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June 9, 2020

Mr. Peter Campbell, Project Manager
Alaska Department of Environmental Conservation / SPAR / CSP
43335 Kalifornsky Beach Road, Suite 11
Soldotna, AK 99669-8250

Re: Trading Bay Production Facility
2020 Groundwater Monitoring and Site Investigation Work Plan
ADEC File Number: 2337.38.007
ADEC Hazard ID Number: 1263

Dear whom it concerns,

Please find enclosed for your files, copies of the following work plan.

- Trading Bay Production Facility - Facility Groundwater Monitoring and Site Investigation Work Plan

The submittal was prepared by Stantec on behalf of Chevron Environmental Management Company (CEMC).

Please do not hesitate to contact Craig Wilson (907 266-1128) and/or Tom Madsen (801 743-4924) with Stantec or myself at 832-854-5601 should you have any questions.

Sincerely,

Jason Michelson

Jason Michelson

Encl.

2020 Trading Bay Production Facility Groundwater Monitoring and Site Investigation Work Plan

June 5, 2020

Prepared for:

Chevron Environmental Management Company

Prepared by:

Stantec Consulting Services Inc.
725 East Fireweed Lane, Suite 200
Anchorage, AK 99503-2245

ADEC File Number: 2337.38.007
ADEC Hazard ID: 1263

Revision	Description	Author		Quality Check		Independent Review	
1	Draft	Craig Wilson	5/5/2020	Tom Madsen	5/7/2020	Michael Zidek	5/11/2020
2	Rev 1	Craig Wilson	5/19/2020	Tom Madsen	5/21/2020		

2020 TRADING BAY PRODUCTION FACILITY GROUNDWATER MONITORING AND SITE INVESTIGATION WORK PLAN

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Prepared by 

(signature)

Craig Wilson

Reviewed by 

(signature)

Mike Zidek

Approved by 

(signature)

Tom Madsen

Table of Contents

LIST OF TABLES

LIST OF FIGURES

Abbreviations & Acronyms

ADEC	Alaska Department of Environmental Conservation
ADNR	Alaska Department of Natural Resources
ACL	Alternative Cleanup level
amsl	feet above mean sea level
bgs	Below ground surface
BTEX	benzene, toluene, ethylbenzene, xylenes
°C	Degrees Celsius
CEMC	Chevron Environmental Management Company
COBC	Compliance Order By Consent
CoC	Chain of Custody
DNR	Alaska Department of Natural Resources
DO	Dissolved oxygen
EM	Electromagnetic
EPA	U.S. Environmental Protection Agency
ft	feet
GAC	granulated activated carbon
GPR	Ground penetrating radar
GSI	Ground water / surface water interface
LED	Light emitting diode
LNAPL	Light Non-Aqueous Phase Liquid
MeOH	methanol
mg/L	milligrams per liter
MS/MSD	Matrix spike / matrix spike duplicate
NAPL	Non-Aqueous Phase Liquid
OIP	Optical Image Profiler
ORP	Oxygen reducing potential
PAH	polycyclic aromatic hydrocarbons
QA	Quality assurance
QC	Quality control
TBPF	Trading Bay Production Facility
Hilcorp	Hilcorp Alaska, LLC
USACE	U.S. Army Corps of Engineers
UNOCAL	Union Oil Company of California
VPH	Volatile petroleum hydrocarbons
VOC	Volatile organic compounds

1.0 INTRODUCTION

Stantec Consulting Services Inc. (Stantec) has prepared this work plan on behalf of Chevron Environmental Management Company (CEMC) in support of investigation and remedial efforts at the Trading Bay Production Facility (TBPF), located on the west side of Cook Inlet, Alaska (**Figure 1**).

This work plan was prepared in compliance with Title 18 of the Alaska Administrative Code (AAC), Chapter 75, Section 355 (18 AAC 75.355; ADEC 2018) and the *ADEC Site Characterization Work Plan and Reporting Guidance for Investigation of Contaminated Sites* (ADEC 2017b). The sampling procedures described in this work plan were developed in accordance with ADEC's *Field Sampling Guidance* (ADEC 2019) and relevant industry standards. The permeable reactive barrier (PRB) monitoring described in this work plan conforms with the ADEC-approved *2019 Trading Bay Production Facility Additional Beach Assessment and Permeable Reactive Barrier Pilot Study Work Plan* (Stantec 2019), with modifications as required due to the State of Alaska Health Mandates authorized under the Public Health Disaster Emergency Declaration signed by Governor Mike Dunleavy on March 11, 2020.

1.1 GENERAL OBJECTIVES

The general objectives of the 2020 investigation and monitoring program described in this work plan are to:

1. Conduct groundwater and pore water monitoring in support of the 1996 Compliance Order by Consent (COBC) (ADEC 1996).
2. Determine effectiveness of the permeable reactive barrier (PRB) installed in 2019.
3. Conduct sampling of upgradient wells to monitor benzene, toluene, ethylbenzene, and xylenes (BTEX) concentrations upgradient of the PRB.
4. Conduct operation and maintenance of the recovery well and air sparge systems.

1.2 PROJECT TEAM AND SCHEDULE

1.2.1 Project Team

The Stantec team member roles and responsibilities are listed in **Table 1**. Additional personnel and subcontractors will be utilized as needed to achieve the work plan goals.

Table 1 Project Team

Name / Position	Role
Tom Madsen Project Manager	Manages and oversees project scope, schedule, and budget. Supports project technical lead in project design, sample collection, and scientific approach.
Michael Zidek Managing Principal	Manages resources and supports project technical lead in review of deliverables, project design, sample collection, and scientific approach, and coordinates field team members to ensure that field goals are being met.
Craig Wilson Project Technical Lead	Manages development of deliverables and completion of field work to ensure that field goals are being met; relays information to CEMC Project Manager; ensures that project requirements are being met; assists in design questions; coordinates job safety briefings and tailgate safety meetings; and oversees general project status.

Name / Position	Role
Roxanne Russell, EIT Project Staff	Assist in field operations and collection of samples. Supports all activities required for project completion, including sample preparation, decontamination, sample collection, packing and transport, as well as QA/QC related tasks; informs Project Manager of project status.
Austin Badger Project Staff	Assist in field operations and collection of samples. Supports all activities required for project completion, including sample preparation, decontamination, sample collection, packing and transport, as well as QA/QC related tasks; informs Project Manager of project status.
John Marshall Project Staff and Site Safety Officer	Assist in field operations and collection of samples. Supports all activities required for project completion, including sample preparation, decontamination, sample collection, packing and transport, as well as quality assurance/quality control (QA/QC) related tasks; informs Project Manager of project status; organizes and oversees tailgate safety meetings and job safety briefings; and ensures QA/QC goals are met.

