# 2023 Trading Bay Production Facility Groundwater Monitoring and Site Investigation Work Plan

May 25, 2023

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 | |
|---|---|---|---|---|---|---|---|
| 0 | Draft | CHW | 5/10/23 | MS | 5/19/23 | THM | 5/22/23 |
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Prepared by ____________________________________________

(signature)

**Craig Wilson**

Reviewed by ____________________________________________

(signature)

**Michael Stauthamer**

Approved by ____________________________________________

(signature)

**Tom Madsen**

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# Abbreviations & Acronyms

| | |
|---|---|
| % | Percent |
| AAC | Alaska Administrative Code |
| ADEC | Alaska Department of Environmental Conservation |
| ADNR | Alaska Department of Natural Resources |
| ACL | Alternative Cleanup level |
| amsl | 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 |
| DO | Dissolved oxygen |
| EB | Equipment blank |
| EM | Electromagnetic |
| FD | Field duplicate |
| GPR | Ground penetrating radar |
| GPS | Global Positioning System |
| Hilcorp | Hilcorp Alaska, LLC |
| 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 |
| NPDES | National Pollutant Discharge Elimination System |
| ORP | Oxygen reducing potential |
| PAH | Polycyclic aromatic hydrocarbons |
| PID | Photo-Ionization Detector |
| PPE | Personal Protective Equipment |
| PRB | Permeable Reactive Barrier |
| QA | Quality assurance |
| QC | Quality control |
| Stantec | Stantec Consulting Services, Inc. |
| TB | Trip blank |
| TBPF | Trading Bay Production Facility |
| USACE | U.S. Army Corps of Engineers |
| USEPA | U.S. Environmental Protection Agency |
| UNOCAL | Union Oil Company of California |
| Weston | Weston Solutions, Inc. |

# 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 (ADEC 2023) and the *ADEC Site Characterization Work Plan and Reporting Guidance for Investigation of Contaminated Sites* (ADEC 2017). The sampling procedures described in this work plan were developed in accordance with the Alaska Department of Environmental Conservation (ADEC) *Field Sampling Guidance for Contaminated Sites and Leaking Underground Storage Tank Sites* (ADEC 2022a) 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 2019a).

## 1.1 GENERAL OBJECTIVES

The general objectives of the 2023 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).
3. Conduct sampling of upgradient wells to monitor benzene, toluene, ethylbenzene, and xylenes (BTEX) concentrations upgradient of the PRB.
4. Conduct operation and maintenance (O&M) of the recovery well and air sparge remediation 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<br>Project Manager | Manages and oversees project scope, schedule, and budget. Supports project technical lead in project design, sample collection, and scientific approach. |
| Michael Zidek<br>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<br>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 |
|---|---|
| John Marshall<br>Project Field Lead and Site Safety Officer | Supervises 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; organizes and oversees tailgate safety meetings and job safety briefings; and ensures QA/QC goals are met. |
| Sydney Souza<br>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. |
| Jeremiah Malenfant<br>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. |

### 1.2.2 Project Schedule

The project schedule includes COBC monitoring, recovery well system maintenance and sampling, and monitoring of the PRB. COBC monitoring events are planned for June, July, and September. Beach activities for these events will be scheduled during periods of minus tides, to maximize safe working time on the beach. Equipment and supplies for the events will be mobilized and demobilized by barge or chartered aircraft and personnel will fly to and from the project site in chartered aircraft.

**Table 2** presents the proposed project schedule for 2023 activities.

**Table 2 2023 Proposed Project Schedule**

| Task | Date | Approximate Duration |
|---|---|---|
| Recovery Well System (RWS) O&M and Sampling | Monthly (April – November) | 1 Day / month |
| Recovery Well System Rehabilitation | May 2023 | 5 Days |
| Beach Seep Sampling & PRB Monitoring, Recovery Well System Rehabilitation | June 2023 | 8 Days |
| Beach Seep Sampling and Monitoring Well Sampling, Recovery Well System Maintenance | July 2023 | 7 Days |
| Beach Seep Sampling & PRB Monitoring, Recovery Well System Maintenance | September 2023 | 5 Days |

# 2.0 SITE DESCRIPTION AND BACKGROUND

## 2.1 SITE DESCRIPTION AND HISTORY

The Trading Bay Production Facility 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 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 (amsl), the groundwater table is at about 25 feet amsl, and a deeper piezometric surface occurs at about 17 feet amsl.

