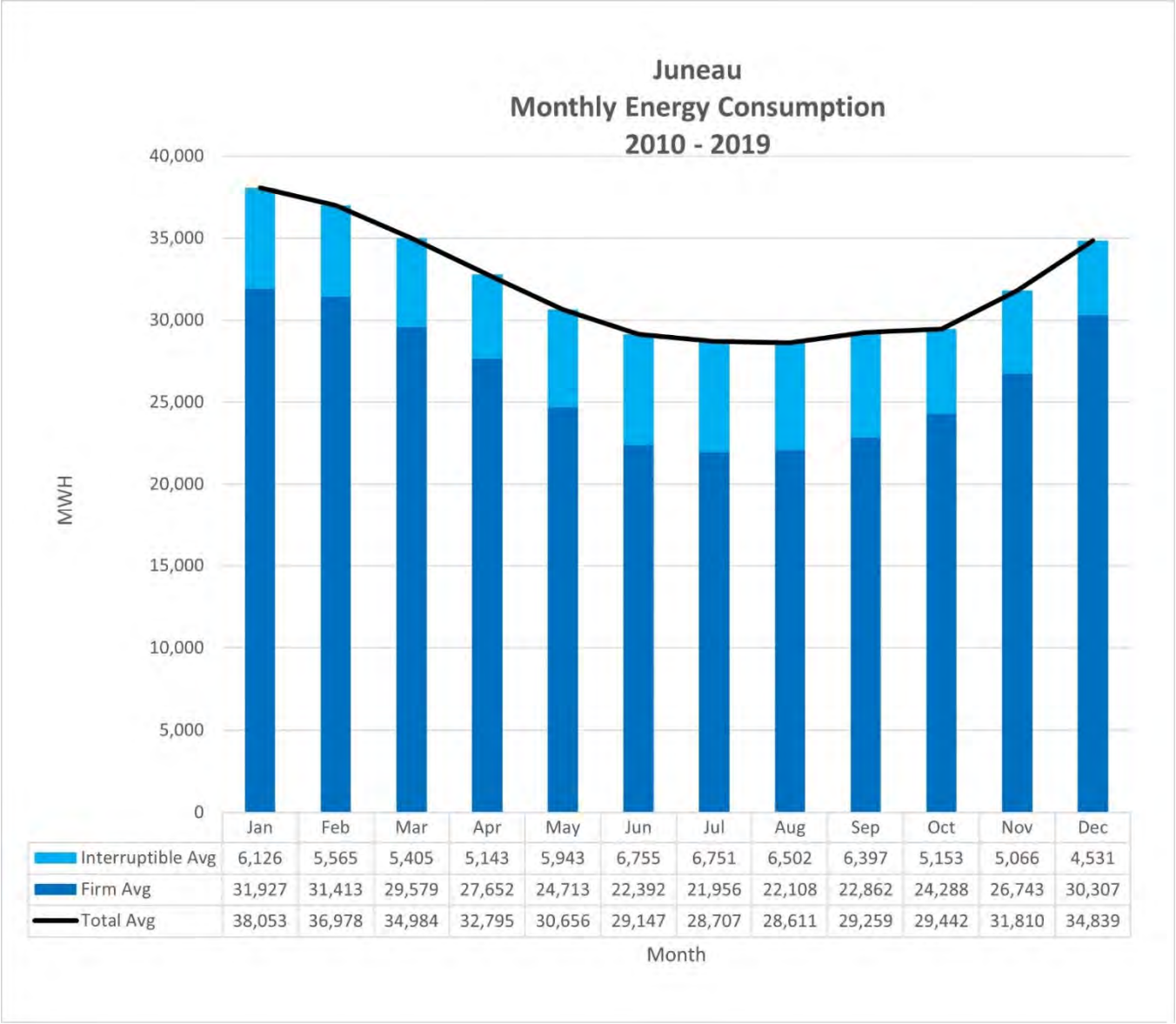
Cruise Line	Ship	Ship Length		Electrical Port Location		Distance from Stern		Peak Load	Voltage
		Meters	Feet	Port Side	Starboard Side	Meters	Feet	MW	Kilovolts
Princess Cruises									
	Sun Princess		857	X		66.0	216.5	8	6.6
	Sea Princess		762	X		66.0	216.5	8	6.6
	Grand Princess		823	X		57.0	187.0	10	6.6
	Golden Princess		823	X		57.0	187.0	10	6.6
	Star Princess		950	X		57.0	187.0	10	6.6
	Caribbean Princess		951	X		57.0	187.0	11	6.6
	Crown Princess		805	X		56.0	183.7	11	11.2
	Emerald Princess		951	X		56.0	183.7	11	11.2
	Ruby Princess		945	X		56.0	183.7	10	11.2
	Royal Princess		1082	X		102.0	334.6	10	11.2
	Regal Princess		1082	X		102.0	334.6	10	11.2
	Majestic Princess			X		102.0	334.6	10	11.2
	Sky Princess		1082	X		102.0	334.6	10	11.2
	Coral Princess		964	X		63.0	206.6	9	11.2
	Island Princess		964	X		63.0	206.6	9	11.2
	Diamond Princess		946	X		52.0	170.6	10	11.2
	Sapphire Princess		946	X		52.0	170.6	10	11.2
	Discovery Princess			Unk	Unk	Unk			
Holland America Line									
	Zuiderdam		936	X		59.0	193.5	7	11.2
	Oosterdam		934		X	52.5	172.2	7	11.2
	Westerdam		935		X	52.5	172.2	7	11.2
	Noordam		951		X	52.5	172.2	7	11.2
	Eurodam		937		X	51.8	169.9	7	11.2
	Nieuw Amsterdam		936		X	51.8	169.9	7	11.2
	Koningsdam		983	X	X	56.7	186.0	6	11.2
	Nieuw Statendam		983	X	X	56.7	186.0	6	11.2
	Volendam		679			62.0	203.4	6	6.6
	Zaandam		780			62.0	203.4	6	6.6
Norwegian Cruise Line Holdings									
	Norwegian Joy		1094		X	59.0	193.5	9	11.2
	Norwegian Bliss		994		X	59.0	193.5	9	11.2
	Norwegian Encore		1094		X	59.0	193.5	9	11.2
	Norwegian Jewel		965		X	64.0	209.9	6	11.2
	OCI Regatta		592	X		21.0	68.9	5	6.6
	RSSC Mariner		702		X	55.0	180.4	5	6.6
	RSSC Splendor		732		X	82.0	269.0	4	6.6
	OCI Insignia		592	X		21.0	68.9	5	6.6
	Norwegian Spirit		880	Unk	Unk	Unk			
	Norwegian Sun		848	Unk	Unk	Unk			
Royal Caribbean International									
	Voyager Class (Adventure, Explorer, Mariner, Navigator of the Seas)	311.1	1020.5		X	59.0	193.6		
	Radiance Class (Brilliance, Jewel, Serenade)	293.5	962.7	X	X	43.1	141.4		
	Grandeur Class (Enchantment of the Seas)	279.6	917.1	X	X	59.1	193.8		
	Quantum Class (Quantum of the Seas, Ovation of the Seas)		1142	Unk	Unk	Unk			
Carnival Cruise Line									
	Vista Class (Vista, Horizon)	323.7	1061.7		X	126.6	415.2		
	Dream Class (Dream, Magic, Breeze)	305.6	1002.4		X	107.3	351.8		
	Excel Class (Mardi Gras)	344.0	1128.3		X	53.3	174.7		
	Conquest Class (Carnival Freedom)		952	Unk	Unk	Unk			
	Spirit Class (Miracle, Spirit, Legend)		959	Unk	Unk	Unk			
Disney Cruise Line									
	Dream	352.1	1154.9		X	80.2	263.1		
	Magic	294.2	965.0	X		93.0	305.0		
	Wonder	294.2	965.0	X		93.0	305.0		
Celebrity Cruises									
	Solstice Class	317.3	1040.7	None	None				
	Millennium		964	Unk	Unk	Unk			
	Eclipse		1040.9	Unk	Unk	Unk			
Crystal Cruises				None	None				
	Crystal Serenity		820.2						
Seabourn				None	None				
	Seabourn Odyssey		581.9						
	Seabourn Sojourn		650.6						
	Seabourn Venture II								
SilverSeas Cruises				None	None				
	Silver Muse		698.2						
	Silver Shadow		610.2						
	Silver Explorer		354.3						
	Silver Wind								
Cunard									
	Queen Elizabeth		964						
Oceania Cruises									
	Regatta								

Appendix B



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Interruptible	72,000	50,447	81,590	58,056	82,866	84,781	82,358	87,691	66,397	27,183
Firm	298,991	314,927	317,555	318,950	316,625	313,667	310,906	326,464	324,209	317,129
Total	370,991	365,374	399,145	377,006	399,491	398,448	393,264	414,155	390,606	344,312
Dry Yr Available	337,008	337,008	337,008	337,008	337,008	337,008	337,008	337,008	337,008	337,008
Typical Yr Available	405,920	405,920	405,920	405,920	405,920	405,920	405,920	405,920	405,920	405,920
Wet Yr Available	488,992	488,992	488,992	488,992	488,992	488,992	488,992	488,992	488,992	488,992

Appendix C1

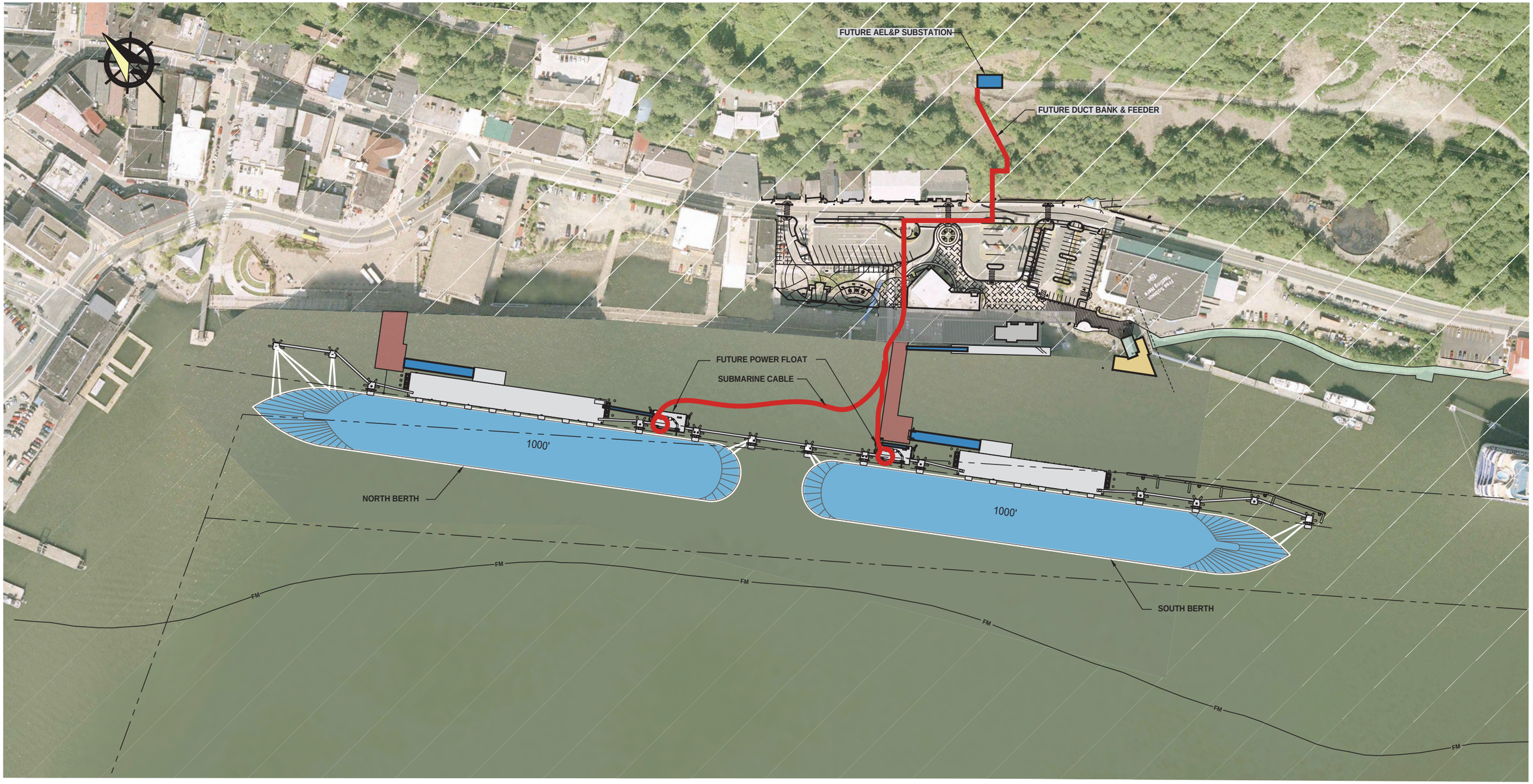


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Interruptible Avg	6,126	5,565	5,405	5,143	5,943	6,755	6,751	6,502	6,397	5,153	5,066	4,531
Firm Avg	31,927	31,413	29,579	27,652	24,713	22,392	21,956	22,108	22,862	24,288	26,743	30,307
Total Avg	38,053	36,978	34,984	32,795	30,656	29,147	28,707	28,611	29,259	29,442	31,810	34,839

Appendix C2


US Coast Guard
CBJ North Berth
CBJ South Berth
Franklin Dock
AJ Dock
Proposed CBJ Dock Substation
Two 69 KV Power Lines
Franklin Dock Shore Power Deployment Equipment
Franklin Dock Shore Power Substation
Google Earth
Image © 2021 Maxar Technologies
N
2000 ft

Appendix D1



OVERALL SITE PLAN

CONCEPT

CITY & BOROUGH OF JUNEAU — DOCKS & HARBORS

REVISIONS

REV.	DATE	DESCRIPTION	DWN.	CKD.	APP.