1.2.2 Project Schedule

Due to travel restrictions related to COVID19, only two COBC monitoring events are planned for 2020. The initial groundwater and beach seep sampling work are scheduled to occur in July 2020 during a period of minus tides, to maximize safe working time on the beach. Equipment for the program will be mobilized and demobilized by barge or chartered aircraft. Personnel will fly to and from the project site in chartered aircraft. The second round of groundwater and beach seep sampling will occur in September. **Table 2** presents the proposed project schedule for 2020 activities.

This proposed schedule is based upon the presumption that State of Alaska Health Mandate 018, prohibiting non-essential travel to remote locations, is rescinded before July 2020. The final schedule will be adjusted as necessary to meet state health mandates and other emergency orders.

Table 2 2020 Proposed Project Schedule

Task	Start Date	Approximate Duration
Beach Seep Sampling and Monitoring Well Sampling	July 2020	5 Days
Beach Seep Sampling & PRB Monitoring	September 2020	11 Days

2.0 SITE DESCRIPTION AND BACKGROUND

2.1 SITE DESCRIPTION AND HISTORY

The Trading Bay Production Facility (TBPF) is a remote onshore crude oil and natural gas processing facility located on the west side of Cook Inlet. The facility has been in continuous operation since 1967. Crude oil, produced water, and natural gas are transported to TBPF via pipelines from offshore platforms in Cook Inlet and separated into three product streams. Crude oil is pumped across Cook Inlet to a refinery in Nikiski and natural gas is piped north for distribution by utility companies. The produced water is held in onsite retention ponds, treated, and discharged to Cook Inlet under a National Pollutant Discharge Elimination System permit[1]. The TBPF is located on private property, currently owned by Hilcorp Alaska, LLC (Hilcorp) in Sections 5 and 6, Township 8 North, Range 14 West, Seward Meridian, latitude 60.816507, longitude -151.788497. A Vicinity Map and a Site Map for the facility are presented on **Figures 1** and **2**, respectively.

2.2 GEOLOGY AND HYDROGEOLOGY

The TBPF is constructed on an eastward sloping terrace about 60 to 100 feet above mean sea level. At the eastern edge of the site is a shoreline bluff which drops, about 40 to 50 feet, to the beach along Cook Inlet. Several site investigations of the impacts beneath the TBPF have been completed by various consulting companies, including by Montgomery Watson in 1994, Tetra Tech in 1995, Geosphere in 1996 and 1997, and Weston Solutions, Inc. (Weston) in 2016 and 2017.

Previous investigations have concluded the soils underlying the TBPF consist predominantly of sands to a depth of about 50 feet, and below about 50 feet there are interlayered sandy and silty strata. The water table generally slopes from the west toward the east (toward Cook Inlet) and ranges in depth from about 15 feet below grade near the Tank Battery 2, to about 44 feet below grade at the bluff top.

During site investigations conducted in 1996 and 1997, there was a relatively flat, grassy, storm berm above the high tide line, at the base of the coastal bluff. The presence of the storm berm facilitated the installation of monitoring wells and the air sparging system at the base of the bluff in the southern portion of the Trading Bay site in 1996 and 1997. Shoreline erosion events removed the beach berm and the beach berm monitoring wells by about 2002, and necessitated repairs to the air sparging system in 2002 and 2013. Additional storm events in 2018 damaged monitoring wells in the northern beach area, requiring their decommissioning. A review of historical photographs, maps, and 2018 and 2019 drone imagery indicate that the beach is slowly eroding away due to currents in Cook Inlet.

Relative to a mean lower low water tidal datum, established during a Global Positioning Satellite (GPS) survey conducted in 2014[2], and additional site surveying in 2018, project features have the following approximate elevations:

- In the northern portion of the TBPF, the bluff top is at an elevation of about 70 feet above mean sea level (ft-amsl), the groundwater table is at about 25 ft-amsl, and a deeper piezometric surface occurs at about 17 ft-amsl.

[1] Permit AKG315002
[2] The 2014 survey datum is about 9.3 ft higher than the local mean sea level datum used in most of the site investigation work conducted prior to 2014

- In the southern portion of the Trading Bay site, the bluff top is at about 65 ft-amsl, the groundwater table is about 25 ft-amsl, and a deeper piezometric surface occurs at about 20 ft-amsl elevation.
- The base of the bluff and top of the beach sand prism is at about 20 to 24 ft-amsl; the groundwater table at the base of the bluff is at about 10 ft-amsl.
- The historical beach seeps sampling locations occur at about 6 to 8 ft-amsl elevation, and the tidal flats start at about 4 to 6 ft-amsl.
- The Nikiski tidal station, on the east side of Cook Inlet, has a mean tide range of 17.7 feet. At Trading Bay, the mean higher high and mean lower low water levels are estimated to be approximately 19 and -1.0 ft-amsl, respectively.

2.3 SUMMARY OF PAST FIELD EFFORTS

In July of 1996, Union Oil Company of California (UNOCAL) and Marathon Oil Company signed Compliance Order by Consent (COBC) No. 91-23-053-02 with the Alaska Department of Environmental Conservation (ADEC) addressing groundwater impacts at TBPF. The COBC set an alternative cleanup level of 0.8 mg/L for benzene and 0.15 mg/L for naphthalene, at the beach seep compliance point; required the installation of an air sparging system to remediate dissolved phase benzene carried by groundwater to the beach of Cook Inlet directly east of the facility; and required a groundwater monitoring program. The TBPF property and the responsibility for compliance with the COBC, was acquired by Chevron in 2004 (Hilcorp Alaska acquired the property from Chevron in 2013).

An air sparging system was installed along the southern beach area and a monitoring program was initiated in 1996, as required by the COBC, and a system of recovery wells was installed along the eastern bluff area in 2018 (**Figure 2**).

In 2015, the ADEC requested additional field investigation at the site. Characterization activities completed in 2016 led to the discovery of Non-Aqueous Phase Liquids (NAPL) in saturated sands extending beyond the bluff to the subsurface of the intertidal beach zone of Cook Inlet. Work completed in 2017 and 2018 subsequently delineated and characterized the presence of thin layers of NAPL in the beach subsurface at depths ranging from 5 to 10 feet. The NAPL appears to underlie a confining silt lens. Monitoring wells completed in these intervals accumulated NAPL indicating that the oil is mobile at the local scale. 2019 field season investigation activities further delineated the extent of the NAPL and dissolved benzene in the beach subsurface.