[1] Permit AKG315002
[2] The 2014 survey datum is about 9.3 feet 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 feet amsl, the groundwater table is about 25 feet amsl, and a deeper piezometric surface occurs at about 20 feet amsl elevation.
- The base of the bluff and top of the beach sand prism is at about 20 to 24 feet amsl; the groundwater table at the base of the bluff is at about 10 feet amsl.
- The historical beach seeps sampling locations occur at about 6 to 8 feet amsl elevation, and the tidal flats start at about 4 to 6 feet 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 feet 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 No. 91-23-053-02 with ADEC, addressing groundwater impacts at TBPF (ADEC 1996). The COBC set an alternative cleanup level of 0.8 milligrams per liter (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).

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 2023 field season.

An air sparging system was installed along the southern beach area in 1996 and a recovery well system was installed along the eastern bluff area in 2018 (Stantec 2018). The air sparge system and recovery well system are displayed on **Figure 2**. These systems continue in operation (see Section 4.1).

In 2015, the ADEC requested additional field investigation at the site, leading to the discovery in 2016 of Non-Aqueous Phase Liquids (NAPL) in saturated sands extending beyond the bluff to the subsurface of the intertidal beach zone of Cook Inlet. Subsequent work in 2017 and 2018 delineated and characterized the presence of thin layers of NAPL in the beach subsurface at depths ranging from 5 to 10 feet (Stantec 2019b). The NAPL appears to underlie a confining silt lens.

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* (Stantec 2019a). This 2023 Work Plan includes groundwater and pore water sampling on the beach at the locations specified in the 2019 Work Plan to continue evaluation of the efficacy of the PRB (**Figure 3**).

# 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 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, 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 previously unlined 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 feet; 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 (bgs) in the beach prism sands. Site investigations during the 2017, 2018, 2019, 2020, and 2021 field seasons delineated the NAPL plume and results suggested 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 Phase II Environmental Work Plan (Geosphere, 1997) found no detectable naphthalene in the beach seeps and determined there was no expectation of naphthalene migrating to the beach, so sampling for naphthalene was suspended.

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.

# 4.0 CURRENT REMEDIATION ACTIVITIES

Current remediation activities at TBPF are focused on operation 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.

The system is checked by Hilcorp TBPF personnel as part of routine operations and by Stantec personnel during regular site visits.

## 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). Eleven (11) of the recovery wells are currently equipped with pneumatic submersible pumps for total fluids recovery. Pump deployment is focused on locations with measurable NAPL and/or dissolved benzene concentrations above the COBC criteria of 0.8 mg/L. Pumps are currently installed in wells RW-1, RW-2, RW-3, RW-4, RW-5, RW-7, RW-9, RW-10, RW-11, RW-12, and RW-13.

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] (USEPA 2007).

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.

### 4.2.1 Recovery Well Maintenance

Iron biofouling and sedimentation in the recovery wells, pumps, and piping have been observed since startup, leading to noticeable declines in performance, increased maintenance requirements, totalizer malfunction and occasional pump down time. In 2021 and 2022, recovery wells RW-1, RW-2, RW-3, RW-4, RW-5, RW-7, RW-9, RW-10, RW-11, RW-12, and RW-13 were manually agitated and flushed to remove silt and sediment that had accumulated in the wells. In 2023, the recovery well system at MH-15N, MH-15S, and MH-16 will be reconfigured to allow vacuum truck cleaning of conveyance lines and a new replacement totalizer will be installed. Additionally, well rehabilitation will

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

involve additional pump cleaning, system flushing, pump replacement as needed, maintenance of hydrographs and maintenance of iMonnit communication sensors.