P N D ENGINEERS, INC.
9360 Glacier Highway Ste 100
Juneau, Alaska 99801
Phone: 907-586-2093
Fax: 907-586-2099
www.pndengineers.com

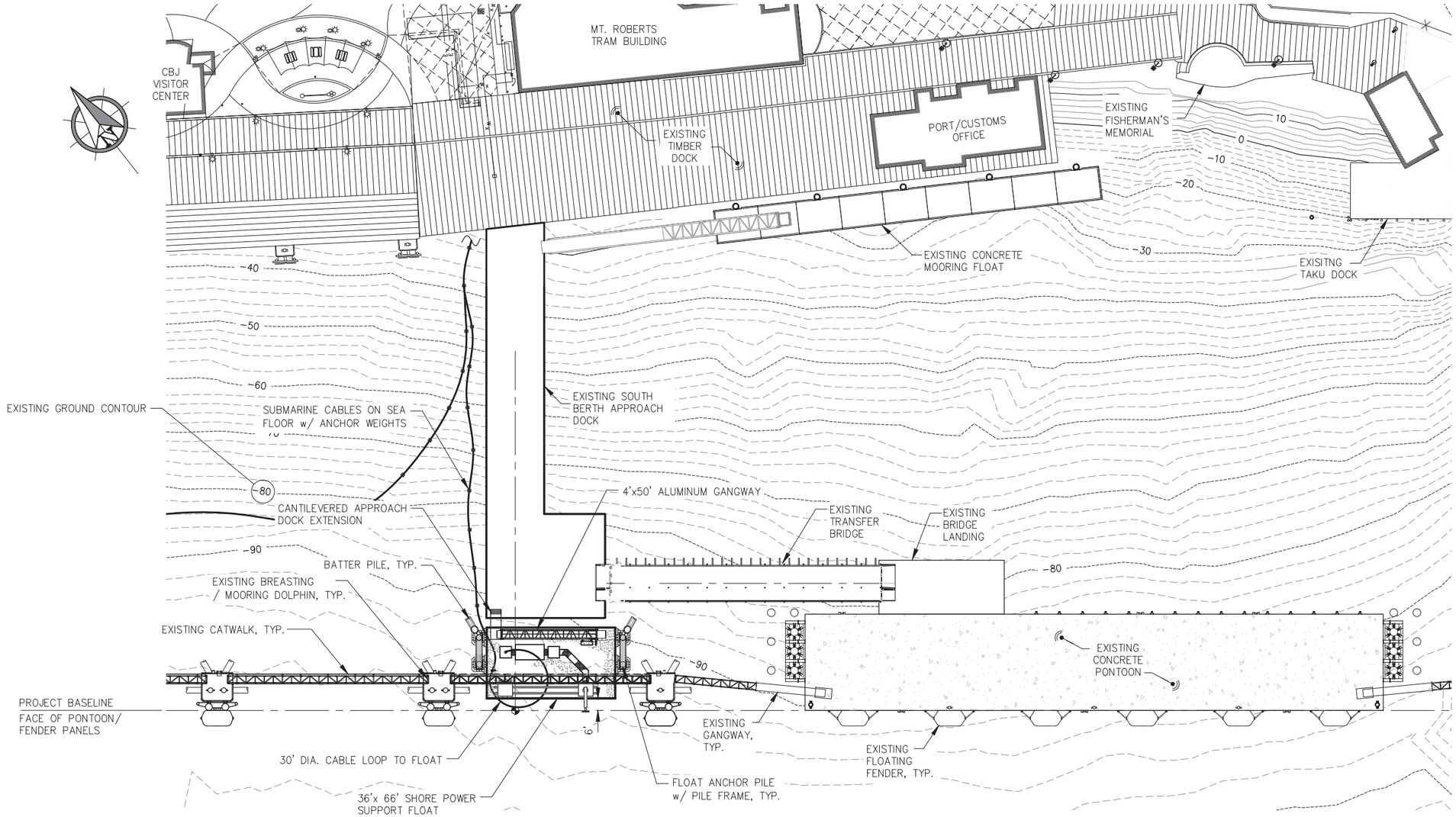
DESIGN: BMI CHECKED: CRS
DRAWN: KLL APPROVED: CRS
SCALE: SCALE IN FEET 0 100 200 FT.
DATE: 08/27/2021

PORT OF JUNEAU CRUISE SHIP BERTHS SHORE TIE POWER STUDY

SHEET TITLE: OVERALL SITE PLAN - CONCEPT

PND PROJECT NO.: 202060 C.A.N. NO.: AECC250

1



OVERALL SITE PLAN

CONCEPT

REVISIONS

REV.	DATE	DESCRIPTION	DWN.	CKD.	APP.

P N D ENGINEERS, INC.
9360 Glacier Highway Ste 100
Juneau, Alaska 99801
Phone: 907-586-2093
Fax: 907-586-2099
www.pndengineers.com

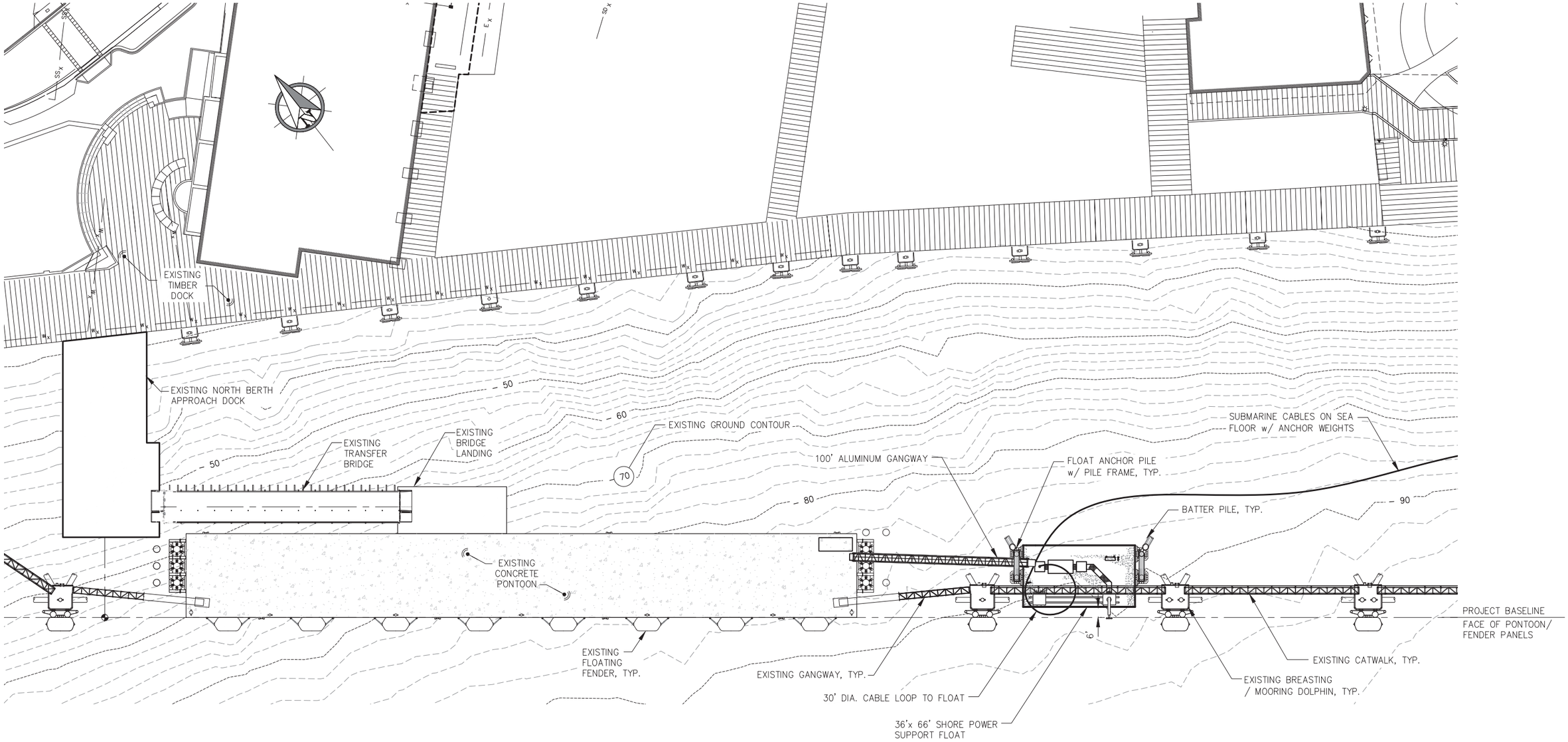
DESIGN: BMI CHECKED: CRS
DRAWN: WRB APPROVED: CRS
SCALE: SCALE IN FEET 0 30 60 FT.
DATE: 08/27/2021

PORT OF JUNEAU CRUISE SHIP BERTHS
SHORE TIE POWER STUDY

SHEET TITLE:
OVERALL SITE PLAN - SOUTH BERTH

PND PROJECT NO.: 202060 C.A.N. NO.: AECC250

2



OVERALL SITE PLAN

CONCEPT

REVISIONS

REV.	DATE	DESCRIPTION	DWN.	CKD.	APP.

PND ENGINEERS, INC.
9360 Glacier Highway Ste 100
Juneau, Alaska 99801
Phone: 907-586-2093
Fax: 907-586-2099
www.pndengineers.com

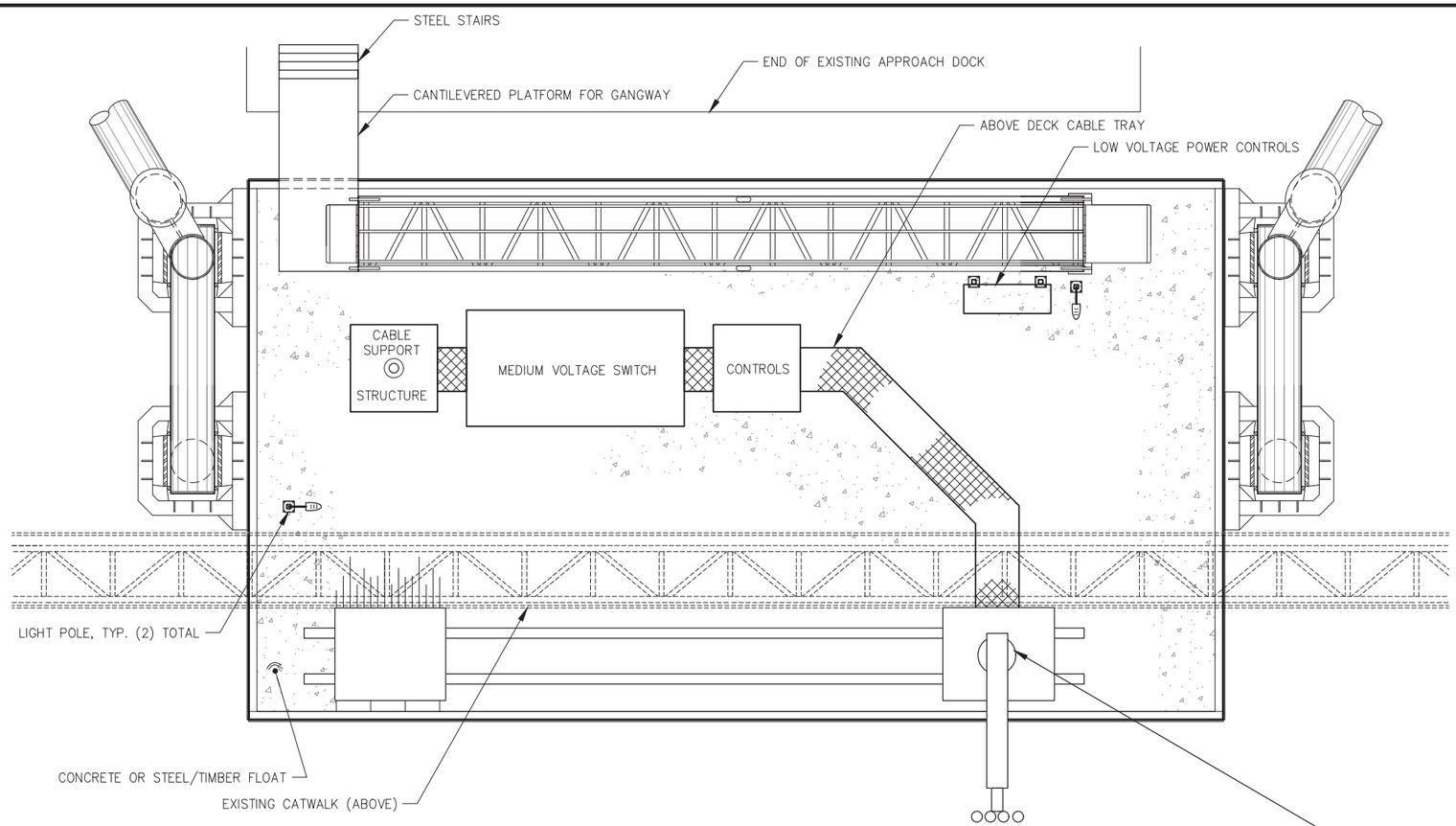
DESIGN: BMI CHECKED: CRS
DRAWN: WRB APPROVED: CRS
SCALE: SCALE IN FEET 0 30 60 FT.
DATE: 08/27/2021

PORT OF JUNEAU CRUISE SHIP BERTHS SHORE TIE POWER STUDY

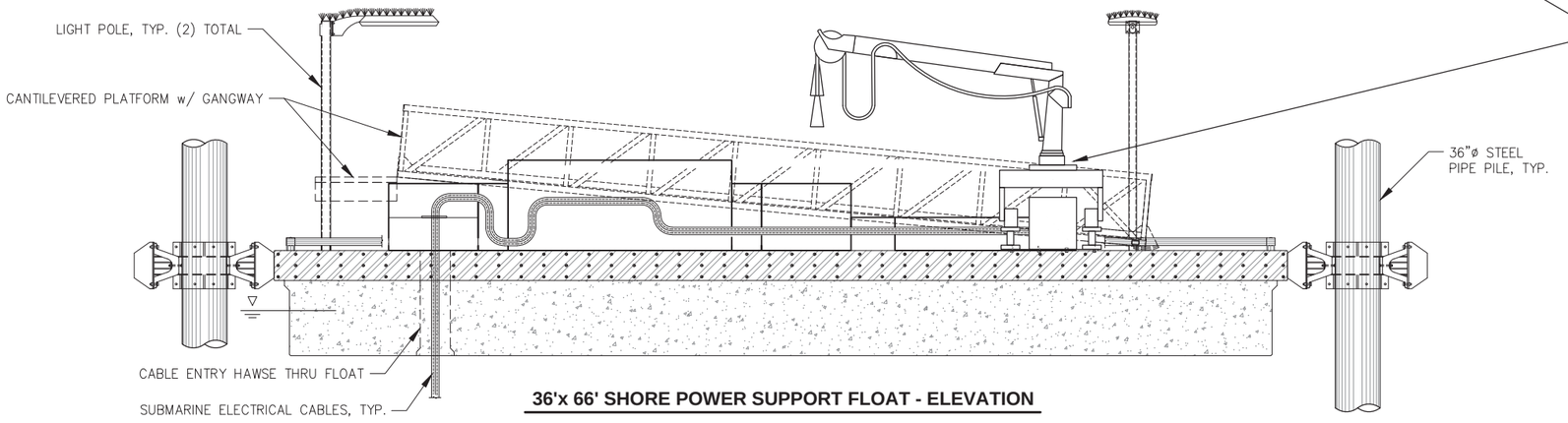
SHEET TITLE: **OVERALL SITE PLAN - NORTH BERTH**

3

PND PROJECT NO.: 202060 C.A.N. NO.: AECC250



36'x 66' SHORE POWER SUPPORT FLOAT - PLAN



36'x 66' SHORE POWER SUPPORT FLOAT - ELEVATION

(*)Hydraulic telescopic crane design

CABLE DEPLOYMENT DEVICE

(PHOTO USED WITH PERMISSION FROM STEMMAN-TECHNIK)

CONCEPT

REVISIONS

REV.	DATE	DESCRIPTION	DWN.	CKD.	APP.