A PRB was installed on the north beach area in 2019 as a result of the 2015-2019 investigations in accordance with the *2019 Trading Bay Production Facility Additional Beach Assessment and Permeable Reactive Barrier Pilot Study Work Plan*, dated August 27, 2019. This 2020 Work Plan includes groundwater and pore water sampling on the beach at the locations specified in the August 2019 Work Plan to evaluate the efficacy of the barrier (**Figure 3**).

Chevron has conducted annual monitoring since 1996, consisting of sampling groundwater in monitoring wells and beach seeps, and measuring water levels and NAPL thickness in groundwater monitoring wells on site. This work plan includes the annual monitoring for the 2020 field season.

3.0 CONTAMINANTS OF POTENTIAL CONCERN

The contaminants of potential concern at the TBPF are crude oil and its constituents, exhibiting in the environment as non-aqueous phase liquids (NAPL) and their associated dissolved phase plumes.

3.1 CRUDE OIL NAPL DISTRIBUTION

Early production processing practices at the TBPF involved separating produced crude oil and water from offshore production platforms in large unlined earthen pits. That practice (long since abandoned), as well as historic leaks and spills from facility infrastructure, caused hydrocarbon contaminants to be released to the soils under the TBPF, creating the current source of contaminants present in soils and groundwater. Two crude oil, non-aqueous phase liquid (NAPL) soil source areas have been identified at Trading Bay, described in this document as the southern and northern source areas.

The southern NAPL source area appears to be primarily associated with Tank Battery 1 (shown on **Figure 2**; referred to as Area B in the 1994 *Remedial Investigation Report* by Montgomery Watson) and a series of heater-treater equipment located just north of Tank Battery 1. The NAPL in the southern source area is interpreted to terminate between the monitoring well M-115 and M-101 locations (NAPL has been observed in M-115 but not in M-101, M-107S, or M-107D).

The northern NAPL source area appears to be associated with Tank Battery 2 (**Figure 2**), a series of heater-treaters just east of Tank Battery 2, and potentially the old produced water retention basins. The NAPL in the northern source area extends to the bluff top monitoring wells in the deeper saturated zone in several locations (e.g. M-102D and M-111). In 1997, Geosphere postulated that the NAPL plume under the TBPF had stabilized such that immobile, continuous NAPL is present where free product is observed in site monitoring wells and discontinuous, residual saturation is present around the perimeter of the source (Geosphere, 1997).

During the 2016 site investigation, crude oil was encountered in four soil borings drilled on the beach on the northern portion of the Trading Bay site. The hydrocarbon impacted soil strata varied in thickness from approximately 0.2 to 2 ft; had a medium to coarse sand texture; were overlain and underlain by sands; and was logged in one borehole as shallow as 6 feet below ground surface in the beach prism sands.

During the 2017 site investigation, 11 monitoring wells were installed within the northern NAPL upper beach area. Four of the monitoring wells (17MW-2S, 17MW-3S, 17MW-4S, and 17MW-5S) contained NAPL, and product bail-down tests were conducted in wells 17MW-3S and 17MW-4S in August 2017. 2018 and 2019 site investigations further delineated the NAPL plume, indicating that the NAPL plume is discontinuous and trapped under the silt lens under hydrostatic pressure during the tidal cycle, impeding further movement of the NAPL.

3.2 DISSOLVED PHASE PLUME

Crude oil NAPL constituents tend to dissolve into the groundwater flowing through the TBPF site, forming dissolved phase plumes downgradient of the northern and southern NAPL source areas. The dissolved phase plumes extend eastward from the source areas toward the Cook Inlet beach. In 1996 and 1997, the dissolved phase benzene concentration in groundwater was measured in two source area monitoring wells, about 20 bluff top monitoring wells, 15 beach berm monitoring wells and 12 beach seep locations.

The monitoring wells at the bluff top and on the former beach berm were screened in the water table aquifer and in the deeper saturated zone. Since 1998, the COBC mandated groundwater monitoring program has focused on two source area monitoring wells, eight bluff top wells and six beach seep sampling locations (expanded to ten locations in 2015 at ADEC request).

Monitoring wells in the NAPL source areas and in wells that are in equilibrium with the crude oil NAPL had dissolved benzene concentrations ranging from about 1 to 7 mg/L; bluff top wells in both the water table aquifer and deeper saturated zone had benzene concentrations ranging from about 1 to 3 mg/L; and beach berm wells in both the water table aquifer and deeper saturated zone had benzene concentrations above 1 mg/L.

The historical beach seep monitoring data shows the following:

1. The COBC cleanup level of 0.8 mg/L benzene for groundwater in the beach seeps has never been exceeded.
2. Most of the seep results (approximately 77%) did not detect benzene.
3. The four highest benzene concentrations, since the beach seep monitoring program was initiated in 1996, were from the BH-9 location and were measured before and/or during the initial startup of the sparging system (the highest single benzene result was 0.61 mg/L).
4. Approximately 12% of the beach seep results exceeded 0.005 mg/L and less than 1% of the beach seep results exceeded 0.1 mg/L since 1997.

In 1995, the *Trading Bay Production Facility Human Health and Ecological Risk Assessment,* conducted by Tetra Tech (Tetra Tech, 1995), identified benzene and naphthalene as the primary chemicals of concern in groundwater at TBPF, based on potential exposures to marine organisms in Cook Inlet. Based on the risk assessment, alternative cleanup levels (ACLs) were established in the COBC, at 0.8 and 0.15 mg/L for benzene and naphthalene, respectively, in groundwater discharging from beach seeps.

The benzene data shows a significant decrease in concentrations between the bluff top wells and the beach seeps. Water level data loggers installed at the base of the bluff in 1996 indicated that during a portion of the high tide, the Cook Inlet water level is higher than the groundwater level on the beach and seawater flows into the beach sands. During the low tide cycle, Cook Inlet water and groundwater are discharged from the beach sand prism. In concept, seawater comprises most of the seepage from the beach sand prism during the early portions of the falling tide cycle, and the line of seeps is relatively high on the beach. Later in the low tide cycle, groundwater (potentially containing benzene) comprises a greater proportion of the discharge, and the seep locations occur lower on the beach. Beach seep concentrations have been historically monitored by collecting water samples from shallow (6-inch deep) holes excavated in saturated beach sand shortly before the incoming tide. Samples collected in this manner were thought to represent the highest benzene concentrations that occur at any time or location on the beach.

4.0 CURRENT REMEDIATION ACTIVITIES

Current remediation activities at TBPF consist of an air sparge system and a permeable reactive barrier on the beach to the east of the facility, and a recovery well system along the eastern blufftop of the facility.