### 4.2.2 Passive Recovery of Free Product

Wells with historically measurable levels of NAPL (e.g., M-111) will be bailed of free product during monthly O&M site visits when practicable. The recovered product will be filtered through the TBPF sand trap filter for processing and reclamation by the facility wastewater treatment process.

## 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 2019a), 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 to establish baseline concentrations of the dissolved benzene plume for future performance monitoring (Stantec, 2020). A single set of performance monitoring data was collected in 2020 and performance monitoring data was collected in 2021 and 2022 (Stantec, 2022). Additional groundwater samples will be collected in 2023 to assess the performance of the barrier.

# 5.0 2023 INVESTIGATION SCOPE OF WORK, METHODS AND APPROACH

The following investigation activities are planned for 2023:

1. Complete 2023 groundwater and surface water monitoring and sampling activities to meet 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 and O&M of the recovery well system.
5. Monitoring of the performance and O&M of the air sparge system.

## 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. Porewater samples will be collected from 12 locations (BH-1, BH-1.5, BH-2, BH-2.5, and BH-3 through BH-10) corresponding to historical COBC sampling locations. The sample locations are approximately 100 feet apart, extending along a north-south line with the exception of locations BH-1.5 and BH-2.5 which are 50 feet south of BH-1 and BH-2, respectively.

## 5.2 FACILITY MONITORING WELL SAMPLING

There are 40 existing groundwater monitoring wells at TBPF (**Table 3**). Ten of these wells were designated in the COBC as part of the annual compliance groundwater monitoring program and are still referred to as such for historical purposes, although ADEC has modified the COBC to remove that designation (ADEC 1997). Groundwater samples from the 10 COBC groundwater monitoring wells, and from the 30 non-COBC wells, will be collected during the July sampling event to assess BTEX concentration trends. Prior to sampling, groundwater surface elevations and NAPL thicknesses will be collected from all 40 groundwater monitoring wells during the June sampling event to confirm groundwater flow direction.

### Table 3 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[a] | | F-MW-1[a] |
| | M-102S[a] | | F-2 |
| | M-102D | Tank Battery 1 | GAMW-1 |
| | M-103[a] | | GAMW-2[a] |
| | M-105S | | GAMW-3 |
| | M-105D[a] | | GAMW-4 |

| Area | Well Designation | Area | Well Designation |
|---|---|---|---|
| Bluff Top | M-106 | Tank Battery 2 | DE-8 |
| | M-107S | | D-MW-1 |
| | M-107D[a] | | E-MW-1 |
| | M-108 | | L-7 |
| | M-109 | | M-5 (Abandoned) |
| | M-110[a] | | M-8 |
| | M-111 | | N-9 |
| | M-112 | West Side of TBPF | CI-1 |
| | S-101 | | M-116 |
| | MW-3[a] | | N-MW-1 |
| | MW-4 | | |
| | MW-5[a] | | |
| | MW-6 | | |

**Notes:**

a Designates the eight (8) bluff top and two-source area monitoring wells specified for COBC monitoring

## 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 performance monitoring events planned for June and September 2023 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 and two locations upgradient of the PRB corresponding to the former locations of monitoring wells 18MW-6 and 18MW-6a (**Table 3**). 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. Groundwater has historically been encountered in the 18 locations from approximately 7 to 14 feet bgs. Grab samples will be collected where groundwater is encountered and will be analyzed for BTEX.

## 5.4 RECOVERY WELL SYSTEM MONITORING

The effluent from the recovery well system will be sampled for BTEX on a monthly basis from April through November, 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.

The individual recovery wells will be sampled for BTEX during the June and September monitoring events.

## 5.5 MONITORING EVENT SCHEDULE

In addition to the monthly monitoring of the recovery well system there will be three discrete monitoring events in 2023, as summarized below and in **Table 4**. These events will be performed in conjunction with the recovery well system monitoring.