PND ENGINEERS, INC.
9360 Glacier Highway Ste 100
Juneau, Alaska 99801
Phone: 907-586-2093
Fax: 907-586-2099
www.pndengineers.com

DESIGN: BMI CHECKED: CRS
DRAWN: WRB APPROVED: CRS
SCALE:

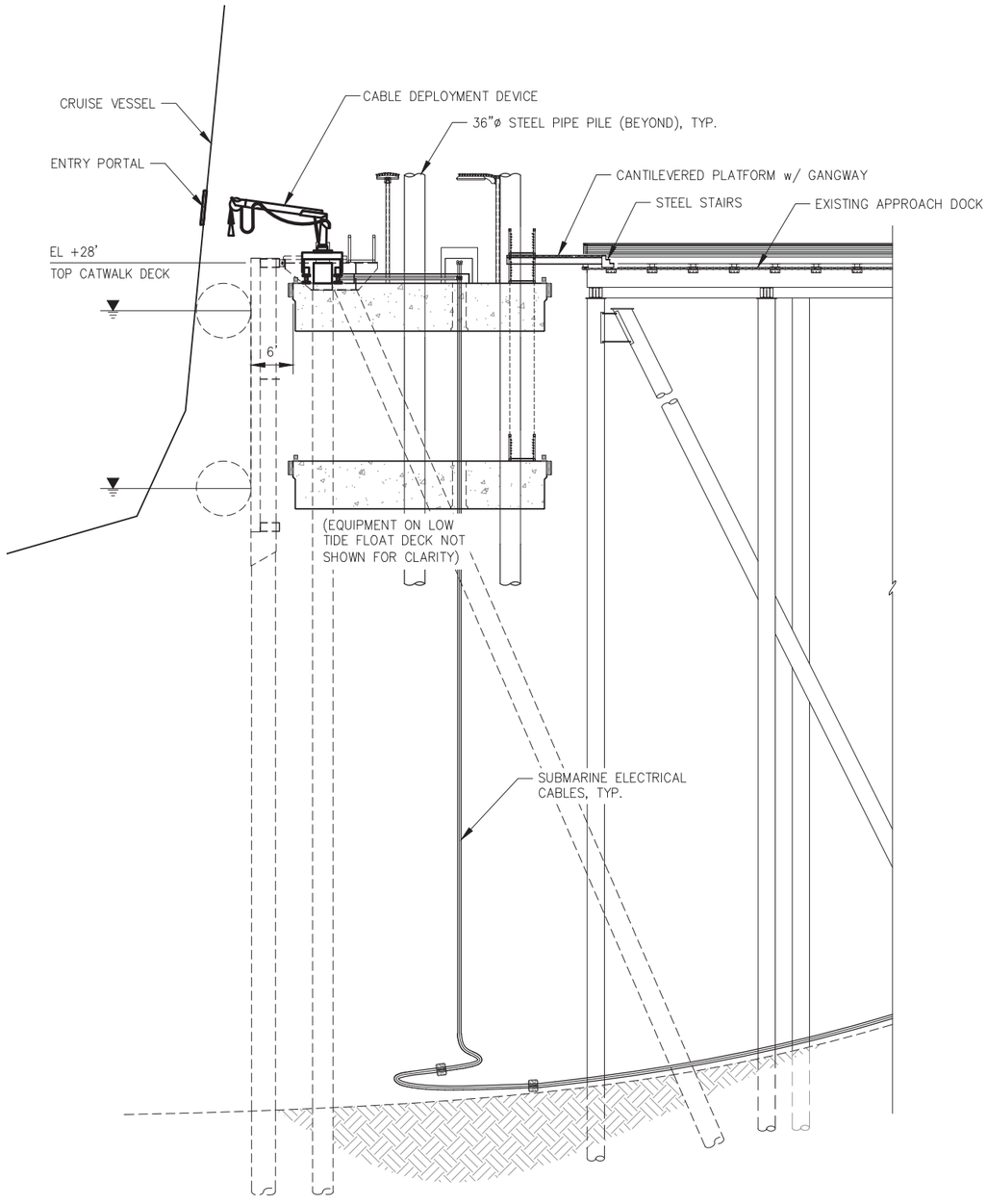
DATE: 08/27/2021

PORT OF JUNEAU CRUISE SHIP BERTHS SHORE TIE POWER STUDY

SHEET TITLE:
SHORE POWER SUPPORT FLOAT PLAN AND ELEVATION

PND PROJECT NO.: 202060 C.A.N. NO.: AECC250

4



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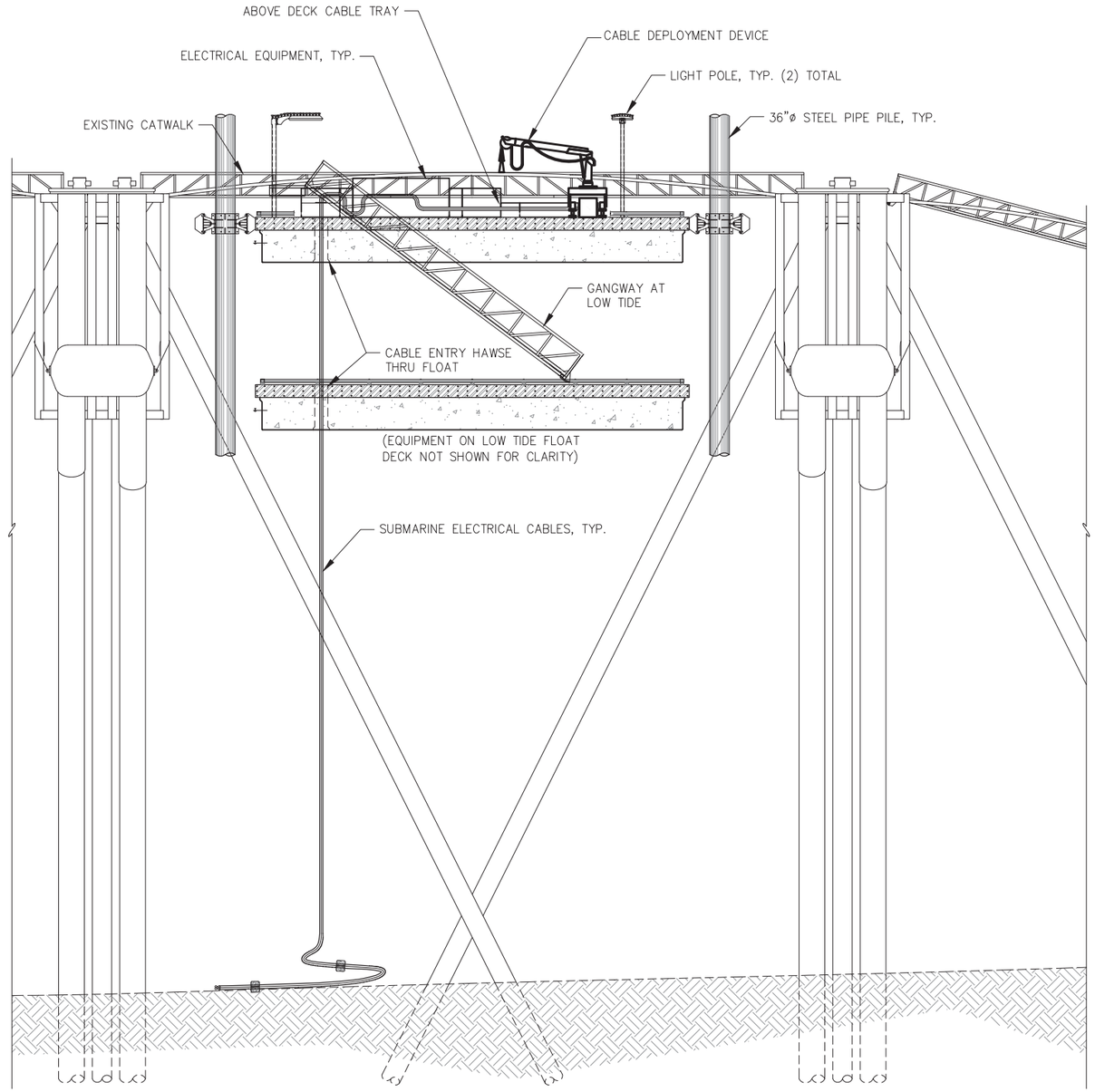


ELEVATION

CONCEPT

CITY & BOROUGH OF JUNEAU — DOCKS & HARBORS

REVISIONS

REV.	DATE	DESCRIPTION	DWN.	CKD.	APP.

P N D ENGINEERS, INC.
9360 Glacier Highway Ste 100
Juneau, Alaska 99801
Phone: 907-586-2093
Fax: 907-586-2099
www.pndengineers.com

DESIGN: BMI CHECKED: CRS
DRAWN: WRB APPROVED: CRS
SCALE:

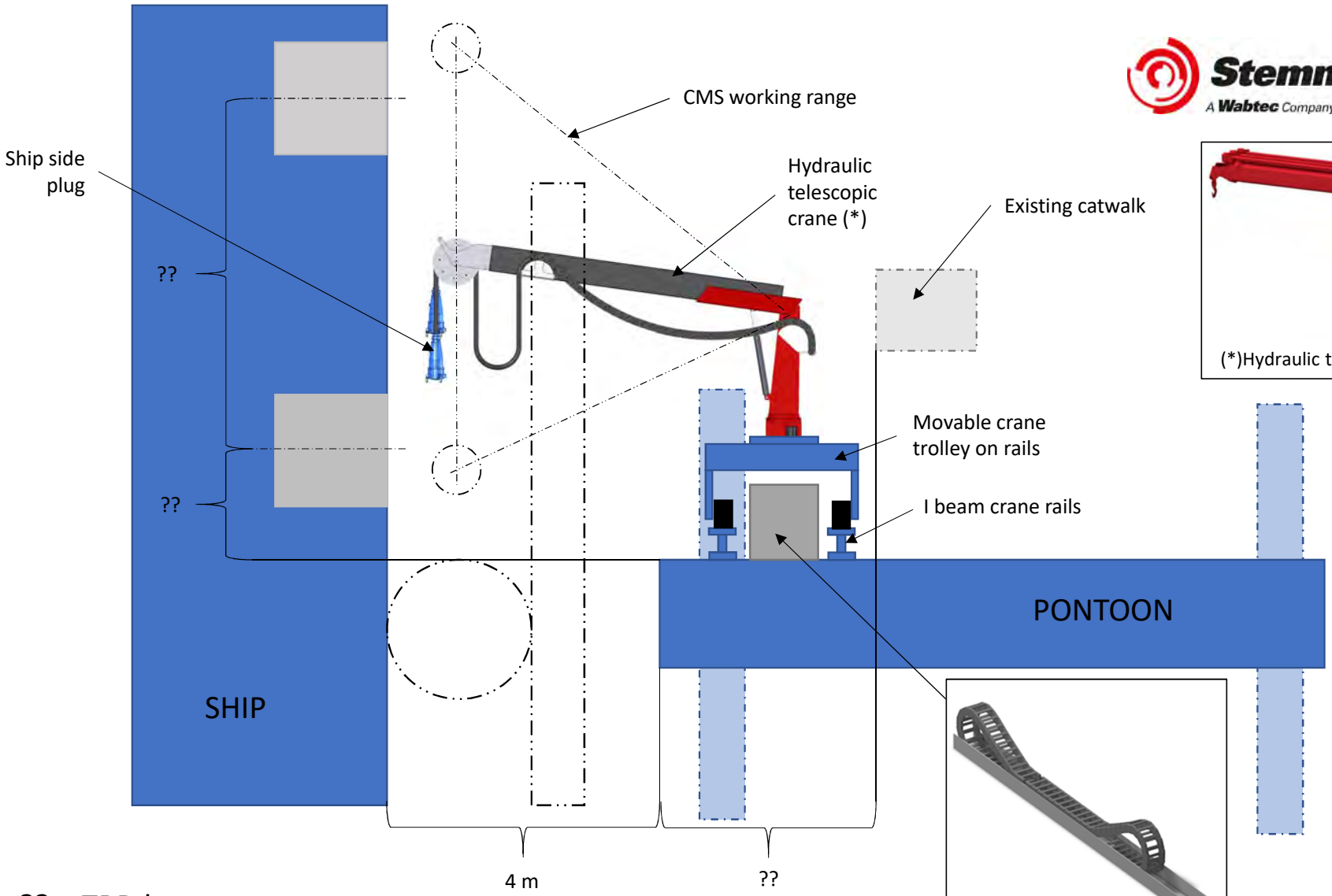
DATE: 08/27/2021

PORT OF JUNEAU CRUISE SHIP BERTHS SHORE TIE POWER STUDY

SHEET TITLE: **SITE ELEVATIONS - SOUTH BERTH**

PND PROJECT NO.: 202060 C.A.N. NO.: AECC250

5

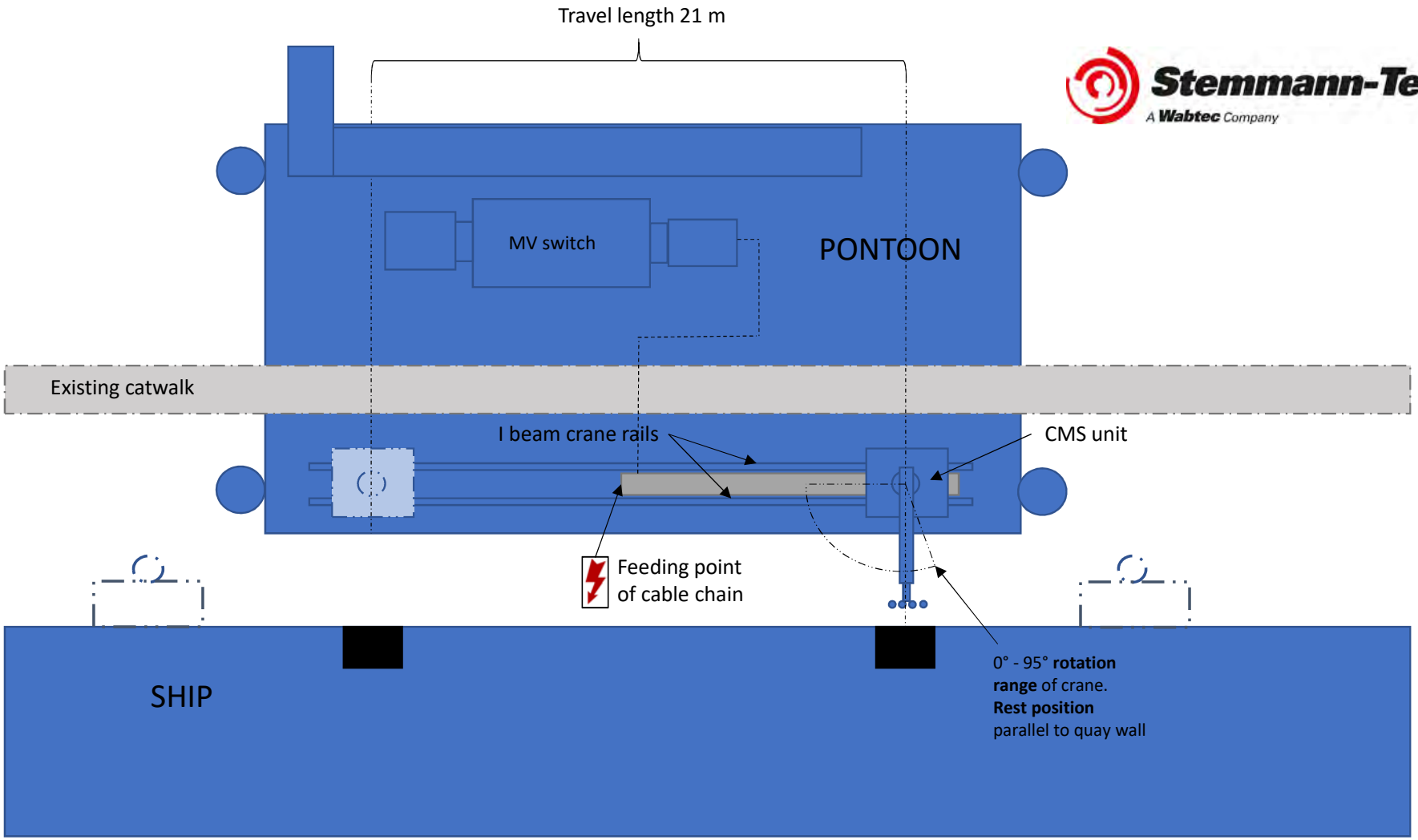


Stemmann-Technik
A Wabtec Company

(*)Hydraulic telescopic crane design

?? = TBD by customer

Appendix D3 - 1



Appendix D3 - 2

PORT OF JUNEAU
CRUISE SHIP ELECTRIFICATION
SHORE POWER CONNECTION STUDY
BUDGET LEVEL ESTIMATE - NORTH BERTH
Prepared by: PND ENGINEERS, INC.
July 2, 2021

Item	Item Description	Units	Quantity	Unit Cost	Amount
1505.1	Mobilization	LS	All Req'd	20%	$1,646,200
2702.1	Construction Surveying	LS	All Req'd	$75,000	$75,000
2894.1	100-ft Aluminum Gangway with Pontoon Mounting Assemblies	LS	All Req'd	$400,000	$400,000
2895.1	Floating Dock, 36' x 66'	SF	2,376	$500	$1,188,000
2896.1	Furnish 36-Inch dia. Steel Pipe Pile	LF	1,200	$350	$420,000
2896.2	Install 36 -Inch dia. Steel Pipe Vertical Pile	EA	4	$30,000	$120,000
2896.3	Install 36 -Inch dia. Steel Pipe Batter Pile	EA	2	$40,000	$80,000
2896.4	Furnish and Install Pile Frames	LS	All Req'd	$250,000	$250,000
2897.1	Transition Plates	LS	All Req'd	$75,000	$75,000
2899.1	Supply and Install Pile Anodes	LS	All Req'd	$75,000	$75,000
5120.1	Electrical Support Assemblies	LS	All Req'd	$50,000	$50,000
11000.1	Cable Positioning Device	LS	All Req'd	$1,000,000	$1,000,000
16000.1	Electrical Substation	LS	All Req'd	$3,193,000	$3,193,000
16000.2	Feeder to Shore	LS	All Req'd	$500,000	$500,000
16000.3	Submarine Cable & Support Structure	LS	All Req'd	$660,000	$660,000
16000.4	Power on Float	LS	All Req'd	$145,000	$145,000
	ESTIMATED CONSTRUCTION COST				**$9,877,200**
	CONTINGENCY (15%)				**$1,481,580**
	ENVIRONMENTAL PERMITTING & IHA				**$200,000**
	FINAL DESIGN & CONTRACT DOCUMENTS (10%)				**$1,135,878**
	CONTRACT ADMINISTRATION & CONSTRUCTION INSPECTION (10%)				**$1,135,878**
	TOTAL RECOMMENDED PROJECT BUDGET				**$13,830,536**

Note: This estimate assumes the North Berth Shore Power System is constructed prior to the South Berth Shore Power System.

Appendix D4 -1

PORT OF JUNEAU
CRUISE SHIP ELECTRIFICATION
SHORE POWER CONNECTION STUDY
BUDGET LEVEL ESTIMATE - SOUTH BERTH
Prepared by: PND ENGINEERS, INC.
July 2, 2021

Item	Item Description	Units	Quantity	Unit Cost	Amount
1505.1	Mobilization	LS	All Req'd	20%	$1,319,000
2702.1	Construction Surveying	LS	All Req'd	$75,000	$75,000
2894.1	50-ft Aluminum Gangway	LS	All Req'd	$100,000	$100,000
2895.1	Floating Dock, 36'x66'	SF	2,376	$500	$1,188,000
2896.1	Furnish 36-Inch dia. Steel Pipe Pile	LF	1,200	$350	$420,000
2896.2	Install 36 -Inch dia. Steel Pipe Vertical Pile	EA	4	$30,000	$120,000
2896.3	Install 36 -Inch dia. Steel Pipe Batter Pile	EA	2	$40,000	$80,000
2896.4	Furnish and Install Pile Frames	LS	All Req'd	$250,000	$250,000
2897.1	Transition Plates	LS	All Req'd	$75,000	$75,000
2898.1	Approach Dock Addition with Gangway Mounting Assemblies	LS	All Req'd	$350,000	$350,000
2899.1	Supply and Install Pile Anodes	LS	All Req'd	$75,000	$75,000
5120.1	Electrical Support Assemblies	LS	All Req'd	$50,000	$50,000
11000.1	Cable Positioning Device	LS	All Req'd	$1,000,000	$1,000,000
16000.1	Electrical Substation	LS	All Req'd	$1,855,000	$1,855,000
16000.2	Feeder to Shore	LS	All Req'd	$482,000	$482,000
16000.3	Submarine Cable & Support Structure	LS	All Req'd	$310,000	$310,000
16000.4	Power on Float	LS	All Req'd	$165,000	$165,000
	ESTIMATED CONSTRUCTION COST				**$7,914,000**
	CONTINGENCY (15%)				**$1,187,100**
	ENVIRONMENTAL PERMITTING & IHA				**$200,000**
	FINAL DESIGN & CONTRACT DOCUMENTS (10%)				**$910,110**
	CONTRACT ADMINISTRATION & CONSTRUCTION INSPECTION (10%)				**$910,110**
	TOTAL RECOMMENDED PROJECT BUDGET				**$11,121,320**

Note: This estimate assumes the North Berth Shore Power System is constructed prior to South Berth Shore Power System.

Appendix D4 -2

PORT OF JUNEAU
CRUISE SHIP ELECTRIFICATION
SHORE POWER CONNECTION STUDY
BUDGET LEVEL ESTIMATE - SOUTH BERTH
Prepared by: PND ENGINEERS, INC.
July 2, 2021

Item	Item Description	Units	Quantity	Unit Cost	Amount
1505.1	Mobilization	LS	All Req'd	20%	$1,590,200
2702.1	Construction Surveying	LS	All Req'd	$75,000	$75,000
2894.1	50-ft Aluminum Gangway	LS	All Req'd	$100,000	$100,000
2895.1	Floating Dock, 36'x66'	SF	2,376	$500	$1,188,000
2896.1	Furnish 36-Inch dia. Steel Pipe Pile	LF	1,200	$350	$420,000
2896.2	Install 36 -Inch dia. Steel Pipe Vertical Pile	EA	4	$30,000	$120,000
2896.3	Install 36 -Inch dia. Steel Pipe Batter Pile	EA	2	$40,000	$80,000
2896.4	Furnish and Install Pile Frames	LS	All Req'd	$250,000	$250,000
2897.1	Transition Plates	LS	All Req'd	$75,000	$75,000
2898.1	Approach Dock Addition with Gangway Mounting Assemblies	LS	All Req'd	$350,000	$350,000
2899.1	Supply and Install Pile Anodes	LS	All Req'd	$75,000	$75,000
5120.1	Electrical Support Assemblies	LS	All Req'd	$50,000	$50,000
11000.1	Cable Positioning Device	LS	All Req'd	$1,000,000	$1,000,000
16000.1	Electrical Substation	LS	All Req'd	$3,193,000	$3,193,000
16000.2	Feeder to Shore	LS	All Req'd	$500,000	$500,000
16000.3	Submarine Cable & Support Structure	LS	All Req'd	$310,000	$310,000
16000.4	Power on Float	LS	All Req'd	$165,000	$165,000
	ESTIMATED CONSTRUCTION COST				**$9,541,200**
	CONTINGENCY (15%)				**$1,431,180**
	ENVIRONMENTAL PERMITTING & IHA				**$200,000**
	FINAL DESIGN & CONTRACT DOCUMENTS (10%)				**$1,097,238**
	CONTRACT ADMINISTRATION & CONSTRUCTION INSPECTION (10%)				**$1,097,238**
	TOTAL RECOMMENDED PROJECT BUDGET				**$13,366,856**

Note: This estimate assumes the South Berth Shore Power System is constructed prior to North Berth Shore Power System.