4.1 AIR SPARGING SYSTEM

In 1996, an air sparging remediation system was installed at the base of the bluff on the southern portion of the Trading Bay site to promote volatilization and biodegradation of dissolved phase benzene before it reached the beach and marine waters of Cook Inlet. The air sparging system consists of two blower units located in steel buildings at the top of the bluff feeding air to 18 injection wells installed in a north-south line in the beach sands just east of the base of the shoreline bluff adjacent to the TBPF (**Figure 2**). The air sparging system is approximately 250 feet in length and operates continuously. In 2002 and 2013, the air sparging system required significant repairs following damage by beach erosion and storms in Cook Inlet.

4.2 RECOVERY WELL SYSTEM

A system of 14 wells were installed along the bluff top in 2018 to depress the water table, recover mobile NAPL, and mitigate potential further migration of impacts into the beach zone (**Figure 3**). The system was installed per the ADEC-approved work plan dated August 10, 2018, and details of construction are documented in the 2018 annual report dated April 12, 2019 (Stantec, 2019). The wells pump continuously, with the effluent injected into the facility's process water treatment system via a conveyance piping system to WEMCO filter units located in the wastewater treatment process train at the TBPF. Discharging of the fluids into the wastewater treatment process train is covered under the TBPF's existing National Pollutant Discharge Elimination System (NPDES) permit AKG-31-5000[3].

The system is remotely monitored by Stantec along with daily checks by Hilcorp TBPF personnel. Stantec personnel travel to TBPF on a regular basis to conduct routine maintenance of the system.

4.3 PERMEABLE REACTIVE BARRIER

In accordance with the *2019 Trading Bay Production Facility Additional Beach Assessment and Permeable Reactive Barrier Pilot Study Work Plan* (Stantec 2019), dated August 27, 2019, a 200-foot long pilot PRB was installed on the north beach in October of 2019 (**Figure 3**). The PRB is perpendicular to the identified groundwater flow to allow for in-situ chemical adsorption and enhanced biodegradation. In accordance with August 2019 Work Plan, groundwater samples were collected upgradient and downgradient of the PRB in order to establish baseline concentrations of the dissolved benzene plume for future performance monitoring. Additional groundwater samples will be collected in 2020 to assess the performance of the barrier.

[3] NPDES Permit Number AKG-31-5000, Section II.G.4.

5.0 2020 INVESTIGATION SCOPE OF WORK, METHODS AND APPROACH

The following is a discussion of the proposed scope of work, methods and approach that will be implemented in 2020 at the TBPF site.

The following investigation activities are planned for 2020:

1. Complete 2020 groundwater and surface water monitoring and sampling activities in accordance with COBC requirements.
2. Conduct fluid level measurements and sampling of TBPF groundwater monitoring wells.
3. Evaluate the performance of the pilot PRB on the north beach.
4. Monitoring of the performance of the recovery well system

The groundwater sampling of the beach areas will require coverage under a U.S Army Corps of Engineers (USACE) Section 404 nationwide general permit (NWP-38), along with an Alaska Department of Natural Resources (ADNR) tidelands lease[4]. Permit coverage will be in place prior to commencing operations.

5.1 COBC GROUNDWATER MONITORING

Compliance Order by Consent No. 91-23-053-02 includes requirements for addressing groundwater contamination at the TBPF as agreed to by Chevron with the ADEC. These requirements include an annual compliance groundwater monitoring program at TBPF consisting of three monitoring events (spring, summer, and fall).

All COBC groundwater sampling will be performed in general accordance with the COBC requirements. Pore water samples will be collected from 12 locations using a clam shell sampler at each of three sampling events. The samples will be analyzed for BTEX concentrations. Polycyclic aromatic hydrocarbon (PAH) analyses will be conducted on 3 of the 12 pore water samples.

5.2 FACILITY MONITORING WELL SAMPLING

Groundwater samples from all known facility groundwater monitoring wells will be collected during the summer sampling event (July) to assess BTEX concentration trends. This sampling event will also include measured oil thickness and piezometric surface elevation of the monitoring wells to confirm groundwater flow direction.

5.3 PRB PERFORMANCE MONITORING

Groundwater samples were collected upgradient and downgradient of the PRB in 2019 to establish baseline concentrations of the dissolved benzene plume for future performance monitoring. Additional direct push groundwater grab samples will be collected during a performance monitoring event planned in September 2020 to determine the effectiveness of the PRB.

Direct push groundwater grab samples will be collected from 16 locations (**Figure 3**) which were previously identified and sampled in 2019 as part of the baseline sampling (**Table 3**). All samples will be analyzed for BTEX, and three (3)

[4] ADNR Tidelands Lease ADL 32549.

samples will be analyzed for polyaromatic hydrocarbons (PAHs) and electron acceptors (nitrate and sulfate by EPA Method 300.0).

The sampling will be done during low tides, both for access safety and to reduce saltwater influence on the samples, using a Geoprobe SP16 (or equal) temporary well point sampling device. Grab samples will be collected at approximately 4 to 6 feet below ground surface, and the samples will be analyzed for BTEX. Additional grab groundwater samples will be collected at two deeper intervals (16 and 20 feet below ground surface (bgs)) at four locations (Z4-12, Z4-13, Z3-11, and Z3-13) to evaluate the vertical extent of the dissolved benzene plume.

5.4 RECOVERY WELL SYSTEM MONITORING

The effluent from the recovery well system will be sampled for BTEX on a monthly basis from July through October, dependent upon access to the site. The sampling will be done at manhole 16, immediately upstream of the system discharge into the TBPF wastewater treatment system.

5.5 MONITORING EVENT SCHEDULE

In addition to the monthly monitoring of the recovery well system there will be three discrete monitoring events in 2020, as summarized below and in **Table 3**. These events will be performed in conjunction with the recovery well system monitoring.

5.5.1 July 2020 Monitoring Event

The initial monitoring event is scheduled to occur in July and will consist of:

- Measuring groundwater elevations and NAPL thickness in about 40 groundwater monitoring wells at the site (see Section 5.2 of this work plan).
- Pore water sampling from 12-beach seep locations for analysis for BTEX. In addition, pore water samples from the BH-1.5, BH 2, and BH 2.5 locations will analyzed for PAHs. A total of 15 water samples plus 6 QA/QC samples will be submitted for laboratory analyses.
- A total of 40 bluff top and recovery well system samples plus 7 QA/QC samples will be submitted for laboratory analyses. The wells sampled will include the COBC-specified wells listed in **Table 3**.
- Inspection and maintenance of the air sparging system.
- The recovery well system will be inspected, maintained, and adjusted for optimal operation.

5.5.2 September 2020 Monitoring Event

The September monitoring event will be the final monitoring activity for 2020. The September event will consist of:

- Pore water sampling from 12-beach seep locations and will be analyzed for BTEX. In addition, water samples from the BH-1.5, BH 2, and BH 2.5 locations will analyzed for PAHs.
- A total of 15 water samples plus 6 QA/QC samples will be submitted for laboratory analyses.
- The air sparging system will be inspected and adjusted as needed.
- The recovery well system will be inspected, maintained, and adjusted for optimal operation.