### 5.5.1 June 2023 Monitoring Event

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

- Sampling pore water from 12 beach seep locations, to be analyzed for BTEX. In addition, pore water samples from the BH-1.5, BH 2, and BH 2.5 locations will be analyzed for PAHs.
- Sampling 18 beach locations (26 samples total) with SP16 for PRB performance monitoring, to be analyzed for BTEX. In addition, three of the samples will be analyzed for PAHs and electron acceptors (nitrate and sulfate).
- Inspection and maintenance of the air sparging system.
- Well rehabilitation of the recovery well system, to reduce iron fouling of the recovery wells.

### 5.5.2 July 2023 Monitoring Event

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

- Gauging groundwater surface elevations and NAPL thickness in 40 facility groundwater monitoring wells.
- Sampling groundwater in 40 monitoring wells and 14 recovery wells, to be analyzed for BTEX.
- Sampling pore water from 12 beach seep locations, to be analyzed for BTEX. In addition, pore water samples from the BH-1.5, BH 2, and BH 2.5 locations will be analyzed for PAHs.
- Inspection and maintenance of the air sparging system.
- Inspection, maintenance, and adjustment of the recovery well system for optimal operation.

### 5.5.3 September 2023 Monitoring Event

The September monitoring event will be the final monitoring activity for 2023. The September event will consist of:

- Sampling pore water from 12 beach seep locations, to be analyzed for BTEX. In addition, pore water samples from the BH-1.5, BH 2, and BH 2.5 locations will be analyzed for PAHs.
- Sampling 18 beach locations (26 samples total) with SP16 for PRB performance monitoring, to be analyzed for BTEX. In addition, three of the samples will be analyzed for PAHs and electron acceptors (nitrate and sulfate).
- Sampling groundwater in 14 recovery wells, to be analyzed for BTEX.
- Inspection and maintenance of the air sparging system.
- Inspection, maintenance, and adjustment of the recovery well system for optimal operation.

## Table 4 Field Sampling Schedule

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

| Sample Type & Location | Location Name | June | | | July | | September | | |
|---|---|---|---|---|---|---|---|---|---|
| | | BTEX | PAHs | Electron Acceptors | BTEX | PAHs | BTEX | PAHs | Electron Acceptors |
| Facility Groundwater Monitoring Wells | A-MW-1 | | | | X | | | | |
| | CL-1 | | | | X | | | | |
| | DE-8 | | | | X | | | | |
| | D-MW-1 | | | | X | | | | |
| | E-MW-1 | | | | X | | | | |
| | F-2 | | | | X | | | | |
| | GAMW-1 | | | | X | | | | |
| | GAMW-3 | | | | X | | | | |
| | GAMW-4 | | | | X | | | | |
| | L-7 | | | | X | | | | |
| | M-102D | | | | X | | | | |
| | M-105S | | | | X | | | | |
| | M-106 | | | | X | | | | |
| | M-107S | | | | X | | | | |
| | M-107D | | | | X | | | | |
| | M-108 | | | | X | | | | |
| | M-109 | | | | X | | | | |
| | M-111 | | | | X | | | | |
| | M-112 | | | | X | | | | |
| | M-113 | | | | X | | | | |
| | M-115D | | | | X | | | | |
| | M-115S | | | | X | | | | |
| | M-116 | | | | X | | | | |
| | M-8 | | | | X | | | | |
| | MW-1 | | | | X | | | | |
| | MW-2 | | | | X | | | | |
| | MW-4 | | | | X | | | | |
| | MW-6 | | | | | | | | |
| | N-9 | | | | X | | | | |
| | N-MW-1 | | | | X | | | | |
| | S-101 | | | | X | | | | |
| Recovery System Wells | RW-1 | | | | X | | X | | |
| | RW-2 | | | | X | | X | | |
| | RW-3 | | | | X | | X | | |
| | RW-4 | | | | X | | X | | |
| | RW-5 | | | | X | | X | | |

