RFI BSEE 1
Pebble Project EIS

Request for Information

Title/Subject:	**Cook Inlet Natural Gas Pipeline: Installation Methodology**
Requestor:	**BSEE**
Date Transmitted:	**12/06/2019**
Recipient:	**Pebble Limited Partnership**
Response Requested by:	Click here to enter text.
Rationale:	BSEE needs information on how the buried sections of the subsea portion of the natural gas pipeline in Cook Inlet will be installed. BSEE specifically needs to know the dredging technology that will be used (e.g., clam shell dredge; suction dredge; jetting) to analyze the impact of authorizing a natural gas pipeline right-of-way. Additionally, BSEE needs explanation for the proposed 11.2 miles of subsea pipeline in Cook Inlet that will not be buried.
Describe the Information Requested and Level of Detail:	We request the following: description of the dredging technology for installing the pipeline and all equipment (e.g., vessels, dredge equipment) necessary to accomplish burying the natural gas pipeline, as well as a rationale for the unburied portion of the pipeline.

Recipient Response Form

Date Received from USACE:	Click here to enter text.
Response from Recipient (Describe Information Requested to the Level of Detail Requested; Provide Attachments as Needed):	Please see attached memorandum from Intecsea.
List Number and Type of Response Attachments:	408005-00888-SU-MEM-00008 BSEE RFI1 Dredging Technology.pdf
Date Returned to USACE:	Click here to enter text.

AECOM Intake Form

Date Response was Received:	Click here to enter text.
Received by (Name):	Click here to enter text.
Describe any Follow-up Related to this RFI (Communications, Clarifications):	Click here to enter text.

MEMORANDUM

DATE	December 13, 2019
TO	Tanya Yang, Stephen Hodgson, James Fueg
FROM	Jonathan Caines, Joost vanHeuveln
COPY	Mike Paulin
PROJECT	Pebble Partnership – Marine Pipeline
SUBJECT	BSEE RFI Response – Installation Methodology (RFI 1)
DOC NO	408005-00888-SU-MEM-00008

INTRODUCTION

Pebble Limited Partnership (Pebble) intends to install an NPS12 x 0.812in wall thickness, ~167 km long, marine pipeline across the southern Cook Inlet as part of their overall Pebble Mine Project; see Figure 1 below. Because the submarine portion of the pipeline crosses the OCS, it will require a Right of Way (ROW) from the Bureau of Safety and Environmental Enforcement (BSEE).

OBJECTIVE

The purpose of this memorandum is to provide responses to a Request for Information that Pebble has received from BSEE, as summarized below.

RFI BSEE NO. 1

Rationale

BSEE needs information on how the buried sections of the subsea portion of the natural gas pipeline in Cook Inlet will be installed. BSEE specifically needs to know the dredging technology that will be used (e.g., clam shell dredge; suction dredge; jetting) to analyze the impact of authorizing a natural gas pipeline right-of-way. Additionally, BSEE needs explanation for the proposed 11.2 miles of subsea pipeline in Cook Inlet that will not be buried.

Information Requested and Level of Detail

We [BSEE] *request the following: description of the dredging technology for installing the pipeline and all equipment (e.g., vessels, dredge equipment) necessary to accomplish burying the natural gas pipeline, as well as a rationale for the unburied portion of the pipeline.*