Table 3 Field Sampling Schedule

Sample Type & Location	Location Name	July		September		
		BTEX	PAHs	BTEX	PAHs	Electron Acceptors
COBC Beach Holes	BH-1	X		X		
	BH-1.5	X	X	X	X	
	BH-2	X	X	X	X	
	BH-2.5	X	X	X	X	
	BH-3	X		X		
	BH-4	X		X		
	BH-5	X		X		
	BH-6	X		X		
	BH-7	X		X		
	BH-8	X		X		
	BH-9	X		X		
	BH-10	X		X		
COBC Bluff-Top Wells	MW-3	X				
	M-101	X				
	M-102S	X				
	MW-5	X				
	M-103	X				
	M-107D	X				
	M-105D	X				
	M-110	X				
	F-MW-1	X				
	GAMW-2	X				

Sample Type & Location	Location Name	July		September		
		BTEX	PAHs	BTEX	PAHs	Electron Acceptors
Recovery Wells	RW-1	X				
	RW-2	X				
	RW-3	X				
	RW-4	X				
	RW-5	X				
	RW-6	X				
	RW-7	X				
	RW-8	X				
	RW-9	X				
	RW-10	X				
	RW-11	X				
	RW-12	X				
	RW-13	X				
	RW-14	X				
PRB Monitoring	Z3-10			X	X	X
	Z3-11			X		
	Z3-12			X		
	Z3-13			X		
	Z3-14			X		
	Z4-10			X	X	X
	Z4-11			X		
	Z4-12			X		
	Z4-13			X		
	Z4-14			X		
	Z5-1			X	X	X
	Z5-2			X		
	Z5-3			X		
	Z5-4			X		
	Z5-5			X		
	Z5-6			X		

6.0 STANDARD OPERATING PROCEDURES FOR SAMPLING

6.1 BEACH PORE WATER SAMPLING

Beach pore water samples will be collected approximately 18 inches bgs during low tide using a clam shell sampler and analyzed for BTEX. The sample locations will be surveyed for horizontal and vertical location using a GPS. The sample locations are expected to collapse

6.2 GROUNDWATER SAMPLING

Grab groundwater samples will be collected by direct push sampling during the September event. In addition, groundwater samples will be collected from facility monitoring wells and recovery wells, including the eight bluff top and two-source area monitoring wells specified for COBC monitoring. All groundwater samples will be analyzed for BTEX as outlined above.

6.2.1 Direct Push Sampling

Grab groundwater sampling on the beach will be accomplished using direct push technology. A Geoprobe SP16 (or equal) temporary well point sampling device will be used, allowing for immediate grab sampling followed by borehole collapse and abandonment. The sample locations will be surveyed for horizontal and vertical location using a GPS.

6.2.1.1 Ground Clearance

While the potential for encountering a subsurface utility along the beach is very low, the following mitigations will be utilized to clear the locations:

1. Stantec has engaged Hilcorp, reviewed historical site plans, and completed a site survey of the area and there is no information or indication that utilities are present in the investigation area along the beach. Stantec did identify one stormwater outfall, which is located outside of our investigation area and will not conflict with our activities.
2. In 2018 and 2019, a geophysical survey was conducted using both EM and GPR in the beach area and no utilities were detected.
3. Prior to advancing direct push tooling, Stantec will probe around the borehole using a 5-foot fiberglass tile probe. Probing locations will surround the proposed profiling or boring location in a triangular pattern (2-foot spacing).
4. As long as there are no indications of a potential subsurface utility, the boreholes will be advanced from the ground surface to borehole completion depth.

6.2.1.2 Contingency Planning

The following procedures will be utilized to prevent hydrocarbons from reaching Cook Inlet during groundwater sampling activities.

1. For boring locations on the upper portion of the beach prism, where non-flowing conditions are expected and NAPL is encountered, the length of the borehole will be backfilled with pelletized bentonite placed and then hydrated as necessary in lifts.
2. For soil borings close to the mudflats where flowing (artesian) conditions may be anticipated and NAPL is encountered:

- If a sheen or other visible indications of NAPL is observed seeping out of the borehole while still advancing the tool, the boring will be grouted while pulling the tooling.
- If a sheen is observed at a boring location after completing a boring, then tooling will be advanced down the existing borehole and grout reinjected via tremie as the tooling is withdrawn.

6.2.2 Monitoring Well Sampling

During the July sampling event, existing monitoring wells will be sampled using the United States Environmental Protection Agency (USEPA) low-flow (minimal drawdown) technique (USEPA 1996). A positive displacement submersible pump (Hurricane pump or equivalent) will be used to purge and sample the wells. A monitoring well sampling form will be completed as part of the groundwater sampling process. The two source area wells (F-MW-1 and GAMW-2) will not be purged but will be sampled by submerging a bailer below the NAPL layer, in accordance with the *Groundwater Monitoring Plan* (Geosphere 1996).

The low-flow (minimal drawdown) purge and sample collection technique involves purging each well at flow rates of 0.1 to 0.5 liters per minute. If significant drawdown occurs, the flow rate will be decreased as described below. During purging, water quality parameters will be monitored until three of the following parameters are met:

- pH is stable within 0.1 pH units
- Temperature is stable within 0.2 degrees Celsius (˚C)
- Conductivity is stable within 3 percent (%)
- Dissolved Oxygen (DO) is stable within 10%

Measurements will be collected every three to five minutes. If stability of the above parameters cannot be achieved, then removal of three well casing volumes will be performed, at which time sampling will commence. The removal of three well volumes is not necessary if stability is achieved sooner during the purge process, as evident from successive readings of the above parameters that are within the stated tolerances. For wells that purge dry, the field team will return to the well once it has recharged to 80% of the original pre-purge volume and a sample will be collected without additional purging or water quality monitoring (generally allowing 12 to 24 hours for recharge).

During low-flow (minimal drawdown) purging, the depth to groundwater will be measured to ensure that minimal drawdown is occurring in the well while sampling. If drawdown of more than 1-foot occurs while sampling, the flow rate will be decreased until the drawdown is stabilized at about 1-foot. Once the parameters are stabilized, a final reading will be recorded for DO, oxygen reduction potential (ORP), pH, temperature, and conductivity. Prior to collecting the sample, the flow-through cell will be disconnected from the flow line. The flow rate during sampling will remain the same as the purging flow rate.