| Sample Type & Location | Location Name | June | | | July | | September | | |
|---|---|---|---|---|---|---|---|---|---|
| | | BTEX | PAHs | Electron Acceptors | BTEX | PAHs | BTEX | PAHs | Electron Acceptors |
| Recovery System Wells | RW-6 | | | | X | | X | | |
| | RW-7 | | | | X | | X | | |
| | RW-8 | | | | X | | X | | |
| | RW-9 | | | | X | | X | | |
| | RW-10 | | | | X | | X | | |
| | RW-11 | | | | X | | X | | |
| | RW-12 | | | | X | | X | | |
| | RW-13 | | | | X | | X | | |
| | RW-14 | | | | X | | X | | |
| PRB Monitoring | Z2-5 | X | | | | | X | | |
| | Z3-4 | X | | | | | X | | |
| | Z3-5 | X | | | | | X | | |
| | Z3-10 | X | X | X | | | X | X | X |
| | Z3-11[a] | X | | | | | X | | |
| | Z3-12 | X | | | | | X | | |
| | Z3-13[a] | X | | | | | X | | |
| | Z3-14 | X | | | | | X | | |
| | Z4-4 | X | | | | | X | | |
| | Z4-10 | X | X | X | | | X | X | X |
| | Z4-11 | X | | | | | X | | |
| | Z4-12[a] | X | | | | | X | | |
| | Z4-13[a] | X | | | | | X | | |
| | Z4-14 | X | | | | | X | | |
| | Z5-2 | X | X | X | | | X | X | X |
| | Z5-3 | X | | | | | X | | |
| | 18MW-6 | X | | | | | X | | |
| | 18MW-6A | X | | | | | X | | |

**Notes:**

a Additional grab groundwater samples will be collected at two deeper intervals and analyzed for BTEX.

# 6.0 STANDARD OPERATING PROCEDURES FOR SAMPLING

## 6.1 BEACH PORE WATER SAMPLING

The sampling locations will be staked using a handheld GPS device and a shovel will be used to dig a hole to approximately 18 inches bgs during low tide. Grab pore water samples will be collected with a disposable scoop approximately thirty minutes to one hour after digging, allowing turbidity to diminish. Field measurements of conductivity (as an indicator of salinity), temperature, pH, dissolved oxygen (DO), and oxidation reduction potential (ORP) will be recorded. The collected pore water samples will be lab analyzed for BTEX concentrations. PAH analysis will be conducted on 3 of the 12 pore water samples.

Past experience indicates that the sample locations collapse after sampling.

## 6.2 GROUNDWATER SAMPLING

Grab groundwater samples will be collected from the beach area by direct push sampling during the May and September events, as described below. In addition, groundwater samples will be collected from facility monitoring wells and recovery wells during the July event. 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 electromagnetic (EM) and ground penetrating radar (GPR) in the beach area and no utilities were detected. No activity, other than this project, has occurred since the surveys.
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-Stress (Low Flow) Purging and Sampling Procedure for the Collection of Groundwater Samples From Monitoring Wells* (USEPA 2017) and ADEC *Field Sampling Guidance for Contaminated Sites and Leaking Underground Storage Tank Sites* (ADEC 2022a). A positive displacement submersible pump 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 0.05 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 stabilization. Water quality parameters are considered stable when three successive readings, collected three to five minutes apart, for three of the following parameters (not including temperature) are within the following ranges:

- ± 3% for temperature (minimum of ± 0.2°C)
- ± 0.1 for pH
- ± 3% for conductivity
- ± 10 millivolts for ORP
- ± 10% for DO for values greater than 0.5 mg/L, if three DO values are less than 0.5 mg/L, consider the values stabilized
- ± 10% for turbidity

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, 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 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.