MEMORANDUM

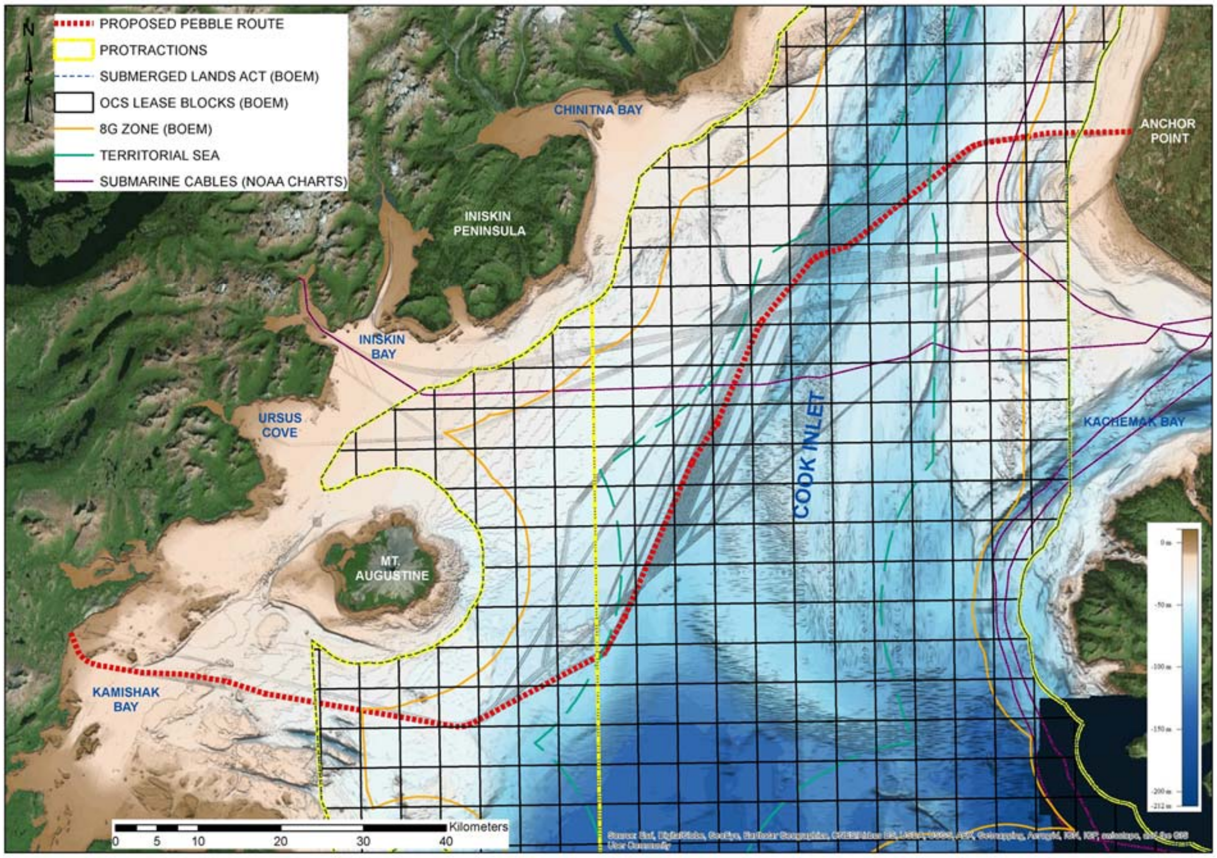

Figure 1 – Pebble Marine Pipeline Route

Response – Proposed Dredging Technology

Using the proposed pipeline cover depths for the Amakdedori Port Route (APR) pipeline (Table 1, per Ref. [1]) and general soil types encountered along the route [Ref. 2], suitable dredging methods are recommended in Table 1, where green shading indicates the method is suitable and red shading denotes unsuitable and/or technology limitations due to the water depth, trench depth and/or soil type(s) anticipated.

Table 1 Suitable Dredging Technology for APR

KP Range		Avg. Water Depth (m)	Min. Cover Depth (m)	Total Trench Depth (m)	General Soil Type (Sand)	Relative Density (%)	Clamshell Dredge	Mechanical Trencher*	Jet Trencher*
0	1	6.9	1	1.3048	Medium to Coarse	50			

MEMORANDUM

KP Range		Avg. Water Depth (m)	Min. Cover Depth (m)	Total Trench Depth (m)	General Soil Type (Sand)	Relative Density (%)	Clamshell Dredge	Mechanical Trencher*	Jet Trencher*
1	6	19.3	0.5	0.8048	Dense	50			
6	14.5	33	0.5	0.8048	Dense	55			
14.5	22	41.8	0.5	0.8048	Dense	55	Water depth may limit the use of clamshell dredgers		
22	27.5	60	0.5	0.8048	Dense	50			
27.5	35.5	75.5	0.5	0.8048	Dense	50			
35.5	46.5	76.1	0.25	0.5548	Medium	45			
46.5	77.5	58.1	0.25	0.5548	Dense	45			
77.5	98	67.9	0	0.3048	Dense	60			
98	116	60	N/R	N/R	Dense	55			
116	127.5	38.9	0	0.3048	Dense	55			
127.5	147.5	32.1	0	0.3048	Medium	50			
147.5	154	21.4	0	0.3048	Dense	40			
154	156	19.1	0	0.3048	Dense	40			
156	158	18.7	0	0.3048	Dense	45			
158	161.68	12.6	0	0.3048	Dense	45			
161.68	166.27	7.5	1	1.3048	Coarse with Gravel	65			Gravel may limit the use of jet trenching
166.27	166.97	2.6	1.22	1.5248	Coarse with Gravel	65			