6.3 WATER QUALITY PARAMETERS

During well purging, water quality parameters will be collected by the field team. Calibration of the water quality meter sensors will be verified prior to use with calibration standards. Personnel operating the water quality meter will understand the working ranges and maximum saturation values for the various sensors and monitor results during purging and testing to ensure they remain within these ranges or beneath maximum theoretical values. In the event the response for any individual sensor fails to meet precision and accuracy criteria specified by the equipment manufacturer, or actual project sample responses fall near or outside the theoretical working range for each sensor, the unit will be recalibrated or repaired as necessary before purging and sampling activities continue.

The normal pH range for groundwater is generally between 4 and 9 with a theoretical range from 0 to 14. The normal DO range for groundwater is between 0 and 12 milligrams per liter (mg/L), with a theoretical saturation point at approximately 12 mg/L.

Date, time, instrument model, serial number and calibration results for all instruments will be recorded. Calibration will be checked daily using a confidence solution, if any of the parameters are not with in the acceptable range, the sensor(s) will be recalibrated.

6.4 WATER LEVEL/NAPL THICKNESS MEASUREMENTS

Groundwater elevation and NAPL thickness measurements will be performed during the July groundwater sampling event, using an oil-water interface probe. **Table 4** lists the groundwater monitoring wells that will be measured for NAPL thickness and depth to groundwater:

Table 4 Groundwater Monitoring Wells

Area	Well Designation	Area	Well Designation
South Side of TBPF	MW-1	Retention Basin	M-113
	A-MW-1		M-115S
	MW-2		M-115D
Bluff Top	M-101		F-MW-1
	M-102S		F-2
	M-102D	Tank Battery 1	GAMW-1
	M-103		GAMW-2
	M-105S		GAMW-3
	M-105D		GAMW-3
	M-106	Tank Battery 2	DE-8
	M-107S		D-MW-1
	M-107D		E-MW-1
	M-108		L-7
	M-109		M-5
	M-110		M-8
	M-111		N-9
	M-112	West Side of TBPF	A-MW-1
	S-101		CL-1
	MW-3		M-116
	MW-4		N-MW-1
	MW-5		
	MW-6		

7.0 QUALITY ASSURANCE AND QUALITY CONTROL

7.1 QUALITY CONTROL SAMPLES

Quality control samples will be collected in the field to assess potential errors introduced during sample collection, handling, and analyses. As part of the field Quality Assurance / Quality Control (QA/QC) program, field duplicate samples, trip blanks, and extra sample volume for matrix spike/matrix spike duplicate (MS/MSD) procedures will be collected.

QC requirements, summarized in **Table 5**, will be collected to assess potential errors introduced during sample collection, handling, and analyses. In summary, QC samples will include:

- One trip blank for each cooler containing BTEX samples,
- One duplicate field sample for every 10 samples collected per laboratory analysis,
- One equipment blank per submersible pump per day, and
- Additional sample volumes for MS/MSD analysis for water samples at a rate of one per 20 samples collected per requested laboratory analysis.

Table 5 Quality Control Requirements - Groundwater Samples

Sampling Event	Analytical Method	Number of Primary Samples	Quality Control Samples	Total Number of Samples
July COBC Sampling	BTEX (8260C)	12	2 Dup + 2 MS/MSD + 1 TB	17
	PAH (8270C)	3	1 Dup + 1 MS/MSD	4
September COBC Sampling	BTEX (8260C)	12	2 Dup + 2 MS/MSD + 1 TB	17
	PAH (8270C)	3	1 Dup + 1 MS/MSD	4
July Bluff Top Sampling	BTEX (8260C)	24	3 Dup + 3 MS/MSD + 1 TB	31
September PRB Monitoring	BTEX (8260C)	16	2 dup + 1 MS/MSD	19
	PAH (8270C)	3	1 dup + 1 MS/MSD	5
	Nitrate and sulfate (300.0)	3	1 dup + 1 MS/MSD	5

Notes:

Dup = duplicate sample;
MS/MSD = matrix spike/matrix spike duplicate;
EB = equipment blank
TB = trip blank

7.2 SAMPLE CONTAINERS, HOLD TIMES, AND PRESERVATION

Table 6 summarizes the sample containers, preservation, and holding times required for each analytical method by which samples will be collected.

Table 6 Sample Containers, Preservation, and Hold Times

Analytical Parameter	Analytical Method	Preparation Holding Time (days)	Containers	Preservation
Groundwater				
BTEX	8260C	14 days	3 – 40 mL VOA vials	pH<2, HCl; Cool to 0-6˚C
PAH	8270C	7 days	2 –250 ml amber glass	Cool to 0-6˚C
Nitrate and sulfate	300.0	48 hours	Lab-supplied glass or plastic bottles	Cool to 4˚C

7.3 SAMPLE LABELING

Each sample container will be sealed and labeled immediately after collection. Sample labels will be completed using waterproof ink and will be affixed firmly to the sample containers. A sample code will be assigned to each sample as an identification number to track collected samples. The sample label will provide the following information: sample identification number; date and time of collection; analysis required; and preservation method used. Field duplicate samples will be submitted as blind duplicates – that is they will be consecutively numbered and will not be identified on the Chain-of-Custody (CoC) as being duplicates (but the fact that they are duplicates will be recorded in the field logbook).

7.4 CHAIN-OF-CUSTODY AND SAMPLE PACKAGING

A Chain of Custody (CoC) record will be completed and shipped with the samples. Proper sample custody is maintained through adherence to the procedures listed below:

- If the samples are not hand delivered, a minimum of one custody seal will be placed over the lid/cooler edge and secured with clear packaging tape.
- A CoC record must accompany the coolers in which the samples are packed. When transferring samples, the individuals relinquishing and receiving the coolers must sign, date, and note the time on the CoC record. This record documents sample custody transfer.

Samples must be packaged carefully to avoid breakage or contamination and must be shipped to the laboratory at proper temperatures. Adherence to the following sample package requirements is essential:

- Sample container lids must never be mixed. All lids must remain with their original container.
- Environmental samples must be cooled to 0 to 6 ˚C to preserve many chemical constituents. All coolers will contain a temperature blank that the laboratory will use to document sample temperatures.
- Any remaining space in the cooler should be filled with inert packing material such as bubble wrap, newspaper, etc. Under no circumstances should material such as sawdust, sand, or Styrofoam peanuts be used.

7.5 DATA REDUCTION, VALIDATION AND REPORTING

Validation and review of all analytical data will be performed by a qualified professional experienced in data validation and review procedures. All data will be validated and reviewed in accordance with appropriate EPA procedural

guidance documents and ADEC regulatory guidance documents. The reference documents include *EPA Functional Guidelines for Organic Data Review* (EPA 2008), and *ADEC Data Quality Objectives, Checklists, Quality Assurance Requirements for Laboratory Data, and Sample Handling, Technical Memorandum* (ADEC 2017).