# 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 (FD), trip blank (TB), equipment blank (EB), and extra sample volume for matrix spike/matrix spike duplicate (MS/MSD) will be collected. QA/QC samples are summarized in **Table 5** and will include:

- One TB for each cooler containing BTEX samples,
- One FD for every 10 samples collected per laboratory analysis,
- One EB 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 |
|---|---|---|---|---|
| May COBC Sampling | BTEX (8260D) | 12 | 2 FD + 1 MS/MSD + 1 TB | 16 |
| | PAH (8270C) | 3 | 1 FD + 1 MS/MSD | 5 |
| May PRB Sampling | BTEX (8260D) | 26 | 3 FD + 2 MS/MSD +1 TB | 32 |
| | PAH (8270C) | 3 | 1 FD + 1 MS/MSD | 5 |
| | Nitrate and sulfate (300.0) | 3 | 1 FD + 1 MS/MSD | 5 |
| July COBC Sampling | BTEX (8260D) | 12 | 2 FD + 1 MS/MSD + 1 TB | 16 |
| | PAH (8270C) | 3 | 1 FD + 1 MS/MSD | 5 |
| July Bluff Top Sampling | BTEX (8260D) | 39 | 3 FD + 2 MS/MSD + 1 TB + 1 EB per day | 30 + EB |
| July Recovery Well Sampling | BTEX (8260D) | 14 | 2 FD + 1 MS/MSD | 17 |
| September COBC Sampling | BTEX (8260D) | 12 | 2 FD + 1 MS/MSD + 1 TB | 16 |
| | PAH (8270C) | 3 | 1 FD + 1 MS/MSD | 5 |
| September PRB Monitoring | BTEX (8260D) | 26 | 3 FD + 2 MS/MSD +1 TB | 32 |
| | PAH (8270C) | 3 | 1 FD + 1 MS/MSD | 5 |
| | Nitrate and sulfate (300.0) | 3 | 1 FD + 1 MS/MSD | 5 |
| September Recovery Well Sampling | BTEX (8260D) | 14 | 2 FD + 1 MS/MSD | 17 |

Notes:

FD = field duplicate;
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 | 8260D | 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 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 *Guidelines for Data Reporting* (ADEC 2022b).

# 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.

## 8.1 PURGE WATER FROM SAMPLING

Purge water from all groundwater sampling events will be filtered through the TBPF sand trap filter for processing by the facility wastewater treatment process stream. 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.

## 8.2 PURGE WATER FROM RECOVERY WELL REHABILITATION

Purge water from the May 2023 recovery well rehabilitation activities will be disposed of on-site through the TBPF sand trap filter for processing by the facility wastewater treatment process stream.

## 8.3 SOIL CUTTINGS

Soil cuttings, if generated, will be field screened using a photo-ionization detector (PID) as specified in ADEC *Field Sampling Guidance for Contaminated Sites and Leaking Underground Storage Tank Sites* (ADEC 2022). Soil that field screens clean will be disposed of onsite. Soils which are visibly 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.

## 8.4 USED SORBENTS

Contaminated sorbent materials will be disposed of through Hilcorp’s oil waste disposal program.