Appendix D4 -3

PORT OF JUNEAU
CRUISE SHIP ELECTRIFICATION
SHORE POWER CONNECTION STUDY
BUDGET LEVEL ESTIMATE - NORTH BERTH
Prepared by: PND ENGINEERS, INC.
July 2, 2021

Item	Item Description	Units	Quantity	Unit Cost	Amount
1505.1	Mobilization	LS	All Req'd	20%	$1,375,000
2702.1	Construction Surveying	LS	All Req'd	$75,000	$75,000
2894.1	100-ft Aluminum Gangway with Pontoon Mounting Assemblies	LS	All Req'd	$400,000	$400,000
2895.1	Floating Dock, 36' x 66'	SF	2,376	$500	$1,188,000
2896.1	Furnish 36-Inch dia. Steel Pipe Pile	LF	1,200	$350	$420,000
2896.2	Install 36 -Inch dia. Steel Pipe Vertical Pile	EA	4	$30,000	$120,000
2896.3	Install 36 -Inch dia. Steel Pipe Batter Pile	EA	2	$40,000	$80,000
2896.4	Furnish and Install Pile Frames	LS	All Req'd	$250,000	$250,000
2897.1	Transition Plates	LS	All Req'd	$75,000	$75,000
2899.1	Supply and Install Pile Anodes	LS	All Req'd	$75,000	$75,000
5120.1	Electrical Support Assemblies	LS	All Req'd	$50,000	$50,000
11000.1	Cable Positioning Device	LS	All Req'd	$1,000,000	$1,000,000
16000.1	Electrical Substation	LS	All Req'd	$1,855,000	$1,855,000
16000.2	Feeder to Shore	LS	All Req'd	$500,000	$482,000
16000.3	Submarine Cable & Support Structure	LS	All Req'd	$660,000	$660,000
16000.4	Power on Float	LS	All Req'd	$145,000	$145,000
	ESTIMATED CONSTRUCTION COST				**$8,250,000**
	CONTINGENCY (15%)				**$1,237,500**
	ENVIRONMENTAL PERMITTING & IHA				**$200,000**
	FINAL DESIGN & CONTRACT DOCUMENTS (10%)				**$948,750**
	CONTRACT ADMINISTRATION & CONSTRUCTION INSPECTION (10%)				**$948,750**
	TOTAL RECOMMENDED PROJECT BUDGET				**$11,585,000**

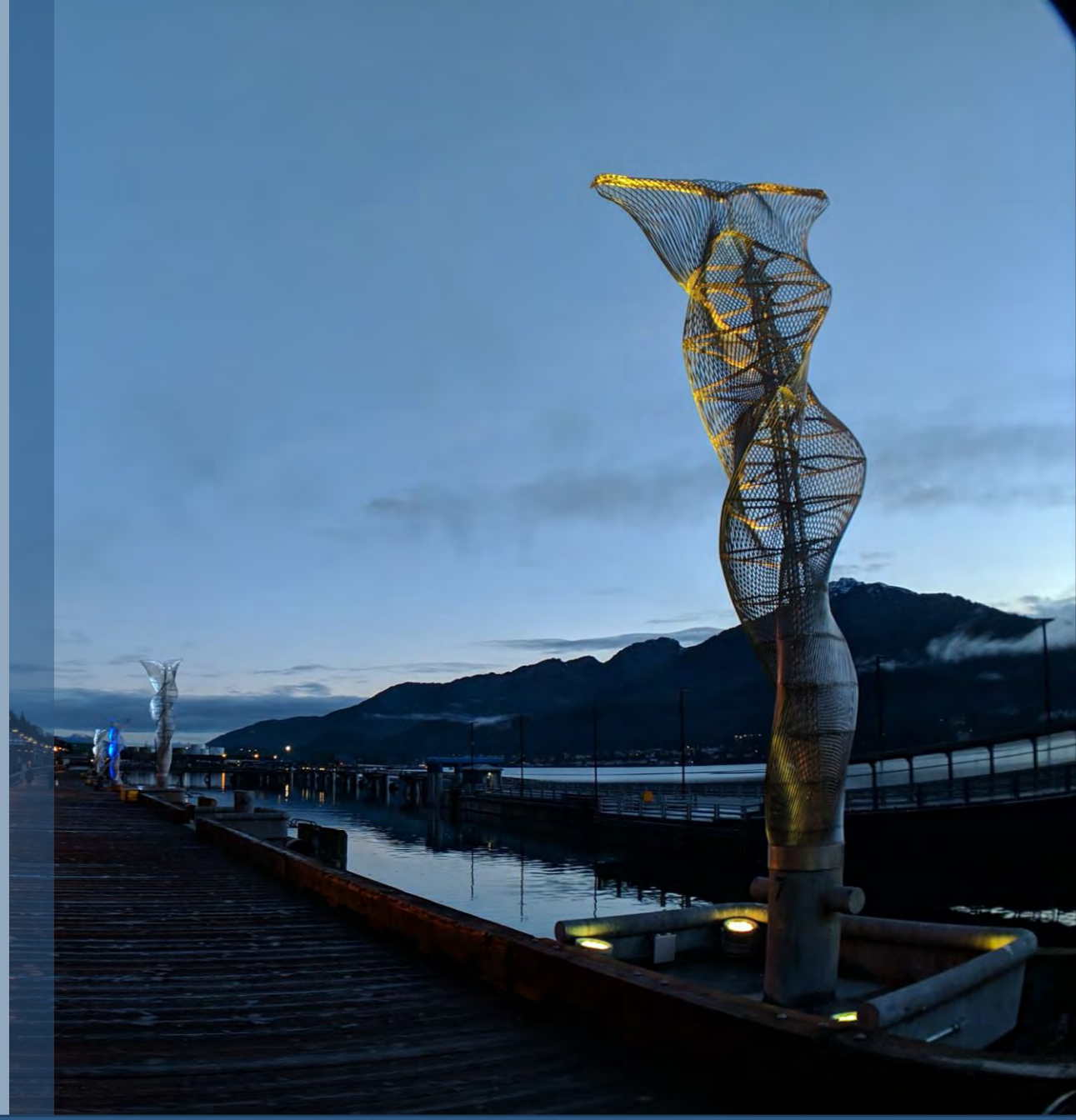
Note: This estimate assumes the South Berth Shore Power System is constructed prior to the North Berth Shore Power System.

Appendix D4 -4

October 2021

Cruise Ship Dock Electrification Study

Appendix D5: Background Supply and Demand Analysis



McKINLEY RESEARCH GROUP, LLC

Formerly McDowell Group

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AEL&P Sales Analysis

Firm Customer Overview

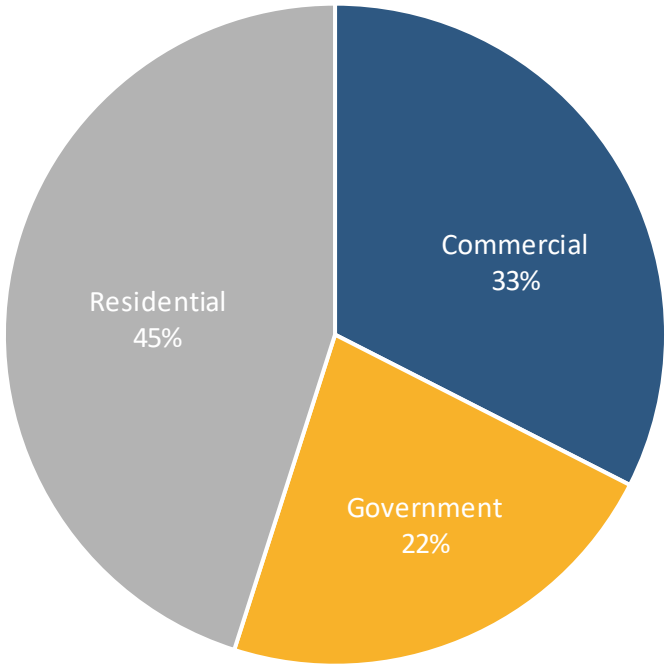
AEL&P Firm Customers and Electric Consumption (2019)

	Customer Count	Electric Consumption (MWhs)	Consumption per Cust (MWhs)
Commercial			
Small Commercial	1,632	39,690	24
Large Commercial	135	61,376	453
Snettisham Hatchery	1	1,899	1,899
Other	72	114	2
Total	1,840	103,079	56
Government			
Small Commercial	395	8,651	22
Large Commercial	89	61,544	695
Other	22	912	42
Total	506	71,107	141
Residential			
Non-Electric Hot Water/Heat*	6,686	48,590	7
Electric Hot Water*	3,626	38,548	11
Electric Heat*	4,337	54,711	13
Other	265	1,093	4
Total	14,914	142,943	10

*Residential Hot Water and Heat is self-reported

Source: AEL&P

AEL&P Firm Customer Electric Consumption by Customer Type (2019)



- Residential sales account for 45% of sales to firm customers
- Residential customers self-report whether they have electric hot water or heat, with those reporting purchasing significantly more electricity on average
- "Other" includes streetlights, EV charging, and residential heat pumps

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Firm Customer Sales

Firm Customer Sales ('000 MWhs)

	2011	2012	2013	2014	2015	2016	2017	2018	2019	Average
Commercial	106	107	109	110	111	110	113	112	103	109
Government	69	69	69	66	63	62	63	63	71	66
Residential	139	142	141	141	139	139	151	149	143	143
Total Firm	**314**	**318**	**319**	**317**	**314**	**311**	**326**	**324**	**317**	**318**

Firm Customers

	2011	2012	2013	2014	2015	2016	2017	2018	2019	Average
Commercial	1,658	1,668	1,700	1,751	1,791	1,805	1,839	1,869	1,840	1,769
Government	466	463	459	456	446	441	441	440	506	458
Residential	13,919	13,989	14,058	14,207	14,382	14,559	14,674	14,811	14,914	14,390
Total Firm	**16,043**	**16,120**	**16,217**	**16,414**	**16,620**	**16,805**	**16,953**	**17,120**	**17,259**	**16,617**

MWhs/Customer

	2011	2012	2013	2014	2015	2016	2017	2018	2019	Average
Commercial	64.0	64.0	64.0	62.7	62.1	60.9	61.5	60.1	56.0	61.7
Government	147.1	149.2	150.6	144.7	141.7	140.2	142.4	143.9	140.6	144.5
Residential	10.0	10.1	10.0	9.9	9.7	9.6	10.3	10.0	9.6	9.9
Average Firm	**19.6**	**19.7**	**19.7**	**19.3**	**18.9**	**18.5**	**19.3**	**18.9**	**18.4**	**19.1**

Source: AEL&P

- Electric sales to firm customers have averaged 318,000 MWhs per year over the last nine years
- The number of customers has increased each year, with an average annual growth rate of 0.9%
- MWHs per customer have generally decreased each year
  - Exception is 2017, which was a cold year
  - Sales per customer may be a function of both energy efficiency and generally warmer weather in later years
  - Relationship between HDDs and demand discussed in detail later
- Base demand for firm customers ranged between 317k-334k MWhs per year

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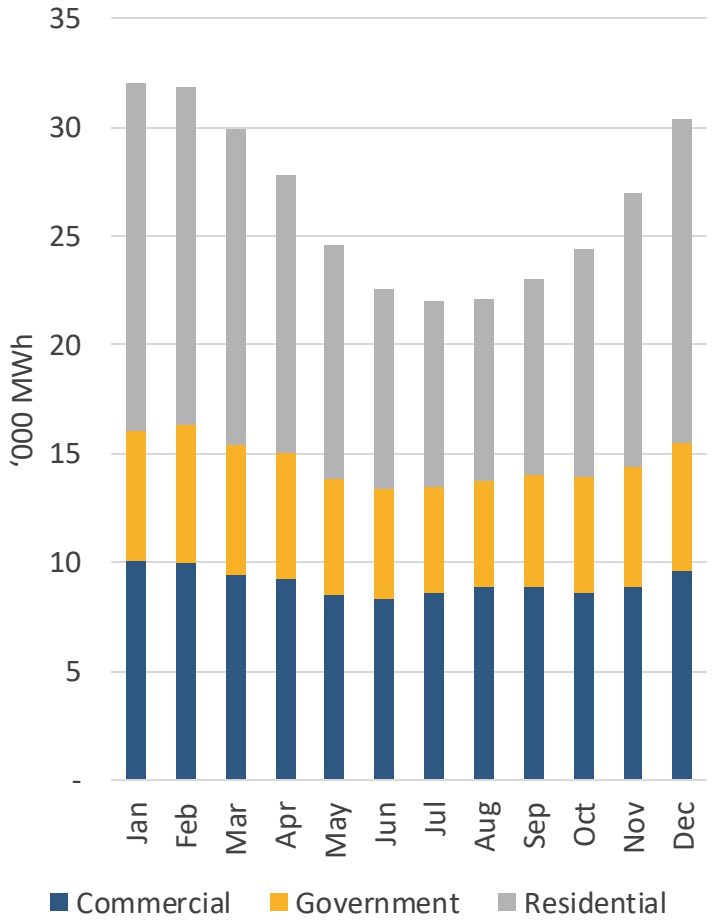
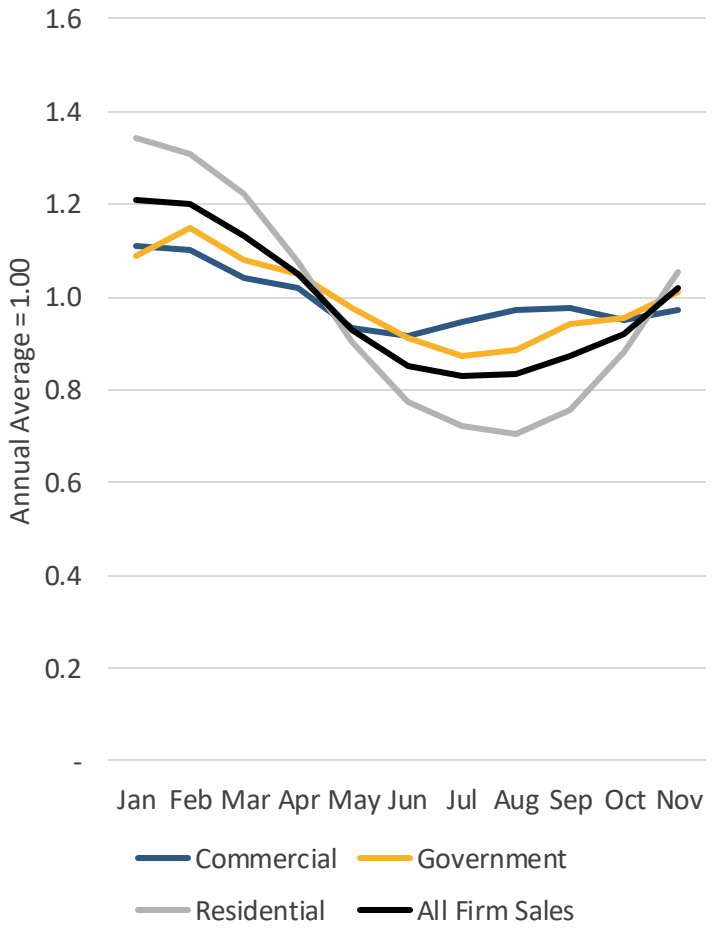
Firm Customer Seasonal Swing

Average Monthly Sales to Firm Customers by Type (2011-2019)





- Sales to firm customers are highly seasonal, with 46% higher sales in January than July.
- Each customer type has different seasonality:
  - Commercial: January is 17% higher than July
  - Government: 25%
  - Residential: 86%
- Residential sales account for 74% of the seasonal swing in sales to firm customers

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Source: AEL&P

Firm Customer Base Year Calculation

HDD vs Average Customer Sales (MWh/Customer)