8.0 INVESTIGATION-DERIVED WASTE

Investigation-derived waste includes soil cuttings, well purge water from water sampling, personal protective equipment (PPE) such as nitrile gloves, and dedicated sampling equipment including polyethylene bailers, peristaltic pump tubing, and paper towels.

Purge water from all wells will be filtered through a granular activated carbon (GAC) filter prior to surface discharge. Personal protective equipment such as nitrile gloves and dedicated sampling equipment, including tubing and paper towels used to decontaminate the oil-water interface probe, will be disposed with general solid waste via a solid waste dumpster staged at the TBPF. Oily waste (sorbent pads) will be disposed with Hilcorp's oily rag waste stream.

Soil cuttings, if generated, will be field screened using a PID as specified in ADEC guidance (ADEC 2019). Soil that field screens clean will be disposed of onsite. Soils which are visually impacted with NAPL or exceed ADEC guidance levels will be placed in open top drums and shipped to an ADEC approved facility for thermal treatment.

9.0 FIELD DOCUMENTATION

Field documentation will include sample identification labels, photographs, laboratory analysis requests, and permanently bound field logs. A field logbook will be maintained by the field team lead to record a detailed description of all field activities and samples collected. Pages will not be removed from any data logbook for any reason. Any corrections will be made by drawing a single line through the original entry, so that the original entry can still be read. The corrections will be written alongside the crossed-out entry and will be initialed and dated.

10.0 REPORTING

After the completion of all three water sampling events, a report documenting the beach prism investigation and annual TBPF monitoring will be prepared for CEMC to present to ADEC. The report will include a summary of the results of the field investigation program; the data logger records; laboratory analytical and QA/QC data; tables comparing groundwater data to relevant ADEC cleanup levels; an interpretation of remedial processes occurring at the site and figures showing sampling locations, the groundwater gradient, and a summary of analytical results. A photographic log documenting the sampling event(s) will also be included.

As part of the reporting effort, Stantec will review and tabulate the laboratory analytical data, prepare a QA Summary Report following ADEC guidance, and complete the ADEC required checklists for each data package generated. The QA Summary Report will include a discussion of data reliability and usability by evaluating data precision, accuracy, representativeness, comparability, completeness, and sensitivity.

11.0 REFERENCES

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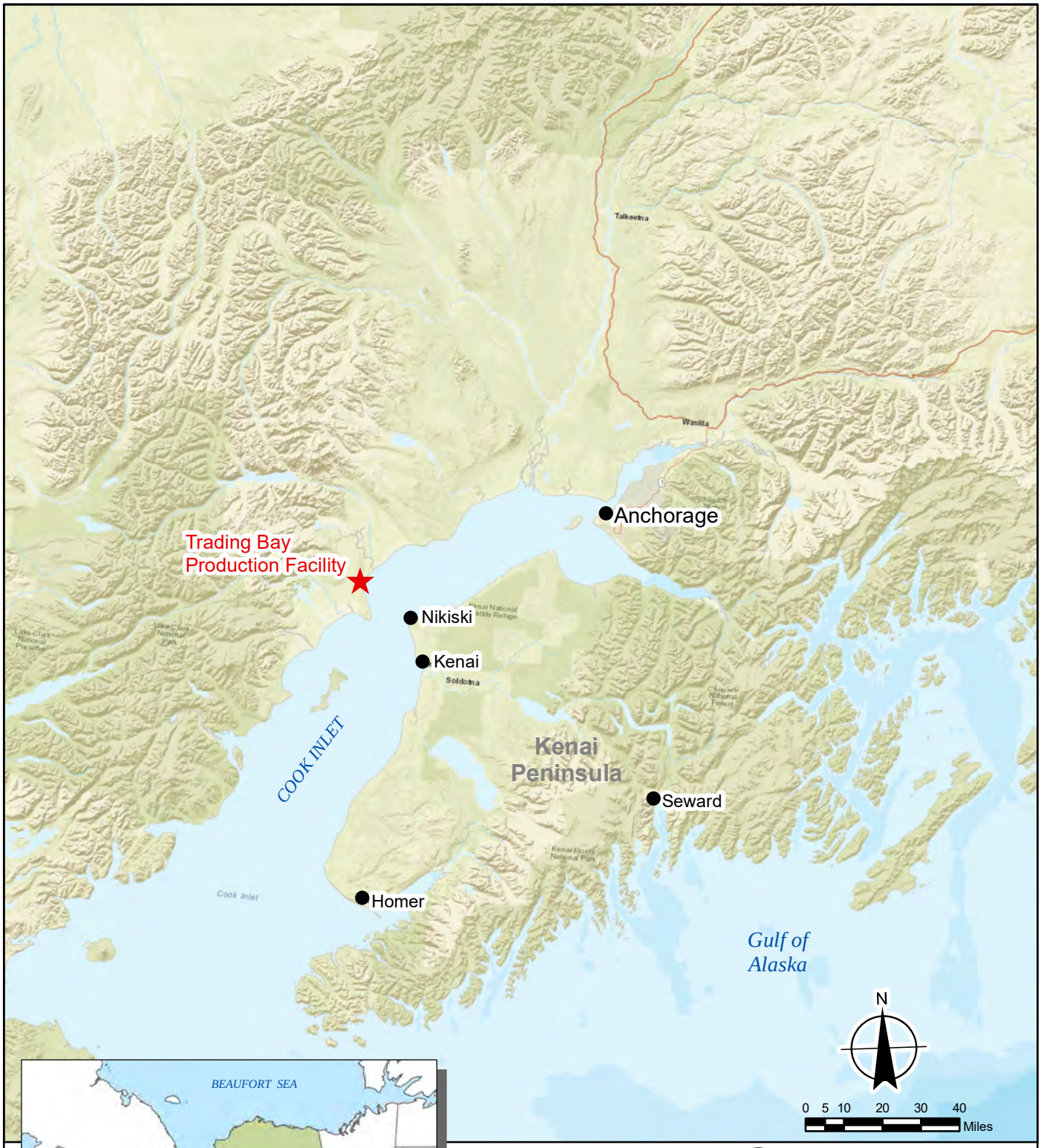
FIGURES



SOURCE:
1. Coordinate System: NAD83 Alaska Albers Equal Area USGS
2. Map Base: ESRI_ShadedRelief_World_2D

Stantec

Project Location
Trading Bay Production Facility
T8N, R14W, S5

Prepared by BT on 2019-01-18
Technical Review by CJ on 2019-01-18
Independent Review by AS on 2019-01-18

Client/Project
Chevron Environmental Management Company
Trading Bay Production Facility
2020 Work Plan