# 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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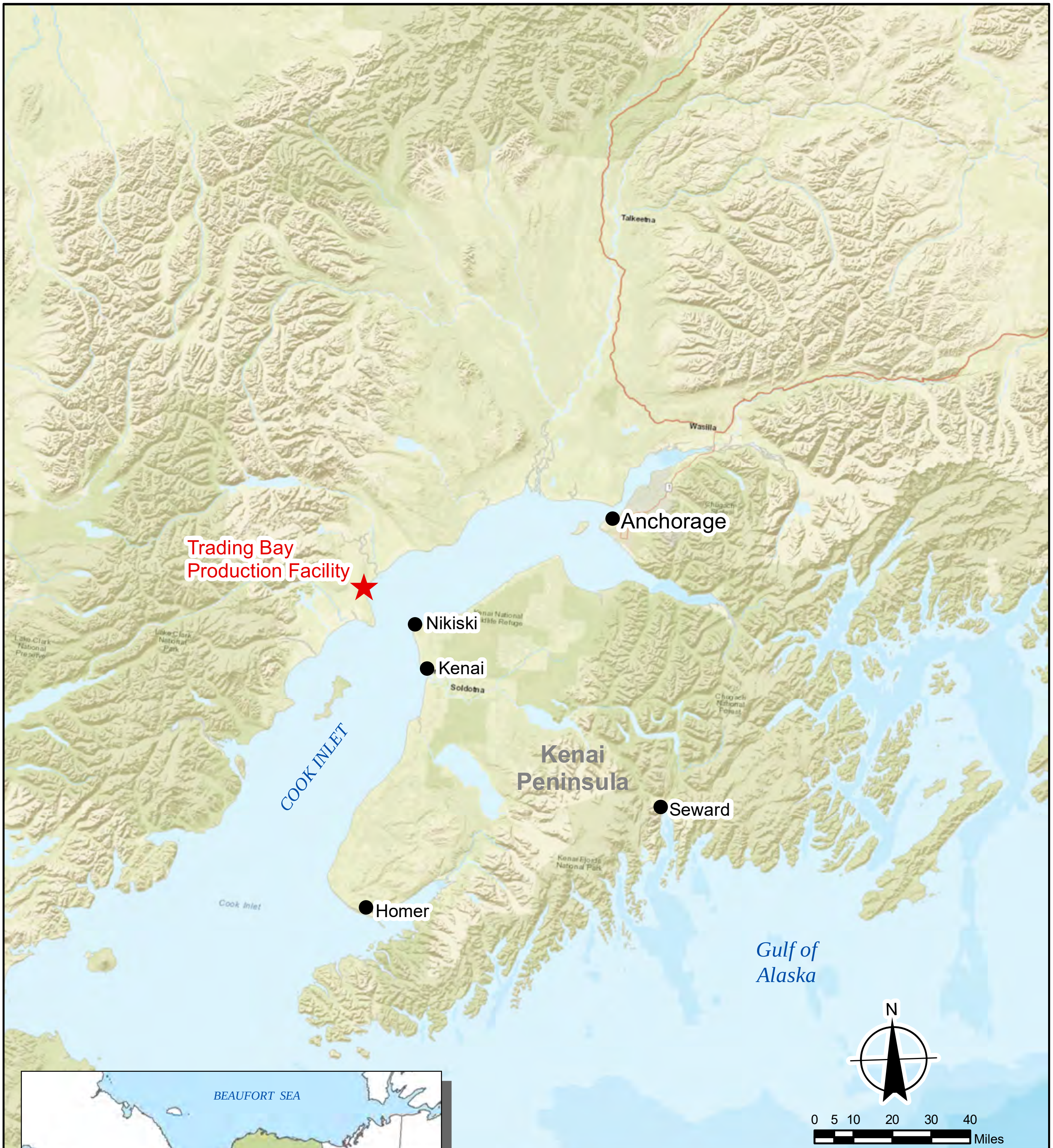
# FIGURES




**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 JO on 2021-04-12
Technical Review by RR on 2021-04-12
Independent Review by TM on 2021-04-12

Client/Project
Chevron Environmental Management Company
Trading Bay Production Facility
2023 Work Plan