***** Jones Act compliance to be assured from US flagged asset, if required.

The pipeline trenching and burial technology available on the market can either be conventional excavation equipment / clamshell dredger for the shallow water sections (typically up to 30m MLLW), or a mechanical or jet trencher in deeper water areas (examples detailed below). Traditional cut and fill excavation using hydraulic extended-reach backhoes could be used for non-HDD shore crossings. Equipment selection, detailed trench design, and trench production planning will be defined during design considering the installation and trenching philosophy (whether pre-lay or post-lay trenching) which will influence the solution selected.

A high-level overview of clamshell dredging, mechanical dredging, and jet trenching is provided below along with samples of potentially suitable equipment.

Ploughs can also be used to lower a pipeline into a trench. This is usually accomplished post-lay, but they can be used for pre-lay trenching as well. Ploughs are usually preferred when the pipeline route is long, due to their relatively quick advance rate. The primary determining factors for plough design, and ultimately its size, are the type of soil and the desired trench depth. This, in turn, affects the force required to pull the plough. The plough is advanced over the seabed by pulling with a large tug or a derrick barge. .Historically, ploughs have achieved a trench bottom depth on the order of 1.5 to 1.8m with an average ploughing speed on the order of 200m/hour, depending on route and soil conditions. Pipeline trenching ploughs tend to be quite large; approximately 90 to 270 tonnes dry weight and 9 to 27m (30 to 89ft) in length. Several ploughs have been fabricated for previous pipeline projects and these may be available for use on the project; however, further work is needed during design to confirm which ploughs, are available and might be suitable for use in lower Cook Inlet. Due to the unknown potential for the use of ploughs, they are not assumed to be a primary option and have not been included in the Table 1 evaluation above. If ploughing can be utilized, the shore approaches would still need to be excavated using other means, such as conventional long-reach backhoe excavation or use of a clamshell dredge.

Ploughing would require a marine support vessel capable of supplying the large pull loads to move the plough along the pipeline route. Also critical is having a large crane or A-frame capable of deploying and recovering the plough. If used for post-lay trenching, these operations would be carefully controlled to avoid damaging the pipe.

Shallow Water (Approximately <30m [100ft]) – Clamshell Dredging / Conventional Excavation

Hydraulic backhoes, clamshell bucket dredges or similar methods will be used to excavate the pipeline trench in shallow waters. In summer, the equipment would be operated from a flat-deck barge, which could maneuver by winching itself forwards and using spuds to remain on location while digging.

Conventional excavation is a proven method. The reach of an extended or long-reach backhoe is limited (practically) to a combined water and trench depth of approximately 15m (50ft).

An example extended reach backhoe is shown in Figure 2 (https://piercepacific.com/products/long-reach-booms/) and an example clamshell dredger that could be used is shown in Figure 3 and Figure 4, from Manson Construction; see https://www.mansonconstruction.com/.

Figure 2 Example Extended Reach Backhoe (Courtesy of https://piercepacific.com/products/long-reach-booms/)

Figure 3 Sample Clamshell Dredging Equipment (Courtesy of https://www.mansonconstruction.com/)

Figure 4 Sample Clamshell Dredging Equipment (Courtesy of https://www.mansonconstruction.com/)

Deep Water (Approximately >30m [100ft])

For the deeper water sections, the intention would be to utilize a mechanical trencher or jet trencher. Depending on the selected trencher model (dimension and weight), this equipment is also able to operate in shallow water.

The trenching machines are normally deployed using a crane or an A-frame mounted on a DP2 construction vessel (dynamically positioned, with redundancy).

Mechanical Trenching

Mechanical trenching is commonly used for burying cables and umbilicals, and has been used on pipeline trenching projects. Typically, this method is used in open water conditions and supported by a large marine vessel capable of supporting the required lifting infrastructure. There are two main types of mechanical trenchers; barge-mounted chain cutters, and tracked, crawler style trenchers.

Barge-mounted mechanical trenchers can be used in water depths less than 100m (330ft). They often feature high volume jetting capability for the removal of overburden and a large chain cutter for stiff soils or rock (as combined mechanical trenching and jetting). The crawler style trenchers are capable of operating in all the required water depths for the pipeline route and may use high pressure jetting as well as chain cutting. The power requirements make these trenchers large and they may require buoyancy tanks to facilitate the handling of the machine and reduce surface pressures and impacts. These trenchers require a large marine vessel which must have a large A-frame to launch and recover the trencher.