Figure No.
1

Title
SITE LOCATION MAP

Date: May 5, 2020

Date: 02 Jan 2020 Created by: CDP/NF V:\2037\Active\182603872\gis_cad\gis\mxds\tb_site_assessment_figures\Figure_1_2019_LocationMap.mxd

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STORMWATER RETENTION POND
PRODUCED WATER RETENTION PONDS
TANK BATTERY 2
TANK BATTERY 1
FACILITY OFFICE

BH-1
BH-1.5
BH-2
BH-2.5
BH-3
BH-4
BH-5
BH-6
BH-7
BH-8
BH-9
BH-10
WCMC

MW-6
RW-14
M-113
F-2
RW-13
RW-12
M-112
F-MW-1
RW-11
M-108
E-MW-1
RW-10
M-111
MW-5
RW-9
DE-8
L-7
M-110
RW-8
M-103
M-102D
M-102S
M-8
RW-7
M-109
N-9
RW-6
MW-4
M-115*
RW-5
M-105*
D-MW-1
RW-4
M-101
S-101
M-107*
RW-3
MW-3
RW-2
N-MW-1
GAMW-4
RW-1
M-106
GAMW-3
CL-1
GAMW-2
GAMW-1
M-116
MW-2
A-MW-1
MW-1
CP-21

N
0 25 50 100
Feet

- Beach Seep Sample Location
- Bluff Top Monitoring Well
- Survey Control
- Recovery Well
- Air Sparge Wells
- Permeable Reactive Barrier (PRB)
- Air Sparge Unit
- Old Outfall Pipeline

Note: * denotes cluster well

SOURCE:
1. Coordinate System: NAD 1983 StatePlane Alaska 4 FIPS 5004 Feet
2. Orthoimagery Source: World Imagerry - Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Stantec

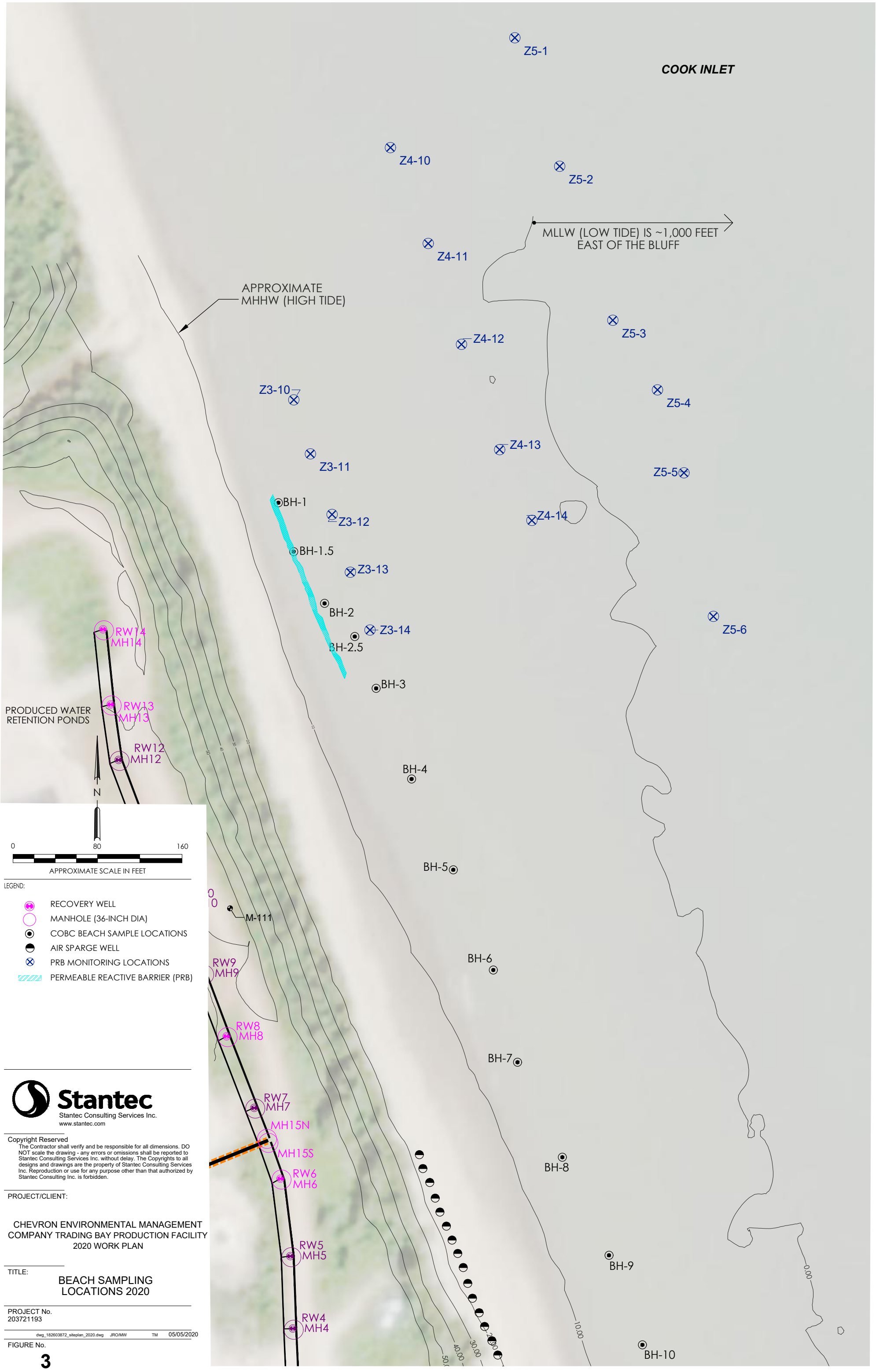
Project Location
Trading Bay Production Facility
T8N, R14W, S5

Prepared by BT on 2019-01-28
Technical Review by JT on 2019-01-28
Independent Review by AS on 2019-01-28

Client/Project
Chevron Environmental Management Company
Trading Bay Production Facility
2020 Work Plan

Figure No.
2

Title
TRADING BAY PRODUCTION FACILITY SITE MAP



LEGEND:

- RECOVERY WELL
- MANHOLE (36-INCH DIA)
- COBC BEACH SAMPLE LOCATIONS
- AIR SPARGE WELL
- PRB MONITORING LOCATIONS
- PERMEABLE REACTIVE BARRIER (PRB)

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PROJECT/CLIENT:

CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY TRADING BAY PRODUCTION FACILITY
2020 WORK PLAN

TITLE:

BEACH SAMPLING LOCATIONS 2020

PROJECT No.
203721193

dwg_182603872_siteplan_2020.dwg JRO/MW TM 05/05/2020

FIGURE No.

3