	2011	2012	2013	2014	2015	2016	2017	2018	2019	Average
HDD	8,884	9,063	8,250	7,980	7,488	7,387	8,610	8,061	7,595	8,054
ComGov	82	82	82	80	78	76	77	76	74	79
Residential	10	10	10	10	10	10	10	10	10	10

High Demand (Cold Year)

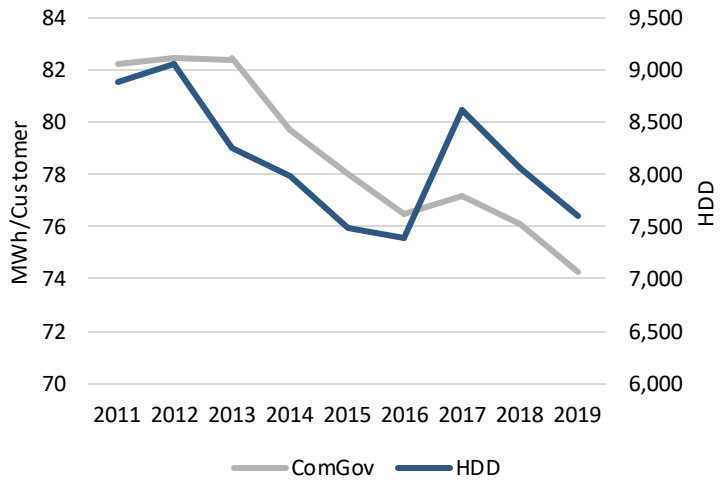
	Count	MWh/ Cust	Sales ('000 MWhs)
ComGov	2,345	74.3	174
Residential	14,914	10.3	153
Total	**17,259**	**19.0**	**327**

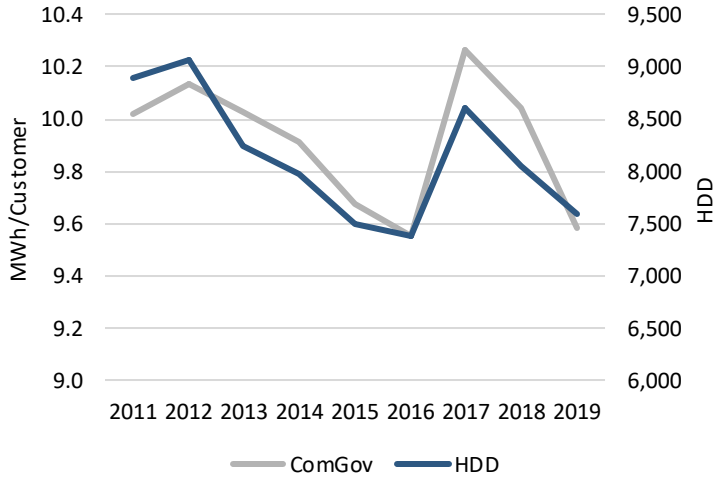
Low Demand (Warm Year)

	Count	MWh/ Cust	Sales ('000 MWhs)
ComGov	2,345	74.3	174
Residential	14,914	9.6	143
Total	**17,259**	**18.4**	**317**

Base Demand (Average Year)

	Count	MWh/ Cust	Sales ('000 MWhs)
ComGov	2,345	74.3	174
Residential	14,914	9.9	148
Total	**17,259**	**18.7**	**322**





- Commercial and Government customers are combined as:
  - They have similar sales patterns
  - About 40 customers switched from comm to gov in 2019
- ComGov sales per customer seem somewhat related to temperature (HDD) but shows persistent downward trend
- Residential sales per customer appear much more related to HDDs
- Base Year sales per customer:
  - ComGov: 2019 (74.3 MWh)
  - Residential
    - High: 2017 (10.3 MWh)
    - Low: 2019 (9.6 MWh)
    - Base: 2018 (10.0 MWh)
- 2019 customer counts are used
  - Expect steady growth in customers

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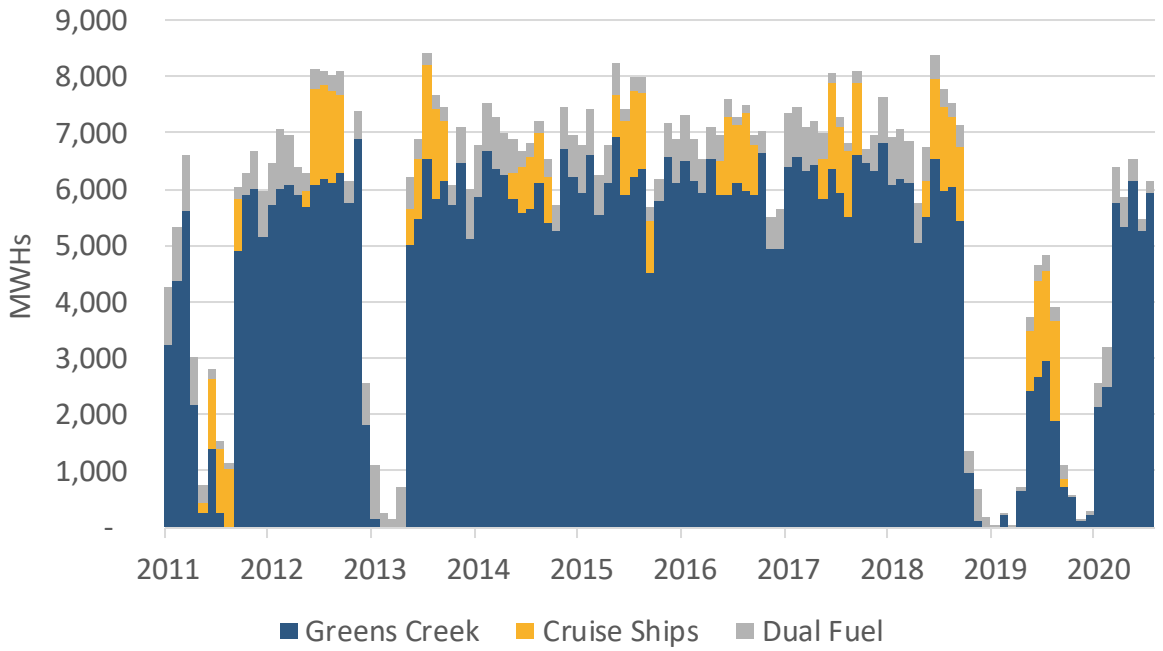
Source: AEL&P, NOAA, MRG Calcs

Interruptible Customer Overview

Interruptible Customer Sales ('000 MWhs)

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2011-2019 Ave.	2014-2017 Ave.	Peak
Greens Creek	39	69	46	72	73	71	76	54	12	57	73	76
Princess Cruises	4	7	6	4	6	5	6	6	6	6	5	7
Dual Fuel	7	6	6	7	6	6	6	6	1	6	6	7
Total Non-Firm	**50**	**82**	**58**	**83**	**85**	**82**	**88**	**66**	**20**	**68**	**84**	**89**



- AEL&P has two large interruptible customers and a few dozen interruptible dual fuel customers
  - Greens Creek Mine is the largest with a max annual demand of 76k MWhs
  - Princess Cruises purchases available power in the summer with a max annual demand of 7k MWhs
  - Dual fuel costumers with total max annual sales of 7k MWhs
- The amount of interruptible sales is dependent on the available hydropower
  - Interruptible sales were curtailed in 2011, 2013 and the fall of 2018 through the beginning of 2020.
  - The available hydropower is a function of seasonal rain and snow and the reservoir water levels
- In a typical year with no curtailments AEL&P sells about 84k MWh of power to interruptible customers

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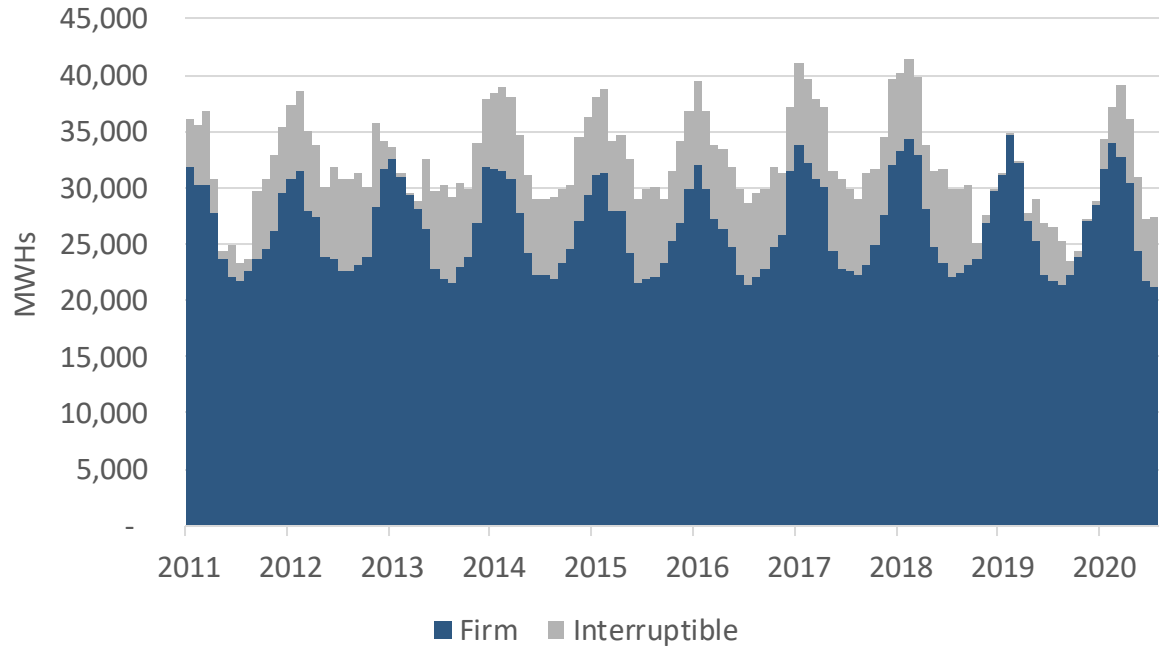
Source: AEL&P

Total Sales

Total Sales ('000 MWhs)

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2011-2019 Ave.	2014-2017 Ave.	Peak
Firm	314	318	319	317	314	311	326	324	317	318	317	326
Non-Firm	50	82	58	83	85	82	88	66	20	68	84	88
Total	**364**	**399**	**377**	**399**	**398**	**393**	**414**	**391**	**337**	**386**	**401**	**414**



- Total sales averaged 386k MWhs from 2011-2019
  - Peak of 414k MWh in 2017
  - Low of 337k MWh in 2019

Source: AEL&P

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Cost Analysis

AEL&P Costs

Rate Base

	$thousands	notes
Plant in Place	$225,959	Does not include Snettisham
Accum Depreciation	-93,428	
Other	7,500	
Deferred Taxes	-17,003	
Rate Base	**$123,029**	

Income Requirement

	$thousands	notes
Rate Base	$123,029	
Return on Equity	7%	58.18% equity at 11.95% ROE
Cost of Debt	2%	41.82% debt at 4.67% cost of debt
Equity Allowance	8,554	
Debt Allowance	2,403	
Income Requirement	**$10,956**	

Income Taxes

	$thousands	notes
State Rate	9%	Adjusted for income under $200k
Federal Rate	21%	
Pre-Tax Income	$11,951	
Post-Tax Income	8,563	
State Tax	1,114	
Federal Tax	2,274	
Total Income Tax	**$3,387**	

Operation and Maintenance

	$thousands	notes
Electric Power Purchase	$10,367	Snettisham
Hydraulic	1,930	
Internal Combustion	607	
Transmission	473	
Distribution	2,778	
Customer	1,132	
A&G	4,480	
Total	**$21,768**	

Revenue Requirement

	$thousands	notes
Snettisham Power Purchase	$10,367	
Other O&M	11,401	
Depreciation	5,478	plant in place is 41 times larger
Other Taxes	1,061	mostly property taxes
Income Tax	3,387	
Income Requirment	10,956	
Revenue Requirment	**$42,651**	

$42.65 million Revenue Requirement is the amount the RCA allows AEL&P to earn each year on its firm and interruptible sales.