Figure No.
**1**

Title
**SITE LOCATION MAP**

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


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

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Stantec

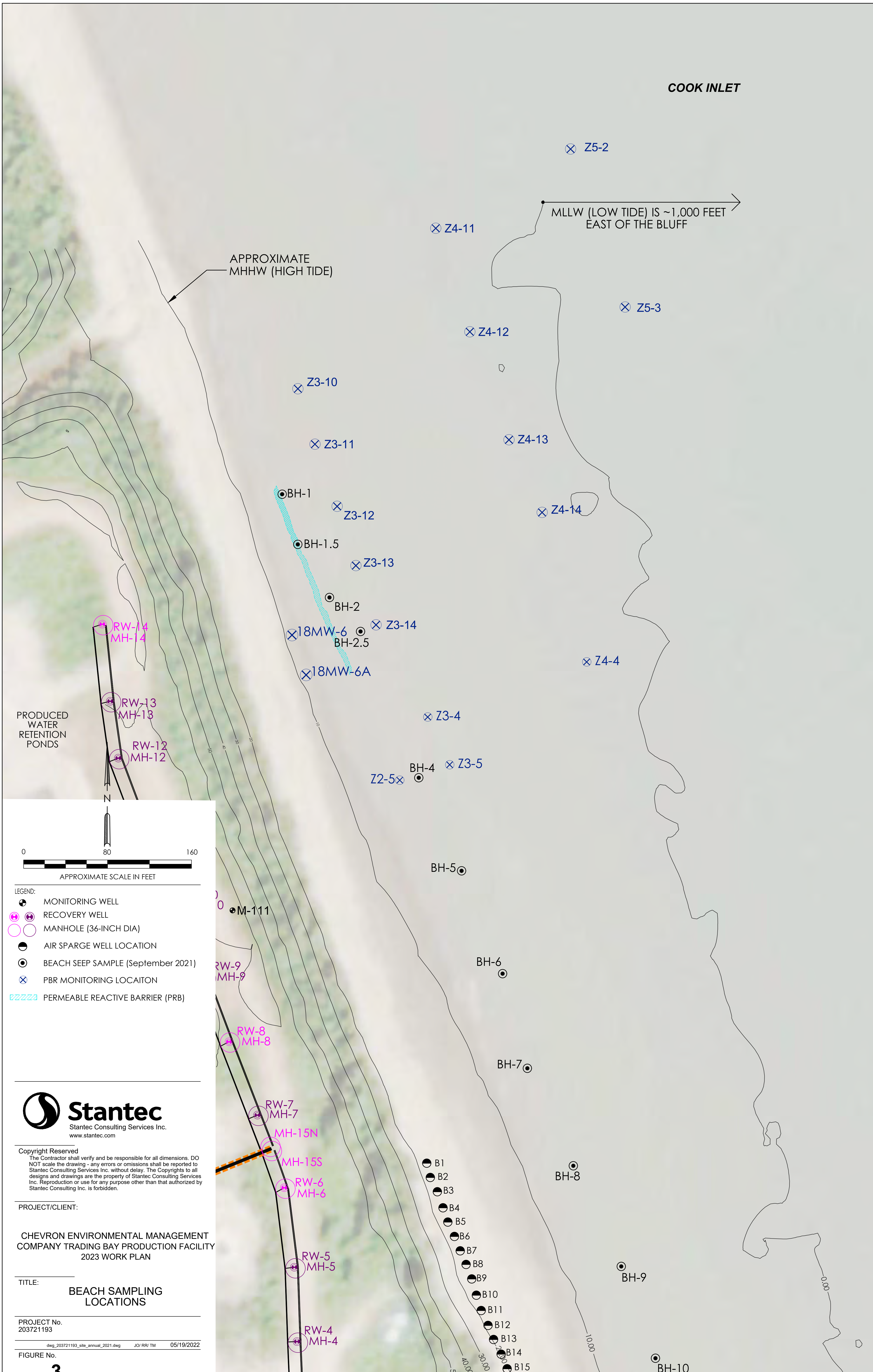
Project Location
Trading Bay Production Facility
T8N, R14W, S5

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
2023 Work Plan

Figure No.
2

Title
TRADING BAY PRODUCTION FACILITY
SITE MAP




LEGEND:

- MONITORING WELL
- RECOVERY WELL
- MANHOLE (36-INCH DIA)
- AIR SPARGE WELL LOCATION
- BEACH SEEP SAMPLE (September 2021)
- PBR MONITORING LOCAITON
- PERMEABLE REACTIVE BARRIER (PRB)

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Stantec Consulting Services Inc.
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PROJECT/CLIENT:

CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY TRADING BAY PRODUCTION FACILITY 2023 WORK PLAN

TITLE:

BEACH SAMPLING LOCATIONS

PROJECT No.
203721193

dwg_203721193_site_annual_2021.dwg JO/ RR/ TM 05/19/2022

FIGURE No.
3

FILEPATH:\\Us0257-ppfss01\shared_projects\203721193\05_report_deliv\drawing_design\cad_fig\dwg_203721193_site_annual_2021.dwg | JOpalekOpsahl | May 19, 2022 at 8:27 | Layout: fig3_sample_2022