Mechanical trenching to achieve a trench depth of 3m (10ft) is well within the capability of present equipment.

Example of such equipment would be Canyon Offshore mechanical trenching equipment, such as e.g. the i-trencher which can post-lay trench and bury a pipeline up to 2m (6.5ft) below seabed in one pass (Figure 5; see https://www.helixesg.com/what-we-do/seabed-clearance/).

Figure 5 Example Mechanical Trenching Machine (Courtesy of https://www.helixesg.com/downloads/iTrencher_-_07-17-2018_-_LTR_-_FINAL-email.pdf)

Jetting:

This method involves either pulling a jet sled along the top of a pipeline after it has been installed or flying a jetting ROV along the specified route before or after laying the pipe. Jet sleds and ROV jetting systems are more generically described as jetters. High pressure water jets liquefy the soil and air lift or eductor pumps remove it from under the pipeline. In the case of post-lay jetting, the pipeline lowers itself to the bottom of the trench as the jet sled advances. Multi-pass techniques may be required, depending on the design trench depth.

Jetting would only work in certain soil types and would be ineffective against large boulders and bedrock. As a supplement to other trenching techniques, localized jetting may be carried out to fluidize the trench bottom in order to lower a pipe that is spanning between local trench floor high points following pipeline installation. The spoils are in a fluidized form and if they must be returned to the trench to meet design backfill requirements, soil may need to be barged in to backfill the pipeline trench. The shore approaches would need to be excavated using other means as jetters suffer from cavitation and overheating in water depths less than 5m.

Enshore Subsea's jet trenching equipment, such as e.g. the T2 jet trenching vehicle is an example of representative jetter technology that may be suitable for the project; see Figure 6 (courtesy of http://www.enshoresubsea.com/http://www.enshoresubsea.com/).

Figure 6 Example Jet Trenching Machine (Courtesy of https://enshoresubsea.com/asset/t2-mechanical-cutter)

The jetting equipment is suitable for sand, but would not be efficient for trenching in areas of gravel. In these sections a mechanical trencher or clamshell dredge would have to be used.

Response – 11.2 mile segment that will not be buried

Based on analyses performed to date, an approximate 11.2 mile segment of the pipeline route between KP 98 and 116 (18 km or ~11.2mi) will not require trenching and burial to maintain on-bottom stability, address pipeline free spanning, mitigate geohazards, or to provide protection against 3rd party risks. The average water depth in this KP range is 60m, with a range of 47.4m to 67.5m.

The heavy wall design of the NPS12 x 0.812in wall thickness pipeline was predicted to be stable on the seabed based on the preliminary on-bottom stability analysis using AGA PRCI Level 2 methods and does not require lowering for mitigation of spanning or to mitigate known geohazards.

MEMORANDUM

A preliminary assessment of 3rd party risks to the APR pipeline system evaluated the predominant hazards to a marine pipeline installed in areas of marine activity (e.g., fishing interaction, shipping interaction, anchoring, dropped objects, ship grounding, and ship sinking). This assessment found that protection against 3rd party risk is not required for the KP 98 to 116 range; see Ref. [1].

Per 49 CFR 192.327(f)(2), "Pipe under water at least 12 feet (3.66 meters) deep must be installed so that the top of the pipe is below the natural bottom, unless the pipe is supported by stanchions, held in place by anchors or heavy concrete coating, or protected by an equivalent means." This guidance is interpreted to require cover to top of pipe to provide protection against unacceptable movement. Since the heavy wall pipe design is currently predicted to be stable on the seabed and not require protection against any 3rd party risks (known at this time) in the KP 98 to 116 range, burial cover is not required since the equivalent means of protection against instability is provided via the heavy wall pipe design.

Therefore a decision was made to place the pipe on the surface to further minimize localized impacts associated with trenching and burial of the pipeline.

REFERENCES

1. Intecsea, "Pebble Partnership – Marine Pipeline, Cook Inlet Pipeline Design Precautions", Doc. No. 408005-00888-SU-MEM-00005, 14-Aug-2019.

2. Intecsea, 2019. "Pebble Limited Partnership – Shallow Hazards Survey and Evaluation of Amakdedori Port Route (APR)", Document No. PEBL-2348-GE-REP-0003, Rev. 0, 20-Aug-2019.