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Source: AEL&P Rate Cases

AEL&P Cost of Power – No Interruptible Sales

Revenue Requirement

	$thousands
Snettisham Power Purchase	10,367
Other O&M	11,401
Depreciation	5,478
Other Taxes	1,061
Income Tax	3,387
Income Requirement	10,956
Revenue Requirement	**42,651**

Base Demand (Average Year)

	Count	MWh/ Cust	Sales ('000 MWhs)
ComGov	2,345	74.3	174
Residential	14,914	9.9	148
Total	**17,259**	**18.7**	**322**

Firm Rates - No Interruptible Sales

Revenue Requirement	42,651	$thousands
Firm Sales	322	'000 MWh
Average Rate	**0.132**	**$/kWh**

Source: AEL&P, AEL&P Rate Cases, McKinley Research Group Calculations

- The average AEL&P cost of power with no interruptible sales is about $0.13 per kWh
  - Calculated by dividing the total annual revenue requirement by the firm power sold in an average year
- The average cost of power is not a "rate"
  - It does not consider:
    - Different rate classes
    - Customer or demand charges
    - Peak vs. non-peak sales
    - Any diesel generation needed
- AEL&P has a complex rate structure tailored for different customers and seasons
- AEL&P also credits interruptible sales in its base rates to firm customers
- The average cost is an effective metric for comparing different scenarios while avoiding the complexities of rates and how much different customers would pay

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AEL&P Cost of Power – With Interruptible Sales

Interruptible Sales

	Sales ('000 MWh)	Rate ($/kWh)	Revenue ($thousands)
Greens Creek	73	0.118	8,628
Princess Cruises	5	0.118	621
Dual Fuel	6	0.055	349
Total/Weighted Average	**84**	**0.114**	**9,598**

Firm Rates - Full Interruptible Sales

		notes
Revenue Requirement	42,651	$thousands
Firm Sales	322	000 MWh
Interruptible Rate	0.114	weighted average interruptible rate
Interruptible Sales	84	000 MWh, assumes no curtailments
Interruptible Revenue	9,598	$thousands
New Revenue Requirement	33,053	Revenue Requirement minus Interruptible Revenue
Average Rate	**0.103**	**$/kWh**

- AEL&P credits all revenue from interruptible sales back to firm customers
  - A portion of the Greens Creek revenue are accounted for in the base rates
  - Any additional interruptible revenue is accounted for in the Cost of Power Adjustment (COPA)
  - If Greens Creek revenue is lower than expected, the COPA is increased to adjust
- In a typical year with no curtailments, AEL&P can sell 84k MWh of interruptible power
- Rates are set by RCA approved contracts
  - Both Greens Creek and Princess Cruises pay $0.118 per kWh
  - Dual Fuel customers pay $0.055 per kWh
- AEL&P can generate almost $10 million per year from interruptible sales
- This can reduce the average power cost to firm customers by almost $0.03 per kWh, a 23% reduction

Source: AEL&P, AEL&P Rate Cases, McKinley Research Group Calculations

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AEL&P Generation Analysis

Generation Capacity

AEL&P Hydro Capacity by Total Capacity and Production Capacity

	Capacity (MW)	Production Capacity ('000 MWhs)		
		Firm	Average	Wet
Snettisham	78.2	245	295	355
Lake Dorothy	14.3	63	75	90
Annex Creek	3.6	22	24	28
Salmon Creek	5.0	23	31	38
Gold Creek Hydro	1.6	4	5	7
Total	**102.7**	**357.0**	**430.0**	**518.0**

- AEL&P has sufficient hydro capacity to serve its full firm customer load with no need to run diesels
  - Firm production is 357k MWhs
  - Peak firm sales were 326k MWhs in 2017
- The more it rains and snows in the area, the more water is in AEL&P reservoirs and it can produce more electricity
- On average or wet years, AEL&P has excess production capacity to serve interruptible customers

AEL&P Diesel Capacity

	Capacity (MW)
Gold Creek Diesel	7.0
Lemon Creek	51.8
Auke Bay	25.2
Industrial	23.5
Total	**107.5**

- AEL&P has enough diesel generation capacity to power all firm customer demand
- Diesel generation is very expensive and is only used when insufficient hydro is available
- AEL&P manages its sales to interruptible customers to reserve sufficient water inventory to meet firm demand.

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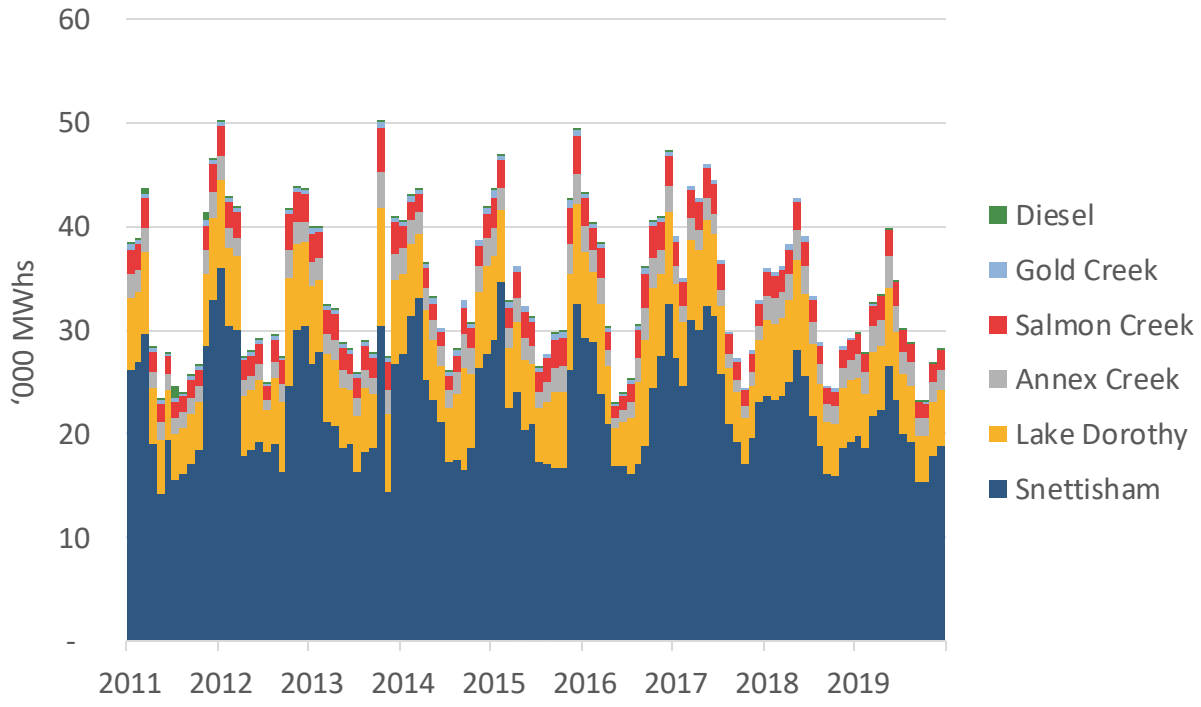
Source: AEL&P

AEL&P Generation

AEL&P Generation ('000 MWh)

	2011	2012	2013	2014	2015	2016	2017	2018	Average
Snettisham	264	290	259	286	278	273	302	260	276
Lake Dorothy	71	84	83	84	85	87	77	82	82
Annex Creek	22	22	25	27	27	26	19	27	24
Salmon Creek	24	28	30	22	31	28	27	24	27
Gold Creek	5	4	5	6	6	5	5	4	5
Total	**386**	**429**	**401**	**424**	**428**	**419**	**431**	**397**	**414**



- From 2011 to 2019, AEL&P generated an average of 408k MWhs
- 99.8% came from hydro
  - Snettisham produces about 72% of AEL&P's power
  - Lake Dorothy came online in 2009 and produces about 21%

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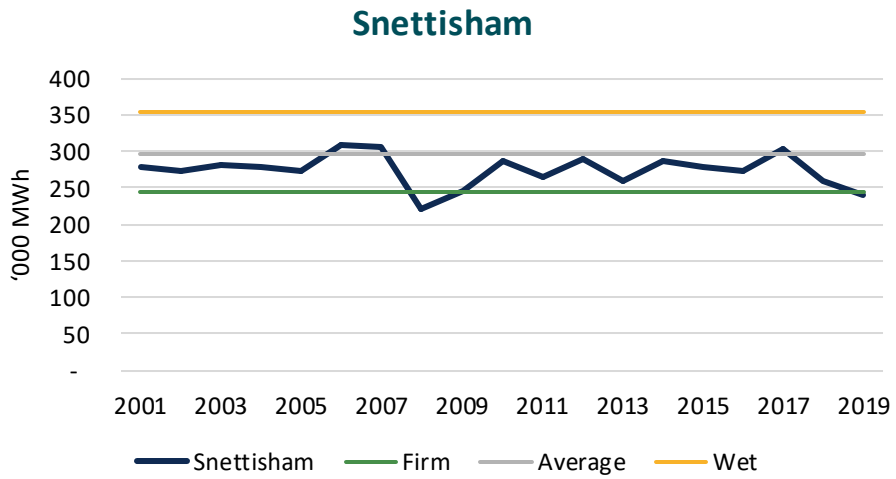
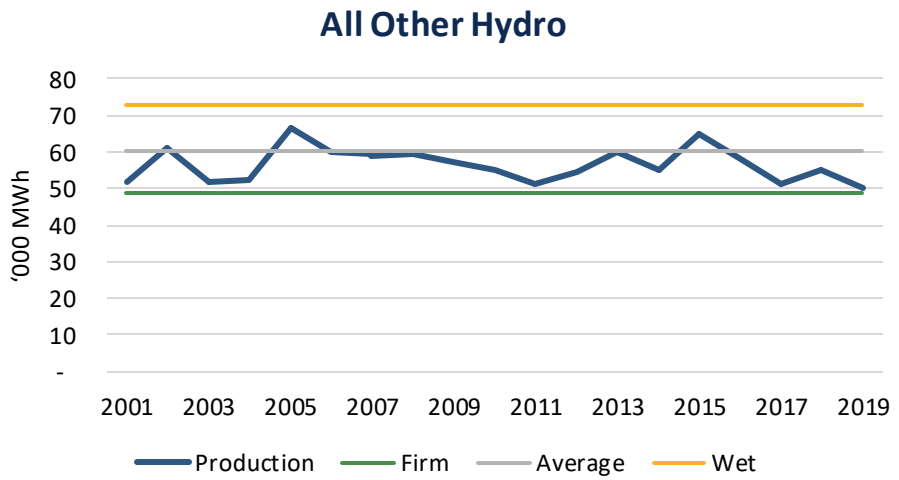
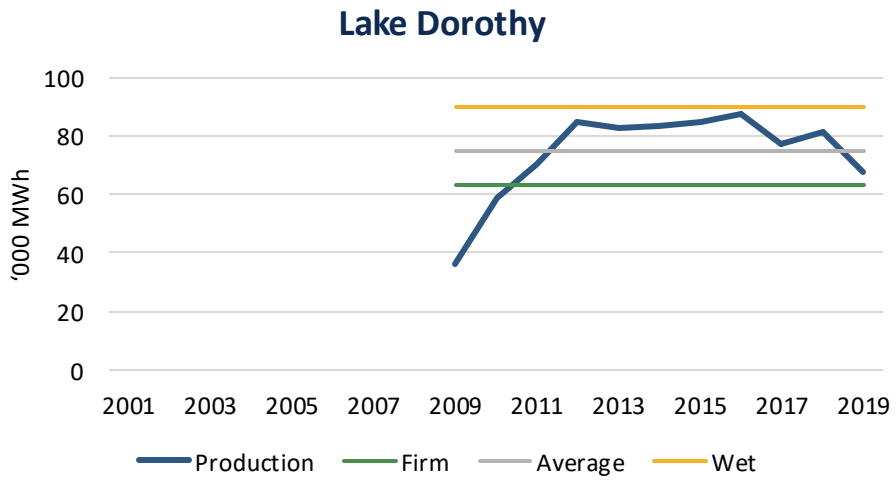
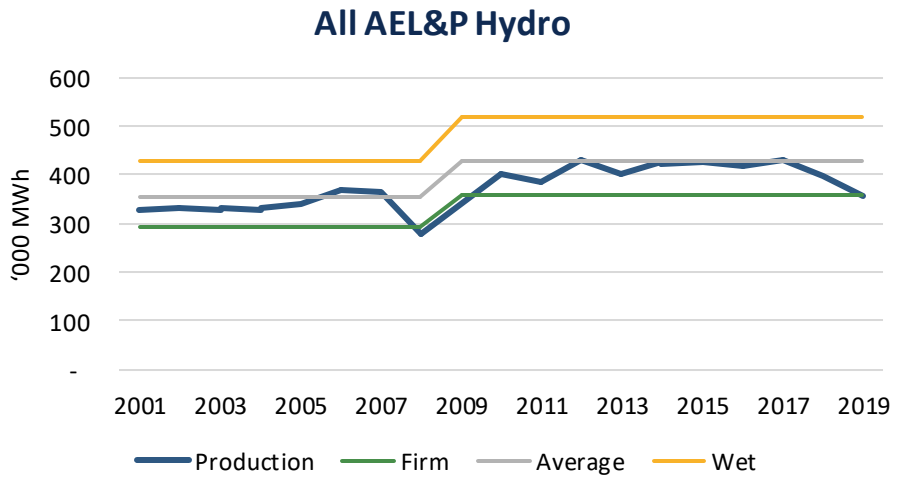
Source: AEL&P, EIA

Generation vs Capacity



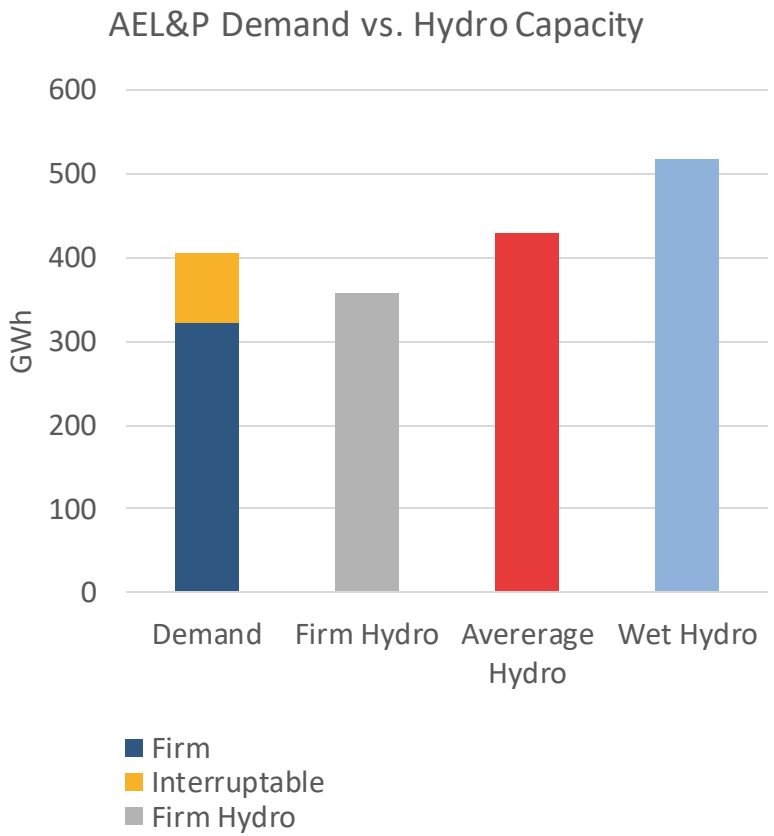






DRAFT *Source: AEL&P, EIA*

Generation Capacity and Demand



- AEL&P's firm hydro capacity exceeds its firm customer demand
  - Firm hydro capacity is 357 GWh/yr
  - Base firm demand is 322 GWh with a cold year peak of 326 GWh
  - Ensures that AEL&P will not need to run diesels to meet firm demand in dry years
- AEL&P's average hydro exceeds its firm and interruptible demand
  - Average hydro capacity is 430 GWh/yr
  - Base firm and interruptible demand is 406 GWh/yr
  - Peak firm and interruptible demand is 414 GWh/yr
- In 2019, AEL&P reported about 20 GWh of power consumed by itself without charge and energy losses
  - When netted out of hydro capacity:
    - Firm hydro capacity is about equal to peak firm demand
    - Average hydro capacity is about equal to peak firm and interruptible demand

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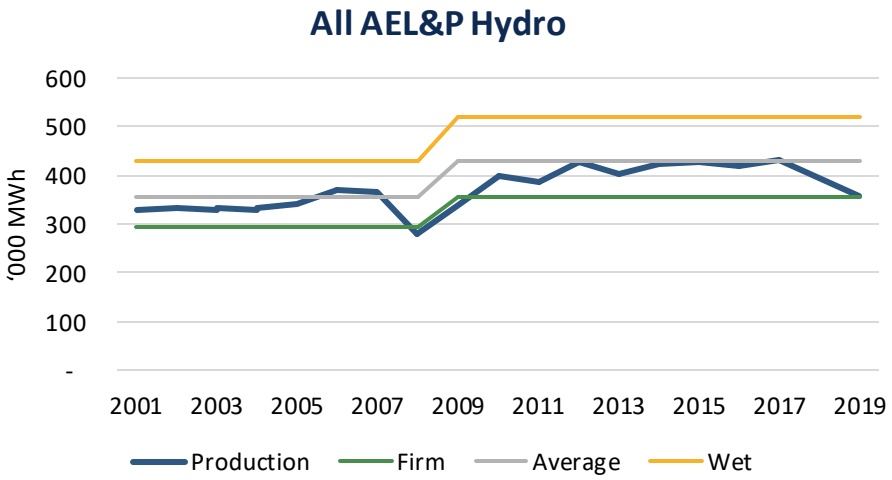
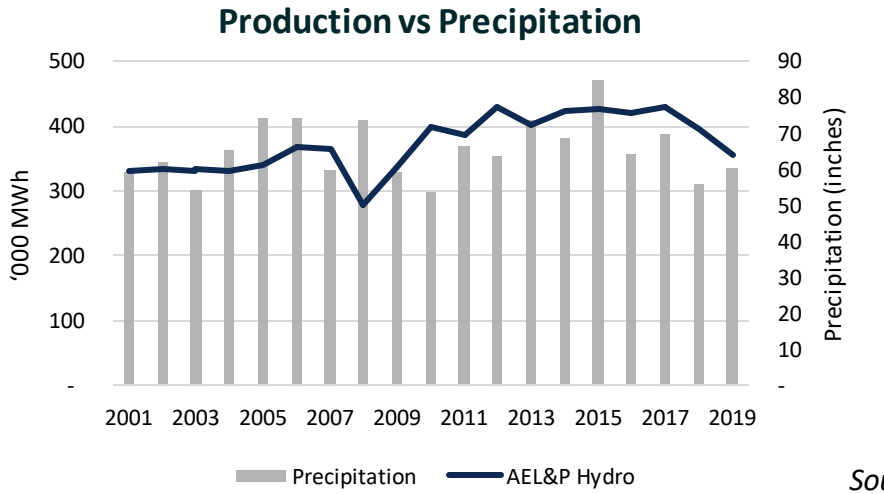
Generation and Precipitation





- AEL&P hydro generation has generally been between the Firm and Average production capacities reported by AEL&P
  - In 2008 the transmission line to Snettisham was taken out by an avalanche for six weeks
  - Lake Dorothy did not produce at full capacity until 2011 after coming into operation in 2009
- No years have significantly exceeded the average production
  - Most years were serving the full interruptible load
  - Uncertain if AEL&P had the production capacity (water) to serve additional load if it was there
- If AEL&P had additional water in excess of what was needed to supply its full firm and interruptible customers then the water would be "spilled"
  - This water could be used to provide power to additional interruptible customers
  - The "Wet" production capacity indicates that water is often spilled
  - No public data exists on the amount of water spilled

Source: AEL&P, EIA, NOAA

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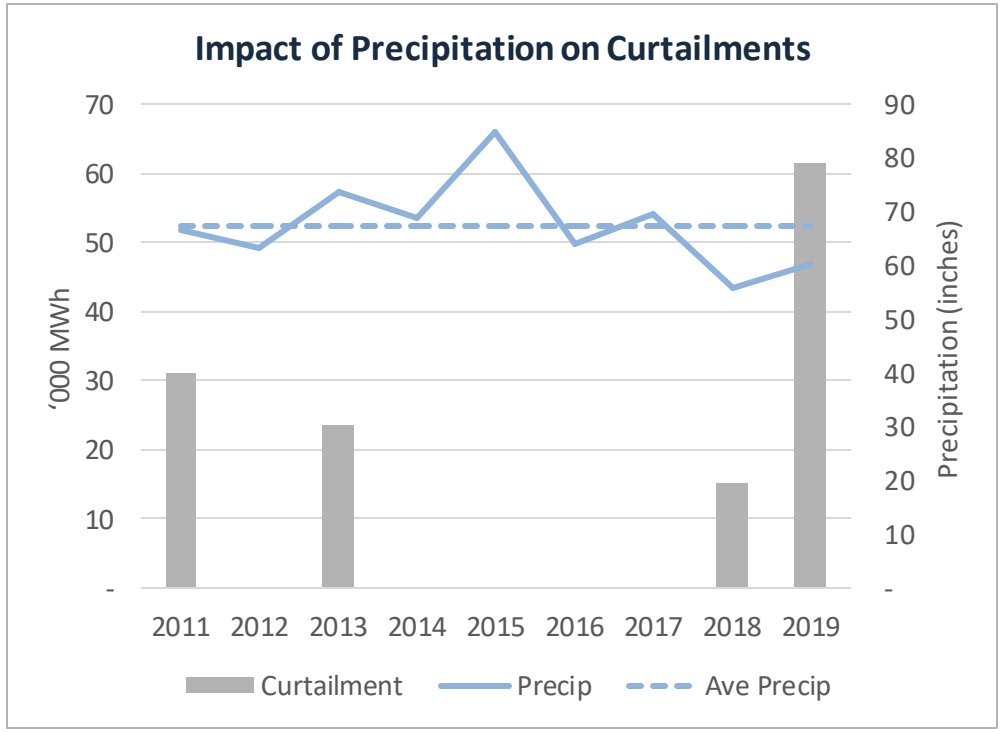
CURTAILMENTS

Total Sales, Curtailments, and Estimated Spills (GWhs)

	2011	2012	2013	2014	2015	2016	2017	2018	2019	Average
Total Hydro Generation	386	429	401	424	428	419	431	397	357	408
Firm	314	318	319	317	314	311	326	324	317	318
Interruptible	50	82	58	83	85	82	88	66	20	68
Curtailment	31	-	23	-	-	-	-	15	61	15



- In the last nine years:
  - Full capacity 5 years
  - Curtailment 4 years
  - Implies that there was four years of excess power and one “average year”

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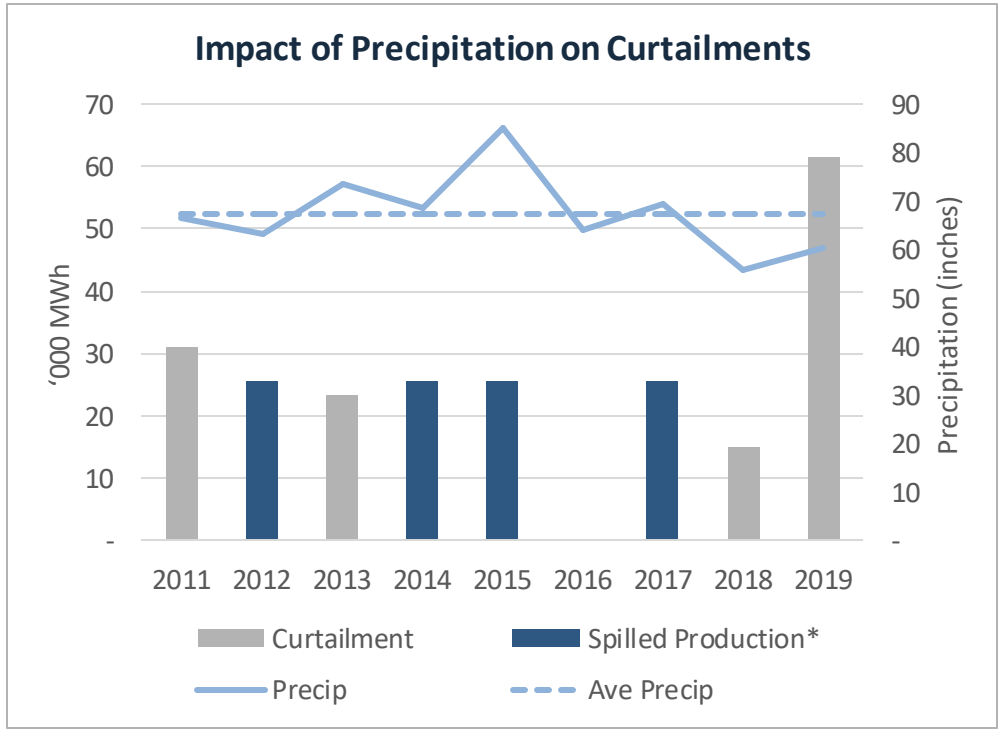
Source: AEL&P, EIA, NOAA, McKinley Research Group Estimates

Curtailments and Estimated Spilled Water Estimate

Total Sales, Curtailments, and Estimated Spills (GWhs)

	2011	2012	2013	2014	2015	2016	2017	2018	2019	Average
Total Hydro Generation	386	429	401	424	428	419	431	397	357	408
Firm	314	318	319	317	314	311	326	324	317	318
Interruptable	50	82	58	83	85	82	88	66	20	68
Curtailment	31	-	23	-	-	-	-	15	61	15
Spilled Production*	-	33	-	33	33	-	33	-	-	15



- **Spilled Production is estimated: No data is available to support. Estimate is based on precipitation, curtailments, and AEL&P Hydro Capacity**
- The average seems to equal the peak load for firm and interruptible customers
  - **Assumption**: there are an equal number of years with high precipitation and water spilling as there are years with low precipitation and curtailments
- Spilled water estimate:
  - Four years of spill (equal to years of curtailment)
  - Average spill volume equals average curtailment volume
- With AEL&P's current hydro capacity, this analysis indicates that there would have been sufficient power to provide CBJ at least 6 GWh in four of the last nine years

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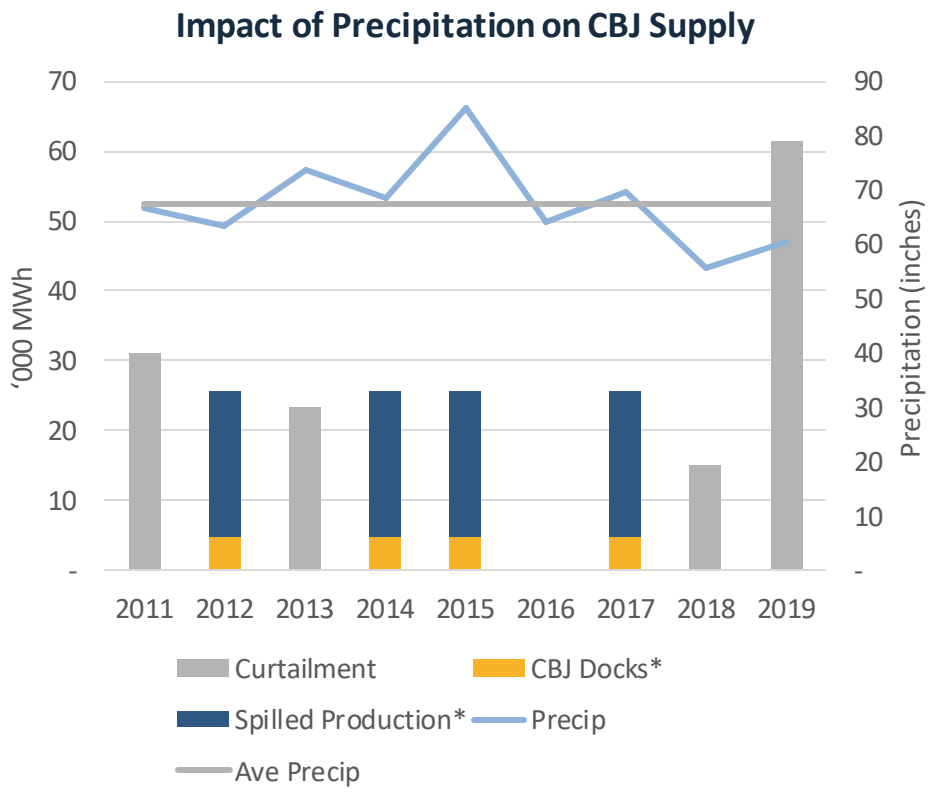
Source: AEL&P, EIA, NOAA, McKinley Research Group Estimates

CBJ Power Supply



Sales: CBJ Docks Electrified (GWh)

	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	Ave
AEL&P Firm	314	318	319	317	314	311	326	324	317	318
Greens Creek	39	69	46	72	73	71	76	54	12	57
Princess	4	7	6	4	6	5	6	6	6	6
Dual Fuel	7	6	6	7	6	6	6	6	1	6
CBJ Docks	-	6	-	6	6	-	6	-	-	3
Total	**364**	**405**	**377**	**405**	**404**	**393**	**420**	**391**	**337**	**389**

- AEL&P is assumed to be spilling water on the years when there is enough precipitation to exceed the "average hydro" capacity
  - Based on earlier analysis, it is assumed that this occurred in 4 or the last 9 years
  - Also assumed that enough energy is spilled to power CBJ docs full 6 GWh demand on those years
- Analysis assumes that if CBJ docks is electrified with no new hydro, it could sell dock power four out of every nine years

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